CIVIL AVIATION AUTHORITY
OF NEW ZEALAND
Te Mana Rererangi Tūmatanui o Aotearoa

Notice of Requirement NTC 91.263

Revision 1

RNP AR APCH Navigation Specification

Preliminary

The Director of Civil Aviation issues the following requirements ("the requirements"), conditions and restrictions relating to the use of the RNP AR APCH Navigation Specification under section 28(5) of the Civil Aviation Act 1990 and Civil Aviation Rule 91.263(1).

Purpose

The purpose of this notice is to specify the requirements for RNP AR APCH operation, determined by the Director under rule 91.263, regarding:

i. the application of the RNP AR APCH operations;

ii. the navigation functionalities the aircraft systems must have;

iii. requirements for system redundancy, including requirements for conventional navigation equipment;

iv. continuing airworthiness requirements;

v. operator procedures;

vi. the operational and training requirements placed on flight crew members; and

vii. approval by the Director for the RNP AR APCH operations.

Rule 91.263(b) requires compliance with the requirements in this notice to ensure the safe operation of aircraft using RNP AR APCH procedures.

General

Civil Aviation Authority (CAA) Notices contain approvals and requirements including the detail about the approvals, standards, conditions, procedures and technical specifications that have been approved or determined by the Director under the Civil Aviation Rules. These details must be complied with by parties to whom it applies. They apply in particular circumstances to particular aviation document holders as specified in the notice.

CAA notices are issued under Civil Aviation Rules in accordance with section 28(5) of the Civil Aviation Act. This section permits the Minister of Transport to make ordinary rules, and to specify any terms and conditions within the rules:

- to require a matter to be determined, or undertaken or approved by the Authority, the Director or another person; or
- to empower the Authority, Director, or another person to impose requirements or conditions as to the performance of any activity, including (but not limited to) any procedures to be followed.

Notices support a performance-based approach to regulation and improve the flexibility and responsiveness of the Civil Aviation Rules. They may be used where performance-based regulation is the appropriate way to achieve the desired regulatory outcome, for example, in circumstances where new technological changes or challenges require more flexibility than prescribing requirements in the rules (and rulemaking may get quickly out-dated), or where there is a need to respond to safety issues which the rules do not adequately deal with.

The requirements stated in this notice are mandatory and must be complied with.

Related Rules

Civil Aviation Rules 91.261, 91.263, 91.263B and 91.263C

Effective Date

This notice comes into effect on 21 December 2022.

Issue of CAA Notice

21/12/2022

Signed by
Director of Civil Aviation

Date

Revision History

Revision 1	Original version

RNP AR APCH Navigation Specification

1. Application

These requirements apply to:

(1) every operator of an aircraft operation operating under instrument flight rules using an RNP AR APCH navigational procedure (RNP AR APCH operations);

(2) every operation to airports where limiting obstacles exist and/or where significant operational efficiencies can be gained; and

(3) every approach operation that requires a lateral cross-track navigation error not greater than the applicable accuracy value of 0.1 NM to 0.3 NM for 95 % of the flight time.

2. Operational Approval Requirements

(a) Description of aircraft equipment:

(1) Due to the unique requirements of RNP AR APCH operations and the demand for crew members' procedures that are specific to each particular aircraft and navigation system, RNP AR APCH operational support documentation is required from the manufacturer.

(2) The documentation describes the navigation capabilities of the applicant's aircraft for the RNP AR APCH operations for which approval is being sought, and provide all the assumptions, limitations and supporting information necessary for the safe conduct of RNP AR APCH operations.

(3) The operator must have a configuration list and, if necessary, a MEL detailing the required aircraft equipment for RNP AR APCH operations.

(b) Training documentation:

(1) An air operator certificated under Part 119 must have a training programme addressing the operational practices, procedures and training phases related to RNP AR APCH operations.

(2) A private operator under Part 91 must be familiar with the practices and procedures referred to in clause 5 of this notice.

(c) Operations manuals and checklists:

(1) The operator must ensure that operations manuals and checklists address information or guidance on operational procedures referred to in clause 4 of this notice.

(2) The operator must ensure that the appropriate manuals contain navigation operating instructions and contingency procedures.

(3) The operator must submit their manuals and checklists to the Director for review as part of the application process.

(d) MEL considerations:

(1) Operators must adjust the MEL, or equivalent, to allow for RNP AR APCH operations specify the required dispatch conditions.

(2) Any MEL revisions necessary to address RNP AR APCH operations must be approved by the Director.

(e) Continuing airworthiness:

The operator must -

(1) submit to the Director the continuing airworthiness instructions applicable to the aircraft's configuration and the aircraft's qualification for RNP AR APCH operations; and

(2) submit to the Director their maintenance programme, including a reliability programme for monitoring the equipment.

