

**APPLICATION FOR AREA NAVIGATION (RNAV) 2 & 1**

**INSTRUCTIONS**

1. The applicant will tick (√) the appropriate yes/no boxes and as applicable insert references from the AFM or Ops Manual with sample pages attached as appendix.

2. Applicant must obtain and submit manufacturer’s written confirmation with regard to continuing maintenance.

3. Operating policy and procedures, training syllabus and lesson plan must be submitted for approval before commencement of flight crew / dispatcher training.

**PARTICULARS**

**Operator : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_AOC No:\_\_\_\_\_\_\_\_\_\_\_ Rep’s Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Position:\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| Aircraft manufacturer,Model and series | Serial number | Registration  | No. of INS / IRS / IRU manufacturer and model | No. of GNSS manufacturer and model | No. of FMS / FMGC manufacturer and model | No. of DMEMake and model. | TSO specof DME |
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| **AC 98-2-4** | **Title of Paragraph** | **Applicant’s Compliance Reference** | **CAAS Use** |
| **4**4.1 □yes □no4.2 □yes □no4.3 □yes □no 4.4 □yes □no**4.5** □yes □no | **AIRWORTHINESS REQUIREMENTS****AIRCRAFT ELIGIBILITY**Aircraft with AFM, STC or manufacturer’s documentation, such as service letters, attesting to RNAV 1 and 2 airworthiness compliance are acceptable by the Authority. For preparation of application for RNAV 1 and 2 operational approval the operator may wish to refer to the following best practice documents:(a) ICAO PBN Manual Document 9613 AN/937(b) EASA/JAA TGL 10 (Rev 1)(c) FAA AC 90-100AOperators holding operational approvals for P-RNAV only under TGL 10 may fly in any State where the routes are predicated on TGL 10. To operate RNAV 1 and 2 the operator must submit application for RNAV 1 and 2 operational approval with evidence of compliance against the differences between TGL 10 and the criteria of RNAV 1 and 2 using Table II-B-3-1 of Volume II of ICAO PBN manual. Operators holding operational approvals for US-RNAV only under FAA AC 90-100 may fly in any State where the routes are predicated on AC 90-100. To operate RNAV 1and 2 the operator must submit application for RNAV 1 and 2 operational approval with evidence of compliance against the differences between AC 90-100 and the criteria of RNAV 1 and 2 using Table II-B-3-1 of Volume II of ICAO PBN manual.Operators holding RNAV 1 and 2 operational approvals are eligible to operate on US-RNAV Type A and Type B and European PRNAV route with no further approval requirements.  |  |  |
| **3**3.1 □yes □no3.2 □yes □no3.3 □yes □no | **FUNCTIONALITY**FMS equipped transport aircraft normally comply with required functionalities for RNAV 1 and 2 operations except for provision of a non-numeric lateral deviation display system. These aircraft are normally provided with numeric indication of cross-track error in 1/10th nm and some cases not within the FOV e.g. CDU. For these aircraft lateral track-keeping accuracy may be maintained by the use of autopilot or flight director system. Aircraft installed with stand-alone GNSS navigation systems should provide track guidance via a CDI or HSI as the unit display is not of sufficient size or suitable position to allow either pilot to adequately maintain cross-track deviation.For stand-alone GNSS systems the operating procedures and training should include limitations in respect of ARINC 424 path terminators which involve an altitude termination. Due to lack of integration of the lateral navigation system and altimetry system, pilot intervention is required.  |  |  |
| **5**5.1 □yes □no5.2 □yes □no5.3 □yes □no5.4 □yes □no | **NAVIGATION DATABASE INTEGRITY**The navigation database integrity must comply with RTCA DO-200A / EUROCAE ED-76 standards. The operator must ensure that the navigation database supplier or vendor to the operator hold valid Type LOA (Letter of Approval) issued in accordance with FAA AC 90–153 or EASA IR 21(G) / EASA Nr 01/2005.The operator should also conduct additional navdata check of any new or changed procedures in particular when operating into hilly areas. Any significant errors must be reported to the database supplier and flight crew must be informed immediately to suspend use of the affected procedures until integrity checks are satisfactorily completed. Notwithstanding paragraph 11.1 above, the operator shall assume sole responsibility for the safety of the operation.  |  |  |
|  □yes □no | **CONTINUING AIRWORTHINESS**Maintenance programme reference  |  |  |
| **2**2.1 □yes □no2.2 □yes □no2.3 □yes □no | **OPERATIONAL REQUIREMENTS**To meet RNAV 1 and RNAV 2 requirements, the aircraft must maintain track-keeping accuracy for 95% of flight time of ±1 nm and ±2 nm respectively. A summary of RNAV 1 and 2 requirements is as follows:(a) Only one RNAV system (b) The RNAV system may be based on (1) DME/DME(2) DME/DME/IRU(3) GNSS (including GNSS/IRU)(c) Navigation database complying with RTCA DO-200A / EUROCAE ED-76(d) Navigation display in pilot’s FOV (field of view) must be sufficient for track following and manoeuvring(e) Maximum permitted cross-track error/deviation is (½ navigation accuracy)(1) 0.5 nm for RNAV 1(2) 1.0 nm for RNAV 2(f) An indication for RNAV system failure is required*Note 1: Refer FAA AC90-100A Compliance Table for use of DME/DME and DME/DME/IRU.* *Note 2: Must have procedure to inhibit NOTAMed DME*GNSS certified under ETSO C129(A)/FAA TSO C129(A), or later, meets requirements for RNAV 1 and 2. Stand-alone ETSO C129/FAA TSO C129 GNSS receivers are acceptable provided they include pseudo-range step detection and health word checking functions. For GNSS-based operations, GNSS availability prediction is required for the route. *Note: PBN manual makes reference to potential need to deselect navigation sensors due to possibility of position error caused by integration of GNSS data and other position data. This method of updating is commonly associated with IRS/GNSS systems and the weighting given to radio updating is such that any potential erosion of accuracy is unlikely to be insignificant in proportion to RNAV 1 and 2 navigation accuracy.* |  |  |
| **6**  □yes □no6.1 □yes □no6.2 □yes □no6.3 □yes □no6.4 □yes □no |  **OPERATING PROCEDURES**Operators with RNAV experience generally meet the basic requirements. The operating procedures shall focus RNAV SIDs and STARS.Pre-flight checks for the pilot should include the following:(a) Appropriate notation in the ATS flight plan (b) NavDatabase identity and is current for the duration of flight(c) Nav-sensors NOTAM: GNSS RAIM prediction and critical DME(d) Cross-check flight against nav-system textual and map displays for discrepancy (e) Contingency procedures for loss of navigation or communications capability.Prior to commencing the take-off, the pilot must ensure that the RNAV system is available. The following are conditions for engagement of RNAV:(a) Aircraft with DME/DME but no GPS or IRU must take off in heading mode until entering adequate DME coverage.(b) Aircraft with DME/DME/IRU but no GPS can engage RNAV but should confirm nav-position versus the take off point is within 300 m (1000 ft).(c) Aircraft using GNSS only must acquire GNSS signal prior to take off.*Note: Pilots must be mindful of and ensure any last minute changes of runway or SID are properly updated in the navigation system.*In-flight procedures should include:(a) where possible, check of flight navigation data using ground aids; (b) as a minimum, arrival checks using suitable of map display; and(c) review of conventional procedures for possible reversion.  |  |  |
| **Doc 9613** □yes □no | **OPERATIONS MANUAL****Flight Planning*** Verify RNAV 5 Operational Approval.
* Confirm adequacy of normal and contingency procedures.

