

Notice of Requirement NTC 91.263

RNP4 Navigation Specification

Revision 1

Preliminary

The Director of Civil Aviation issues the following requirements (“the requirements”), conditions and restrictions relating to the use of the RNP4 navigation specification under section 28(5) of the Civil Aviation Act 1990 and Civil Aviation Rule 91.263.

Purpose

The purpose of this notice is to specify the requirements for using a RNP4 navigational procedure or route (RNP4 operations), determined by the Director under rule 91.263, in relation to the following:

- i. the application of the RNP4 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 for flight crew members; and
- vii. approval by the Director for RNP4 operations.

Rule 91.263(b) requires compliance with the requirements in this Notice to ensure the safe operation of aircraft using RNP 4 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 rule making 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, 91.263D, 91.263F

Effective Dates

This notice comes into effect on [date that the new rules come into force.]

Issue of CAA Notice

Signed by
Director of Civil Aviation

Date

Revision History

Revision 1	Original version
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RNP4 Navigation Specification

1. Application

These requirements apply to:

- (1) every operator of an aircraft operation carried out under instrument flight rules using a RNP4 navigational procedure or route (RNP 4 operations); and
- (2) every operation in oceanic or remote airspace with little or no ATS surveillance, and no ground-based navigation aid infrastructure; and
- (3) every operation that requires a lateral navigation accuracy full term of TSE (TSE) of 4 nautical miles, which is expected to be achieved at least 95 % of the flight time by the population of aircraft operating within the airspace, route or procedure.

2. Operational Approval Requirements

- (a) Description of aircraft equipment:

The operator must have a configuration list and, if necessary, an MEL detailing the required aircraft equipment for RNP 4 operations.

- (b) Training documentation:

- (1) A commercial operator certificated under Part 119 or Part 129 must have a training programme addressing the operational practices, procedures and training items related to RNP 4 operations (e.g. initial, upgrade or recurrent training for pilots, dispatchers or maintenance personnel).
- (2) A private operator under Part 91 must be familiar with the practices and procedures referred to in section 6 of this notice: “Pilot knowledge and training”.

- (c) Operations Manuals and checklists:

- (1) Operations Manuals (OMs) and checklists for commercial operators must address information/guidance on operational procedures referred to in section 5 of this notice.

- (2) The appropriate manuals should contain navigation operating instructions and contingency procedures, where specified.
 - (3) The operator must submit to the Director their manuals and checklists for review as part of the application process.
- (d) Minimum Equipment List (MEL) considerations:
- (1) Any MEL revisions necessary to address RNP 4 operations must be approved by the Director.
 - (2) Operators must adjust the MEL, or equivalent, and specify the required dispatch conditions.
- (e) Continuing airworthiness:
The operator must submit to the Director –
- (1) the continuing airworthiness instructions applicable to the aircraft's configuration and the aircraft's qualification for RNP4 operations; and
 - (2) their maintenance programme, including a reliability programme for monitoring the equipment.
- (f) Aircraft Requirements:
- (1) For RNP 4 operations in oceanic or remote airspace, at least 2 fully serviceable independent Long Range Navigation Systems (LRNSs), with integrity such that the navigation system does not provide misleading information, must be fitted to the aircraft and form part of the basis upon which RNP4 operational approval is granted.
 - (2) GNSS must be used and can be used as either a stand-alone navigation system or as one of the sensors in a multi-sensor system.
 - (3) The equipment configuration used to demonstrate the required accuracy must be identical to the configuration specified in the MEL or flight manual.
 - (4) The design of the installation must comply with the design

standards that are applicable to the aircraft being modified and changes must be reflected in the flight manual prior to commencing operations requiring an RNP 4 navigation approval.

3. On-board Performance Monitoring and Alerting

(a) Accuracy:

- (1) During operations in airspace or on routes designated as RNP 4, the lateral TSE must be within ± 4 NM for at least 95% of the total flight time.
- (2) The along-track error must also be within ± 4 NM for at least 95% of the total flight time.

(b) Integrity:

Malfunction of the aircraft navigation equipment is classified as a major failure condition under airworthiness regulations (i.e. 1×10^{-5} per hour).

(c) Continuity:

- (1) Loss of function is classified as a major failure condition for oceanic and remote navigation.
- (2) The continuity requirement is satisfied by the carriage of dual independent long-range navigation systems (excluding SIS).

(d) On-board performance and monitoring:

The RNP system, or the RNP system and pilot in combination, shall provide an alert if the accuracy requirement is not met, or if the probability that the lateral TSE exceeds 8 NM is greater than 10^{-5} .