3. Aircraft Requirements

(a) The operator must ensure that the following requirements regarding on-board performance monitoring and alerting are met:

(1) Path definition:

(i) Aircraft performance is evaluated around the path defined by the published procedure and RTCA/DO-236B Section 3.2; EUROCAE ED-75B, or an equivalent standard acceptable to the Director.

(ii) All vertical paths used in conjunction with the FAS will be defined by a flight path angle as specified in RTCA/DO 236B as a straight line emanating to a fix and altitude.

(b) The operator must ensure that the following requirements regarding lateral accuracy are met:

(1) All aircraft operating on RNP AR APCH procedures must have a cross-track navigation error not greater than the applicable accuracy value of 0.1 NM to 0.3 NM for 95 % of the flight time. This includes positioning error, FTE, PDE and display error.

(2) The aircraft along-track positioning error must be not greater than the applicable accuracy value for 95 % of the flight time.

(c) The operator must ensure that the following requirements regarding vertical accuracy are met:

(1) The vertical system error includes altimetry error assuming the temperature and lapse rates of the International Standard Atmosphere, the effect of along-track error, system computation error, data resolution error, and FTE.

(2) The 99.7% of system error in the vertical direction must be

$$\sqrt{\left((6076.115)(1.225)RNP \cdot \tan\theta\right)^2 + (60\tan\theta)^2 + 75^2 + \left((-8.8 \cdot 10^{-8})(h+\Delta h)^2 + (6.5 \cdot 10^{-3})(h+\Delta h) + 50\right)^2}$$

less than the following as measured in feet:

(i) Where θ is the VNAV path angle, h is the height of the local altimetry reporting station and Δh is the height of the aircraft above the reporting station.

(ii) VNAV systems compliant with the performance requirements of the RNP APCH down to LPV minima per Navigation Specification Notice RNP APCH (LP and LPV), meet or exceed this vertical accuracy performance criteria.

(d) The operator must ensure that the following requirements regarding system monitoring are met:

(1) The navigation system must monitor the achieved navigation performance and identify to the pilot whether the operational requirement is or is not met during the operation.

(2) The management of FTE must be addressed as a pilot procedure.

(e) GNSS updating:

The operator must ensure that the flight crew members are alerted when GNSS updating is lost, unless the navigation system provides an alert when the selected RNP no longer meets the requirements for continued navigation.

(f) The operator must ensure that the following requirements regarding airspace containment are met:

(1) RNP and baro-VNAV systems:

RNP systems based primarily on GNSS and VNAV systems based on barometric altimetry compliant with the requirements of this navigation specification provide the requisite performance and assurance to satisfy the airspace requirements and safety margins through a variety of monitoring and alerting such as “Unable RNP”, GNSS alert limit, and path deviation monitoring.

(2) Other systems or alternate means of compliance:

For other systems of means of compliance to paragraph (1), the probability of the aircraft exiting the lateral and vertical extent of the obstacle clearance volume of the procedure must not exceed 1×10^{-7} per approach and including the missed approach.

(3) The requirement referred to in paragraph (2) may be satisfied by an operational safety assessment applying -

(i) appropriate quantitative numerical methods;

(ii) qualitative operational and procedural considerations and mitigations; or

(iii) an appropriate combination of both quantitative and qualitative methods.

(g) The operator must ensure that the following requirements for specific navigation services are met:

(1) ABAS and other GNSS augmentations based on GPS:

(i) The sensor must comply with the guidelines in AC 20-138() or AC 20-130A or an equivalent standard acceptable to the Director.

(ii) For systems that comply with AC 20-138(), the following sensor accuracies can be used in the total system accuracy analysis without additional substantiation: GPS (ABAS) sensor lateral accuracy is better than 119 ft (95%), and augmented GPS (GBAS or SBAS) sensor lateral accuracy is better than 7 ft (95%).

(iii) If a latent GPS satellite fails, and marginal GPS satellite geometry such as HIL equal to the horizontal alert limit, the probability that the aircraft remains within the obstacle clearance volume used to evaluate the procedure must be greater than 95% (both laterally and vertically).

(iv) Other GNSS systems meeting or exceeding the accuracy of GPS may use the criteria specified in paragraphs (ii) and (iii).

(h) The operator must ensure that the following requirements regarding IRS are met:

(1) An IRS must satisfy the criteria of US 14 CFR Part 121 Appendix G, or an equivalent standard acceptable to the Director.

(2) The requirement for a 2 NM per hour drift rate (95 %) for flights up to 10 hours may not apply to an RNP system after loss of position updating.

(3) Systems that have demonstrated compliance with US 14 CFR Part 121 Appendix G or an equivalent standard acceptable to the Director, can be assumed to have an initial drift rate of 8 NM/hour for the first 30 minutes (95 %) without further substantiation.