**Pre-flight procedures*** Verify flight plan entry.
* Verify navdata for validity and currency
* Verify Navaid infrastructure and if GNSS fault detection (5minutes).l

**En-route ABAS**Check RAIM.**General operating procedures****Contingency procedures.** |  |  |
| **7**  □yes □no7.1 □yes □no7.2 □yes □no7.3 □yes □no7.4 □yes □no | **PILOT KNOWLEDGE AND TRAINING** The operator should ensure that the flight crew members are familiar with RNAV concept and operations, SIDs and STARs as well as the functionality of the equipage and its use. Particular attention should be placed on: (a) ability of the equipment to fly designed flight path and pilot intervention due to limitations in equipment functionality;(b) managing of changes (procedure, runway, track);(c) route modification (insertion/deletion of waypoints, direct to waypoint); and(d) route interception, radar vectors.Where GNSS is used, flight crews should be trained in GNSS principles related to en-route navigation. Training for RNAV 1 and 2 can be conduct by classroom briefing, computer based training, followed by flight simulator exercises. For stand-alone GNSS operations, computer based simulator programs are available from GPS manufacturers who will provide a convenient method for familiarity with programming and operation of stand-alone GNSS systems. *Note: Should VNAV be used for SIDs and STARs, the flight crew should pay attention to the management of VNAV specifically the potential for altitude constraints to be compromised in cases where the lateral flight path is changed or intercepted.* |  |  |
| □yes □no | **MEL** Minimum equipment list showing LRNS provisions |  |  |
| □yes □no | **HMI** Human / Machine Interface review. |  |  |
| □yes □no | **QSRA** Qualitative Safety Risk Assessment |  |  |

**“Warning: Notice is given that the operator shall accept full responsibility for all information given in this application form. Any attempt to provide false information will result in rejection of the application and, if already granted, the withdrawal of the Operational Approval. In addition, the operator may render himself liable to prosecution under section 29C(1)(b) of the Air Navigation Act.”**

    “I declare to the best of my knowledge and belief that the statements made and the information supplied in this form are complete and correct.  I understand that any false representations made by me for the purpose of procuring the Singapore aviation safety instrument is an offence under section 29C(1)(b) of the Air Navigation Act and I may be subject to the penalties stipulated thereunder and any Singapore aviation safety instrument granted pursuant to the application will be revoked.”

**Signature / Name of person representing the operator:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Signature / Name of FS Officer accepting this form:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| Revision History |
| Version | Date | Paragraph(s) | Details |
| 1.0 | 01 October 2015 | Various | Minor editorial |
| 2.0 | 31 July 2019 | Various | Change in References |

**REFERENCES**

Regulatory: (1) ANR-98

Compliance: (1) CAAS AC 98-2-4 (2) ICAO Doc 9613 (3) EASA/JAA TGL 10 Rev 1 (4) FAA AC 90-100A