(e) Signal-In-Space:

If using GNSS, the aircraft navigation equipment shall provide an alert if the probability of Signal-In-Space (SIS) errors causing a lateral position error greater than 8 NM exceeds 10^{-7} per hour.

4. Functional Requirements for on-board navigation system

(a) Required functions for on-board navigation system:

The on-board navigation system must have the following functionalities:

- (1) display of navigation data;
 - (2) TF;
 - (3) DF;
 - (4) direct to function;
 - (5) CF;
 - (6) parallel offset;
 - (7) fly-by transition criteria;
 - (8) user interface displays;
 - (9) flight planning path selection;
 - (10) flight planning fix sequencing;
 - (11) user defined CF;
 - (12) path steering;
 - (13) alerting requirements;
 - (14) navigation database access;
 - (15) wgs-84 geodetic reference system; and
 - (16) automatic radio position updating.
- (b) Required functionalities:

- (1) Display of navigation data:

The display of navigation data must use either a lateral deviation display described in paragraph (2) or a navigation map display described in paragraph (3) that meets the following requirements:

- (2) Lateral deviation display:

A non-numeric lateral deviation display (e.g. CDI, EHSI), with a to/from indication and failure annunciation, for use as a primary flight instrument for navigation of the aircraft, for manoeuvre

anticipation, and for failure/status/integrity indication, with the following attributes:

- (i) the display must be visible to the pilot and located in the primary view (± 15 degrees from the pilot's normal line of sight) when looking forward along the flight path;
- (ii) lateral deviation scaling must agree with any alerting and annunciation limits, if implemented;
- (iii) lateral deviation display must be automatically slaved to the RNAV computed path. The lateral deviation display also must have full-scale deflection suitable for the current phase of flight and must be based on the required track-keeping accuracy. The course selector of the lateral deviation display should be automatically slewed to the RNAV computed path, or the pilot must adjust the CDI or HIS selected course to the computed desired track;

Note.— The normal function of stand-alone GNSS equipment meets this requirement.

- (iv) display scaling may be set automatically by default logic or set to a value obtained from the navigation database. The full-scale deflection value must be known or must be available to the pilot and must be commensurate with en-route, terminal or approach phase values;

(3) Navigation map display:

A navigation map display, readily visible to the pilot, with appropriate map scales (scaling may be set manually by the pilot), and giving equivalent functionality to a lateral deviation display.

(4) Parallel offset:

- (i) The system must have the capability to fly parallel tracks at a selected offset distance.

- (ii) When executing a parallel offset, the navigation accuracy and all performance requirements of the original route in the active flight plan must be applicable to the offset route.
 - (iii) The system must provide for entry of offset distances in increments of 1 NM, left or right of course.
 - (iv) The system must be capable of offsets of at least 20 NM. When in use, system offset mode operation must be clearly indicated to the pilot.
 - (v) When in offset mode, the system must provide reference parameters (e.g. cross-track deviation, distance-to-go, time-to-go) relative to the offset path and offset reference points. An offset must not be propagated through route discontinuities, unreasonable path geometries, or beyond the IAF.
 - (vi) Annunciation must be given to the pilot prior to the end of the offset path, with sufficient time to return to the original path.
 - (vii) Once a parallel offset is activated, the offset must remain active for all flight plan route segments until removed automatically, until the pilot enters a direct-to routing, or until pilot (manual) cancellation.
 - (viii) The parallel offset function must be available for en-route TF and the geodesic portion of DF leg types.
- (5) Fly-by transition criteria:
- (i) The navigation system must be capable of accomplishing fly-by transitions. No predictable and repeatable path is specified because the optimum path varies with airspeed and bank angle. However, boundaries of the transition area are defined.

- (ii) PDE is defined as the difference between the defined path and the theoretical transition area. If the path lies within the transition area, there is no PDE.
- (iii) Fly-by transitions must be the default transition when the transition type is not specified. The theoretical transition area requirements are applicable for the following assumptions.
- (iv) Course changes do not exceed 120° for low altitude transitions (aircraft barometric altitude is less than FL 195).
- (v) Course changes do not exceed 70° for high altitude transitions (aircraft barometric altitude is equal to or greater than FL 195).