(4) Aircraft manufacturers and applicants may demonstrate improved inertial performance in accordance with the methods specified in Appendix 1 or 2 of FAA Order 8400.12A, or an equivalent standard acceptable to the Director.

(i) The operator must ensure that the following requirements regarding DME are met:

(1) When authorised by the NAA, the aircraft may use DME/DME-updating as a reversionary navigation mode during an approach or during the missed approach when the navigation system continues to comply with the required navigation accuracy.

(2) The aircraft manufacturer must identify any requirements for the DME infrastructure or any necessary operational procedures and limitations when conducting a procedure through use of DME/DME updating of the aircraft's position.

(j) The operator must ensure that the following requirements regarding VOR are met:

(1) The aircraft's RNP system may not use VOR-updating when conducting RNP AR APCH procedures.

(2) The aircraft manufacturer must identify any pilot procedures or techniques for an aircraft to comply with this requirement.

(k) Multi-sensor systems:

For multi-sensor systems, the operator must ensure that there is automatic reversion to an alternate area navigation sensor if the primary area navigation sensor fails. Automatic reversion from one multi-sensor system to another multi-sensor system is not required.

(l) Altimetry System Error:

The operator must ensure that the 99.7 % aircraft ASE for each aircraft must be less than or equal to the following with the aircraft in the approach configuration:

$$ASE = -8.8 \cdot 10^{-8} \cdot H^2 + 6.5 \cdot 10^{-2} \cdot H + 50(\text{ft})$$

Where H is the true altitude of the aircraft.

(m) The operator must ensure that the following requirements regarding temperature compensation systems are met:

(1) Systems that provide temperature-based corrections to the barometric VNAV guidance which applies to the FAS, must comply with RTCA/DO-236B Appendix H.2, or an equivalent standard acceptable to the Director.

(2) Manufacturers must document compliance to this standard to allow the operator to conduct RNP approaches when the actual temperature is below or above the published procedure design limit.

(n) The operator must ensure that the following functional requirements are met:

(1) Path definition and flight planning:

(i) The aircraft must have the capability to execute leg transitions and maintain tracks consistent with the following paths:

(A) a geodesic line between 2 fixes;

(B) a direct path to a fix;

(C) a specified track to a fix, defined by a course; and

(D) a specified track to an altitude.

(ii) The aircraft must have the capability to execute fly-by and fly-over fixes.

(iii) For fly-by turns, the navigation system must limit the path definition within the theoretical transition area defined in EUROCAE ED-75B/ RTCA DO-236B and in ICAO Doc 9905.

(iv) The fly-over turn is not compatible with RNP flight tracks and will only be used when there is no requirement for repeatable paths.

(v) The navigation database must provide sufficient data resolution to ensure that the navigation system achieves the required accuracy.

(vi) The waypoint resolution error must be less than or equal to 60 ft, including both the data storage resolution and the RNP system computational resolution used internally for construction of flight plan waypoints.

(vii) The navigation database must contain vertical angles which are light path angles, stored to a resolution of hundredths of a degree, with computational resolution such that the system-defined path is within 5 ft of the published path.

(viii) The navigation system must have a “direct-to” function that the pilot can activate at any time. This function must be available to any fix and be capable of generating a geodesic path to the designated “To” fix, without “S-turning” and without undue delay.

(ix) The navigation system must be capable of defining a vertical path by a flight path angle to a fix and specifying a vertical path between altitude constraints at 2 fixes in the flight plan.

(x) Fix altitude constraints must be defined as one of the following:

(A) an “AT” or “ABOVE” altitude constraint:

(B) an “AT” or “BELOW” altitude constraint:

(C) an “AT” altitude constraint; or

(D) a “WINDOW” constraint.

(xi) Altitudes and/or speeds associated with published terminal procedures must be extracted from the navigation database.

(xii) The system must be able to construct a path to provide guidance from the current position to a vertically constrained fix.

(xiii) The navigation system must have the capability to load the entire procedure(s) to be flown into the RNP system from the on-board navigation database, which includes missed approach and the approach transitions for the selected airport and runway.

(xiv) The navigation system must provide the ability for the pilot to verify the procedure to be flown through review of the data stored in the on-board navigation database, including the ability to review the data for individual waypoints and for NAVAIDs.

(xv) For paths defined by a course such as CF and FA path terminators, the navigation system must use the magnetic variation value for the procedure in the navigation database.

(xvi) RNP changes to lower navigation accuracy must be completed by the fix defining the leg with the lower navigation accuracy, and any operational procedures necessary for accomplishing the task must be identified.

(xvii) The navigation system must provide the capability to automatically sequence to the next leg and display the sequencing to the pilot in a readily visible manner.

(xviii) A display of the altitude restrictions associated with flight plan fixes must be available to the pilot.

(xix) If there is a specified navigation database procedure with a flight path angle associated with any flight plan leg, the equipment must display the flight path angle for that leg.

