



SAM/IG/5  
WP/05  
19/04/10

**International Civil Aviation Organization  
South American Regional Office**

**FIFTH WORKSHOP/MEETING OF THE SAM IMPLEMENTATION GROUP (SAM/IG/5)  
REGIONAL PROJECT RLA/06/901**

**Lima, Peru, 10 - 14 May 2010**

**Agenda Item 4: Standards and procedures for the approval of performance-based navigation operations**

**Progress made within Project RLA/99/901 in terms of performance-based navigation**

(Presented by the SRVSOP Technical Committee)

**Summary**

This working paper presents:

- ✓ Draft advisory circular (CA) 91-004 and its work aid concerning RNP 4 approval of aircraft and operators.

It also presents the following revisions to PBN approval documents, in which the opportunities for improvement identified at the RNAV approval course held in Lima, Peru, on 22-26 March 2010 have been added:

- ✓ The second revision to CA 91-002 and its work aid concerning RNAV 5 approval of aircraft and operators; and
- ✓ The first revision to RNAV 10 (RNP 10), RNAV 1, and RNAV 2 work aids.

**References:**

- Regional Project RLA/06/901
- Regional Project RLA/99/901
- SAM/IG/4 meeting report

**1 Background**

1.1 At the Second Workshop/Meeting of the SAM Implementation Group (SAM/IG/2) (Lima, Peru, 3-7 November 2008), the meeting took note of the work programme presented by the Technical

Committee (TC) of the Latin American Regional Safety Oversight Cooperation System (SRVSOP) for the development of PBN advisory circulars, and of the contents of AC 91-002 concerning RNAV 5 approval of aircraft and operators.

1.2 In this respect, the meeting considered that the work programme and guidance material presented by the SRVSOP TC were appropriate for regional requirements, and thus approved the aforementioned development of the work programme and the contents of the guidance material.

1.3 At the third workshop/meeting of the SAM Implementation Group (SAM/IG/3) (Lima, Peru, 20-24 April 2009), the meeting was informed about the development of ACs on the approval of aircraft and operators for RNP APCH, RNP AR APCH and APV/baro-VNAV operations. In this respect, the meeting approved them with minor modifications.

1.4 At the fourth workshop/meeting of the SAM Implementation Group (SAM/IG/4) (Lima, Peru, 19-23 October 2009), the meeting was informed about the development of ACs concerning the approval of aircraft and operators for RNAV 10 (designated and authorised as RNP 10), RNAV 1/RNAV 2 and basic RNP 1 operations. In this regard, the meeting agreed to approve the aforementioned ACs, inserting in all of them a new section on continuing airworthiness. The meeting also agreed to include that new section (continuing airworthiness) in all the ACs previously approved by the SAM/IG/2 and SAM/IG/3 meetings.

## **2 Discussion**

2.1 Continuing with the work programme approved for PBN implementation, the SRVSOP TC developed the following AC for submission to the SAM/IG/5 meeting:

- ✓ AC 91-004 – Approval of aircraft and operators for RNP 4 operations.

2.2 *AC 91-004 - Approval of aircraft and operators for RNP 4 operations* defines the criteria for RNP 4 approval of aircraft and operators in oceanic or remote airspace with 30-NM lateral and longitudinal separation minima. The implementation of the 30-NM lateral and longitudinal separation minima in oceanic or remote airspaces with RNP 4 will benefit operators in terms of a larger number of optimum routes, reduced delays, increased flexibility, and reduced costs without sacrificing safety. ATS providers will derive benefits from the efficient use of airspace and increased air traffic flow.

2.3 The implementation of RNP 4 operations in the SAM Region requires the participation of all States and the harmonisation of requirements and procedures for this type of operation.

2.4 Before authorising RNP 4 operations, States shall include requirements concerning this navigation specification in their national regulations and develop related procedures for the approval of aircraft and operators.

2.5 During the aircraft and operator RNAV approval course held in Lima, Peru, on 22-26 March of this year, the participants identified opportunities for improvement of AC 91-002 - Approval of aircraft and operators for RNAV 5 operations, and of RNAV 10 (RNP 10), RNAV 5 and RNAV 1/RNAV 2 work aids. Consequently, the SRVSOP TC amended the aforementioned documents.

2.6 The following attachments, with their related documents, are presented to the meeting:

- ✓ Attachment A: CA 91-004 – Approval of aircraft and operators for RNP 4 operations.
- ✓ Attachment B: RNP 4 Work Aid.
- ✓ Attachment C: Revision of AC 91-002 - Approval of aircraft and operators for RNAV 5 operations.
- ✓ Attachment D: Revision of RNAV 10 (RNP 10) Work Aid.
- ✓ Attachment E: Revision of RNAV 5 Work Aid.
- ✓ Attachment F: Revision of RNAV 1 and RNAV 2 Work Aid.

2.7 In the revised documents, the text of the amendment is shown in such a way that the text to be deleted is crossed out and the new text is shaded, as illustrated below:

- |  |                                      |
|--|--------------------------------------|
| 1. <del>The text to be deleted is crossed out</del>  | Text to be deleted                   |
| 2. <b>The new text to be inserted is shaded</b>  | New text to be inserted              |
| 3. <del>The text to be deleted appears crossed out</del> <b>followed</b><br>by the new shaded text | New text to replace the existing one |

### 3 Suggested action

3.1 The Meeting is invited to:

- a) Take note of the information provided in this working paper and its attachments; and
- b) Review, modify as necessary, and approve the original text of AC 91-004 and its work aid, as well as the revisions of AC 91-002 and RNAV 10 (RNP 10), RNAV 5, RNAV 1 and RNAV 2 work aids.

\* \* \* \* \*

**APPENDIX A**

**ADVISORY CIRCULAR**

|           |   |          |
|-----------|---|----------|
| AC        | : | 91-004   |
| DATE      | : | 01/06/10 |
| REVISION  | : | Original |
| ISSUED BY | : | SRVSOP   |

**SUBJECT: AIRCRAFT AND OPERATOR APPROVAL FOR RNP 4 OPERATIONS**

## ADVISORY CIRCULAR

AC : 91-004  
DATE : 01/06/10  
REVISION : Original  
ISSUED BY : SRVSOP

### SUBJECT: AIRCRAFT AND OPERATOR APPROVAL FOR RNP 4 OPERATIONS

#### 1. PURPOSE

This Advisory Circular (AC) establishes the requirements for the approval of aircraft and operators to conduct RNP 4 operations in oceanic or remote airspace.

An operator may use alternate means of compliance, provided those means are acceptable to the Civil Aviation Administration (CAA).

The future tense of the verb or the term "shall" apply to operators who choose to meet the criteria set forth in this AC.

#### 2. RELEVANT SECTIONS OF THE LATIN AMERICAN AERONAUTICAL REGULATIONS (LAR) OR EQUIVALENT

LAR 91: Sections 91.1015 and 91.1640 or equivalents

LAR 121: Section 121.995 (b) or equivalent

LAR 135: Section 135.565 (c) or equivalent

#### 3. RELATED DOCUMENTS

|                   |   |
|-------------------|---|
| Annex 2           | Rules of the air  |
| Annex 6           | Operation of aircraft   |
| Annex 11          | Air traffic services  |
| Annex 15          | Aeronautical information services   |
| ICAO Doc 9613     | Manual on performance-based navigation (PBN)  |
| ICAO Doc 4444     | Procedures for air navigation services – Air traffic management (PANS-ATM)  |
| ICAO Doc 7030     | Regional Supplementary Procedures   |
| ICAO Doc 8168     | Procedures for air navigation services - Aircraft operations (PANS-OPS): Volume II – Parts I and III                    |
| FAA Order 8400.33 | Procedures for obtaining authorization for required navigation performance 4 (RNP-4) oceanic and remote area operations |

#### 4. DEFINITIONS AND ABBREVIATIONS

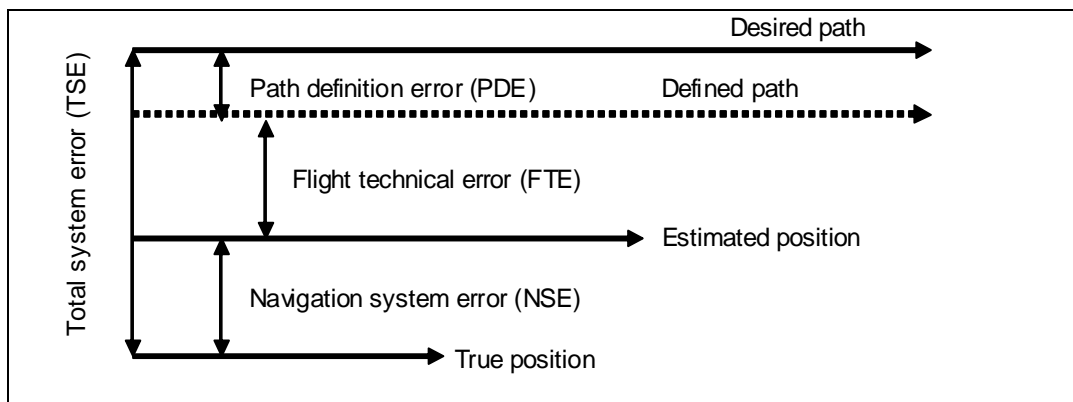
##### 4.1 Definitions

- a) **Controller-pilot data link communications (CPDLC).**- A means of communication between controller and pilot, using data link for air traffic control (ATC) communications.

- b) **Track.-** The projection on the earth's surface of the path of an aircraft, the direction of which path at any point is usually expressed in degrees from North (true, magnetic or grid).
- c) **Fault detection and exclusion (FDE).-** A function performed by some on-board GNSS receiver that can detect the signal of a faulty satellite, and exclude it from the position estimation. At least one satellite needs to be available (6 satellites) in addition to the number required in order to have the receiver autonomous integrity monitoring (RAIM) function.
- d) **Path definition error (PDE).-** The difference between the defined path and the desired path at a given place and time.
- e) **Navigation system error (NSE).-** The difference between the true position and the estimated position.
- f) **Flight technical error (FTE).-** The accuracy with which an aircraft is controlled as measured by the indicated aircraft position with respect to the indicated command or desired position. It does not include blunder errors.
- a) **Total system error (TSE).-** The difference between the true position and the desired position. This error is equal to the sum of the vectors of the path definition error (PDE), the flight technical error (FTE), and the navigation system error (NSE).

*Note.- On occasions, the FTE is known as path steering error (PSE), and the NSE as position estimation error (PEE).*

#### Total system error (TSE)



- g) **Oceanic airspace.-** Airspace over oceanic area considered as international airspace and where ICAO procedures and separations apply. The responsibility for the provision of air traffic services in this airspace is delegated to those States with greater geographic proximity and/or availability of resources.
- h) **Navigation specifications.-** Set of aircraft and flight crew requirements needed to support performance-based navigation operations in a defined airspace. There are two kinds of navigation specifications:

*Required Navigation Performance (RNP) Specification.-* Navigation specification based on area navigation (RNAV) that includes the on-board performance control and alerting requirement, designated by the prefix RNP; e.g., RNP 4, RNP APCH, RNP AR APCH.

*Area Navigation (RNAV) Specification.-* Navigation specification based on area navigation that does not include the on-board performance control and alerting requirement, designated by the prefix RNAV; e.g., RNAV 5, RNAV 2, RNAV 1.

*Note 1.- The Manual on Performance-Based Navigation (PBN) (Doc 9613), Volume II, contains detailed guidelines on navigation specifications.*

**Note 2.-** The term RNP, formerly defined as “a statement of the navigation performance necessary for operation within a defined airspace”, has been deleted from the Annexes to the Convention on International Civil Aviation because the RNP concept has been replaced by the PBN concept. In said Annexes, the term RNP is now only used within the context of the navigation specifications that require on-board performance control and alerting; e.g., RNP 4 refers to the aircraft and the operational requirements, including a lateral performance of 4 nautical miles (NM), with the requirement for on-board performance control and alerting as described in the PBN Manual (Doc 9613).

- i) **Estimated position uncertainty (EPU).**- A measure in nautical miles (NM) based on a defined scale that indicates the estimated performance of the current position of the aircraft, also known as actual navigation performance (ANP) or estimated position error (EPE) in some aircraft. The EPU is not an estimate of the actual error but a defined statistical indication of potential error.
- b) **Performance-based navigation (PBN).**- Performance-based navigation specifies system performance requirements for aircraft operation along an ATS route, in an instrument approach procedure, or in a designated airspace.  
  
Performance requirements are defined in terms of the precision, integrity, continuity, availability, and functionality required for conducting the proposed operation within the context of a particular airspace concept.
- c) **Area navigation (RNAV).**- A navigation method that allows aircraft to operate on any desired flight path within the coverage of ground - or space- based navigation aids, or within the coverage limits of self-contained aids, or a combination of both.  
  
Note.- Area navigation includes performance based navigation as well as other RNAV operations that do not meet the definition of performance-based navigation.
- j) **RNP operations.**- Aircraft operations using an RNP system for RNP applications.
- k) **Waypoint (WPT).** A specified geographical location used to define an area navigation route or the flight path of an aircraft employing area navigation. Way-points are identified as either:  
  
*Fly-by waypoint (fly-by WPT).*- A waypoint which requires turn anticipation to allow tangential interception of the next segment of a route or procedure.  
  
*Fly over waypoint (fly over WPT).*- A waypoint at which a turn is initiated in order to join the next segment of a route or procedure.
- l) **Heading (of the aircraft).**- The direction in which the longitudinal axis of an aircraft is pointed, usually expressed in degrees from North (true, magnetic, compass or grid).
- m) **Aircraft-based augmentation system (ABAS).**- A system which augments and/or integrates the information obtained from the other GNSS elements with information available on board the aircraft. The most common form of ABAS is the receiver autonomous integrity monitoring (RAIM).
- n) **Flight management system (FMS).**- An integrated system consisting of an on-board sensor, a receiver and a computer with databases on navigation and aircraft performance, capable of providing performance values and RNAV guidance to a display and automatic flight command system.
- o) **Global positioning system (GPS).**- The global positioning system (GNSS) of the United States is a satellite-based radio navigation system that uses precise distance measurements to determine the position, speed, and time in any part of the world. The GPS is made up by three elements: the spatial, control, and user elements. The GPS spatial segment nominally consists of at least 24 satellites in 6 orbital planes. The control element consists of 5 monitoring stations, 3 ground antennas, and one main control station. The user element consists of antennas and receivers that provide the user with position, speed, and precise time.
- p) **Stand-alone global positioning system (Stand-alone GPS).**- GPS that is not connected to, or combined with, another navigation system or sensor.
- q) **Primary-means navigation system.**- Navigation system approved for a given operation or flight phase, which has to meet the precision and integrity requirements, but not full service

availability and continuity conditions. Safety is ensured by limiting flights to specific time periods and by establishing timely restrictive procedures.

- r) **Sole-means navigation system.-** Navigation system approved for a given operation or flight phase that allows the aircraft to meet the four navigation system requirements: precision, integrity, availability and continuity of service.
- s) **Supplemental-means navigation system.-** A navigation system that must be used together with a sole means navigation and meet the precision and integrity requirements but not availability and continuity conditions.
- t) **Global navigation satellite system (GNSS).-** A generic term used by the International Civil Aviation Organization (ICAO) to define any global position, speed, and time determination system that includes one or more main satellite constellations, such as GPS and the global navigation satellite system (GLONASS), aircraft receivers and several integrity monitoring systems, including aircraft-based augmentation systems (ABAS), satellite-based augmentation systems (SBAS), such as the wide area augmentation systems (WAAS), and ground-based augmentation systems (GBAS), such as the local area augmentation system (LAAS).  
Distance information will be provided by GPS and GLONASS, at least in the immediate future.
- u) **RNP system.-** An area navigation system which supports on-board performance monitoring and alerting.
- v) **Receiver autonomous integrity monitoring (RAIM).-** A technique used in a GPS receiver/processor to determine the integrity of its navigation signals, using only GPS signals or GPS signals enhanced with barometric altitude data. This determination is achieved by comparing redundant pseudo-range measurements. At least one available satellite is required in addition to the number of satellites needed for the navigation solution.
- w) **Automatic dependent surveillance - contract (ADS-C).-** A means that allows the ground system and the aircraft to establish, through data link, the conditions of an ADS-C agreement, which stipulates the conditions under which ADS-C reports must be initiated, as well the data that must appear on such reports.

#### 4.2 Abbreviations

- |    |       |  |
|----|-------|--|
| a) | CAA   | Civil Aviation Administration/Civil Aviation Authority |
| b) | AAIM  | Aircraft autonomous integrity monitoring               |
| c) | ABAS  | Aircraft-based augmentation system                     |
| d) | ADS-C | Automatic dependent surveillance - contract            |
| e) | AC    | Advisory circular (FAA)                                |
| f) | AFM   | Aircraft flight manual                                 |
| g) | AIP   | Aeronautical information publication                   |
| h) | ANP   | Actual navigation performance                          |
| i) | AP    | Automatic pilot  |
| j) | ATC   | Air traffic control                                    |
| k) | ATS   | Air traffic services                                   |
| l) | CA    | Advisory circular (SRVSOP)                             |
| m) | CDI   | Lateral deviation indicator                            |
| n) | CDU   | Control and display unit                               |
| o) | CF    | Course to a fix  |

---

|     |         |  |
|-----|---------|--|
| p)  | CFR     | Code of Federal Regulations (United States)                                |
| q)  | CNS/ATM | Communications, navigation and surveillance/air traffic management systems |
| r)  | CPDLC   | Controller-pilot data link communications                                  |
| s)  | CS      | Certification specifications (EASA)  |
| t)  | DAC     | Director of civil aviation   |
| u)  | DF      | Direct to a fix  |
| v)  | DME     | Distance-measuring equipment   |
| w)  | DV      | Flight dispatcher  |
| x)  | EASA    | European Air Safety Agency   |
| y)  | EHSI    | Electronic horizontal situation indicator                                  |
| z)  | EPE     | Estimated position error   |
| aa) | EPU     | Estimated position uncertainty   |
| bb) | ETOPS   | Extended range operations by twin-engine aeroplanes                        |
| cc) | ETSO    | European technical standard order  |
| dd) | FAA     | United States Federal Aviation Administration                              |
| ee) | FD      | Flight director  |
| ff) | FDE     | Fault detection and exclusion  |
| gg) | FMS     | Flight management system   |
| hh) | FTE     | Flight technical error   |
| ii) | GBAS    | Ground-based augmentation system   |
| jj) | GNSS    | Global navigation satellite system   |
| kk) | GLONAS  | Global navigation satellite system   |
| ll) | GPS     | Global positioning system  |
| mm) | GS      | Ground speed   |
| nn) | HAL     | Horizontal alerting system   |
| oo) | IF      | Initial fix  |
| pp) | IMC     | Instrument meteorological conditions                                       |
| qq) | IPC     | Illustrated part catalogue   |
| rr) | LAAS    | Local area augmentation system   |
| ss) | LAR     | Latin American Aeronautical Regulations                                    |
| tt) | LNAV    | Lateral navigation   |
| uu) | LOA     | Letter of authorisation/letter of acceptance                               |
| vv) | LRNS    | Long-range navigation system   |
| ww) | MCM     | Maintenance control manual   |
| xx) | MEL     | Minimum equipment list   |
| yy) | MIO     | Operations inspector manual (SRVSOP)                                       |

|       |             |   |
|-------|-------------|---|
| zz)   | NAVAIDS     | Navigation aids   |
| aaa)  | NM          | Nautical mile   |
| bbb)  | NSE         | Navigation system error   |
| ccc)  | ICAO        | International Civil Aviation Organization                       |
| ddd)  | OM          | Operations manual   |
| eee)  | OpSpecs     | Operation specifications  |
| fff)  | PANS-OPS    | Procedures for Air Navigation Services - Aircraft operations    |
| ggg)  | PANS-ATM    | Procedures for Air Navigation Services - Air traffic management |
| hhh)  | PBN         | Performance-based navigation                                    |
| iii)  | PDE         | Path definition error   |
| jjj)  | PEE         | Position estimation error                                       |
| kkk)  | POH         | Pilot operations handbook                                       |
| lll)  | PSE         | Path steering error   |
| mmm)  | RAIM        | Receiver autonomous integrity monitoring                        |
| nnn)  | RNAV        | Area navigation   |
| ooo)  | RNP         | Required navigation performance                                 |
| ppp)  | RNP APCH    | Required navigation performance approach                        |
| qqq)  | RNP AR APCH | Required navigation performance authorisation required approach |
| rrr)  | SBAS        | Satellite-based augmentation system                             |
| sss)  | SOP         | Standard operating procedures                                   |
| ttt)  | SLOP        | Strategic lateral displacement procedures                       |
| uuu)  | SRVSOP      | Regional Safety Oversight Cooperation System                    |
| vvv)  | SSR         | Secondary surveillance radar                                    |
| www)  | STC         | Supplemental type certificate                                   |
| xxx)  | TC          | Type certificate  |
| yyy)  | TF          | Track to a fix  |
| zzz)  | TSE         | Total system error  |
| aaaa) | TSO         | Technical standard order  |
| bbbb) | VMC         | Visual meteorological conditions                                |
| cccc) | VOR         | VHF omnidirectional radio range                                 |
| dddd) | WAAS        | Wide area augmentation system                                   |
| eeee) | WGS         | World geodetic system   |
| ffff) | WPT         | Waypoint  |

## 5. INTRODUCTION

5.1 As part of the global efforts towards the implementation of the International Civil Aviation Organization (ICAO) global air navigation plan (Doc 9750) for communications, navigation and surveillance/air traffic management (CNS/ATM) systems, the lateral and longitudinal separation

minima are being reduced in oceanic regions. This reduction will require an RNP 4 navigation standard.

