

Advisory Circular

OPERATIONAL APPROVAL FOR REQUIRED NAVIGATION PERFORMANCE RNP-4

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GENERAL

Advisory Circulars (ACs) are issued by the Director-General of Civil Aviation (DGCA) from time to time to provide practical guidance or certainty in respect of the statutory requirements for aviation safety. ACs contain information about standards, practices and procedures acceptable to CAAS. An AC may be used, in accordance with section 3C of the Air Navigation Act (Cap. 6) (ANA), to demonstrate compliance with a statutory requirement. The revision number of the AC is indicated in parenthesis in the suffix of the AC number.

PURPOSE

This AC provides guidance to demonstrate compliance with the requirements regarding, and information related to an application for, an approval or specified navigation performance operations in accordance with ANR-98.

APPLICABILITY

This AC is applicable for the operator seeking approval for RNP-4 operations.

RELATED REGULATIONS

This AC relates specifically to Division 2 in Part 2 of ANR-98.

RELATED ADVISORY CIRCULARS

- AC 98-1-1 Application for an Approval to Conduct a Special Operation

CANCELLATION

This AC supersedes AC AOC-25.

EFFECTIVE DATE

This AC is effective from 1 October 2018.

OTHER REFERENCES

- ICAO Annex 11 Air Traffic Services
- ICAO Doc 4444 Procedures for Air Navigation Services – Air Traffic Management
- ICAO Doc 7030 Regional Supplementary Procedures
- FAA AC 20-138D Airworthiness approval of positioning and navigation systems
- FAA TSO C115B Airborne area navigation equipment using multi-sensor inputs

1 INTRODUCTION

RNP-4 was developed for operations in oceanic and remote airspace, independent of ground based navigation aids; The primary navigation sensor to support RNP-4 is GNSS either as stand-alone navigation system or as part of a multi-sensor system.

2 COMMUNICATION, SURVEILLANCE AND SEPARATION REQUIREMENT

- 2.1 Subject to Regional Supplementary Procedures (Doc 7030) and State AIP, RNP-4 separation requirement may scale down to 30/30 (lateral/longitudinal) provided CPDLC and ADS-C with the appropriate update rate in the complete CNS solution.
- 2.2 This AC addresses only the navigation requirements associated with RNP-4. For information on separation minima including communication and surveillance requirements, refer to ICAO Annex 11 Chapter 3 and ICAO PANS-ATM Doc 4444 Chapter 5.4.

3 OPERATIONAL REQUIREMENTS

- 3.1 To meet RNP-4 requirements, the aircraft should maintain track-keeping accuracy of ± 4 NM for 95% of flight time and for RNP specification, the functionality has to include monitoring and alerting system.
- 3.2 A summary of RNP-4 requirements is as follows:
 - (a) Two LRNS (long range navigation systems)
 - (b) At least one GNSS receiver
 - (c) Navigation database
 - (d) Navigation displays in the pilot's FOV must be sufficient to permit track following and manoeuvring
 - (e) Maximum permitted cross-track error/deviation is 2 NM

4 GNSS

- 4.1 GNSS is fundamental to the RNP-4 navigation specification, and its carriage precludes any need for operating time limitation. The loss of GNSS navigation though remote, needs to be considered and here are a number of requirements in the navigation specification to address this situation:
 - (a) A fault detection and exclusion (FDE) function needs be installed even though the probability that a fault may be detected en-route is remote. As this function is not standard on TSO C129a receivers, a modification is required for oceanic operations.
 - (b) With FDE fitted, integrity monitoring is available provided there are sufficient satellites of a suitable configuration in view. Some reduction in availability and integrity of positioning service may result in requirement for additional satellites. As the alerting requirements for RNP 4 are robust, it is highly improbable that this service will not be available.

- 4.2 RNP-4 operation supported by a multi-sensor system does not require dispatch prediction of the availability of integrity monitoring (with FDE). The multi-sensor system integrates GNSS and IRS signals and will revert to IRS in the remote possibility that GNSS is unavailable.
- 4.3 Other methods of integrity monitoring include proprietary hybrid GNSS/IRS monitoring systems which provide high level of navigation with integrity need no GNSS availability prediction.

5 FUNCTIONALITY

- 5.1 Aircraft equipped with flight management systems (FMS) normally comply with required functionalities for RNP-4 operations except for provision of a non-numeric lateral deviation display system. For this category deviation is not normally displayed on a CDI or HSI but is commonly available on a map display, usually with numeric indication of cross-track error in 1/10th NM and in some cases the display is not within the FOV e.g. CDU.
- 5.2 Aircraft equipped with stand-alone GNSS navigation systems should provide track guidance via a CDI or HSI. The CDI/HSI should be coupled to the RNAV route providing a direct indication of lateral position reference to the flight planned track. This type of unit in en-route mode (normal outside 30NM from departure and destination airports) defaults to a CDI/HIS full-scale display of 5 NM, which is adequate for RNP-4. A lateral deviation display is often incorporated in the unit, and may be suitable if of sufficient size and position to allow either pilot to manoeuvre and monitor cross-track deviation.
- 5.3 Other functionalities required for RNP-4:
 - (a) Display of nav-data
 - (b) Track to fix (TF) path terminator
 - (c) Direct to track (DF)
 - (d) Direct to waypoint function
 - (e) Course to fix (CF)
 - (f) Parallel offset
 - (g) Fly-by transition criteria
 - (h) User interface displays
 - (i) Flight planning path selection
 - (j) Flight planning fix sequencing
 - (k) User course to fix
 - (l) Path steering
 - (m) Alerting requirement
 - (n) Nav-database access
 - (o) WGS-84 geodetic reference system
 - (p) Automatic radio position update

6 SUPPORTING DOCUMENTATION

- 6.1 The operator should provide relevant documentation to attest the capability of the aircraft equipment to support RNP operations. The following documentation in Table 1 should be provided to the CAAS for assessment.

Table 1 Supporting documentation for various aircraft equipment

Equipment	Supporting documentation
Aircraft with formal approval of RNP integration accounting for oceanic and remote area operations.	Documentation attesting to RNP-4 airworthiness compliance, such as AFM, STC or manufacturer's documentation (eg. service letter).
Aircraft with GNSS as primary LRNS	AFM or airworthiness documentation attesting that the GNSS installation meets requirements for oceanic and remote operations
Aircraft with multi-sensor system integrating GPS with RAIM and FDE	Documentation attesting that: <ul style="list-style-type: none">• FAA AC 20-138D is adhered to; or• AAIM function is incorporated in accordance with TSO C115B.

7 OPERATION PROCEDURES

- 7.1 The operator should develop standard operating procedures for RNP 4 operations over oceanic and remote routes based on the guidance in this AC as well as documents listed in paragraph 6 above.
- 7.2 The essential elements to be incorporated in the operator's procedures are:
- (a) The aircraft is serviceable for RNP 4 operations
 - (b) The RNP 4 capability is indicated on the flight plan
 - (c) En-route loss of capability is identified and reported
 - (d) Procedures for alternative navigation are described
- 7.3 GNSS based operations require the prediction of FDE availability. GNSS service prediction programs are generally based on prediction at a destination and not over a route or a large area. In view that the probability of the constellation unable to support FDE for RNP-4 operations is remote, the operator may satisfy this requirement by either a general route analysis or a dispatch prediction of satellite availability.

8 PILOT KNOWLEDGE AND TRAINING.

The operator holding RNAV operational approval will need to familiarise with the monitoring and alerting functionality of RNP operations and to ensure that flight crew are familiar with the principles and operations of GNSS.