(2) Demonstration of path steering performance:

(i) The demonstration of path steering performance must be completed in a variety of operational conditions, such as rare-normal conditions and non-normal conditions.

(ii) Realistic and representative procedures are to be used such as the number of waypoints, placement of waypoints, segment geometry and leg types.

(iii) The non-normal assessments are to consider the following factors:

(A) criteria for assessing probable failures during the aircraft qualification are to demonstrate that the aircraft trajectory is maintained within a 1 × RNP corridor, and 75 ft vertical;

(B) proper documentation of the demonstration referred to in paragraph (A) in the AFM, AFM extension, or appropriate aircraft operational support

document, alleviates the operational evaluations;

(C) RNP-significant improbable failure cases are to be assessed to show that the aircraft can be safely extracted from the procedure;

(D) failure cases may include dual system resets, flight control surface runaway and complete loss of flight guidance function; and

(E) the aircraft performance demonstrations during the operational evaluations may be based on a mix of analyses and flight technical evaluations using expert judgement.

(iv) Operating procedures resulting from the. demonstration such as one engine inoperative performance must be documented in the AFM, AFM extension, or appropriate aircraft operational support document.

(3) Displays:

(i) The navigation system must provide the capability to continuously display to the pilot flying, on the primary flight instruments for navigation of the aircraft, the aircraft position relative to the RNP defined path for both lateral and vertical deviation.

(ii) The display must allow the pilot to readily distinguish if the cross-track deviation exceeds the lateral navigation accuracy such as 1 × RNP or a smaller value, and if the vertical deviation exceeds 75 ft or a smaller value, during RNP AR APCH operations.

(iii) The navigation system must provide a display identifying the active waypoint either in the pilot's

primary optimum field of view, or on a readily accessible and visible display to the pilot.

(iv) The navigation system must provide a display of distance and bearing to the active (To) waypoint in the pilot's primary optimum field of view. Where not viable, a readily accessible page on a control display unit readily visible to the pilot, may display the data.

(v) The navigation system must provide the display of ground speed and time to the active (To) waypoint in the pilot's primary optimum field of view. Where not viable, a readily accessible page on a control display unit readily visible to the pilot, may display the data.

(vi) The navigation system must provide a "To" display in the pilot's primary optimum field of view.

(vii) The navigation system must have the capability to continuously display to the pilot flying the desired aircraft track and the display must be on the primary flight instruments for navigation of the aircraft.

(viii) The navigation system must provide a display of the actual aircraft track or track angle error either in the pilot's primary optimum field of view, or on a readily accessible and visible display to the pilot.

(ix) The aircraft must provide a means to annunciate failures of any aircraft component of the RNP system, including navigation sensors and the annunciation must be visible to the pilot and located in the primary optimum field of view.

(x) The navigation system must provide a course selector automatically slaved to the RNP computed path.

(xi) The navigation system must provide a readily visible means for the pilot monitoring to verify the

aircraft's RNP-defined path and the aircraft's position relative to the defined path.

(xii) The navigation system must provide the ability to display distance to go to any waypoint selected by the pilot.

(xiii) The navigation system must provide the ability to display the distance between flight plan waypoints.

(xiv) The navigation system must provide a numeric display of the vertical and lateral deviation. Vertical deviation must have a resolution of 10 ft or less for RNP AR APCH operations.

(xv) Lateral deviation resolution must be:

(A) 0.1 NM or less for RNP operations not less than 0.3; or

(B) 0.01 NM or less for operations below 0.3.

(xvi) The aircraft must display barometric altitude from 2 independent altimetry sources, 1 in each of the pilot's primary optimum field of view-

(A) to support an operational cross-check comparison of altitude sources; or

(B) if the aircraft altitude sources are automatically compared, the output of the independent altimetry sources, is expected to be analysed and provide an alert in the pilot's primary optimum field of view when the deviation exceeds 100 ft; and

(C) when barometric vertical guidance is used, the altimeter setting input is expected to be used simultaneously by the aircraft altimetry system and by the RNP system.

(xvii) The aircraft must either display the current navigation sensor(s) in use or indicate sensor loss/degradation in navigation system performance.

(4) Design Assurance:

(i) For RNP accuracy RNP 0.3, the system design assurance must be consistent with at least a major failure condition for the display of misleading lateral or vertical guidance on an RNP AR APCH procedure at 1×10^{-5}/FH.

(ii) For RNP accuracy less than RNP 0.3, the system design assurance must be consistent with at least a hazardous failure condition for the display of misleading lateral or vertical guidance on an RNP AR APCH procedure at 1×10^{-7}/FH.

(iii) The system design assurance must be consistent with at least a major failure not exceeding 1×10^{-5}/FH condition for the loss of lateral guidance and a minor failure not exceeding 1×10^{-3}/FH condition for loss of vertical guidance on an RNP AR APCH procedure.