5.2 The criteria of this CA provide guidance on airworthiness and operational approvals. These approvals will allow an operator to obtain RNP 4 authorisation to operate in oceanic or remote airspaces with 30 nautical mile (NM) lateral and longitudinal separations based on distance.

5.3 The implementation of the 30 NM lateral and longitudinal separation minima in oceanic or remote airspaces with RNP 4 will provide benefits to the operators in terms of more optimum routes, reduced delays, increased flexibility and reduced costs without decreasing safety. ATS providers will derive benefits from the efficient use of airspace and increased air traffic flow.

5.4 This guidance document does not address all the requirements that can be specified for a given operation. These requirements are specified in other documents, such as the operating rules, aeronautical information publications (AIPs) and Doc 7030 – Regional supplementary procedures.

5.5 Although operational approval is mainly related to airspace navigation requirements, operators and flight crews must take into account all of the associated operational documents required by the CAA before conducting flights in said airspace.

5.6 The approval process described in this AC is limited to the aircraft that have received airworthiness certification indicating that the installed navigation systems meet RNP 4 performance requirements. This certification may have been issued at the time of manufacture or during service, when the aircraft was retrofitted to meet RNP 4 requirements, through the granting of an appropriate supplemental type certificate (STC).

5.7 The material described in this AC has been developed based on the following document:

- ✓ ICAO Doc 9613, Volume II, Part C, Chapter 1 – Implementing RNP 4.

5.8 This AC has been harmonised with the following guidance material:

- ✓ FAA Order 8400.33 – Procedures for obtaining authorization for required navigation performance 4 (RNP 4) oceanic and remote area operations.

## 6. GENERAL CONSIDERATIONS

### 6.1 Navigation aid infrastructure

RNP 4 was developed for operations in oceanic and remote areas, therefore, it does not require any ground-based navaid infrastructure. The global navigation satellite system (GNSS) is the primary navigation sensor that supports RNP 4, either as a stand-alone navigation system or as part of a multi-sensor system.

### 6.2 ATS communications and surveillance

Although this guidance material was developed to support 30 NM lateral and longitudinal separation minima based on RNP 4, it should be noted that it only includes the navigation requirements associated to these standards and does not specifically refer to air traffic service (ATS) communications or surveillance requirements.

*Note.- The provisions related to these separation minima, including ATS communications and surveillance requirements, are contained in Section 5.4 of ICAO Doc 4444 – Procedures for air navigation services – Air traffic management (PANS-ATM). Provided that they can support an increased reporting rate required, controller-pilot data link communications (CPDLC) and automatic dependent surveillance – contract (ADS – C) systems which meet the requirements for application of the 50 NM lateral and longitudinal separation minima based on RNP 10 will also meet the requirements for the application of the 30 NM lateral and longitudinal minima.*

### 6.3 Obstacle clearance and en-route spacing

- a) Doc 8168 – Procedures for air navigation services – Aircraft operations (PANS OPS), Volume II, provides a detailed guide on obstacle clearance. The general criteria of Parts I and III apply.
- b) Separation minima are described in Section 5.4 of Doc 4444 PANS-ATM.

- c) RNP 4 may be used to support the application of en-route separation/spacing standards of less than 30 NM in continental airspace, provided the CAA has conducted the necessary safety assessments described in Doc 4444, PANS-ATM. However, the ATS communications and surveillance parameters that support the application of new separation standards will be different from those used for a 30 NM standard.

#### 6.4 Publications

- a) When reference is made to the existing routes, the AIP should clearly indicate that the navigation application is RNP 4. The route should identify the minimum altitude requirements of the segments.
- b) The navigation information published in the AIP for routes and supporting navigation aids must meet the requirements of Annex 15 – Aeronautical information services. All routes must be based on the World Geodetic System - 1984 (WGS-84) coordinates.

#### 6.5 Additional considerations

- a) Many aircraft have the following capabilities:
- 1) fly parallel paths displaced to the left or right of the original active route; and
  - 2) execute a holding pattern manoeuvre using an RNP system. The purpose of this function is to give the ATC flexibility for the design of RNP operations.

### 7. AIRWORTHINESS AND OPERATIONAL APPROVAL

7.1 Commercial air transport operators require two types of approvals before receiving an RNP 4 authorisation:

- a) Airworthiness approval, issued by the State of Registry (see Article 31 of the Chicago Convention, and Paragraphs 5.2.3 and 8.1.1 of Annex 6, Part I); and
- b) Operational approval, issued by the State of the Operator (see Paragraph 4.2.1 and Attachment F to Annex 6, Part I).

7.2 For general aviation operators, the State of Registry will determine if the aircraft meets the applicable RNP 4 requirements, and will issue the operational authorisation (e.g., a letter of authorisation – LOA) (see paragraph 2.5.2.2 of Annex 6, Part II).

7.3 Before submitting their request, operators shall review all aircraft qualification requirements. Compliance with airworthiness or equipment installation requirements, by themselves, does not constitute operational approval.

### 8. AIRWORTHINESS APPROVAL

#### 8.1 Aircraft requirements

##### 8.1.1 Navigation systems

- a) For RNP 4 operations in oceanic or remote airspace, the aircraft must have, at least *two fully operational and independent long-range navigation systems (LRNS)*, with integrity such that the navigation system does not provide misleading information and form part of the basis upon which RNP 4 operations approval is granted. GNSS must be used as either a stand-alone navigation system or as one of the sensors in a multi-sensor system.
- b) The United States Federal Aviation Administration (FAA) AC 20-138A – Airworthiness approval of global navigation satellite system (GNSS) equipment, or equivalent documents provide an acceptable means of complying with installation requirements for aircraft that use, but do not integrate, the GNSS output with that of other sensors.

- c) The FAA AC 20-130A – Airworthiness approval of navigation or flight management systems integrating multiple navigation sensors, or equivalent documents describe an acceptable means of compliance for navigation systems with multiple sensors that incorporate GNSS.
- d) The configuration of the equipment used for demonstrating the required accuracy must be identical to the one specified in the minimum equipment list (MEL) or in the aircraft flight manual (AFM).
- e) The installation design must meet the design standards applicable to the aircraft that is being modified, and changes must be reflected in the AFM before starting operations requiring RNP 4 navigation approval.

### 8.1.2 System performance, monitoring and alert

- a) **Accuracy.-** During operations in airspace or on routes designates as RNP4:
  - 1) The lateral total system error must not exceed  $\pm 4$  NM for at least 95% of the total flight time.
  - 2) Likewise, the along-track error must not exceed  $\pm 4$  NM at least 95% of the total flight time.
  - 3) A flight technical error (FTE) of 2.0 NM (95%) may be assumed.
- b) **Integrity.-** Malfunctioning of the aircraft navigation equipment is classified as a major failure according to airworthiness regulations (e.g.,  $10^{-5}$  per hour).
- c) **Continuity.-** Loss of function is classified as a major failure for oceanic and remote navigation. The continuity requirement is met by carrying on board two independent LRNS systems (excluding the signal-in-space).
- d) **Performance monitoring and alerting.-** The RNP system or the RNP system in combination with the pilot will provide an alert if the accuracy requirement is not met, or if the probability that the lateral total system error exceeds 8 NM is greater than  $10^{-5}$ .
- e) **Signal-in-space.-** If GNSS is used, the aircraft navigation equipment must provide an alert if the probability of signal-in-space errors causing a lateral position error greater than 8 NM exceeds  $10^{-7}$  per hour (Annex 10, Volume I, Table 3.7.2.4-1).

*Note.- Compliance with the performance monitoring and alerting requirement does not imply an automatic monitor of FTE. The on-board monitoring and alerting function should consist at least of a navigation system error (NSE) monitoring and alerting algorithm and a lateral deviation display that enables the crew to monitor the FTE. To the extent operational procedures are used to monitor FTE, the crew procedures, equipment characteristics, and installations are evaluated for their effectiveness and equivalence as described in the functional requirements and operating procedures. The path definition error (PDE) is considered negligible due to the quality assurance process (Section 13) and crew procedures (Section 11).*

### 8.1.3 GNSS Monitor

The GNSS navigation system must detect satellite failures before they cause the aircraft to exceed the limits of the defined airspace. This requirement is derived from the overall effect of a GNSS failure and applies to all navigation uses of the system. The probability of missed detection of satellite failures must be less than or equal to  $10^{-3}$  and the effective limit of the monitor for these failures of the navigation solution, known as the horizontal alert limit (HAL) must consider the other normal errors that may exist during the satellite fault, the latency of the alert, the crew reaction time to an alert and the aircraft response. An acceptable means of compliance is to use a HAL of 4 NM for RNP 4 oceanic airspace.

## 8.2 Determination of aircraft eligibility for RNP 4 operations

### 8.2.1 Airworthiness eligibility documents

- a) The operator must have relevant documentation acceptable to the CAA of the State of Registry showing that aircraft are equipped with RNP systems that meet RNP 4 requirements.

- b) In order to avoid unnecessary regulatory activity, the determination of the eligibility of existing systems should take into account the acceptance of manufacturer documentation of compliance, e.g., EASA AMC 20 series.
- c) New systems may demonstrate compliance with RNP 4 requirements for oceanic or remote operations as part of their airworthiness approval.
- d) For existing systems, the operator shall determine RNP 4 compliance as stated in the AFM supplement or additional airworthiness documents, or as obtained per amended type certificate (TC) or supplemental type certificate (STC).
- e) Documented confirmation by the manufacturer will be required, indicating that aircraft meet the RNP 4 performance requirements of this AC, if the operator chooses to claim additional performance beyond the original airworthiness approval or as declared in the AFM, amended TC or STC. Navigation performance must consider the navigation infrastructure used in the original airworthiness approval.

#### 8.2.2 Aircraft eligibility groups

- a) **Group 1: RNP certification**
  - 1) Group 1 aircraft are those that have official certification and approval of on-board RNP integration. RNP compliance is documented in the AFM.
  - 2) Certification will not be necessarily limited to a given type of RNP. The AFM must address the RNP levels that have been demonstrated and any related provisions applicable to their use (e.g., navaid sensor requirements). Operational approval is based on the performance stated in the AFM.
  - 3) This method is also applicable in case where certification is received through an STC issued to cover retrofitting of equipment, such as the installation of GNSS receivers to enable the aircraft to meet RNP 4 requirements in oceanic and remote airspace.
- b) **Group 2: Previous certification of the navigation system**
  - 1) Group 2 aircraft are those than can equate their certified level of performance, granted on the basis of previous requirements, to RNP 4 criteria. The standards shown in Sub-paragraphs (a) to (c) can be used to classify aircraft in Group 2.
    - (a) **Global navigation satellite systems (GNSS) as primary means of navigation.-** Aircraft equipped only with GNSS as **primary** means of long-range navigation, approved for operations in oceanic and remote airspace, must meet the technical requirements specified in Paragraph 8.1.1 of this section. The AFM must indicate that **dual GNSS equipment**, approved according to an appropriate standard, is required. The appropriate standards are FAA technical standard orders (TSO) C129a or C146(), and the European technical standard orders (ETSO) C129a or C146() of EASA. Furthermore, an approved dispatch fault detection and exclusion (FDE) availability prediction programme must be used. The maximum allowable time for which FDE capability is projected to be unavailable on any event is 25 minutes. This maximum outage time must be included as a condition for RNP 4 operational approval. If predictions indicate that the maximum allowable FDE outage time will be exceeded, the operation must be rescheduled to a time when FDE is available.
    - (b) **Multi-sensor systems that incorporate GNSS with integrity provided by receiver autonomous integrity monitoring (RAIM).-** Multi-sensor systems that incorporate the global positioning system (GPS) with RAIM and FDE, and which are approved based on FAA AC 20-130A or other equivalent documents, meet the performance requirements specified in Paragraph 8.1.1 of this section. It should be noted that there is no requirement to use dispatch FDE availability prediction programmes when multi-sensor systems are installed and used.

- (c) **Multi-sensor systems that incorporate GNSS with integrity provided by aircraft autonomous integrity monitoring (AAIM).**- The AAIM uses the redundancy of position calculations from multiple sensors, including GNSS, to provide integrity performance that is at least equivalent to RAIM. These airborne augmentations must be certified according to TSO C-115b, ETSO C-115b or other equivalent documents. An example is the use of an inertial navigation system or other navigation sensors as an integrity check on GNSS data when RAIM is not available but GNSS positioning information continues to be valid.

c) **Group 3: New technology**

This group has been included in order to cover new navigation systems that meet the technical requirements for operations in RNP 4 airspace.

8.3 **Required functions**

8.3.1 The on-board navigation system must provide the following functions:

- a) navigation data display;
- b) track to a fix (TF);
- c) direct to a fix (DF);
- d) direct to function;
- e) course to a fix (CF);
- f) parallel offset;
- g) fly-by transition criteria
- h) user interface displays;
- i) displays and controls;
- j) flight planning path selection;
- k) flight planning fix sequencing;
- l) user defined course to fix (CF);
- m) path steering;
- n) alerting requirements;
- o) navigation database access; and
- p) WGS 84 reference system.

8.3.2 **Explanation of the required functions**

a) **Navigation data display**

The navigation data display must use either a lateral deviation display or a navigation map display that meets the following requirements:

- 1) a non-numerical lateral deviation display (e.g., a lateral deviation indicator (CDI) or an electronic horizontal situation indicator ((E)HSI)), with a to/from indication and failure annunciation, to be used as a primary flight instrument for aircraft navigation, for manoeuvre anticipation, and for failure/status/integrity indication, with the following attributes:
  - (a) the display must be visible to the pilot and located in his/her primary field of view ( $\pm 15$  degrees from the pilot's normal line of sight) when looking forward along the flight path;

- (b) lateral deviation scaling must agree with any alerting and annunciation limits, if implements;
- (c) the lateral deviation display must be automatically slaved to the RNP 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 RNP computed path, or the pilot must adjust the CDI or HSI selected course to the computed desired track.

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

- (d) the 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 consistent with the values of the en-route, terminal or approach phases.
- 2) 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.

b) **Track to a fix (TF)**

The primary segment of an RNAV straight route is a TF route. The TF leg is a geodetic path between two waypoints (WPT). The first is a termination WPT of the previous leg or an initial fix (IF). The intermediate and final approach segments should always be TF routes. In cases where an FMS requires a *course to fix (CF)* to the final approach segment, the database coder may use a CF instead of a TF. The termination fix is normally provided by the navigation database, but can also be defined by the user.

c) **Direct to a fix (DF)**

The DF leg is used to define a route segment from an unspecified position, on the aircraft's present track, to a specified fix/WPT. The DF path termination does not provide a predictable flight path that can be repeated, and is very variable in its application.

d) **"Direct to" function**

The "direct to" function must be able to be activated at any time by the flight crew, as necessary. The "direct to" function must be available to any fix. The system must be capable of generating a geodetic path to the designated "to" fix. The aircraft must capture this path without "S turns" and without undue delays.

e) **Course to a fix (CF)**

A CF is defined as a course that ends at a fix/WPT followed by a specific route segment. The inbound course at the termination fix and the fix are provided by the navigation database. If the inbound course is defined as the magnetic course, the source of the magnetic variation needed to convert magnetic courses to true courses is required.

f) **Parallel offset**

The system must have the capability to fly parallel tracks at a selected offset distance. When executing a parallel offset, the navigation precision and all the performance requirements of the original route in the active flight plan must be applicable to the offset route. The system must permit the entry of offset distances in increments of 1 MN, to the left or right of the course. The system must be capable of offsets of at least 20 NM. When in use, the system offset mode of operation must be clearly indicated to the flight crew. When in offset mode, the system must provide reference parameters (for example, 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 (excessive) path geometries, or beyond the initial approach fix. An announcement must be given to the flight crew before the end of the offset path, giving sufficient time to return to the original path. Once a parallel

offset has been activated, it must remain active throughout all the route segments of the flight plan until removed automatically, until the flight crew enters a direct-to route, or until manually cancelled by the flight crew. The parallel offset function must be available for the en-route TF segment and the geodetic portion of DF leg types.

g) ***“Fly-by” transition criteria***

The navigation system must be capable of performing “fly-by” transitions. No predictable and repeatable path is specified because the optimum path varies with airspeed and bank angle. However, the boundaries of the transition are defined. The path definition error (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. “Fly-by” transitions must be the default transitions when the type of transition is not specified. The theoretical transition area requirements are applicable for the following assumptions:

- 1) course changes do not exceed 120° for low altitude transitions (when the barometric altitude of the aircraft is less than FL 195); and
- 2) course changes do not exceed 70° for high-altitude transitions (when the barometric altitude of the aircraft is equal to or greater than FL 195).

h) ***User interface displays***

The general features of user interface displays must permit the display of information, provide situational awareness, and be designed and implemented taking into account human factors. The main design considerations include:

- 1) minimizing reliance on flight crew memory for any operational procedure or task of a system;
- 2) developing a clear and unambiguous display of system modes and sub-modes and navigation data, with emphasis on the requirements for enhanced situational awareness for any automatic changes in the mode, if provided;
- 3) the use of the context-sensitive help capability and error messages (e.g., invalid inputs or invalid data entry messages should provide a simple means for determining how to enter “valid” data);
- 4) failure-tolerant data entry methods instead of rigid rule-based concepts;
- 5) placing special emphasis on the number of steps and minimizing the time required to accomplish flight plan modification to accommodate ATS clearances, holding procedures, changes of runway and instrument approaches, missed approaches and diversions to alternate destination aerodromes; and
- 6) minimizing the number of nuisance alerts so that the flight crew may recognize the real ones and properly respond when so required.

i) ***Displays and controls***

- 1) Each display element used as primary flight instrument for aircraft guidance and control, for manoeuvre anticipation, or for failure/status/integrity annunciation, must be located in a place clearly visible to the pilot (in the pilot’s primary field of view) with the least possible deviation with respect to the normal position of the pilot and his/her line of vision when looking forward towards the flight path. It is expected that aircraft that meet the requirements of the Latin American Aeronautical Regulations (LAR) 25 / Title 14, Part 25 of the United States Code of Federal Regulations (CFR) / Certification Specification (CS) 25 of the European Air Safety Agency (EASA) or equivalent documents, will meet the provisions of certification documents, such as AC 25-11, AMJ 25-11 and other applicable documents.
- 2) All system displays, controls and annunciations must be readable under normal cockpit conditions and under foreseen ambient lighting conditions. Night lighting provisions must

be compatible with other lighting conditions in the cockpit.