(6) User interface displays:

General user interface display features must clearly present information, provide situational awareness, and be designed and implemented to accommodate human factors considerations. Essential design considerations include:

- (i) minimizing reliance on pilot memory for any system operating procedure or task;
- (ii) developing a clear and unambiguous display of system modes/sub-modes and navigational data with emphasis on enhanced situational awareness requirements for any automatic mode changes, if provided;
- (iii) the use of context-sensitive help capability and error messages (e.g. invalid input or invalid data entry messages should provide a simple means to determine how to enter “valid” data);
- (iv) fault-tolerant data entry methods rather than rigid rule-based concepts;
- (v) placing particular emphasis on the number of steps and minimizing the time required to accomplish

flight plan modifications to accommodate ATS clearances, holding procedures, runway and instrument approach changes, missed approaches and diversions to alternate destinations; and

- (vi) minimizing the number of nuisance alerts so the pilot will recognize and react appropriately, when required.

(7) Displays and controls:

- (i) Each display element used as a primary flight instrument in the guidance and control of the aircraft, for manoeuvre anticipation, or for failure/status/integrity annunciation, must be located where it is clearly visible to the pilot (in the pilot's primary field of view) with the least practicable deviation from the pilot's normal position and line of vision when looking forward along the flight path.
- (ii) For those aircraft meeting the requirements of FAR/CS/JAR 25, compliance with the provisions of certification documents, such as AC 25-11, AMJ 25-11 and other applicable documents, should be met.
- (iii) All system displays, controls and annunciations must be readable under normal cockpit conditions and expected ambient light conditions.
- (iv) Night lighting provisions must be compatible with other cockpit lighting.
- (v) All displays and controls must be arranged to facilitate pilot accessibility and usage.
- (vi) Controls that are normally adjusted in flight must be readily accessible with standardized labelling as to their function. System controls and displays must be designed to maximize operational suitability and minimize pilot workload.

- (vii) Controls intended for use during flight must be designed to minimize errors, and when operated in all possible combinations and sequences, must not result in a condition that would be detrimental to the continued performance of the system.
 - (viii) System controls must be arranged to provide adequate protection against inadvertent system shutdown.
- (8) Flight planning path selection:
- (i) The navigation system must provide the crew the capability to create, review and activate a flight plan.
 - (ii) The system must provide the capability for modification (e.g. deletion and addition of fixes and creation of along-track fixes), review and user acceptance of changes to the flight plans.
 - (iii) When the capability for modification is exercised, guidance output must not be affected until the modification(s) is activated.
 - (iv) Activation of any flight plan modification requires the pilot to transition to the new flight planned route as soon as the modification has been loaded and verified.

- (9) Flight planning fix sequencing:

The navigation system must provide the capability for automatic sequencing of fixes.

- (10) User-defined CF:

The navigation system must provide the capability to define a user-defined course to a fix. The pilot must be able to intercept the user-defined course.

- (11) FTE:

- (i) The system must provide data to enable the generation of command signals for autopilot/flight director/CDI, as applicable.
 - (ii) In all cases, an FTE must be defined at the time of certification, which will meet the requirements of the desired RNP operation in combination with the other system errors.
 - (iii) During the certification process, the ability of the crew to operate the aircraft within the specified FTE must be demonstrated.
 - (iv) Aircraft type, operating envelope, displays, autopilot performance, and leg transitioning guidance (specifically between arc legs) should be accounted for in the demonstration of FTE compliance.
 - (v) A measured value of FTE may be used to monitor system compliance to RNP requirements. For operation on all leg types, this value must be the distance to the defined path.
 - (vi) For cross-track containment compliance, any inaccuracies in the cross-track error computation (e.g. resolution) must be accounted for in the TSE.
- (12) Alerting requirements:
- (i) The system must also provide an annunciation if the manually entered navigation accuracy is larger than the navigation accuracy associated with the current airspace as defined in the navigation database.
 - (ii) Any subsequent reduction of the navigation accuracy must reinstate this annunciation.
 - (iii) When approaching RNP airspace from non-RNP airspace, alerting must be enabled when the cross-track to the desired path is equal to or less than one-half the navigation accuracy and the aircraft has passed the first fix in the RNP airspace.

- (13) Navigation database access:
- (i) The navigation database must provide access to navigation information in support of the navigation systems reference and flight planning features.
 - (ii) Manual modification of the data in the navigation database must not be possible. This requirement does not preclude the storage of “user-defined data” within the equipment (e.g. for flex-track routes).
 - (iii) When data are recalled from storage they must also be retained in storage. The system must provide a means to identify the navigation database version and valid operating period.
- (14) Geodetic reference system:
- (i) The World Geodetic System — 1984 (WGS-84) or an equivalent Earth reference model must be the reference Earth model for error determination.
 - (ii) If WGS-84 is not employed, any differences between the selected Earth model and the WGS-84 Earth model must be included as part of the PDE. Errors induced by data resolution must also be considered.
- (15) Contingency navigation systems:

For commercial operations conducted under a Part 119 or 129 air operator certificate, the aircraft must be equipped with at least one independent alternative navigation system appropriate to allow continued safe navigation on the route being flown.