(5) Navigation database:

(i) The aircraft navigation system must use an on-board navigation database which can receive updates in accordance with the AIRAC cycle and allow retrieval and loading of RNP AR APCH procedures into the RNP system.

(ii) The RNP system must not allow the pilot to modify the data stored in the on-board navigation database.

(iii) The aircraft must provide a means to display the validity period of the on-board navigation database to the pilot.

(6) Terrain Awareness and Warning System (TAWS):

(i) The aircraft must be fitted with an operable Class A TAWS for all RNP AR APCH procedures.

(ii) The TAWS must not utilise the captain's altimeter subscale setting as the sole reference to help militate against a dual QNH setting error by the pilot.

(7) Requirements for RNP AR approaches with RF legs:

(i) The navigation system must have the capability to execute leg transitions and maintain tracks consistent with an RF leg between 2 fixes.

(ii) The aircraft must have an electronic map display of the selected procedure.

(iii) The RNP system, the flight director system and autopilot must be capable of commanding a bank angle up to 25 degrees above 400 ft AGL and up to 8 degrees below 400 ft AGL.

(iv) Upon initiating a go-around or missed approach through activation of TOGA or other means, the flight guidance mode must remain in lateral navigation to enable continuous track guidance during an RF leg.

(v) When evaluating an FTE on RF legs, the effect of rolling into and out of the turn must be considered to ensure that the aircraft is able to get back on the desired track if a slight overshoot at the start of the turn occurs.

(8) Requirements for RNP AR approaches to less than RNP 0.3:

(i) The aircraft must have at least the following equipment:

(A) dual GNSS sensors;

(B) dual FMS;

(C) dual air data systems;

(D) dual autopilots, and

(E) a single IRU.

(ii) The system design assurance must be consistent with at least a major failure condition for the loss of lateral or vertical guidance on an RNP AR APCH where RNP less than 0.3 is required to avoid obstacles or terrain while executing the procedure not exceeding 1×10^{-5}/FH.

(iii) Upon initiating a go-around or missed approach through activation of TOGA or other means, the flight guidance mode must remain in lateral navigation to enable continuous track guidance during an RF leg.

(iv) If the aircraft does not provide the capability referred to in paragraph (iii), the following requirements apply -

(A) If the aircraft supports RF legs, the lateral path after initiating a go-around (TOGA), given a minimum 50-second straight segment between the RF end point and the DA, must be within 1 degree of the track defined by the straight segment through the DA point. The prior turn can be of arbitrary angular extent and radius as small as 1 NM, with speeds commensurate with the approach environment and the radius of the turn.

(B) The pilot must be able to couple the autopilot or flight director to the RNP system (engage lateral navigation) by 400 ft AGL.

(v) After initiating a go-around, or missed approach following loss of GNSS, the aircraft must automatically revert to another means of navigation that complies with the navigation accuracy.

(9) Requirements for approaches with missed approach less than RNP 1.0:

(i) The aircraft must have at least the following equipment:

(A) dual GNSS sensors;

(B) dual FMS;

(C) dual air data systems;

(D) dual autopilots; and

(E) a single IRU.

(ii) The system design assurance must be consistent with at least a major failure condition for the loss of lateral or vertical guidance on an RNP AR APCH where RNP less than 1.0 is required to avoid obstacles or terrain while executing a missed approach at 1×10^{-5}/FH.

(iii) For RNP AR APCH missed approach operations requiring less than 1.0 to avoid obstacles or terrain, the loss of the display of lateral guidance is considered a hazardous failure condition at 1×10^{-7}/FH.

(iv) Upon initiating a go-around or missed approach through activation of TOGA or other means, the flight guidance mode must remain in lateral navigation to enable continuous track guidance during an RF leg.

(v) If the aircraft does not provide the capability referred to in paragraph (iv), the following requirements apply -

(A) If the aircraft supports RF legs, the lateral path after initiating a go-around (TOGA) given a minimum 50-second straight segment between the RF end point and the DA) must be within 1 degree of the track defined by the straight segment through the DA point. The prior turn can be of arbitrary angular extent and the

radius as small as 1 NM, with speeds commensurate with the approach environment and the radius of the turn.

(B) The pilot must be able to couple the autopilot or flight director to the RNP system, which is to engage lateral navigation, by 400 ft AGL.

(vi) After initiating a go-around or missed approach following loss of GNSS, the aircraft must automatically revert to another means of navigation that complies with the navigation accuracy.

4. Operating Procedures

(a) Pre-flight considerations:

(1) The operator must ensure that its MEL addresses the equipment requirements for RNP AR instrument procedures.

(2) The required equipment may depend on the intended navigation accuracy and whether the missed approach requires an RNP less than 1.0.