- 3) All displays and controls must be arranged to facilitate access and use by the flight crew. The controls that are normally adjusted in flight must be readily accessible and have standardized labels indicating their function. System controls and displays must be designed to maximize operational suitability and minimize pilot workload. The controls intended for use during the flight must be designed to minimize errors, and when operated in all possible combinations and sequences, they must not result in a condition that would be detrimental to the continued performance of the system. System controls must be arranged to provide adequate protection against inadvertent system failure.

j) ***Flight planning path selection***

The navigation system must provide the crew the capability to create, review and activate a flight plan. The system must provide the capability for modification (e.g., deletion and addition of fixes and creation of along the track fixes), review and user acceptance of changes to the flight plans. When this capability is exercised, guidance output must not be affected until the modification(s) is(are) activated. The activation of any flight plan modification must require a positive action and verification by the flight crew after data entry.

k) ***Flight planning fix sequencing***

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

l) ***User-defined course to a fix (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.

m) ***Path steering***

The system must provide data to enable the generation of command signals for the autopilot/flight director/CDI, as applicable. In all cases, a path steering error (PSE) 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. During the certification process, the ability of the crew to operate the aircraft within the specified PSE must be demonstrated. Aircraft type, operating envelope, displays, autopilot performance and leg transition guidance (specifically between arc legs) should be accounted for in the demonstration of PSE compliance. A measured PSE value may be used to monitor system compliance with RNP requirements. For operations in all leg types, this value must be the distance to the defined path. In order to comply with cross-track containment, any inaccuracies in the cross-track errors computation (e.g., resolution) must be accounted for in the total system error (TSE),

n) ***Alerting requirements***

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 data base. Any subsequent reduction of the navigation accuracy must reinstate this annunciation. When an aircraft is approaching to RNP airspace from non-RNP airspace, an alert must be provided when the cross-track distance 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.

o) ***Navigation database access***

The navigation database must provide access to navigation information in support of navigation system references and flight planning characteristics. Manual modification of data in the navigation database must not be possible. This requirement does not preclude the storage of "user-defined data" in the equipment (e.g., for flex-track routes). When data are retrieved from storage they must also be retained in storage. The system must provide a means to identify the version of the navigation database and the validity of the operating period.

p) **Geodetic reference system**

The World Geodetic System - 1984 (WGS-84) or an equivalent Earth reference model must be the reference Earth model for error determination. If the WGS-84 is not used, any differences between the selected Earth model and the WGS-84 Earth model must be included as part of the PDE. Errors induced by the data resolution must also be taken into account.

8.4 **Recommended functions**

a) The following additional functions are recommended:

- 1) display of cross-track error on the control and display unit (CDU);
- 2) display present position of the aircraft in terms of distance/bearing to the selected waypoints (WPT);
- 3) provide time to WPTs on the CDU;
- 4) display along-track distance;
- 5) display ground speed (GS);
- 6) indication of track angle;
- 7) provide automatic navigation aids selection;
- 8) manually inhibit a navigation facility;
- 9) automatic selection and tuning of the distance-measuring equipment (DME) and/or VHF omnidirectional radio range (VOR);
- 10) estimate of position uncertainty (EPU);
- 11) display current RNP level and type selection;
- 12) capability to display flight plan discontinuities; and
- 13) display of operating and degraded navigation sensors.

8.5 **Automatic radio position updating**

Automatic updating is considered to be any updating procedure that does not require the crew to insert the coordinates manually. If used, automatic updating may be considered as acceptable for operations in RNP 4 airspace, provided:

- a) automatic updating procedures are included in the operator training programme; and
- b) crews are knowledgeable of the updating procedures and of the effect of the update on the navigation solution.

8.6 **Continued airworthiness**

- a) Operators of RNP 4 approved aircraft must ensure the continuity of their technical capability to meet the technical requirements established in this AC.
- b) Each operator requesting an RNP 4 operational approval shall submit to the CAA of the State of Registry a maintenance and inspection programme that includes all those maintenance requirements needed to ensure that the navigation systems will continue to meet the RNP 4 approval criteria.
- c) The following maintenance documents must be revised, as applicable, to incorporate RNP 4 aspects:
  - 1) Maintenance control manual (MCM);
  - 2) Illustrated part catalogues (IPC); and
  - 3) Maintenance programme.

- d) The approved maintenance programme for the aircraft involved must include the maintenance practices indicated in the corresponding maintenance manual of the aircraft and component manufacturer, and must consider that:
- 1) equipment involved in RNP 4 operations must be maintained according to the instructions of the component manufacturer;
  - 2) any modification or change in the navigation system that affects in any way the initial RNP 4 approval must be reported and reviewed by the CAA for acceptance or approval of said changes prior to their implementation; and
  - 3) any repair that is not included in the approved/accepted maintenance documentation and that could affect navigation performance integrity must be reported to the CAA for its acceptance and approval of such repair.
- e) RNP maintenance documentation must contain the training programme for maintenance personnel, which, amongst other aspects, must include:
- 1) the PBN concept;
  - 2) RNP 4 implementation;
  - 3) the equipment involved in the RNP 4 operation; and
  - 4) use of the MEL.

## 9. OPERATIONAL APPROVAL

Airworthiness approval alone does not authorise an applicant or operator to conduct RNP 4 operations. In addition to the airworthiness approval, the applicant or operator must obtain an operational approval to confirm the suitability of normal and contingency procedures in connection to the installation of specific equipment.

For commercial air transport, applications for RNP 4 operational approval are assessed by the State of the Operator, in accordance with current operating rules (e.g., LAR 121.995 (b) and LAR 135.565 (c) or equivalent) supported by the criteria described in this AC.

For general aviation, applications for RNP 4 operational approval are assessed by the State of Registry, in accordance with current operating rules (e.g., LAR 91.1015 and LAR 91.1640 or equivalent), supported by the criteria established in this AC.

### 9.1 Operational approval requirements

9.1.1 In order to obtain RNP 4 approval, the applicant or operator will take the following steps, taking into account the criteria established in this paragraph and in Paragraphs 10, 11, 12 and 13:

- a) *Airworthiness approval.*- Aircraft shall have the corresponding airworthiness approvals, pursuant to Paragraph 8 of this AC.
- b) *Application.*- The operator will submit the following documentation to the CAA:
  - 1) *The application for RNP 4 operational approval;*
  - 2) *Airworthiness documents related to aircraft eligibility.*- The operator will submit relevant documentation, acceptable to the CAA, establishing that the aircraft has long-range navigation systems (LRNS) that meet RNP 4 requirements, as described in Paragraph 8 of this AC. For example, the operator will submit the parts of the AFM or AFM supplement that contain the airworthiness statement.
  - 3) *Description of aircraft equipment.*- The operator will provide a configuration list with details of the relevant components and the equipment to be used for RNP 4 operations. The list shall include each manufacturer, model and version of the GNSS equipment and of the software of the installed FMS.

- 4) *Flight crew and flight dispatcher training programme*
    - (a) Commercial operators (e.g., LAR 121 and 135 operators) must submit to the CAA the training curriculum and other appropriate material (e.g., computer-based training) to show that operational procedures and practices and the training aspects described in Paragraph 12 concerning RNP 4 operations, have been included in the training programmes, as applicable (for example, in the initial, upgrade or recurrent training curriculum for flight crews and flight dispatchers).

*Note.- A separate training programme is not required if the RNP 4 training identified in Paragraph 12 has already been included in the training programme of the operator. However, it should be possible to identify what aspects of RNP 4 are covered in the training programme.*
    - (b) Non-commercial operators (e.g., LAR 91 operators) must be familiar with, and demonstrate that they will implement the practices and procedures described in Paragraph 11.
  - 5) *Operations manual and checklists*
    - (a) Commercial operators (e.g., LAR 121 and 135 operators) must revise the operations manual (OM) and the checklists to include information and guidance on the standard operating procedures (SOP) detailed in Paragraph 11 of this AC. The appropriate manuals must contain the operating instructions of the navigation system and the contingency procedures, where specified (e.g., procedures for deviations due to weather conditions). The manuals and checklists must be submitted for review as attachments to the formal application in Phase 2 of the approval process.
    - (b) Non-commercial operators (e.g., LAR 91 operators) must develop navigation system operating instructions and contingency procedures. This information must be available for crews in the OM or in the pilot operations handbook (POH). These manuals and manufacturer instructions on the operation of aircraft navigation equipment, as appropriate, must be submitted as attachments to the formal application, for review by the CAA.
  - 6) *Minimum equipment list (MEL).*- Any revision of the MEL to incorporate RNP 4 provisions must be approved. Operators must modify the MEL and specify the required dispatch conditions.
  - 7) *Maintenance.*- All operators or owners must submit for approval, at the time of the application, their maintenance programmes, including equipment monitoring reliability programme. The holder of the design approval, including either the type certificate (TC) or supplemental type certificate (STC), for each individual navigation system installation, must provide at least one set of complete instructions for continuing airworthiness.
  - 8) *Training programme for maintenance personnel.*- Operators will send the training curriculum that corresponds to their maintenance personnel, pursuant to Paragraph 8.6 e).
  - 9) *Performance history.*- The application will include the operating history of the operator. The applicant will include the events or incidents related to navigation errors in oceanic or remote airspace (e.g., those reported in the navigation error investigation forms of each State) and the methods used by the operator to address such events or incidents through new or revised training programmes, procedures, maintenance or aircraft modifications.
  - 10) *Navigation data validation programme.*- The operator will present the details of the navigation data validation programme, as described in Appendix 1 to this AC.
- c) *Programming of the training.*- Once the amendments to manuals, programmes and documents submitted have been accepted or approved, the operator will provide the required training to its personnel.
  - d) *Validation flight.*- The CAA may deem it advisable to conduct a validation flight before granting the operational approval. Such validation may be performed on commercial flights. The validation flight will be carried out according to Chapter 13, Volume II, Part II of the Operation

Inspector Manual (MIO) of the Regional Safety Oversight Cooperation System (SRVSOP).

- e) *Issuance of the authorisation to conduct RNP 4 operations* - Once the operator has successfully completed the operational approval process, the CAA will grant the operator the authorisation to conduct RNP 4 operations.
  - 1) LAR 121 and/or 135 operators.- For LAR 121 and/or LAR 135 operators, the CAA will issue the corresponding operation specifications (OpSpecs) reflecting the authorisation to conduct RNP 4 operations.
  - 2) LAR 91 operators.- For LAR 91 operators, the CAA will issue a letter of authorisation (LOA).

## 10. OPERATIONAL REQUIREMENTS

### 10.1 Navigation performance

For RNP 4 operations, aircraft must meet a cross-track (lateral) keeping accuracy and along-track (longitudinal) position accuracy of not greater than  $\pm 4$  NM for 95% of the flight time.

### 10.2 Navigation equipment

For RNP 4 operations in oceanic or remote airspace, the aircraft must have, at least *two fully operational and independent long-range navigation systems (LRNS)*, with integrity such that the navigation system does not provide misleading information and form part of the basis upon which RNP 4 operations approval is granted. GNSS must be used as either a stand-alone navigation system or as one of the sensors in a multi-sensor system.

### 10.3 Flight plan designation

- a) Operators must indicate their ability to meet RNP 4 for the route or airspace in accordance with Doc 4444 - *Procedures for air navigation services – Air traffic management (PANS-ATM)*, Appendix 2, which requires the insertion of letter “R” in Block 10 (equipment) of the ICAO flight plan. Likewise, operators must meet other additional flight planning requirements specified in Doc 7030 and in the State AIP.
- b) The insertion of letter “R” indicates that the pilot has:
  - 1) examined the planned flight route, including routes to alternate aerodromes, in order to determine the types of RNP involved;
  - 2) confirmed that the operator and the aircraft have been approved by the CAA for conducting RNP 4 operations; and
  - 3) confirmed that the aircraft can meet all the approval conditions for the planned flight route, within airspace or on routes requiring RNP 4.
- c) Additional information should be displayed in the remarks section indicating the accuracy capability, such RNP 4 versus RNP 10. It is important to understand that additional requirements will have to be met for operational authorization in RNP 4 airspace or on RNP 4 routes.
- d) Controller-pilot data link communication (CPDLC) and automatic dependent surveillance - contract (ADS-C) systems will also be required when the lateral and/or longitudinal separation standard is 30 NM. The on-board navigation data must be current and include appropriate procedures.

**Note.-** *It is expected that navigation databases will be valid for the duration of the flight. If the AIRAC cycle expires during the flight, operators and pilots must establish procedures to ensure the accuracy of the navigation data, including the adequacy of navigation facilities used for defining the routes and procedures for the flight.*

### 10.4 Availability of navigation aids (NAVAIDS)

At the time of aircraft dispatch or during flight planning, the operator must make sure that the appropriate en-route navigation aids are available to allow the aircraft to conduct RNP 4

operations.

## 11. OPERATING PROCEDURES

11.1 The following topics must be standardized and included in the training programmes and in the operational practices and procedures. Some topics may have been properly standardized in the existing programmes and procedures of the operator. The new technologies can also eliminate the need for the crew to take some actions. If this is the case, it can be considered that the objective of this text has been met.

*Note.- This guidance material has been written for a wide variety of operator types and therefore some topics may not be applicable to all operators.*

- a) **Flight planning.-** During flight planning, flight crews and flight dispatchers must pay special attention to the conditions that may affect operations in RNP 4 airspace or routes, including, but not limited to:
- 1) verifying if the aircraft is approved for RNP 4 operations in oceanic or remote airspace;
  - 2) verifying if the operator is authorised to conduct RNP 4 operations in oceanic or remote airspace. This authorisation supports the 30 NM lateral and longitudinal separation (or other) minima required by RNP 4 operations.
    - (a) it should be noted that the authorisation only addresses navigation requirements associated to these standards.
    - (b) the authorisation does not consider communications or surveillance requirements. These requirements are listed in the AIPs and in the regional supplementary procedures (ICAO Doc 7030) for a specific airspace or ATS route.
  - 3) verifying that letter "R" has been entered in Block 10 (equipment) of the ICAO flight plan;
  - 4) verifying GNSS requirements, such as FDE, if applicable to the operation; and
  - 5) verifying if any operating restriction related to the RNP 4 approval has been taken into account, if so required.
- b) **Pre-flight procedures.-** The following action must be taken during pre-flight:
- 1) review the technical flight records (maintenance logs) and forms to determine the condition of the equipment required for flying in RNP 4 airspace or route.
  - 2) ensure that maintenance action has been taken to correct defects on the required equipment; and
  - 3) review the contingency procedures for operations in airspace or routes that require RNP 4 navigation capability. These are no different than normal oceanic contingency procedures with one exception: crews must be able to recognize, and the ATC must be advised, when the aircraft is no longer able to navigate to its RNP 4 navigation capability.
- c) **GNSS availability.-** During flight planning or at dispatch, the operator must ensure that GNSS availability requirements on which the operator approval has been based will be met throughout the flight.
- d) **En-route procedures.-** The following shall be obtained:
- 1) At least two LRNS, capable of navigating to RNP 4 and listed in the AFM must be operational at the entry point of the RNP airspace. In an item of equipment required for RNP 4 operations is unserviceable, then the pilot will consider an alternate route or diversion for repairs;
  - 2) In-flight operating procedures of the operator must include mandatory cross-check procedures to identify navigation errors sufficiently in advance, in order to prevent the

aircraft from inadvertently deviating from the routes cleared by the ATC;

- 3) Crews must advise the ATC of any deterioration or failure of the navigation equipment that cause navigation performance to fall below the required level, and/or any deviation required for a contingency procedure; and
- 4) Pilots must use a lateral deviation indicator, a flight director (FD) or an automatic pilot (AP) in the lateral navigation mode (LNAV) in RNP 4 routes. Pilots may use a navigation map display with equivalent functionality to a lateral deviation indicator. The 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 (e.g.,  $\pm 4$  NM). All pilots are expected to maintain the route centrelines, as depicted by on-board lateral deviation indicators and/or flight guidance during all RNP 4 operations, unless authorized by ATC to deviate or due to emergency conditions. For normal operations, the cross-track error/deviation (the difference between the RNP system computed path and aircraft position relative to the path) shall be limited to  $\pm \frac{1}{2}$  the navigation accuracy associated with the flight route (e.g., 2 NM). Small deviations from this requirement are allowed (e.g., overshoots or undershoots) during and immediately after a route turn, up to a maximum of one-times the navigation accuracy (e.g., 4 NM).

e) **Contingency procedures**

- 1) Flight crews and flight dispatchers shall be familiar with the following general provisions:
  - (a) if an aircraft cannot continue the flight according to the current ATC authorization or cannot maintain RNP 4 accuracy, it will not enter into or continue operating in RNP 4 airspace. In this case, the pilot will obtain a revised clearance, if that is possible, before initiating any action.
  - (b) in all cases, the flight crew shall follow the contingency procedures established for each region or area of operation (e.g., South Atlantic (SAT), Pacific, etc.) and obtain ATC clearance as soon as possible.
- 2) *Procedures for flight contingencies, deviations due to weather conditions and strategic lateral offset procedures.*- The operator will develop procedures for flight contingencies, deviations due to weather conditions and strategic lateral offset procedures (SLOP), in accordance with Paragraph 15.2 of ICAO Doc 4444 – Special procedures for flight contingencies in oceanic airspace. These procedures are of general application in oceanic and remote continental areas of operation. As a minimum, the following aspects will be included:
  - (a) Special procedures for flight contingencies in oceanic airspace.
    - (1) Introduction;
    - (2) General procedures; and
    - (3) Extended-range operations by twin-engine aeroplanes (ETOPS).
  - (b) Procedures for deviating due to weather conditions.
    - (1) General;
    - (2) Measures to be adopted when controller-pilot communications are established;
    - (3) Measures to be adopted if a revised clearance from the ATC cannot be obtained; and
  - (c) Strategic lateral offset procedures in oceanic airspaces and remote continental areas.