5. Operating Procedures:

- (a) Requirements for pre-flight planning:
- (1) Operators should use the appropriate ICAO flight plan designation specified for the RNP route.
 - (2) The letter “R” should be placed in block 10 of the ICAO flight plan to indicate the pilot has reviewed the planned

route of flight and determined the RNP requirements and the aircraft and operator approval for RNP routes.

- (3) Additional information should be displayed in the remarks section indicating the accuracy capability, such as RNP 4 versus RNP 10.
- (4) CPDLC and ADS-C systems are required when the separation standard is 30 NM lateral and/or longitudinal.
- (5) The on-board navigation data must be current and include appropriate procedures.

(b) Pilot requirements:

The pilot must:

- (1) review maintenance logs and forms to ascertain the condition of the equipment required for flight in RNP 4 airspace or on routes requiring RNP 4 navigation capability;
- (2) ensure that maintenance action has been taken to correct defects in the required equipment;
- (3) be familiar with the contingency procedures for operations in RNP 4 airspace or on routes requiring an RNP 4 navigation capability; and
- (4) be able to recognise, and advise ATC, when the aircraft is no longer able to navigate to its RNP 4 navigational capability.

(c) Availability of GNSS:

At dispatch or during flight planning, the operator must ensure that adequate navigation capability is available en-route to enable the aircraft to navigate to RNP 4 procedures and to include the availability of FDE, if appropriate for the operation.

(d) En route:

- (1) At least 2 LRNSs, capable of navigating to RNP 4, and listed in the flight manual, must be operational at the entry point of the RNP airspace.
- (2) If an item of equipment required for RNP 4 operations is unserviceable, then the pilot should consider an alternate route or diversion for repairs.
- (3) In flight operating procedures must include mandatory cross-checking procedures to identify navigation errors in sufficient time to prevent inadvertent deviation from ATC-cleared routes.
- (4) Pilot-in-command must ensure that ATC is advised of any deterioration or failure of the navigation equipment that cause navigation performance to fall below the required level, and/or any deviations required for a contingency procedure.
- (5) Pilots should use a lateral deviation indicator, flight director, or autopilot in lateral navigation mode on RNP 4 operations.
- (6) Pilots may use a navigation map display with equivalent functionality to a lateral deviation indicator referred to in section 4(b)(3) of this notice.
- (7) Pilots of aircraft with a lateral deviation indicator must ensure that the lateral deviation indicator scaling (full-scale deflection) is suitable for the navigation accuracy associated with the route (i.e. ± 4 NM or less).
- (8) All pilots are expected to maintain route centre lines, as depicted by on-board lateral deviation indicators and/or flight guidance during all RNP operations described in this notice unless authorized to deviate by ATC or under emergency conditions.
- (9) For normal operations, cross-track error/deviation (the difference between the RNAV system computed path and the aircraft position relative to the path) should be limited

to $\pm\frac{1}{2}$ the navigation accuracy associated with the route (i.e. 2 NM).

- (10) Brief deviations from this standard (e.g. overshoots or undershoots) during and immediately after route turns, up to a maximum of one-times the navigation accuracy (i.e. 4 NM), are allowable.

6. Pilot knowledge and training

- (1) Operators must ensure that pilots are trained and have appropriate knowledge of the topics contained in AC 61-17, the limits of their RNP 4 navigation capabilities, the effects of updating, and RNP 4 contingency procedures.
- (2) Pilots must be appropriately licensed, rated and endorsed on the specific equipment to be used for RNP4 operations, including knowledge of specific organisational standard operating procedures.

7. Navigation database

- (1) The navigation database must be obtained from a supplier that complies with RTCA DO 200A/EUROCAE document ED 76, Standards for Processing Aeronautical Data.
- (2) Discrepancies that invalidate the RNP4 route must be reported to the navigation database supplier and the affected route must be prohibited by an operator's notice to its pilots.
- (3) Aircraft operators must conduct periodic checks of the operational navigation databases in order to meet existing quality system requirements.

8. RNP4 operations must be approved by Director

A person must not carry out RNP4 operations unless –

- (1) the person meets all the applicable requirements of this notice; and
- (2) the operations are approved by the Director.