(3) The operator must ensure that dual equipment is used for approaches when using a line of minima less than RNP 0.3 and/or where the missed approach has an RNP less than 1.0.

(4) The operator must ensure that an operable Class A TAWS is used for all RNP AR APCH procedures and the pilot must be familiar with the required equipment.

(5) The operator must ensure that RNP AR APCH procedures with a lateral navigation accuracy of less than RNP 0.3 or with RF legs use an autopilot or flight director driven by the RNP system in all cases.

(6) The autopilot or flight director must be operable and able to track the lateral and vertical paths defined by the procedure.

(7) When the dispatch of a flight is predicated on flying an RNP AR APCH procedure requiring the autopilot at the destination and/or alternate, the dispatcher must determine that the autopilot is operational.

(8) The operator must have a predictive performance capability which can forecast whether or not the specified RNP will be available at the time and location of a desired RNP AR APCH procedure.

(9) The operator must establish procedures requiring use of the predictive performance capability as both a pre-flight dispatch tool and as a flight-following tool in the event of reported failures.

(10) The operator must ensure that the RNP assessment considers the specific combination of the aircraft capability such as its sensors and integration, and the following factors -

(i) when GNSS updating, the predictive capability must account for known and predicted outages of GNSS satellites or other impacts on the navigation system's sensors;

(ii) the prediction programme must not use a mask angle below 5 degrees;

(iii) the prediction must use the actual GNSS constellation with the integrity monitoring algorithm identical to that used in the actual equipment. For RNP AR APCH operations with high terrain, use a mask angle appropriate to the terrain; and

(iv) RNP AR APCH operations must have GNSS updating available before the commencement of the procedure.

(11) The operator must establish procedures for excluding NAVAID facilities in accordance with NOTAMs such as DMEs, VORs and localisers.

(12) During system initialisation, pilots of aircraft equipped with an RNP capable system, must confirm that the navigation database is current, and must remain current for the duration of the flight.

(13) If the AIRAC cycle changes during flight, operators and pilots must establish procedures for ensuring the accuracy of the navigation data, including the suitability of the navigation facilities used to define the routes and procedures for the flight.

(14) The operator must ensure that an outdated database must not be used to conduct the RNP AR APCH operation unless it has been established that any amendments to the database have no material impact on the procedure.

(15) The operator must ensure that if an amended chart is published for the procedure, the database must not be used to conduct the operation.

(b) In-flight considerations:

(1) Pilots must not fly a published RNP AR APCH procedure unless it is retrievable by the procedure name from the aircraft navigation database and conforms to the charted procedure.

(2) The pilot must not modify the lateral path of the procedure referred to in paragraph (1) except if -

(i) 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; or

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

(3) The pilot must have a required list of equipment for conducting RNP AR APCH operations or alternate

methods to address in-flight equipment failures prohibiting RNP AR APCH procedures.

(4) The pilot must ensure that the operating procedures provide for the navigation system to use the appropriate navigation accuracy throughout the approach.

(5) If multiple lines of minima associated with a different navigation accuracy are shown on the approach chart, the pilot must confirm that the desired navigation accuracy is entered in the RNP system.

(6) If the navigation system does not extract and set the navigation accuracy from the on-board navigation database for each leg of the procedure, the pilot must ensure that the operating procedures provide for the smallest navigation accuracy required to complete the approach or missed approach is selected before initiating the procedure.

(7) The pilot must ensure that all RNP AR instrument procedures require GNSS updating of the navigation position solution.

(8) The pilot must verify that GNSS updating is available before commencing the RNP AR procedure.

(9) During an approach, if at any time GNSS updating is lost and the navigation system does not have the performance to continue the approach, the pilot must abandon the RNP AR APCH unless the pilot has in sight the visual references required to continue the approach.

(10) Initiation of all RNP AR APCH procedures is based on the availability of GNSS updating, except where specifically designated on a procedure as “Not Authorised”, DME/DME updating can be used as a reversionary mode during the approach or missed approach when the system complies with the navigation accuracy.

(11) VOR updating is not authorised at the phase referred to in paragraph (10) and the pilot must comply with the operator’s procedures for inhibiting specific facilities.

(12) The pilot must confirm that the correct procedure has been selected which includes confirmation of the waypoint sequence, reasonableness of track angles and distances, and any other parameters that can be altered by the pilot, such as altitude or speed constraints.

(13) Pilots must ensure that a procedure is not used if the validity of the navigation database is in doubt, and a navigation system textual display or navigation map display must be used.

(14) Pilots must use a lateral deviation indicator and/or flight director in lateral navigation mode on RNP AR APCH procedures.

(15) Pilots of aircraft with a lateral deviation indicator must ensure that lateral deviation indicator scaling including full-scale deflection is suitable for the navigation accuracy associated with the various segments of the RNP AR APCH procedure.