**12. TRAINING PROGRAMME**

12.1 Operators or owners must ensure that flight crews have been trained and have the appropriate knowledge on the topics contained in these guidelines.

- a) Commercial operators (e.g., LAR 121 and 135 operators).- Commercial operators must make sure that their programmes cover training for flights crews and flight dispatchers on the following aspects:
  - 1) General
    - (a) definition of RNP in relation to RNP 4 requirements;
    - (b) knowledge of the airspace where RNP 4 is required;
    - (c) aeronautical charts and documents that reflect RNP 4 operations;
    - (d) equipment required to operate in RNP 4 airspace, and its operation;
    - (e) limitations associated to navigation equipment; and
    - (f) use of the MEL.
  - 2) Operational procedures
    - (a) flight planning;
    - (b) pre-flight procedures;
    - (c) GNSS availability;
    - (d) en-route operations;
    - (e) contingency procedures; and
    - (f) aspects contained in this AC.
- b) Non-commercial operators (e.g., LAR 91 operators).- Non-commercial operators must demonstrate the CAA that their pilots have knowledge of the material contained in this AC. The following are acceptable means for these operators: training at home, LAR 142 training centres or other training courses. Upon determining whether the training of a non-commercial operator is appropriate, the CAA may:
  - 1) accept a certificate from a training centre without any further assessment;
  - 2) assess a training course before accepting a certificate from a given training centre;
  - 3) accept a statement in the operator application in the sense that the operator guarantees and will continue to guarantee that flight crews are aware of the RNP 4 practices and operational procedures contained in this AC; and
  - 4) accept a statement by the operator in the sense that it has already implemented or will implement an RNP 4 at-home training programme and that it will use the guide contained in this document.

### 13. NAVIGATION DATABASE

13.1 The on-board database must be valid and suitable for RNP 4 operations and must include the navigation aids and waypoints (WPTs) required for the route.

- a) The operator must obtain the navigation database from a supplier that complies with document RTCA DO 200A/EUROCAE ED 76 – Standards for processing aeronautical data.
- b) Navigation data suppliers must have a letter of acceptance (LOA) for processing navigation information (e.g., FAA AC 20-153 or a document on the conditions for the issuance of letters of acceptance to navigation data suppliers by the European Aviation Safety Agency – EASA (EASA IR 21 Sub-part G) or equivalent documents). An LOA recognises as data suppliers the one whose information quality, integrity and quality management practices are consistent with

the criteria contained in document DO-200A/ED-76. The database suppliers of an operator must have a Type 2 LOA and its respective suppliers must have a Type 1 or 2 LOA. The CAA may accept an LOA issued to navigation data suppliers or issue its own LOA.

- c) The operator must advise the navigation data supplier of any discrepancy that invalidates a route, or prohibit the use of the procedures involved through a notice to flight crews.
- d) Operators should consider the need to conduct periodic verifications of the navigation databases in order to maintain the existing requirements of the quality system or safety management system.

**14. SURVILLANCE, INVESTIGATION OF NAVIGATION ERRORS AND WITHDRAWAL OF RNP 4 AUTHORISATION**

- a) The operator will establish a process to receive, analyse and follow-up on navigation error reports in order to determine the appropriate corrective action.
- b) The information on the potential of repetitive errors may call for a modification of the training programme of the operator.
- c) Information that attributes multiple errors to the pilot may call for additional training or a license revision.
- d) The occurrence of repetitive navigation errors attributed to a piece of equipment or a specific part of the navigation equipment or to operating procedures may result in the cancellation of the operational approval (withdrawal of RNP 4 authorisation from the OpSpecs or withdrawal of the LOA in the case of private operators).

## NAVIGATION DATA VALIDATION PROGRAMME

### 1. INTRODUCTION

Information stored in the navigation database defines the aircraft lateral and longitudinal guide for RNP 4 operations. The navigation database is updated every 28 days. The navigation data used for each update are critical for the integrity of each RNP 4 route. This appendix provides guidance on operator procedures for validating the navigation data associated with RNP 4 operations.

### 2. DATA PROCESSING

- a) In its procedures, the operator will identify the person responsible for updating navigation data.
- b) The operator must document a process for accepting, verifying and loading navigation data into the aircraft.
- c) The operator must place its documented data process under configuration control.

### 3. INITIAL DATA VALIDATION

3.1 The operator must validate each RNP 4 route before flying under instrument meteorological conditions (IMC) to ensure compatibility with its aircraft and to ensure that the resulting paths are consistent with the published routes. As a minimum, the operator must:

- a) compare the navigation data of the routes to be loaded into the FMS with a valid chart containing the published routes.
- b) validate the navigation data loaded for the routes, either on the flight simulator or on the aircraft under visual meteorological conditions (VMC). The routes outlined on a chart display must be compared to the published procedures. The complete routes must be flown in order to ensure that the paths can be used, that they have no apparent lateral or longitudinal discrepancies, and that they are consistent with the published routes.
- c) Once the routes are validated, a copy of the validated navigation data must be kept and maintained in order to compare them with subsequent data updates.

### 4. DATA UPDATING

Upon receiving a navigation data update and before using such data on the aircraft, the operator must compare the update with the validated routes. This comparison must identify and resolve any discrepancy in the navigation data. If there are significant changes (any change affecting the path or the performance of the routes) in any part of the routes, and if those changes are verified through the initial data, the operator must validate the amended route in accordance with the initial data validation.

### 5. NAVIGATION DATA SUPPLIERS

Navigation data suppliers must have a letter of acceptance (LOA) in order to process these data (e.g., FAA AC 20-153 or the document on the conditions for the issuance of letters of acceptance to navigation data suppliers by the European Aviation Safety Agency – EASA (EASA IR 21 Sub-part G) or equivalent documents). A LOA recognises the data supplier as one whose data quality, integrity and quality management practices are consistent with the criteria of document DO-200A/ED-76. The supplier of an operator (e.g., an FMS company) must have a Type 2 LOA and its respective suppliers must have a Type 1 or 2 LOA. The CAA may accept a LOA issued to navigation data suppliers, or issue its own LOA.

### 6. AIRCRAFT MODIFICATIONS (DATABASE UPDATE)

If an aircraft system necessary for RNP 4 operations is modified (e.g., change of software), the operator is responsible for validating the RNP 4 routes with the navigation database and the modified system. This may be accomplished without any direct evaluation if the manufacturer verifies that the modification has no effect on the navigation database or path computation. If there is no such verification by the manufacturer, the operator must perform an initial validation of the navigation data with the modified system.

## APPENDIX 2

**RNP 4 APPROVAL PROCESS**

- a) The RNP 4 approval process consists of two types of approvals, airworthiness and operational. Although the two have different requirements, they must be considered in one single process.
- b) This process is an orderly method used by the CAA to ensure that applicants meet the established requirements.
- c) The approval process is made up by the following phases:
  - 1) Phase one: Pre-application
  - 2) Phase two: Formal application
  - 3) Phase three: Documentation evaluation
  - 4) Phase four: Inspection and demonstration
  - 5) Phase five: Approval
- d) In *Phase one - Pre-application*, the CAA calls the applicant or operator to a pre-application meeting. At this meeting, the CAA informs the applicant or operator of all the operational and airworthiness requirements that must be met during the approval process, including the following:
  - 1) the contents of the formal application;
  - 2) the review and evaluation of the application by the CAA;
  - 3) the limitations (if any) applicable to the approval; and
  - 4) conditions under which the RNP 4 approval could be cancelled.
- e) In *Phase two – Formal Application*, the applicant or operator submits the formal application along with all the relevant documentation, as established in Paragraph 9.1.1 b) of this AC.
- f) In *Phase three – Documentation evaluation*, the CAA evaluates all the documentation and the navigation system to determine their eligibility and the approval method to be followed in connection with the aircraft. As a result of this analysis and evaluation, the CAA may accept or reject the formal application along with the documentation.
- g) In *Phase four – Inspection and demonstration*, the operator will provide training to its personnel and will carry out the validation flights, if required.
- h) In *Phase five - Approval*, the CAA issues the RNP 4 approval once the operator has met the airworthiness and operational requirements. For LAR 121 and 135 operators, the CAA will issue the OpSpecs, and for LAR 91 operators, a LOA.

**PAGE LEFT BLANK INTENTIONALLY**

**APPENDIX 3**

**SAMPLE LETTER OF APPLICATION TO OBTAIN RNP 4 OPERATIONAL AUTHORISATION**

(Company letterhead)

*[Date]*Mr. *[Name of the Director of Civil Aviation (DCA)]**[Title of the DCA]*

Dear sir,

(Insert the name of the operator) hereby requests authorisation to conduct RNP 4 operations in oceanic or remote airspace.

The following aircraft meet the requirements and capabilities specified in SRVSOP CA 91-004 dated 20 January 2010, for RNP 4 operations.

| Make/Model/<br>Series | Registration | Hexadecimal<br>SSR code | RNP 4<br>Equipment | Communication<br>equipment |
|-----------------------|--------------|-------------------------|--------------------|----------------------------|
|                       |              |                         |                    |                            |
|                       |              |                         |                    |                            |
|                       |              |                         |                    |                            |
|                       |              |                         |                    |                            |

The documents required in Paragraph 9.1 of the aforementioned AC are herewith attached.

Yours truly,

(Signature)

(Name and position)

Director of Operations

**PAGE LEFT BLANK INTENTIONALLY**

**SAMPLE LETTER OF RNP 4 OPERATIONAL AUTHORISATION**

(CAA letterhead)

**RNP 4 OPERATIONAL AUTHORISATION***[Date]*Mr. *[Name of the operator representative]**[Title]*

Dear sir,

After analysing your request, this CAA grants the RNP 4 operational authorisation for operations in oceanic or remote airspace, in accordance with SRVSOP CA 91-004 dated 20 January 2010 and ICAO Regional Supplementary Procedures (Doc 7030/4). This approval is valid exclusively for the following aircraft.

|                      |                 |
|----------------------|-----------------|
| Operator             | (Company)       |
| Fleet                | (Model)         |
| Serial number        | (Serial number) |
| Registrations        | (Registrations) |
| Associated equipment |                 |

(Signature)

(Name and position)

**PAGE LEFT BLANK INTENTIONALLY**

## **APPENDIX B**

### **RNP 4 JOB AID**

#### **APPLICATION TO CONDUCT RNP 4 OPERATIONS**

## RNP 4 JOB AID

### APPLICATION TO CONDUCT RNP 4 OPERATIONS

#### 1. Introduction

This Job Aid was developed by the Latin American Regional Safety Oversight Cooperation System (SRVSOP) to provide States, operators, and inspectors with guidance on the process to be followed by an operator in order to obtain RNP 4 approval.

#### 2. Purposes of the Job Aid

- 2.1 To provide operators and inspectors information on the main reference documents on RNP 4.
- 2.2 To provide tables showing the contents of the application, the related reference paragraphs, the place in the application of the operator where RNP 4 elements are mentioned, and columns for inspector comments and follow-up on the status of various elements of RNP 4.

#### 3. Recommended actions for the inspector and operator

Some recommendations on how the Job Aid can be used follow:

- 3.1 At the pre-application meeting with the operator, the inspector reviews the “basic events of the RNP 4 approval process” described in Part 1 of this Job Aid, in order to provide an overview of approval process events.
- 3.2 The inspector reviews this Job Aid with the operator in order to establish the form and content of the RNP 4 approval application.
- 3.3 The operator uses this Job Aid as a guide to compile the documents/annexes of the RNP 4 application.
- 3.4 The operator inserts in the Job Aid references showing in what part of its documents can the elements of the RNP 4 programme be found.
- 3.5 The operator sends the Job Aid and the application (documents/annexes) to the inspector.
- 3.6 The inspector indicates in the Job Aid whether an item is in compliance or needs corrective action.
- 3.7 The inspector informs the operator as soon as possible when a corrective action by the operator is required.
- 3.8 The operator provides the inspector with the revised material when so requested.
- 3.9 The CAA provides the operator with the operation specifications (OpSpecs) or a letter of authorisation (LOA), as applicable, when the tasks and documents have been completed.

**Structure of the Job Aid**

| <b>Parts</b> | <b>Subjects</b>   | <b>Page</b> |
|--------------|---|-------------|
| Part 1       | General information   | 3           |
| Part 2       | Information on aircraft and operator identification   | 5           |
| Part 3       | Operator application (Annexes and documents)  | 7           |
| Part 4       | Contents of the operator application for RNP 4  | 11          |
| Part 5       | Guide to determine RNP 4 eligibility of aircraft  | 15          |
| Part 6       | Basic pilot procedures for RNP 4 operations   | 17          |
| Part 7       | Procedures for flight contingencies, diversions due to weather conditions, and strategic lateral displacement | 21          |

**4. Primary sources of documents, information, and contacts**

To access CA 91-004, visit the ICAO/SAM Regional Office website ([www.lima.icao.int](http://www.lima.icao.int)) under the SRVSOP link.

**5. Primary documents of reference**

| <b>Documents of reference</b> | <b>Subjects</b>   |
|-------------------------------|---|
| Annex 6                       | Operation of aircraft   |
| ICAO Doc 9613                 | Performance-based navigation (PBN) manual   |
| FAA Order 8400.33             | Procedures for obtaining authorization for required navigation performance 4 (RNP-4) oceanic and remote area operations                       |
| AMC 20-5                      | Acceptable means of compliance for airworthiness approval and operational criteria for the use of the NAVSTAR Global positioning system (GPS) |
| AC 20-130A                    | Airworthiness approval of navigational or flight management systems integrating multiple navigation sensors                                   |
| AC 20-138A                    | Airworthiness approval of global navigation satellite system (GNSS) equipment   |
| AC 25-15                      | Approval of FMS in transport category airplanes   |
| AC 90-45A                     | Approval of area navigation systems for use in the U.S. National Airspace System  |

## PART 1: GENERAL INFORMATION

### Basic events in RNP 4 authorization process

|   | Operator actions   | CAA actions  |
|---|--|--|
| 1 | Establishes need to obtain authority for RNP 4 operations.   |  |
| 2 | Reviews AFM, AFM supplement or Type Certificate Data Sheet (TCDS), or other appropriate documents (e.g., service bulletins (SB), service letters (SL), etc.) to determine the eligibility of the aircraft for RNP 4 operations. The operator contacts the aircraft or avionics manufacturer, if necessary, to confirm RNP 4 or higher eligibility of the aircraft. |  |
| 3 | Contacts the CAA to arrange a pre-application meeting to discuss operational approval requirements.  |  |
| 4 |  | During the pre-application meeting, establishes: <ul style="list-style-type: none"> <li>• the form and contents of operator application</li> <li>• the supporting documents for RNP 4 approval</li> <li>• the date in which the application will be submitted for evaluation</li> <li>• the need for a validation flight to be observed by the CAA.</li> </ul> |
| 5 | Submits the application at least 60 days before starting RNP 4 operations  |  |
| 6 |  | Reviews the application submitted by the operator.   |
| 7 | Once the amendments to manuals, programmes, and documents have been approved or accepted, provides training to flight crews, flight dispatchers and maintenance personnel, and conduct a validation flight, if required by the CAA.  | Only if required, participates in the validation flight.   |
| 8 |  | Once the operational and airworthiness requirements have been met, issues the operational approval in the form of authorization by means of the OpSpecs for LAR 121 or 135 operators or equivalents, or an LOA for LAR 91 operators or equivalents, as appropriate.  |

**Notes related with the approval process****1. Responsible authority**

- a. **Commercial air transport (LAR 121 and/or 135 or equivalent regulations).**- The **State of Registry** determines that the aircraft meets the airworthiness requirements. The **State of the Operator** issues the RNP 4 authorization (*e.g.*, OpSpecs).
- b. **General Aviation (LAR 91 or equivalent regulations).**- The **State of Registry** determines that the aircraft meets airworthiness requirements and issues the operational authorization (*e.g.*, an LOA).

2. The CAA does not need to issue an LOA or equivalent document for each individual area of operation in the case of LAR 91 operators.

3. LAR 121 and/or 135 operators with RNP 4 approval must list the individual areas of operation in the OpSpecs.

4. Related sections of the Latin American Aeronautical Regulations (LAR) or equivalent regulations

- a. LAR 91        Sections 91.1015 and 91.1640 or equivalent
- b. LAR 121      Section 121.995 (b) or equivalent
- c. LAR 135      Section 135.565 (c) or equivalent

5. Related ICAO Documents

- a. Annex 2 to the Convention on International Civil Aviation – Rules of the Air
- b. Annex 6 to the Convention on International Civil Aviation – Operation of Aircraft
- c. ICAO Doc 9613 – Performance-based navigation (PBN) manual
- d. ICAO Doc 4444 – Procedures for Air Navigation Services – Air Traffic Management
- e. ICAO Doc 7030 – Regional Supplementary Procedures

**PART 2: AIRCRAFT AND OPERATORS IDENTIFICATION INFORMATION**

**OPERATOR NAME:** \_\_\_\_\_

| Aircraft make, model and series | Registration numbers | Serial numbers | Long-Range Navigation Systems (LRNS) Number, manufacturer and model | RNP specification |
|---------------------------------|----------------------|----------------|---|-------------------|
|                                 |                      |                |   |                   |
|                                 |                      |                |   |                   |
|                                 |                      |                |   |                   |
|                                 |                      |                |   |                   |
|                                 |                      |                |   |                   |
|                                 |                      |                |   |                   |
|                                 |                      |                |   |                   |

DATE OF PRE-APPLICATION MEETING \_\_\_\_\_

DATE ON WHICH THE APPLICATION WAS RECEIVED \_\_\_\_\_

DATE ON WHICH THE OPERATOR PLANS TO START RNP 4 OPERATIONS \_\_\_\_\_

¿IS THE NOTIFICATION DATE TO CAA APPROPRIATE? YES \_\_\_\_\_ NO \_\_\_\_\_

**PAGE LEFT BLANK INTENTIONALLY**

## PART 3 – OPERATOR APPLICATION (ANNEXES AND DOCUMENTS)

| Annex | Annex/Document title  | Operator indication of inclusion | Inspector comments |
|-------|---|----------------------------------|--------------------|
| A     | <b>Letter from the operator requesting authorisation for conducting RNP 4 operations</b>  |                                  |                    |
| B     | <b>Aircraft eligibility group</b><br>Statement by the operator indicating the RNP 4 eligibility group or groups into which the aircraft/long-range navigation system (LRNS) combinations fall.  |                                  |                    |
| C     | <b>Airworthiness documents showing RNP 4 eligibility of aircraft</b><br>AFM, AFM revision, AFM supplement or type certificate data sheet (TCDS) showing LRNS eligibility for RNP 4.   |                                  |                    |
| D     | <b>Aircraft modified to meet RNP 4 standards. Aircraft inspection and/or modification documentation, if applicable.</b> Maintenance records documenting the installation or modification of aircraft systems (e.g., FAA Form 337 – major repairs and alterations).                              |                                  |                    |
| E     | <b>Maintenance programme</b> <ul style="list-style-type: none"> <li>• For aircraft with established LRNS maintenance practices, provide the list of document or programme reference.</li> <li>• For newly installed LRNS systems, provide the LRNS maintenance practices for review.</li> </ul> |                                  |                    |
| F     | <b>Minimum equipment list (MEL) (only for operators conducting operations based on an MEL):</b><br>MEL showing provisions concerning LRNS systems.  |                                  |                    |
| G     | <b>Training</b><br>1. <b>LAR 91 operators or equivalent: Training methods:</b> Training at  |                                  |                    |

| Annex | Annex/Document title  | Operator indication of inclusion | Inspector comments |
|-------|---|----------------------------------|--------------------|
|       | <p>home, LAR 142 training centres, or other training courses, course completion records.</p> <p><b>2. LAR 121 and/or 135 operators or equivalents:</b> Training programmes (curricula) for flight crews, flight dispatchers and maintenance personnel.</p>  |                                  |                    |
| H     | <p><b>Operating policies and procedures</b></p> <p><b>1. LAR 91 operators or equivalent:</b> Operations manual (OM) or sections of operator's application documenting RNP 4 operational policies and procedures.</p> <p><b>2. LAR 121 and/or 135 operators or equivalent:</b> Operations manual and checklists.</p> |                                  |                    |
| I     | <p><b>Performance history.</b> Previous problems, incidents, path-keeping errors, corrective action, if any, will be included.</p>  |                                  |                    |
| J     | <p><b>Navigation data validation programme.</b> Details of the navigation data validation programme, as described in Appendix 1 to this AC</p>  |                                  |                    |
| K     | <p><b>Withdrawal of RNP 4 approval.</b> Indication of the need to follow up on navigation error reports submitted, and the possibility of withdrawal of RNP 4 approval.</p>   |                                  |                    |
| L     | <p><b>Validation flight plan:</b> Only if required by the CAA.</p>  |                                  |                    |

**APPLICATION CONTENT TO BE SUBMITTED BY THE OPERATOR**

\_\_\_\_\_ **AIRCRAFT/ RNP 4 NAVIGATION SYSTEM COMPLIANCE DOCUMENTATION**

\_\_\_\_\_ **OPERATIONAL POLICIES AND PROCEDURES**

\_\_\_\_\_ **MAINTENANCE MANUAL SECTIONS RELATED TO LRNS (if not previously reviewed)**

**Note 1:** Documents may be grouped in a single folder or may be sent as individual documents.

## PART 4: CONTENTS OF THE OPERATOR APPLICATION FOR RNP 4 OPERATIONS

| # | Content of operator application for RNP 4   | Reference paragraphs CA 91-004   | Where found in operator Annexes/documents | Inspector recommendations and/or comments | Inspector tracking: Item status and date |
|---|---|--|---|---|--|
| 1 | <b>Operator request letter</b><br>Statement of intent to obtain RNP 4 authority.  | Paragraph 9.1.1 b) 1)<br>Appendix 2,<br>Paragraph e)                             | Annex A                                   |   |  |
| 2 | <b>Aircraft/Navigation System RNP 4 eligibility group</b><br>Airworthiness documents that establish the proposed aircraft/navigation system group, its RNP 4 approval status and, in a format acceptable to the inspector, a list of the aircraft included in that group. | Paragraphs 8.2.2 and<br>9.1.1 b) 2)  | Annex B<br>Annex C                        |   |  |
| 3 | <b>Dual equipage and GNSS requirement</b><br>GNSS required. At least two long-range navigation systems (LRNS) with adequate display and functionality required.   | Paragraphs 6.1; 8.1.1<br>a); 8.2.2 b) 1) (a);<br>10.2; 11.1 c) and<br>11.1 d) 1) | Annex B<br>Annex C                        |   |  |
| 4 | <b>Description of aircraft equipment</b>  | Paragraph 9.1.1 b) 3)  | Annex B<br>Annex C                        |   |  |
| 5 | <b>Training</b><br><b>1. LAR 91 operators or equivalent:</b><br><b>Training methods:</b> The following methods are acceptable for these operators: Training at home, LAR  | Paragraphs 9.1.1 b)<br>4) (b) and 12.1 b)  | Annex F                                   |   |  |

| # | Content of operator application for RNP 4  | Reference paragraphs CA 91-004   | Where found in operator Annexes/documents | Inspector recommendations and/or comments | Inspector tracking: Item status and date |
|---|--|--|---|---|--|
|   | <p>142 training centres, or other training courses.</p> <p><b>2. LAR 121 or 135 operators or equivalent: Training programmes:</b><br/>Training programmes for flight crews, flight dispatchers and maintenance personnel.</p>  | Paragraphs 8.6 e); 9.1.1 b) 4) (a) and 12.1 a)                                   |   |   |  |
| 6 | <p><b>Operations manual or documents</b></p> <p><b>1. LAR 91 or equivalent operators:</b><br/>Operations manual or section of operator's application documenting RNP 4 operational policies and procedures.</p> <p><b>2. LAR 121 and/or 135 or equivalent operators:</b> Operations manual and checklists.</p> | <p>Paragraphs 9.1.1 b) 5) (b) and 11</p> <p>Paragraph 9.1.1 b) 5) (a) and 11</p> | Annex G                                   |   |  |
| 7 | <p><b>Maintenance practices</b></p> <ul style="list-style-type: none"> <li>• For aircraft with established LRNS maintenance practices, the operator will provide document references.</li> <li>• For newly installed LRNS systems, the operator will provide the maintenance practices for review.</li> </ul>  | Paragraphs 8.6 d) and 9.1.1 b) 7)  | Annex D                                   |   |  |
| 8 | <b>Minimum equipment list (MEL) updates</b>  | Paragraph 9.1.1 b) 6)  | Annex E                                   |   |  |

| #  | Content of operator application for RNP 4   | Reference paragraphs<br>CA 91-004 | Where found in operator Annexes/documents | Inspector recommendations and/or comments | Inspector tracking: Item status and date |
|----|---|-----------------------------------|---|---|--|
|    | Applicable to operators conducting operations according to a MEL.   |                                   |   |   |  |
| 9  | <b>Performance history.</b> Performance record identifying previous problems, incidents, path-keeping errors, and corrective action.                                    | Paragraph 9.1.1 b) 9)             |   |   |  |
| 10 | <b>Navigation data validation programme</b><br>The operator will present the details of the navigation data validation programme, as described in Appendix 1 to this AC | Paragraph 9.1.1 b) 10)            |   |   |  |
| 11 | <b>Withdrawal of RNP 4 approval</b><br>Indication of the need for follow-up on the navigation error reports and the possibility of withdrawal of RNP 4 approval.        | Paragraph 14                      | Annex H                                   |   |  |
| 12 | <b>Validation flight plan, only if required</b><br>The validation flight plan will be submitted only if required.   | Paragraph 9.1.1 d)                | Annex H                                   |   |  |

## PART 5 – GUIDE FOR DETERMINING AIRCRAFT ELIGIBILITY FOR RNP 4 OPERATIONS

| #  | Topics   | Reference paragraphs<br>CA 91-004             | Location<br>in the<br>Annexes<br>of the<br>operator | Comments and/or<br>recommendations by<br>the inspector | Inspector tracking:<br>Item status and date |
|----|--|---|---|--|---|
| 1  | <b>Eligibility group(s) to which the operator aircraft belong</b>  | Paragraph 8.2.2                               | Annex B   |  |   |
| 2  | <b>Dual long-range navigation system (LRNS) requirement</b>  | Paragraph 8.1.1 a)                            | Annex B   |  |   |
| 3  | <b>GNSS equipment requirement for RNP 4 operations</b>   | Paragraphs 6.1; 8.1.1 a);<br>10.2 and 11.1 c) | Annex B   |  |   |
| 4  | <b>Eligibility Group 1 - RNP certification.-</b><br>Aircraft eligibility through RNP certification (RNP compliance documented in the AFM).                   | Paragraph 8.2.2 a)                            | Annex B   |  |   |
| 5  | <b>Eligibility Group 2 – Previous certification of the navigation system.-</b> Aircraft eligibility through previous certification of the navigation system. | Paragraph 8.2.2 b)                            | Annex B   |  |   |
| 5a | GNSS as primary means of long-range navigation<br><br>Approved dispatch fault detection and exclusion (FDE) availability prediction programme                | Paragraph 8.2.2 b) 1) (a)                     | Annex B   |  |   |
| 5b | Multi-sensor systems that incorporate GNSS with RAIM integrity   | Paragraph 8.2.2 b) 1) (b)                     | Annex B   |  |   |
| 5c | Multi-sensor systems that incorporate GNSS   | Paragraph 8.2.2 b) 1) (c)                     | Annex B   |  |   |

| #  | Topics  | Reference paragraphs<br>CA 91-004 | Location<br>in the<br>Annexes<br>of the<br>operator | Comments and/or<br>recommendations by<br>the inspector | Inspector tracking:<br>Item status and date |
|----|---|-----------------------------------|---|--|---|
|    | with AAIM integrity   |                                   |   |  |   |
| 6  | <b>Eligibility Group 3 – New technology</b>   | Paragraph 8.2.2 c)                | Annex B   |  |   |
| 7  | <b>Aircraft requirements</b>  | Paragraph 8.1                     | Annex B   |  |   |
| 7a | Navigation systems  | Paragraph 8.1.1                   | Annex B   |  |   |
| 7b | System performance, monitoring and alert  | Paragraph 8.1.2                   | Annex B   |  |   |
| 7c | Required functions  | Paragraphs 8.3; 8.3.1             | Annex B   |  |   |
| 7d | Explanation of required functions   | Paragraph 8.3.2                   | Annex B   |  |   |
| 8  | <b>Controller-pilot data link communication (CPDLC) and automatic dependent surveillance - contract (ADS-C) systems.</b><br><br>Controller-pilot data link communication (CPDLC) and automatic dependent surveillance - contract (ADS-C) systems are required when the lateral and/or longitudinal separation standard is 30 NM | Paragraph 10.3 c)                 | Annex B   |  |   |
| 9  | <b>Navigation database</b>  | Paragraph 13                      | Annex B   |  |   |

## PART 6 - BASIC PILOT PROCEDURES FOR RNP 4 OPERATIONS

| Topics                      |  | Reference paragraphs<br>CA 91-004 | Location in the Annexes of the operator | Comments and/or recommendations by the CAA | Inspector tracking: Item status and date |
|-----------------------------|--|-----------------------------------|---|--|--|
| <b>Operating procedures</b> |  | Paragraph 11                      | Annex G                                 |  |  |
| 1                           | <b>Flight planning</b>   | Paragraph 11.1 a)                 |   |  |  |
|                             | Verify if the aircraft is approved for RNP 4 operations in oceanic or remote airspace.   | Paragraph 11.1 a) 1)              |   |  |  |
|                             | Verify if the operator is authorised to conduct RNP 4 operations in oceanic or remote operations. This authorisation supports the 30 NM lateral and longitudinal separation minima (or other minima) required by RNP 4 operations.<br><br>It should be noted that the authorisation only addresses navigation requirements associated to these standards.<br><br>The authorisation does not consider communication or surveillance requirements. These requirements are listed in the AIPs and in the regional supplementary procedures (ICAO Doc 7030) for a given airspace or ATS route. | Paragraph 11.1 a) 2)              |   |  |  |
|                             | Verify the letter "R" has been entered in Box 10 (equipment) of the ICAO flight plan.  | Paragraph 11.1 a) 3)              |   |  |  |
|                             | Verify GNSS requirements, such as FDE, if applicable to the operation.   | Paragraph 11.1 a) 4)              |   |  |  |
|                             | Verify if any operational restriction related to the RNP 4 approval has been taken into account, if so required.   | Paragraph 11.1 a) 5)              |   |  |  |

|   | Topics   | Reference paragraphs<br>CA 91-004 | Location in the Annexes of the operator | Comments and/or recommendations by the CAA | Inspector tracking: Item status and date |
|---|--|-----------------------------------|---|--|--|
| 2 | <b>Pre-flight procedures</b>   | Paragraph 11.1 b)                 |   |  |  |
|   | Review the flight technical records (maintenance logs) and the forms to determine the condition of the equipment required to fly in RNP 4 airspace or routes.  | Paragraph 11.1 b) 1)              |   |  |  |
|   | Ensure that maintenance action has been taken to correct defects in the required equipment.  | Paragraph 11.1 b) 2)              |   |  |  |
|   | Review the contingency procedures for operations in airspace or routes that require RNP 4 navigation capability. These are no different than normal oceanic contingency procedures with one exception: crews must be able to recognize, and the ATC must be advised, when the aircraft is no longer able to navigate to its RNP 4 navigation capability. | Paragraph 11.1 b) 3)              |   |  |  |
| 3 | <b>GNSS availability</b><br>During flight planning or at dispatch, the operator must ensure that GNSS availability requirements on which the operator approval has been based will be met throughout the flight.   | Paragraph 11.1 c)                 |   |  |  |
| 4 | <b>En route procedures</b>   | Paragraph 11.1 d)                 |   |  |  |
|   | At least two LRNS, capable of navigating to RNP 4 and listed in the AFM must be operational at the entry point of the RNP airspace. In an item of equipment required for RNP 4 operations is unserviceable, then the pilot will consider an alternate route or diversion for repairs.  | Paragraph 11.1 d) 1)              |   |  |  |

|   | Topics   | Reference paragraphs<br>CA 91-004 | Location in the Annexes of the operator | Comments and/or recommendations by the CAA | Inspector tracking: Item status and date |
|---|--|-----------------------------------|---|--|--|
|   | In-flight operating procedures of the operator must include mandatory cross-check procedures to identify navigation errors sufficiently in advance, in order to prevent the aircraft from inadvertently deviating from the routes cleared by the ATC.  | Paragraph 11.1 d) 2)              |   |  |  |
|   | Crews must advise the ATC of any deterioration or failure of the navigation equipment that cause navigation performance to fall below the required level, and/or any deviation required for a contingency procedure.   | Paragraph 11.1 d) 3)              |   |  |  |
|   | Pilots must use a lateral deviation indicator, a flight director (FD) or an automatic pilot (AP) in the lateral navigation mode (LNAV) in RNP 4 routes. Pilots may use a navigation map display with equivalent functionality to a lateral deviation indicator. The 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 (e.g., $\pm 4$ NM). All pilots are expected to maintain the route centrelines, as depicted by on-board lateral deviation indicators and/or flight guidance during all RNP 4 operations, unless authorized by ATC to deviate or due to emergency conditions. For normal operations, the cross-track error/deviation (the difference between the RNP system computed path and aircraft position relative to the path) shall be limited to $\pm \frac{1}{2}$ the navigation accuracy associated with the flight route (e.g., 2 NM). Small deviations from this requirement are allowed (e.g., overshoots or undershoots) during and immediately after a route turn, up to a maximum of one-times the navigation accuracy (e.g., 4 NM). | Paragraph 11.1 d) 4)              |   |  |  |
| 5 | <b>Contingency procedures</b>  | Paragraph 11.1 e)                 |   |  |  |

## PART 7 – IN-FLIGHT CONTINGENCIES, DEVIATIONS DUE TO WEATHER CONDITIONS AND STRATEGIC LATERAL OFFSET PROCEDURES

| Subject           |  | Reference paragraphs<br>CA 91-004<br>Doc 4444, Paragraph 15.2           | Location<br>in operator<br>Annexes | Comments and/or<br>recommendations by<br>the CAA | Inspector<br>tracking: Item<br>status and date |
|-------------------|--|---|------------------------------------|--|--|
| <b>Procedures</b> |  |   | Annex G                            |  |  |
| 1                 | <b>Special procedures for in-flight contingencies in oceanic airspace</b>  | CA 91-004, Paragraph 11.1 e) 2) (a)<br>Doc 4444, Paragraph 15.2         |                                    |  |  |
|                   | Introduction   | CA 91-004, Paragraph 11.1 e) 2) (a) (1)<br>Doc 4444, Paragraph 15.2.1   |                                    |  |  |
|                   | General procedures   | CA 91-004, Paragraph 11.1 e) 2) (a) (2)<br>Doc 4444, Paragraph 15.2.2   |                                    |  |  |
|                   | Extended range operations by twin-engine aeroplanes (ETOPS)                | CA 91-004, Paragraph 11.1 e) 2) (a) (3)<br>Doc 4444, Paragraph 15.2.2.4 |                                    |  |  |
| 2                 | <b>Procedures for deviating due to weather conditions</b>                  | CA 91-004, Paragraph 11.1 e) 2) (b)<br>Doc 4444, Paragraph 15.2.3       |                                    |  |  |
|                   | General  | CA 91-004, Paragraph 11.1 e) 2) (b) (1)<br>Doc 4444, Paragraph 15.2.3.1 |                                    |  |  |
|                   | Measures to be taken when controller-pilot communications are established. | CA 91-004, Paragraph 11.1 e) 2) (b) (2)<br>Doc 4444, Paragraph 15.2.3.2 |                                    |  |  |

| <b>Subject</b>  | <b>Reference paragraphs</b><br><b>CA 91-004</b><br>Doc 4444, Paragraph 15.2 | <b>Location</b><br><b>in operator</b><br><b>Annexes</b> | <b>Comments and/or</b><br><b>recommendations by</b><br><b>the CAA</b> | <b>Inspector</b><br><b>tracking: Item</b><br><b>status and date</b> |
|---|---|---|---|---|
| Measures to be taken if a revised ATC clearance cannot be obtained.   | CA 91-004, Paragraph 11.1 e) 2) (b) (3)<br>Doc 4444, Paragraph 15.2.3.3     |   |   |   |
| <b>3</b> <b>Procedures for strategic lateral displacement in oceanic airspaces and remote continental areas</b> | CA 91-004, Paragraph 11.1 e) 2) (c)<br>Doc 4444, Paragraph 15.2.4           |   |   |   |

SRVSOP contacts:

Marcelo Ureña Logroño: SRVSOP Safety Oversight Specialist/Aircraft operations e-mail: [murena@lima.icao.int](mailto:murena@lima.icao.int)

Job Aid: RNP 4  
Version: Original  
Date: 01/06/2010

## APPENDIX C

### ADVISORY CIRCULAR

AC : 91-002  
DATE : ~~12/10/09~~ 01/06/10  
REVISION : 4 ~~2~~  
ISSUED BY : SRVSOP

**SUBJECT: AIRCRAFT AND OPERATORS APPROVAL FOR RNAV 5 OPERATIONS**

## ADVISORY CIRCULAR

**AC** : **91-002**  
**DATE** : **12/10/09**  
**01/06/10**  
**REVISION** : **1 2**  
**ISSUED BY** : **SRVSOP**

### **SUBJECT: AIRCRAFT AND OPERATORS APPROVAL FOR RNAV 5 OPERATIONS**

#### **1. PURPOSE**

This advisory circular (AC) provides acceptable means of compliance (AMC) concerning aircraft and operators approval for RNAV 5 operations.