(16) Pilots are to maintain procedure centre lines, as depicted by on-board lateral deviation indicators and/or flight guidance during all RNP operations described in this notice, unless authorised to deviate by ATC or under emergency conditions.

(17) For normal operations, cross-track error/deviation (the difference between the RNP system computed path and the aircraft position relative to the path) is to be limited to ±½ the navigation accuracy associated with the procedure segment.

(18) Brief lateral deviations from the standard referred to in paragraph (17) during and immediately after turns, up to a maximum of one-times the navigation accuracy of the procedure segment are permitted.

(19) The vertical deviation must be within 75 ft during the FAS noting that transients in excess of 75 ft above the vertical path are acceptable.

(20) Vertical deviation is to be monitored above and below the vertical path; while being above the vertical path provides margin against obstacles on the final approach, continued intentional flight above the vertical path can result in a go-around decision closer to the runway and reduce the margin against obstacles in the missed approach.

(21) Pilots must execute a missed approach if the lateral deviation exceeds 1 × RNP or the vertical deviation exceeds –75 ft, unless the pilot has in sight the visual references required to continue the approach.

(22) Where a moving map, low-resolution vertical deviation indicator (VDI), or numeric display of deviations are to be used, pilot training and procedures must ensure the effectiveness of these displays, such as the demonstration of the procedure with a number of trained pilots and inclusion of this monitoring procedure in the recurrent RNP AR APCH training programme.

(23) For installations that use a CDI for lateral path tracking, the AFM or aircraft qualification guidance is to state which navigation accuracy and operations the aircraft supports and the operational effects on the CDI scale.

(24) Pilots must know the CDI full-scale deflection value. The avionics may automatically set the CDI scale dependent on the phase of flight or the pilot may manually set the scale.

(25) If pilots manually select the CDI scale, the operator must have procedures and training in place to ensure that the selected CDI scale is appropriate for the intended RNP operation.

(26) The deviation limit must be readily apparent dependent on the scale.

(27) For approaches with a navigation accuracy less than RNP 0.3, pilots must monitor the lateral and vertical guidance provided by the navigation system by ensuring it is consistent with other available data and displays that are provided by an independent means.

(28) An RNP AR APCH procedure may require the ability to execute an RF leg to avoid terrain or obstacles, and the requirement is to be noted on the chart.

(29) If an RF leg is to be executed, pilots must be competent to conduct this procedure.

(30) When flying an RF leg, pilots must not exceed the maximum airspeeds shown in Table 1 throughout the RF leg segment. A missed approach prior to DA may require the segment speed for that segment be maintained.

Table 1Maximum airspeed by segment and category

Indicated airspeed (knots)						
Segment	Indicated airspeed by aircraft category					
	Cat H	Cat A	Cat B	Cat C	Cat D	Cat E
Initial and intermediate (IAF to FAF)	120	150	180	240	250	250
Final (FAF to DA)	90	100	130	160	185	As specified
Missed Approach (DA to MAHF)	90	110	150	240	265	As specified
Airspeed restriction*	As specified					
* RNP AR APCH procedure design may use airspeed restrictions to reduce the RF turn radius regardless of aircraft category. Operators therefore need to ensure they comply with the limiting speed for planned RNP AR APCH operations under all operating configurations and conditions.						

(31) For aircraft with temperature compensation capabilities, approved operating procedures may allow pilots to disregard the temperature limits on RNP AR APCH procedures if the operator provides pilot training on the use of the temperature compensation function.

(32) Temperature compensation by the system is applicable to the baro-VNAV guidance and is not a substitute for the pilot compensating for the cold temperature effects on minimum altitudes or the DA.

(33) Pilots must be familiar with the effects of the temperature compensation on intercepting the compensated path described in EUROCAE ED-75B/ RTCA DO-236B Appendix H or an equivalent path that is acceptable to the Director.

(34) When using GNSS vertical guidance on RNP AR operations such as SBAS or GBAS, the temperature limits for the procedure do not apply. The pilot may be required to compensate for the cold temperature effects on minimum altitudes or the DA.

(35) The pilot must ensure that the current local QNH is set before the FAF and remote altimeter settings are not permitted.

(36) Pilots must complete an altimetry cross-check ensuring the pilots' altimeters agree within ±100 ft before the FAF but not earlier than the IAF on approach. If the altimetry cross-check fails then the procedure must not be continued.

(37) If the avionics systems provide a comparator warning system for the pilots' altimeters, the pilot procedures must address actions to take if a comparator warning for the pilots' altimeters occurs while conducting an RNP AR APCH procedure.

(38) The operational check referred to in paragraph (36) is not required if the aircraft automatically compares the altitudes to within 100 ft or when the aircraft uses GNSS vertical guidance such as SBAS or GBAS.