An operator may use alternative means of compliance, as far as those means are acceptable for their respective Civil Aviation Authority (CAA).

The use of the verb in future or the word “must”, is applied to an applicant or operator choosing to fulfill the criteria described in this AC.

This AC also provides guidelines to operators when the stand-alone global positioning system (GPS) is used as the means of navigation in RNAV 5 operations (where the stand-alone GPS equipment provides the only RNAV capability installed on board the aircraft).

#### **2. LATIN AMERICAN AERONAUTICAL REGULATIONS (LAR) RELATED SECTIONS OR EQUIVALENT REGULATIONS**

LAR 91: Sections 91.1015 and 91.1640 or equivalents

LAR 121: Section 121.995 (b) or equivalent

LAR 135: Section 135.565 (c) or equivalent

#### **3. RELATED DOCUMENTS**

ICAO Doc 9613 Performance-based navigation (PBN) manual and its related documentation

EASA AMC 20-4 Airworthiness approval and operational criteria for the use of navigation systems in European airspace designated for Basic RNAV operations and its related documentation

FAA AC 90-96A Approval of U.S. operators and aircraft to operate under instrument flight rules (IFR) in European airspace designated for basic area navigation (B-RNAV) and precision area navigation (P-RNAV) and its related documentation

Spain DGAC CO 1/98 Resolution for operational approval and criteria for the use of navigation systems in European airspace designated for Basic RNAV operations

#### **4. DEFINITIONS AND ABBREVIATIONS**

##### **4.1 Definitions**

a) **Area navigation (RNAV).**- A method of navigation which permits aircraft operation on any

desired flight path within the coverage of ground or space-based navigation aids or within the limits of the capability of self-contained aids, or a combination of these.

*Note.- Area navigation includes performance-based navigation as well as other operations that do not meet the definition of performance-based navigation.*

- b) **Area navigation route.-** An Air traffic services (ATS) route established for the use of aircraft capable of employing area navigation.
- c) **Global positioning system (GPS).-** The United States Global navigation Satellite System (GNSS) is a satellite-based radio navigation system which utilizes precise range measurements to determine position, velocity and time in anywhere in the world. The GPS is composed by three elements: space, control, and user. The space element is formed of at least 24 satellites in 6 orbital planes. The control element consists of 5 monitor stations, 3 ground antennas, and a master control station. The user element consists of antennas and receivers that provide positioning, velocity and precise timing to the user.
- d) **Navigation specifications.-** A set of aircraft and air crew requirements, needed to support performance based navigation operations within a defined airspace. There are two kinds of navigation specifications: RNAV and RNP. A RNAV specification does not include requirements for on-board performance monitoring and alerting. A RNP specification includes requirements for on-board performance monitoring and alerting.
- e) **Performance based navigation (PBN).-** Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.
 

*Note.- Performance requirements are expressed in navigation specifications (RNAV specification, RNP specification) in terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept.*
- f) **Receiver autonomous integrity monitoring (RAIM).-** A technique used within a GPS receiver/processor to determine the integrity of its navigation signals using only GPS signals, or GPS signals augmented with barometrical altitude data. This determination is achieved by a consistency check among redundant pseudo-range measurements. At least one additional satellite needs to be available in respect to the number of satellites that are needed to obtain the navigation solution.
- g) **RNAV operations.-** Aircraft operations using area navigation for RNAV applications. RNAV operations include the use of area navigation for operations which are not developed in accordance with the PBN manual.
- h) **RNAV system.-** Area navigation system, which permits aircraft operation on any desired flight path within the coverage of ground or space-based navigation aids, or within the limits of the capability of self-contained aids, or a combination of both. A RNAV system may be included as part of the Flight Management System (FMS)

#### 4.2 Abreviaturas

- a) AC            Advisory circular (FAA)
- b) ADF         Automatic direction finder
- c) AFM         Aircraft flight manual
- d) AIP         Aeronautical information publication
- e) AIRAC       Aeronautical information regulation and control
- f) AMC         Aceptable means of compliance
- g) ANSP        Air navigation services provider
- h) ATC         Air traffic control

---

|     |         |  |
|-----|---------|--|
| i)  | ATS     | Air traffic services                               |
| j)  | B-RNAV  | Basic area navigation                              |
| k)  | CA      | Advisory circular (in spanish - SRVSOP)            |
| l)  | CAA     | Civil Aviation Authority                           |
| m)  | CDI     | Course deviation indicator                         |
| n)  | CDU     | Control display unit                               |
| o)  | CO      | Operational Circular (Spain)                       |
| p)  | DME     | Distance measuring equipment                       |
| q)  | DOP     | Dilution of precision                              |
| r)  | EASA    | European Aviation Safety Agency                    |
| s)  | ETSO    | EASA Technical standard order                      |
| t)  | EUROCAE | European organization for civil aviation equipment |
| u)  | FAA     | Federal Aviation Administration (United States)    |
| v)  | FDE     | Fault detection and exclusion                      |
| w)  | FMS     | Flight management system                           |
| x)  | FTE     | Flight technical error                             |
| y)  | GNSS    | Global navigation satellite system                 |
| z)  | GPS     | Global positioning system                          |
| aa) | HSI     | Horizontal situation indicator                     |
| bb) | IFR     | Instrument flight rules                            |
| cc) | INS     | Inertial navigation system                         |
| dd) | IRS     | Inertial referente system                          |
| ee) | IRU     | Inertial referente unit                            |
| ff) | LAR     | Latin American Aeronautical Regulations            |
| gg) | LOA     | Letter of authorization/Letter of acceptance       |
| hh) | MEL     | Minimum equipment list                             |
| ii) | NAVAIDS | Navigation aids                                    |
| jj) | NDB     | Non-directional beacon                             |
| kk) | ND      | Navigation display                                 |
| ll) | NOTAM   | Notice to airmen                                   |
| mm) | ICAO    | Internacional Civil Aviation Orgatization          |
| nn) | OM      | Operations manual                                  |
| oo) | PBN     | Performance based navigation                       |
| pp) | PF      | Pilot flying                                       |
| qq) | PNF     | Pilot not flying                                   |
| rr) | POH     | Pilot operating handboock                          |
| ss) | RAIM    | Receiver autonomous integrity monitoring           |

|      |        |  |
|------|--------|--|
| tt)  | P-RNAV | Precision area navigation                              |
| uu)  | RAIM   | Receiver autonomous integrity monitoring               |
| vv)  | RNAV   | Area navigation  |
| ww)  | RTCA   | Radio technical commission for aeronautics             |
| xx)  | SA     | Selective availability                                 |
| yy)  | SB     | Service bulletin                                       |
| zz)  | STC    | Supplemental type certificate                          |
| aaa) | TCDS   | Type certificate data sheet                            |
| bbb) | TLS    | Target level of safety                                 |
| ccc) | TSO    | Technical standard order                               |
| ddd) | VOR    | Very high frequency (VHF) omni-directional radio range |
| eee) | WGS    | World geodetic system                                  |
| fff) | WPT    | Waypoint   |

## 5. INTRODUCTION

5.1 In January 1998, the European Air Safety Agency (EASA) published the document related to the acceptable means of compliance (AMC 20-4) which replaced the Temporary guidance Leaflet No. 2 (TGL No. 2) issued by former JAA. This AMC contains acceptable means of compliance related to airworthiness approval and operational criteria for the use of navigation systems in European air space designated for basic area navigation operations (Basic RNAV or B-RNAV).

5.2 In the same manner, the Federal Aviation Administration (FAA) of the United States (U.S.) replaced the AC 90-96 of March 1998 by AC 90-96A issued in January 2005. This new circular provides guidance material in regards to the airworthiness and operational approval for operators of U.S. registered civil aircraft operating in European air space designated for Basic area navigation (B-RNAV) and Precision area navigation (P-RNAV).

5.3 Both current documents, AMC 20-4 and AC 90-96A, require similar operational and functional requirements.

5.4 In the context of the terminology adopted in the Performance based navigation manual (PBN manual) of the International Civil Aviation Organization (ICAO), B-RNAV requirements are termed RNAV 5.

5.5 The basis of specifications developed by EASA and FAA are supported on the capacity of RNAV equipments incorporated in the early 70s.

5.6 While RNAV operation requirements are addressed primarily in an ATS surveillance environment, RNAV 5 implementation has occurred in areas where there is no surveillance. This has required an increase in route spacing to ensure compliance with the desired level of safety (TLS).

5.7 RNAV 5 specification does not require an alert to the pilot in the event of excessive navigation errors, neither requires two RNAV Systems, thus, the potential for loss of RNAV capability requires the aircraft to be provided of an alternative navigation source.

5.8 The performance level selected for RNAV operations allows a wide range of RNAV systems to be approved for these operations, including INS with a two hour limit after its last alignment/position update performed on the ground, when they do not have a function for automatic radio updating of aircraft position.

5.9 Although RNAV 5 specification does not include requirements for on-board performance

monitoring and alerting, it does require that the on-board equipment keeps a lateral and longitudinal navigation accuracy on route of  $\pm 5$  NM or better during 95% of the total flight time.

## 6. GENERAL CONSIDERATIONS

### 6.1 Navaid infrastructure

- a) The CAA may prescribe RNAV 5 navigation specification for specific routes or for specific areas or flight levels of an airspace.
- b) RNAV 5 systems permit aircraft navigation along any desired flight path within the coverage of ground or space-base navigation aids (NAVAIDS) or within the limits of the capability of self-contained aids or a combination of both methods.
- c) RNAV 5 operations are based on the use of RNAV equipment which automatically determines the aircraft position in the horizontal plane using input from one sensor or a combination of the following types of position sensors, together with the means to establish and follow a desired path:
  - 1) VOR/DME;
  - 2) ME/DME;
  - 3) INS or IRS; and
  - 4) GNSS.

*Note.- the application of the sensors is subject to the limitations contained in this AC.*

- d) The Air navigation services providers (ANSP) must assess the NAVAID infrastructure in order to ensure that it is sufficient for the proposed operations, including reversionary modes.
- e) It is acceptable for gaps in NAVAIDS coverage to be present; when this occurs, route spacing and obstacle clearance surfaces must be consider due to the expected increase in lateral track-keeping errors during the “dead reckoning” phase of flight.

### 6.2 Communication and air traffic services (ATS) surveillance

- a) Direct pilot to ATC voice communication is required.
- b) When reliance is placed on the use of ATS surveillance to assist contingency procedures, its performance should be adequate for that purpose.
- c) Radar monitoring by the ATS may be used to mitigate the risk of gross navigation errors, provided the route lies within the ATS surveillance and communications service volumes and the ATS resources are sufficient for the task.

### 6.3 Obstacle clearance and route spacing

- a) Detailed guidance on obstacle clearance is provided in PANS-OPS (Doc 8168), Volume II; the general criteria in Parts I and III apply.
- b) The ANSP is responsible for route spacing and should have ATS surveillance and monitoring tools to support detection and correction of navigation errors.
- c) In an ATC surveillance environment, the route spacing will depend on acceptable ATC workload and availability of controller tools.
- d) The route design should account for the navigation performance achievable using the available NAVAID infrastructure, as well as the functional capabilities required by this document. Two aspects are of particular importance:

#### 1) Spacing between routes in turns

- (a) Automatic leg sequencing and associated turn anticipation is only a

recommended function for RNAV 5. The track followed in executing turns depends upon the true airspeed, applied bank angle limits and wind. These factors, together with the different turn initiation criteria used by manufacturers, result in a large spread of turn performance. Studies have shown that for a track change of as little as 20 degrees, the actual path flown can vary by as much as 2 NM. This variability of turn performance must be considered in the design of the route structure where closely spaced routes are proposed.

2) **Along track distance between leg changes**

- a) A turn can start as early as 20 NM before the waypoint in the case of a large track angle change. Manually initiated turns may overshoot the following track.
- b) The track structure design has to ensure leg changes do not occur too closely together. The required track length between turns shall depend upon the required turn angle.

6.4 **Publication**

- a) The AIP shall clearly indicate the navigation application is RNAV 5. The requirement for the carriage of RNAV 5 equipment in specific airspace or on identified routes should be published in the AIP.
- b) The route must rely on normal descent profiles and identify minimum segment altitude requirements.
- c) The navigation data published in the AIP for the routes and supporting navigation aids must meet the requirements of Chicago Convention Annex 15 - Aeronautical Information Services.
- d) All routes must be based upon WGS-84 coordinates.
- e) The available NAVAID infrastructure must be clearly designated on all appropriate charts (e.g. GNSS, DME/DME, VOR/DME). Any navigation facilities that are critical to RNAV 5 operations shall be identified in the relevant publications.
- f) A navigation database does not form part of the required functionality of RNAV 5. The absence of such a database necessitates manual waypoint entry, which significantly increases the potential for waypoint errors. En-route charts should support gross error checking by the flight crew by publishing fix data for selected waypoints on RNAV 5 routes.

6.5 **Additional considerations**

- a) Many aircraft have the capability to fly a path parallel to, but offset left or right from, the original active route. The purpose of this function is to enable offsets for tactical operations authorized by ATC.
- b) In the same way, many aircraft have the capability to execute a holding pattern manoeuvre using their RNAV system; this capability can provide flexibility to ATC in designing RNAV 5 operations.

7. **AIRWORTHINESS AND OPERATIONAL APPROVAL**

7.1 In order to the operator receives an RNAV 5 authorization, this must comply with two types of approval:

- a) Airworthiness approval in charge of the State of registry; (See Art. 31, Chicago Convention, Paragraph 5.2.3 and 8.1.1 of Annex 6, Part I; and
- b) Operational approval required by the State of the operator (See Paragraph 4.2.1 and Attachment F of Annex 6 Part I).

7.2 For general aviation operators, the State of registration (See Paragraph 2.5.2.2 of Annex 6 Part II) will submit a Letter of Appointment (LOA) once determined that the aircraft accomplishes all applicable requirements of this document for RNAV 5 operations.

7.3 Compliance with airworthiness requirements by themselves does not constitute the operational approval.

## 8. AIRWORTHINESS APPROVAL

### 8.1 Aircraft equipment

- a) An aircraft may be considered eligible for an RNAV 5 approval if it is equipped with one or more navigation systems approved and installed in accordance with the guide included in this document.
- b) An aircraft capacity to perform RNAV 5 operations can be demonstrated or reached in the following cases
  - 1) First case: Demonstrated capacity in the manufacturing process and declared in the Aircraft flight manual (AFM) or in the AFM supplement or in the Type certificate data sheet (TCDS) or in the Pilot operating handbook (POH).
  - 2) Second case: Capacity reached in-service:
    - (a) By applying the service bulletin or supplemental type certificate or service letter or equivalent document and inclusion of the supplement in the AFM; or
    - (b) through aircraft navigation system approval.

**8.2 Eligibility based on AFM or AFM supplement or TCDS or POH.** To determine eligibility of the aircraft in function of AFM or AFM supplement, TCDS or POH, aircraft RNAV 5 capacity must have been demonstrated in production (aircraft in manufacturing process or new construction).

#### a) Aircraft RNAV 5 systems eligibility.

- 1) An aircraft may be considered eligible for RNAV 5 operations, if AFM or AFM supplement or TCDS or POH shows the appropriate instruments flight rules (IFR) navigation system installation has received airworthiness approval in accordance with this AC or AMC 20-4 or with one of the following FAA documents:
  - (a) AC 90-96, AC 90-45A, AC 20-121A, AC 20-130, AC 20-138 o AC 25-15
- 2) Airworthiness approval guidance included in this AC provides aircraft navigation performance equivalent to EASA AMC 20-4 and FAA AC 90-96A.
- 3) Once aircraft eligibility has been established, operator approval will proceed, according to paragraph 9 of this AC.

#### b) LAR 91 aircraft approval

- 1) LAR 91 operators should revise the AFM or AFM supplement or TCDS or POH to assure that the aircraft navigation system is eligible to perform RNAV 5 operations, according to describe on paragraph 8.2 a) 1) of this AC.
- 2) After having determined eligibility of the navigation system, LAR 91 operators will present respective documents to the AAC.
- 3) In case LAR 91 operators are not able to determine, based on the AFM or AFM supplement or TCDS or POH, whether the Aircraft system has been installed and approved according with an appropriate CA or AC or AMC, they will proceed according to paragraph 8.3. of this document.

#### c) LAR 121 and/or 135 aircraft approval

- 1) LAR 121 and/or 135 operators will present the following documents to AAC:
  - (a) Sections of the AFM or AFM supplement or TCDS that document airworthiness

approval in accordance with this AC or with guidance materials mentioned in Paragraph 8.2 a) 1) of the this document.

- 2) These operators will ensure that the aircraft navigation system will meet the functions required in paragraph 8.6 of this CA.
- 3) In case a LAR 121 and/ or 135 operator is not able to determine, based on the AFM or AFM supplement or TCDS, whether the system has been installed and approved according to an appropriate CA or AC or AMC, it will proceed in accordance with to the steps established in the following paragraph.

**8.3 Eligibility not based on AFM or TCDS or AFM Supplement or POH – RNAV 5 capacity reached during service.**

a) *Determination of the aircraft eligibility through evaluation of its navigation equipment.*

- 1) The operator makes a request for assessment of aircraft RNAV equipment for eligibility to the airworthiness inspection Direction or equivalent CAA entity. The operator, together with the request, will provide the following:
  - (a) RNAV system make, model and part number;
  - (b) evidence that the equipment meets lateral and longitudinal navigation accuracy on route of  $\pm 5$  NM or better during 95% of the total flight time. This can be determined through the evaluation of system design. Evidence of meeting the requirements of another AC can be used for this purpose.
  - (c) proof that the system meets the required functions for RNAV 5 operations described in this CA on paragraph 8.6.
  - (d) crew operating procedures and bulletins; and
  - (e) any other pertinent information required by the CAA.
- 2) in case the airworthiness inspection Direction or CAA equivalent entity is not able to determine RNAV equipment eligibility, evaluation request together with supporting documents will be forward to the aircraft certification Direction or equivalent entity from the State of registry. In any case, aircraft certification Division or equivalent will inform to airworthiness inspection Direction or CAA equivalent entity about the eligibility of the proposed equipment to perform RNAV 5 operations.
- 3) *LAR 91 Operators.-* Once the CAA has determined the aircraft equipment is eligible for RNAV 5 operations, the airworthiness inspection Direction or CAA equivalent entity will issue a letter of finding documenting that the aircraft RNAV equipment is eligible to perform those operations.
- 4) *LAR 121 or 135 operators.-* The CAA will verify aircraft RNAV system eligibility including the required functions on paragraph 8.6 of this AC.

**8.4 Limitations on the design and/or use of navigation systems.-** Although the following navigation systems offer RNAV capability, these present limitations for their use in RNAV 5 operations.

a) **Inertial navigation systems/Inertial reference systems (INS/IRS)**

- 1) Inertial systems may be used either as a stand alone inertial navigation system (INS) or as an inertial reference (IRS) acting as part of a multi-sensor RNAV system where inertial sensors provides augmentation to the basic position sensors as well as a reversionary position data source when out of cover of radio navigation sources.
- 2) INS without a function for automatic radio updating of aircraft position and approved in accordance with FAA AC 25-4, when complying with the functional criteria of paragraph 8.6 of this AC, may be used only for a maximum of two (2) hours from the last alignment/position update performed on ground. Consideration may be given to specific

INS configurations (e.g. triple mix) where either equipment or aircraft manufacturer's data justifies extended use from the last position update.

- 3) INS without automatic radio updating of aircraft position, including those systems where manual selection of radio channels is performed in accordance with flight crew procedures, must be approved in accordance with FAA AC 90-45A or AC 20-130A or any other equivalent document.
- b) **VHF omnidirectional radio range (VOR)**
- 1) VOR accuracy can typically meet accuracy requirements for RNAV 5 up to 60 NM from the navigation aid and Doppler VOR up to 75 NM. Specific regions within the VOR coverage may experience larger due to propagation effect (e.g. multipath). Where such errors exist this can be accommodated by prescribing areas where the affected VOR may not be used.
- c) **Distance measuring equipment (DME)**
- 1) DME signals are considered sufficient to meet requirements of RNAV 5 wherever the signals are received and there is no closer DME on the same channel, regardless of the published coverage volume. Where the RNAV 5 system does not take account of published "Designated operational coverage" of the DME, the RNAV system must execute data integrity checks to confirm that the correct DME signal is being received.
- d) **Global navigation satellite system (GNSS)**
- 1) **Global positioning system (GPS)**
    - (a) The use of GPS to perform RNAV 5 operations is limited to equipment approved in accordance with the TSO-C 129(), TSO-C-145() and TSO-C-146() from FAA or ETSO-129(), ETSO-145() and ETSO-146() from EASA or equivalent documents which include the minimum systems functions specified in the present CA on Paragraph 8.6.
    - (b) The integrity of GPS system must be provided by the receiver autonomous integrity monitoring (RAIM) or an equivalent means within a multi-sensor navigation system. The equipment must be approved in accordance with the AMC 20-5 or equivalent document. In addition, stand-alone GPS equipment must include the following functions according to the TSO-C 129a or ETSO-129a criteria:
      - Pseudorange step detection; and
      - Health word checking
    - (c) Compliance with these two requirements can be determined the following way:
      - (1) a statement in the AFM or POH indicating the GPS equipment meets the criteria for primary means of navigation in oceanic and remote airspace; or
      - (2) a placard on the GPS receiver certifying it meets TSO-C 129 (), TSO-C-145 () and TSO-C-146 () from FAA or ETSO-129 (), ESTO-145 () and ESTO-146 () from EASA; or
      - (3) a CAA letter of design approval for the applicable equipment. Operators should contact the avionics equipment's manufacturer to determine if the equipment complies with these requirements and ask if a letter of design approval is available. Manufacturers may obtain this letter by submitting appropriate documentation to the certifications offices of the States of aircraft design or manufacturer. Operators will keep the letter of design approval within the AFM or POH as evidence of the RNAV 5 eligibility. Any limitations included in the letter of design approval should be reflected in a letter of finding to LAR 91 operators or in the operations specifications

(OpSpecs) for LAR 121 and/or 135 operators.

- (d) Traditional navigation equipment (e.g., VOR, DME or automatic direction finder (ADF)) must be installed and operative, so as to provide an alternative navigation means of navigation.
- (e) Where approval for RNAV 5 requires the use of traditional navigation equipment as a back up in the event of loss of GPS, the required navigation aids as defined in the approval (e.g. VOR, DME or ADF) must be installed and serviceable.

## 2) **Stand-alone GPS equipments**

- (a) Stand-alone GPS equipments approved in accordance with guidance provided in this AC may be used in RNAV 5 operations, subject to the limitations included in this document. Such equipment must be operated in accordance with procedures acceptable to the CAA. The flight crew must receive appropriate training for use the stand-alone GPS equipment regarding normal and contingency procedures detailed in the Paragraph 10 of this AC.

## 8.5 **RNAV-5 system requirements**

### a) Accuracy

- 1) The navigation performance of aircraft approved for RNAV 5 requires a track keeping accuracy equal to or better than  $\pm 5$  NM during the 95% of the flight time. This value includes signal source error, airborne receiver error, display system error and flight technical error (FTE).
- 2) This navigation performance assumes the necessary coverage provided by satellite or ground based navigation aids is available for the intended route to be flown.

### b) Availability and integrity

The minimum level of availability and integrity required for RNAV 5 systems can be met by a single installed system comprising by:

- 1) one sensor or a combination of the following sensors: VOR/DME, DME/DME, INS or IRS and GNSS or GPS;
- 2) RNAV computer;
- 3) control display unit (CDU); and
- 4) navigation display(s) [(e.g. navigation display (ND), horizontal situation indicator (HSI) or course indicator deviation (CDI)] provided that the system is monitored by the flight crew and that in the event of a system failure the aircraft retains the capability to navigate relative to ground based navigation aids (e.g. VOR, DME or Non-directional beacon (NDB)).

## 8.6 **Functional requirements**

### a) *Required Functions*.- The following system functions are the minimum required to conduct RNAV 5 operations:

- 1) Continuous indication of the aircraft position relative to track to be displayed to the pilot flying (PF) on a navigation display situated in his primary field of view;
- 2) In addition, where the minimum flight crew is two pilots, indication of the aircraft position relative to track to be displayed to the pilot not flying (PNF) on a navigation display situated in his primary field of view.
- 3) Display of distance and bearing to the active (To) waypoint;
- 4) Display of ground speed or time to active (To) waypoint;
- 5) Storage of a minimum of 4 waypoints; and

- 6) Appropriate failure indication of the RNAV system, including the sensors failure.
- b) *RNAV 5 navigation displays*
  - 1) Navigation data must be available for display either on a display forming part of the RNAV equipment or on a lateral deviation display (e.g. CDI, (E)HSI, or a navigation map display).
  - 2) These displays must be used as primary flight instruments for the navigation of the aircraft, for maneuver anticipation and for failure/status/integrity indication. They should meet the following requirements:
    - (a) The displays must be visible to the pilot when looking forward along the flight path.
    - (b) The lateral deviation display scaling should be compatible with any alerting and annunciation limits, where implemented.
    - (c) The lateral deviation display must have a scaling and full-scale deflection suitable for the RNAV 5 operation.

### **8.7 Continued airworthiness**

- a) The operators of aircraft approved to perform RNAV 5 operations, must ensure the continuity of the technical capacity of them, in order to meet technical requirements established in this AC.
- b) Each operator who applies for RNAV-5 operational approval shall submit to the CAA of State of registry, a maintenance and inspection program that includes all those requirements of maintenance necessary to ensure that navigation systems continue fulfilling the RNAV 5 approval criteria.
- c) The following maintenance documents must be revised, as appropriate, to incorporate RNAV 5 aspects:
  - 1) Maintenance control manual (MCM);
  - 2) Illustrated parts catalogs (IPC); and
  - 3) Maintenance program.
- d) The approved maintenance program for the affected aircrafts should include maintenance practices listed in maintenance manuals of the aircraft manufacturer and its components, and must consider:
  - 1) that equipment involved in the RNAV 5 operation should be maintained according to directions given by manufacturer's components;
  - 2) that any amendment or change of navigation system affecting in any way RNAV 5 initial approval, must be forwarded and reviewed by the CAA for its acceptance or approval of such changes prior to its implementation; and
  - 3) that any repair that is not included in the approved/accepted maintenance documentation, and that could affect the integrity of navigation performance, should be forwarded to the CAA for acceptance or approval thereof.
- e) Within the RNAV maintenance documentation should be presented the training program of maintenance personnel, which inter alia, should include:
  - 1) PBN concept;
  - 2) RNAV 5 application;
  - 3) equipment involved in a RNAV 5 operation; and
  - 4) MEL use.

## **9. OPERATIONAL APPROVAL**

- 9.1 *Requirements to obtain the operational approval.*- To obtain the operational approval, the operator will comply with the following steps considering the operational procedures established in Paragraph 10 of this AC.
- a) *Airworthiness approval.*- The Aircraft must have the corresponding airworthiness approvals as mentioned in Paragraph 8 of this CA.
  - b) *Documentation.*- The operator will present to the AAC the following documents:
    - 1) The application to obtain RNAV 5 authorization;
    - 2) Amendments to the operations manual (OM) which must include operations procedures according to what is described in Paragraph 10 of this CA, for crews and dispatchers, if applicable;
    - 3) Amendments, when applicable, of maintenance manuals and programs which must have the maintenance procedures for the new equipment, as well as the training of the maintenance associated personnel, in accordance with Paragraph 8.7 e);
    - 4) A copy of the AFM parts, or AFM supplement or TCDS or POH, to verify the airworthiness approval for RNAV 5 for each affected aircraft;
    - 5) The amendments to the Minimum Equipment List (MEL), which must identify the minimum necessary equipment to comply with RNAV 5; and
    - 6) Training programs or amendments to the operator's training program for crews and flight dispatchers, if applicable, according to what is described in Paragraph 11 of this document;
  - c) *Training.*- Once the amendments to manuals, programs and documents have been accepted or approved, the operator will provide required training to its personnel.
  - d) *Validation flights.*- The AAC may perform a validation flight, if determines it is necessary in the interest of safety.
- 9.2 *Authorization issuance to perform RNAV 5 operations.*- Once the operator has successfully completed the operational approval process, the AAC will issue the operator, when applicable, the corresponding authorization to perform RNAV 5 operations.
- a) *LAR 91 operators.*- For LAR 91 operators, the AAC does will issue a letter of authorization (LOA).
  - b) *LAR 121 and/or 135 operators.*- For LAR 121 and/or LAR 135 operators, the AAC will issue the corresponding OpSpecs, which will show RNAV 5 authorization.

## **10. OPERATION PROCEDURES**

### **10.1 Flight planning.**

- a) Before operating on a RNAV 5 route, the operator will ensure that:
  - 1) The aircraft counts on a RNAV 5 approval;
  - 2) The necessary equipment to operate RNAV 5 work correctly and are not degraded;
  - 3) Navigation aids based on space or ground are available;
  - 4) The crews check the contingency procedures.
- b) *Stand-alone GPS equipment.* During the planning phase the following procedures must be accomplish in regards to the stand-alone GPS equipment:
  - 1) An aircraft can depart without further action in the following cases, when:
    - (a) all satellites are scheduled to be in service; or
    - (b) one satellite is scheduled to be out of service in case of GPS equipment that

includes barometrical altitude.

- 2) The availability of GPS integrity RAIM shall be confirmed for the intended flight (route and time) through the use of a prediction program either ground-based or incorporated in the on-board system, following the criteria established in Appendix 1 of the CAA, when:
    - (a) any satellite is scheduled to be out of service; or
    - (b) more than one satellite is scheduled to be out of service in case of GPS equipment that includes barometric altitude.
  - 3) This prediction is required for any route and route segment RNAV 5 based upon the use of GPS.
  - 4) The specified route of flight, including trajectory to any alternative aerodrome will be defined by a series of waypoints and by the estimated time of pass over them for a speed or series of speed, which at the same time will be in function of the intensity and previous wind direction.
  - 5) Taking in consideration that during flight may occur deviations in regards to the specified ground speed, prediction must be done using different speeds within the predictable margin for them.
  - 6) Prediction program must be executed with a maximum anticipation of two hours preview to the flight departure. The operator will confirm that data about the state of the constellation and GPS ephemerides, have been updated with the latest information distributed by notice to airmen (NOTAM).
  - 7) In order to get exact prediction, the program will allow manual de-selection of satellites considered non operative, as well as selection of those back to service condition during the flight time.
  - 8) The operator will not dispatch or release a flight in case of continuous prediction loss of RAM higher than 5 minutes to any part of the previewed route. In this event, flight can be delayed, cancelled or re-routed in which RAM requirements may be accomplished.
- c) *ATS – ICAO flight plan.*- At the time to file the ATS flight plan, authorized aircraft operators on RNAV 5 route, will insert corresponding code on flight plan form's box 10 (equipment), as defined within ICAO Doc 7030 for these operations.

**10.2 Preview flight procedures at the aircraft.**- The crew will perform on the aircraft the following procedures preview to the flight:

- a) check registrations and forms to be sure that maintenance actions have been taken in order to correct defects in the equipment; and
- b) check data base validation (current AIRAC cycle), if it is installed.
- c) route corresponds to the authorization. **Flight crews must cross-check the cleared flight plan by comparing charts or other applicable resources with the navigation system textual display and the aircraft map display, if applicable. If required, the exclusion of specific navigation aids must be confirmed;**

**10.3 En route operations.**

- a) The crew will assure the aircraft correct functioning of its navigation system during its operation in a RNAV 5 route, confirming that:
  - 1) necessary RNAV 5 equipment have not degraded during flight;
  - 2) route corresponds to the authorization;
  - 3) aircraft navigation accuracy is pertinent for RNAV 5, assuring this through pertinent cross check; ~~and~~

- 4) others navigation aids (for example VOR, DME y ADF) must be selected in a way to permit a cross check or immediate reversion in the event of a RNAV capacity loss;
- 5) For RNAV 5, pilots must use a lateral deviation indicator, flight director or autopilot in lateral navigation mode. Pilots may use a navigation map display as described in Paragraph 8.6 b), without a flight director or autopilot. Pilots of aircraft with a lateral deviation display must ensure that lateral deviation scaling is suitable for the navigation accuracy associated with the route/procedure (e.g. full-scale deflection:  $\pm 5$  NM);
- 6) All pilots are expected to maintain route centrelines, as depicted by on-board lateral deviation indicators and/or flight guidance, during all RNAV 5 operations, unless authorized to deviate by ATC or under emergency conditions. For normal operations, cross-track error/deviation (the difference between the RNAV system-computed path and the aircraft position relative to the path) must be limited to  $\pm \frac{1}{2}$  the navigation accuracy associated with the procedure or route (2.5 NM). Brief deviations from this standard (e.g. overshoots or undershoots) during and immediately after procedure/route turns, up to a maximum of one-times the navigation accuracy (5 NM), are allowable; and  
*Note.- Some aircraft do not display or compute a path during turns; pilots of these aircraft may not be able to adhere to the  $\pm \frac{1}{2}$  accuracy standard during route turns, but are still expected to satisfy the standard during intercepts of the final track following the turn and on straight segments.*
- 7) If ATS issues a heading assignment taking the aircraft off a route, the pilot must not modify the flight plan in the RNAV system until a clearance is received to rejoin the route or the controller confirms a new clearance. When the aircraft is not on the published route, the specified accuracy requirement does not apply.

#### 10.4 Contingency procedures.

- a) Flight crews must familiarize with the following general provisions:
  - 1) An aircraft must not enter or continue the operations in airspace designated as RNAV 5, according to the present ATC authorization, if because of a failure or degradation the navigation systems falls under RNAV 5 requirements, the pilot will obtain as soon as possible an amended authorization;
  - 2) According to ATC instructions, operations will continue in regards to the present ATC authorization, or when not possible, will be requested a revised authorization to return to the VOR/DME conventional navigation;
  - 3) in the event of communications failure, the flight crew must continue with the flight plan, in accordance with the published lost communication procedures; and
  - 4) in any case, the crew must follow contingency procedures established for every operation region, and obtain an ATC authorization as soon as possible.
- b) Stand-alone GPS equipment.
  - 1) The operating procedures must identify the flight crew actions required in the event of RAIM function loss or exceedance of integrity alarm limit (erroneous position). This procedures must include:
    - (a) In case of loss of the RAIM detection function.- The flight crew may continue navigating with the GPS equipment. The flight crew should attempt to cross-check the aircraft position with the information provided for the ICAO conventional nav aids: VOR, DME and ADF, in order to confirm the existence of a required level of precision. In other case, the crew must revert to an alternative navigation means;
    - (b) In the event of an observed failure (including the failure of a satellite impacting the performance of the navigation systems based on GPS), the flight crew must revert to an alternative means of navigation.

- (c) In case of exceedance of the alarm limit.- The flight crew must revert to an alternative means of navigation.
- 2) *On-board equipment availability VOR, DME or ADF.*- The operator must have installed on the aircraft the VOR, DME or ADF on-board equipment capacity according to the applied rules of operation LAR 91, 121 and 135. This capacity must be available along the intended route of flight to assure the availability of navigation alternative means in case of a GPS/RNAV system failure.
- c) Any incidence registered in flight must be notified to the AAC in a maximum time of seventy two hours, unless justified cause.

## 11. NAVIGATION ERROR REPORTS FOLLOW UP PROCESS

- a) The operator will establish a process to receive, analyze and do a follow up of the navigation error reports which allow determine the appropriate corrective action.
- b) Repetitive navigation error occurrences, attributed to a specific part of the navigation equipment must be analyzed in order to correct its cause.
- c) The nature and severity of the error may result in temporary withdrawn of the authorization to use the navigation equipment until the cause of the problem has been identified and rectified.

## 12. TRAINING PROGRAM

- a) The training programs for flight crews and flight dispatchers, if correspond, must be reviewed and approved by the AAC. The operator will included at least the following modules:
  - 1) Required equipments, capacities, limitations and operation of these equipments in RNAV 5 airspace.
  - 2) The routes and airspace for which the RNAV system is approved to operate.
  - 3) The NAVAID limitations in respect of the operation of the RNAV system to be used for the RNAV 5 operation.
  - 4) Contingency procedures for RNAV failures.
  - 5) The Radio/Telephony Phraseology for the airspace in accordance to Doc 4444 and Doc 7030 as appropriate.
  - 6) The flight planning requirements for the RNAV operation.
  - 7) RNAV requirements as determined from chart depiction and textual description.
  - 8) RNAV 5 en route procedures;
  - 9) Methods to reduce navigation errors through dead-reckoning techniques.
  - 10) RNAV system-specific information, including:
    - (a) Levels of automation, mode annunciations, changes, alerts, interactions, reversions, and degradation.
    - (b) Functional integration with other aircraft systems.
    - (c) Monitoring procedures for each phase of flight (for example, monitor PROG or LEGS page).
    - (d) Types of navigation sensors (for example, DME, IRU, GNSS) utilized by the RNAV system and associated system prioritization/weighting/logic.
    - (e) Turn anticipation with consideration to speed and altitude effects.
    - (f) Interpretation of electronic displays and symbols.