(39) The momentary deviation below the published minimum procedure altitude is acceptable if the deviation does not exceed 100 ft and is a result of a normal VNAV capture. This applies to both "level off" or "altitude acquire" segments following a climb or descent, or vertical climb or

descent segment initiation, or joining of climb or descent paths with different gradients.

(40) When an approach procedure specifies a non-standard climb gradient, the operator must ensure the aircraft is capable of complying with the published climb gradient at the aircraft landing weight under ambient atmospheric conditions.

(41) Where possible, the missed approach requires a navigation accuracy of RNP 1.0. Where necessary, navigation accuracy less than RNP 1.0 is to be used in the missed approach. Approval to conduct these approaches, equipage and procedures must meet the criteria specified in clause 3(n)(9) (Requirements for approaches with missed approach less than RNP 1.0).

(42) Activating TOGA during the initiation of a go-around or missed approach may cause a change in lateral navigation mode or functionality, and track guidance may revert to track-hold derived from the inertial system. In such cases, lateral navigation guidance to the autopilot and flight director must be re-engaged as quickly as possible.

(43) The pilot procedures and training must address the impact on navigation capability and flight guidance if the pilot initiates a go-around while the aircraft is in a turn. When initiating an early go-around, the pilot must ensure adherence to the published track unless ATC has issued a different clearance.

(c) Failure while en-route:

The pilot must be able to assess the impact of equipment failure on the anticipated RNP AR APCH procedure and take appropriate action, and assess the impact of changes in the GNSS constellation and take appropriate action.

(d) Failure on approach:

The operator must ensure that its contingency procedures address the following conditions –

(1) failure of the RNP system components, including those affecting lateral and vertical deviation performance such as failures of a GPS sensor, the flight director or automatic pilot; and

(2) loss of navigation SIS which is the loss or degradation of external signal.

5. Pilot knowledge and training

(a) Operators must ensure that pilots are trained and have appropriate knowledge of the topics specific to RNP AR APCH operations as contained in AC 91-21, or AC 61-17, if applicable.

(b) Pilots must be appropriately licensed, rated and endorsed on the specific equipment to be used for RNP AR APCH operations, including knowledge of specific organisational standard operating procedures, if applicable.

6. Navigation database:

(a) The operator must identify the responsible manager for the data updating process within their procedures.

(b) The operator must document a process for accepting, verifying and loading navigation data into the aircraft.

(c) The operator must place their documented data process under configuration control.

(d) The operator must validate every RNP AR procedure before flying the procedure in instrument meteorological conditions to ensure compatibility with their aircraft and to ensure the resulting path matches the published procedure.

(e) As a minimum, the operator must:

(i) compare the navigation data for the procedure(s) to be loaded into the RNP system with the published procedure;

(ii) validate the loaded navigation data for the procedure, either in a simulator or in the actual aircraft in visual meteorological conditions;

(iii) ensure that the depicted procedure on the map display is compared to the published procedure;

(iv) ensure that the entire procedure is flown to ensure the path does not have any apparent lateral or vertical path disconnects, and is consistent with the published procedure; and

(v) once the procedure is validated, retain and maintain a copy of the validated navigation data for comparison to subsequent data updates.

(f) Upon receipt of each navigation data update, and before using the navigation data in the aircraft, the operator must compare the update to the validated procedure to identify and resolve any discrepancies in the navigation data.

(g) If there are significant changes affecting the approach path or performance to any portion of a procedure and source data verifies the changes, the operator must validate the amended procedure in accordance with initial data validation.

(h) The operator's supplier must have a Type 2 LOA or an equivalent standard acceptable to the Director, and their respective suppliers must have a Type 1 or 2 LOA or an equivalent standard acceptable to the Director.

(i) The operator must ensure that the navigation database complies with RTCA DO 200A/EUROCAE document ED 76, Standards for Processing Aeronautical Data, or an equivalent standard acceptable to the Director.

(j) The operator must –

(1) report any discrepancies that invalidate an approach procedure to the navigation database supplier;

(2) inform the pilots of the discrepancies;

(3) prohibit the pilots from using the affected procedures; and

(4) conduct periodic checks of the operational navigation databases to ensure that the existing quality system requirements are met.

(j) If an aircraft system required for RNP AR APCH operations is modified, the operator –

(1) must validate the RNP AR APCH procedures using the navigation database and the modified system; and

(2) may perform the validation without any direct evaluation if the manufacturer verifies that the modification has no effect on the navigation database or path computation.

(k) If a verification by the manufacturer referred to in paragraph (j)(2) is not available, the operator must conduct an initial data validation using the modified system noting that flight control computers, FMS OPS and display software changes are critical.

7. Operator to comply with requirements and RNP AR APCH operations be approved by Director

An operator must not carry out RNP AR APCH operations unless –

(1) the operator complies with all the applicable requirements of this notice; and

(2) the Director has approved the RNP AR APCH operations.