- 11) RNAV equipment operating procedures, as applicable, including how to perform the following actions:
  - (a) Verify currency of aircraft navigation data.
  - (b) Verify successful completion of RNAV system self-tests.
  - (c) Initialize RNAV system position.
  - (d) Fly direct to a waypoint.
  - (e) Intercept a course/track.
  - (f) Be vectored off and rejoin a procedure.
  - (g) Determine cross-track error/deviation.
  - (h) Remove and reselect navigation sensor input.
  - (i) When required, confirm exclusion of a specific navigation aid or navigation aid type.
  - (j) Perform gross navigation error check using conventional navigation aids.
- b) Training program on the GPS as a primary means of navigation.
  - 1) Besides the training modules describe on the previous paragraphs, operators' training programs which use RNAV systems based on GPS as a primary navigation means will include modules described in Appendix 2.

### **13. NAVIGATION DATA BASE**

Where a navigation database is carried and used, it must be current and appropriate for the region of intended operation and must include the navigation aids and waypoints required for the route. If this is the case, the operator must present together with the application a navigation data validation program in accordance with SRVSOP CA 91-001, Appendix 1.

**Note.-** Navigation databases are expected to be current for the duration of the flight. If the AIRAC cycle is due to change during flight, operators and pilots should establish procedures to ensure the accuracy of the navigation data, including the suitability of navigation facilities used to define the routes for the flight. Traditionally, this has been accomplished by verifying electronic data against paper products.

## Appendix 1

### GPS integrity monitoring (RAIM) prediction program

Where a GPS integrity monitoring (RAIM) prediction program is used as a means of compliance with paragraph 5.2 (a) of this document, it should meet the following criteria:

- a) The program should provide prediction of availability of the integrity monitoring (RAIM) function of the GPS equipment, suitable for conducting RNAV 5 operations in designated European airspace.
- b) The prediction program software should be developed in accordance with at least RTCA DO 178B/EUROCAE 12B, Level D guidelines.
- c) The program should use either a RAIM algorithm identical to that used in the airborne equipment or an algorithm based on assumptions for RAIM prediction that give a more conservative result.
- d) The program should calculate RAIM availability based on a satellite mask angle of no less than 5 degrees, except where use of lower mask angle has been demonstrated to be acceptable to the authority.
- e) The program should have the capability to manually designate GPS satellites which have been notified as being out of service for the intended flight.
- f) The program should allow the user to select:
  - 1) the intended route and declared alternates; and
  - 2) the time and duration of the intended flight.

**PAGE INTENTIONALLY LEFT BLANK**

## Appendix 2

### Training program on the GPS as a primary means of navigation

The training programs for flight crews that use RNAV 5 systems based on the GPS as a primary means of navigation will include a segment with the following training modules:

- a) GPS system components and operating principles.- Understanding of the GPS system and its operating principles:
  - 1) GPS system components: control segment, user segment, and space segment;
  - 2) on-board equipment requirements;
  - 3) GPS satellite signals and pseudo-random code;
  - 4) positioning principle;
  - 5) receiver clock error;
  - 6) masking function;
  - 7) performance limitations of the different types of equipment;
  - 8) WGS84 coordinate system;
- b) Navigation system performance requirements.- Define the following terms in relation to the navigation system and evaluate the degree of compliance by the GPS system of the requirements associated with the following terms:
  - 1) precision;
  - 2) integrity;
    - (a) means to improve GPS integrity: RAIM and fault detection and exclusion (FDE)
  - 3) availability;
  - 4) service continuity
- c) Authorizations and documentation.- Requirements applicable to pilots and navigation equipment for GPS operation:
  - 1) pilot training requirements;
  - 2) aircraft equipment requirements;
  - 3) AFM system certification criteria and limitations;
  - 4) GPS-related NOTAMs.
- d) GPS system errors and limitations.- Cause and magnitude of typical GPS errors:
  - 1) ephemerides;
  - 2) clock;
  - 3) receiver;
  - 4) atmospheric/ionospheric;
  - 5) multi-reflection;
  - 6) selective availability (SA);
  - 7) total typical error associated to the C/A code;
  - 8) effect of the dilution of precision (DOP) on the position;
  - 9) susceptibility to interference;

- 10) comparison of vertical and horizontal errors; and
  - 11) path-tracking precision. Collision avoidance.
- e) Human factors and GPS.- Limitations on the use of GPS equipment due to human factors. Operating procedures that offer protection against navigation errors and loss of awareness of the real situation due to the following causes:
- 1) mode errors;
  - 2) data entry errors;
  - 3) data checks and validation, including independent cross-checking procedures;
  - 4) automation-induced relaxation;
  - 5) lack of standardization of GPS equipment;
  - 6) information processing by humans and situational awareness.
- f) GPS equipment – Specific navigation procedures.- Knowledge of the appropriate operating procedures for GPS in the typical navigation tasks for each specific type of equipment in each type of aircraft that includes:
- 1) selection of the appropriate operating mode;
  - 2) review of the different types of information contained in the navigation database;
  - 3) forecast of the availability of the RAIM function;
  - 4) procedure for entering and checking the waypoints defined by the user;
  - 5) procedure for entering, retrieving and checking flight plan data;
  - 6) interpretation of the typical information shown on the GPS navigation display: LAT/LONG, distance and heading to the waypoint, CDI;
  - 7) interception and maintenance of the GPS-defined routes;
  - 8) in-flight determination of ground speed (GS), estimated time of arrival (ETA), time and distance to the waypoint;
  - 9) indication of waypoints over flight;
  - 10) use of the “DIRECT TO” function;
  - 11) use of the “NEAREST AIRPORT” function;
  - 12) use of the GPS in GPS or DME/GPS arrival procedures.
- g) Verification of GPS equipment.- For each type of equipment in each aircraft, the following operational and start-up checks must be conducted at the appropriate time:
- 1) constellation status;
  - 2) RAIM and FDE functional status;
  - 3) dilution of precision (DOP) status;
  - 4) currency of the instrument flight rules (IFR) database;
  - 5) receiver operating condition;
  - 6) CDI sensitivity;
  - 7) position indication.
- h) GPS messages and warnings.- For each type of equipment in each aircraft, timely action must be recognized and taken in face of GPS messages and warnings, including the following:
- 1) loss of RAIM function;

- 2) 2D/3D navigation;
- 3) dead-reckoning navigation mode;
- 4) database not updated;
- 5) loss of the database;
- 6) GPS equipment failure;
- 7) barometric data entry failure;
- 8) power failure;
- 9) prolonged parallel displacement; and
- 10) satellite failure.

**PAGE INTENTIONALLY LEFT BLANK**

### Appendix 3

#### RNAV 5 approval process

- a) The RNAV 5 approval process is comprised of two types of approvals: the airworthiness approval and the operational approval, even though, they have different requirements, both must be considered under one process only.
- b) This process constitutes a well-arrange method, which is used by the CAA to ensure the applicants comply with the established requirements.
- c) The approval process is conformed by the following phases:
  - 1) Phase one: Pre-application
  - 2) Phase two: Formal application
  - 3) Phase three: Analysis of the documentation
  - 4) Phase four: Demonstration and inspection
  - 5) Phase five: Approval
- d) *In Phase One - Pre-application*, the CAA holds a meeting with the operator (the pre-application meeting), in which the operator will be informed about all the requirements that he needs to comply during the approval process.
- e) *In Phase Two - Formal application*, the operator submits the formal application with all applicable documents.
- f) *In Phase Three - Analysis of the documentation*, the CAA reviews the submission and evaluates the navigation equipment in order to determine the method of approval (aircraft equipment eligibility). As a result of this evaluation the CAA may accept or return the Formal Application with the documentation.
- g) *In Phase Four - Demonstration and inspection*, the operator will accomplish the training program and the validation flight if this is required by the CAA, otherwise the process will advance to the next phase.
- h) *In phase Five - Approval*, the CAA issues the RNAV 5 authorization, once the operator has completed the airworthiness and operations requirements. For LAR 121 and/or 135 operators, the AAC will issue the OpSpecs and for LAR 91 operators will issue a LOA.

**PAGE INTENTIONALLY LEFT BLANK**

## **APPENDIX D**

**RNAV 10 (DESIGNATED AND AUTHORIZED AS RNP 10) JOB AID**

**APPLICATION TO CONDUCT RNP 10 OPERATIONS**

## **RNAV 10 (DESIGNATED AND AUTHORIZED AS RNP 10) JOB AID**

### **APPLICATION TO CONDUCT RNP 10 OPERATIONS**

#### **1. Introduction**

This Job Aid was developed by the Latin American Regional Safety Oversight Cooperation System (SRVSOP) to provide States, operators, and inspectors with guidance on the process to be followed by an operator in order to obtain an RNP 10 authorization. RNAV 10 maintains the designation RNP 10, as specified in ICAO Doc 9613 – Performance-based navigation (PBN) manual.

#### **2. Purposes of the Job Aid**

- 2.1 To give operators and inspectors information on the main RNP 10 reference documents.
- 2.2 To provide tables showing the contents of the application, the associated reference paragraphs, the place in the application of the operator where RNP 10 elements are mentioned and columns for inspector comments and follow-up on the status of various RNP 10 elements.

#### **3. Actions Recommended for the inspector and operator**

Some recommendations for use of the Job Aid follow:

- 3.1 At the pre-application meeting with the operator, the inspector reviews the “basic events of the RNP 10 approval process” described in Part 1 of this Job Aid, in order to provide an overview of the approval process events.
- 3.2 The inspector reviews this Job Aid with the operator in order to establish the form and content of the RNP 10 approval application.
- 3.3 The operator uses this Job Aid as a guide to collect the documents/annexes of the RNP 10 application.
- 3.4 The operator inserts in the Job Aid references showing in what part of its documents are the RNP 10 programme elements located.
- 3.5 The operator submits the Job Aid and the application to the inspector (documents/annexes).
- 3.6 The inspector indicates in the Job Aid whether an item is in compliance or needs corrective action.
- 3.7 The inspector informs the operator as soon as possible when a corrective action by the operator is required.
- 3.8 The operator provides the inspector with the revised material when so requested.
- 3.9 The CAA provides the operator with the operational specifications (OpSpecs) or a letter of authorisation (LOA), as applicable, when the tasks and documents have been completed.

#### 4. Structure of the Job Aid

| Parts  | Topics   | Page |
|--------|--|------|
| Part 1 | General information  | 3    |
| Part 2 | Information on aircraft and operator identification  | 5    |
| Part 3 | Operator application (Annexes and documents)   | 7    |
| Part 4 | Contents of the operator application for RNP 10  | 11   |
| Part 5 | Guide to determine the eligibility of RNP 10 aircraft  | 15   |
| Part 6 | Basic pilot procedures for RNP 10 operations   | 17   |
| Part 7 | Procedures for flight contingencies, deviations due to weather, and strategic lateral displacement | 23   |

#### 5. Main sources of documents, information and contacts

Advisory Circular CA 91-001 is available on the ICAO/SAM Regional Office web page ([www.lima.icao.int](http://www.lima.icao.int)) through the SRVSOP link.

#### 6. Main reference documents

| Reference Documents | Title   |
|---------------------|---|
| Annex 6             | Operation of aircraft   |
| ICAO Doc 9613       | Manual on performance-based navigation  |
| FAA Order 8400.12A  | Required navigation performance 10 (RNP 10) operational approval  |
| AMC 20-12           | Recognition of FAA Order 8400.12A for RNP 10 operations   |
| Spain DGAC CO 01/01 | Aprobación operacional y criterios de utilización de sistemas para la navegación en espacio aéreo designado RNP 10                            |
| AMC 20-5            | Acceptable means of compliance for airworthiness approval and operational criteria for the use of the NAVSTAR Global positioning system (GPS) |
| AC 20-130()         | Airworthiness approval of multi-sensor navigational system for use in the U.S. National Airspace System                                       |
| AC 20-138A          | Airworthiness approval of Global navigation satellite system (GNSS) equipment   |
| AC 25-4             | Inertial navigation system (INS)  |
| AC 25-15            | Approval of FMS in transport category airplanes   |
| AC 90-45A           | Approval of area navigation systems for use in the U.S. National Airspace System  |

**PART 1: GENERAL INFORMATION****Basic events of the RNP 10 approval process**

|   | <b>Action by the Operator</b>   | <b>Action by the CAA</b>  |
|---|---|---|
| 1 | Establishes the need to obtain RNP 10 authorization.  |   |
| 2 | Reviews the AFM, AFM supplement or Type Certificate Data Sheet (TCDS), or other appropriate documents ( <i>e.g.</i> , service bulletins (SB), service letters (SL), etc.) to determine the eligibility of the aircraft for RNP 10 operations. The operator contacts the aircraft or avionics manufacturer, if necessary, to confirm RNP 10 or better eligibility of the aircraft. |   |
| 3 | Contacts the CAA to schedule a pre-application meeting to discuss the operational approval requirements.  |   |
| 4 |   | During the pre-application meeting, establishes: <ul style="list-style-type: none"> <li>• the form and contents of the application;</li> <li>• the documents that support RNP 10 approval</li> <li>• the date in which the application will be submitted for evaluation</li> <li>• if necessary, conducts a validation flight observed by the CAA.</li> </ul> |
| 5 | Submits the application at least 60 days before the start-up of RNP 10 operations.  |   |
| 6 |   | Reviews the operator submission   |
| 7 | Once the amendments to manuals, programmes, and documents have been approved, provides training to flight crews, flight dispatchers, and maintenance personnel, and conducts a validation flight, if required by the CAA.   | Only if required, participates in the validation flight.  |
| 8 |   | Once the operational and airworthiness requirements have been met, issues the operational approval in the form of OpSpecs for LAR 121 or 135 or equivalent operators, or an LOA for LAR 91 or equivalent operators, as appropriate.   |

**Notes related to the approval process****1. Responsible authority**

- a. **Commercial air transport (LAR 121 and/or 135 or equivalent regulations).**- The **State of registry** determines that the aircraft meets the airworthiness requirements. The **State of the operator** issues the RNP 10 approval (e.g., OpSpecs).
- b. **General aviation (LAR 91 or equivalent regulations).**- The **State of registry** determines that the aircraft meets the airworthiness requirements and issues the operational approval (e.g., an LOA).

2. The CAA does not need to issue an LOA or an equivalent document for each individual area of operation in the case of LAR 91 operators.

3. LAR 121 and/or 135 operators with RNP 10 approval must list the individual areas of operation in the OpSpecs.

4. Related sections of the Latin American Aeronautical Regulations (LAR) or equivalent regulations

- a. LAR 91        Sections 91.1015 and 91.1640 or equivalents
- b. LAR 121     Section 121.995 (b) or equivalent
- c. LAR 135     Section 135.565 (c) or equivalent

5. Related ICAO Documents

- a. Annex 2 to the Convention on International Civil Aviation – Rules of the Air
- b. Annex 6 to the Convention on International Civil Aviation – Operation of Aircraft
- c. OACI Doc 9613 – Performance-based navigation (PBN) Manual
- d. OACI Doc 4444 – Procedures for air navigation services – Air traffic management.
- e. OACI Doc 7030 – Regional supplementary procedures

**PART 2: INFORMATION ON THE IDENTIFICATION OF AIRCRAFT AND OPERATORS**

**NAME OF THE OPERATOR:** \_\_\_\_\_

| Aircraft manufacturer, model and series | Registration numbers | Serial numbers | Long-range navigation systems (LRNS) Number, manufacturer and model | RNP specification |
|---|----------------------|----------------|---|-------------------|
|   |                      |                |   |                   |
|   |                      |                |   |                   |
|   |                      |                |   |                   |
|   |                      |                |   |                   |
|   |                      |                |   |                   |
|   |                      |                |   |                   |

DATE OF PRE-APPLICATION MEETING \_\_\_\_\_

DATE IN WHICH THE APPLICATION WAS RECEIVED \_\_\_\_\_

DATE IN WHICH THE OPERATOR INTENDS TO BEGIN RNP 10 OPERATIONS \_\_\_\_\_

IS THE CAA NOTIFICATION DATE APPROPRIATE? YES \_\_\_\_\_ NO \_\_\_\_\_

**PAGE LEFT BLANK INTENTIONALLY**

**PART 3 – OPERATOR APPLICATION (ANNEXES AND DOCUMENTS)**

| <b>Annex</b> | <b>Title of Annex/document</b>   | <b>Indication of inclusion by the operator</b> | <b>Comments by the Inspector</b> |
|--------------|--|--|----------------------------------|
| A            | <b>Operator letter requesting RNP 10 authorization</b>   |  |                                  |
| B            | <b>Group of aircraft</b><br>Statement by the operator as to whether the aircraft and LRNS combinations belong to a group or aircraft or not  |  |                                  |
| C            | <b>Airworthiness documents showing aircraft eligibility for RNP 10.</b><br>AFM, AFM revision, AFM supplement, or Type certificate data sheet (TCDS) showing LRNS eligibility for RNP 10.   |  |                                  |
| D            | <b>Aircraft modified to meet RNP 10 standards. Documentation on aircraft inspection and/or modification, if applicable.</b> Maintenance records documenting the installation or modification of LRNS and of the aircraft (e.g., FAA Form 337 – major repairs and alterations).   |  |                                  |
| E            | <b>For aircraft equipped only with INS or IRU: RNP 10 time limit and area of operations.</b> Documentation showing RNP 10 time limit and the area of operation or routes for which the navigation system/aircraft is eligible. (Not applicable for aircraft equipped with GNSS.) |  |                                  |
| F            | <b>Maintenance programme</b> <ul style="list-style-type: none"> <li>• For aircraft with established LRNS maintenance practices, the list of references of the document or programme.</li> <li>• For recently installed LRNS, the maintenance practices for review.</li> </ul>    |  |                                  |
| G            | <b>Minimum equipment list (MEL) (only for operators conducting</b>   |  |                                  |

| Annex | Title of Annex/document  | Indication of inclusion by the operator | Comments by the Inspector |
|-------|--|---|---------------------------|
|       | <p><b>operations based on a MEL):</b><br/>MEL showing LRNS provisions.</p>   |   |                           |
| H     | <p><b>Training</b></p> <ol style="list-style-type: none"> <li>1. <b>LAR 91 operators or equivalent: Training method:</b> Training at home, LAR 142 training centres, or other training courses, course completion records.</li> <li>2. <b>LAR 121 and/or 135 operators or equivalent:</b> Training programmes (training curricula) for flight crews, flight dispatchers, and maintenance personnel.</li> </ol> |   |                           |
| I     | <p><b>Operating policies and procedures</b></p> <ol style="list-style-type: none"> <li>1. <b>LAR 91 operators or equivalent:</b> Operations manual (OM) or sections to be attached to the application, corresponding to RNP 10 operating procedures and policies.</li> <li>2. <b>LAR 121 and/or 135 operators or equivalents:</b> Operations manual and checklists.</li> </ol>                                 |   |                           |
| J     | <p><b>Past performance.</b> If any, previous problems, incidents, path-keeping errors, corrective action will be included.</p>   |   |                           |
| K     | <p><b>Withdrawal of RNP 10 approval</b></p> <p>Indication of the need to follow up on navigation error reports submitted and the possibility of withdrawal of RNP 10 approval.</p>   |   |                           |
|       | <p><b>Validation flight plan:</b> Only if required by the CAA.</p>   |   |                           |

**CONTENTS OF THE APPLICATION TO BE SUBMITTED BY THE OPERATOR**

\_\_\_\_ **RNP 10 COMPLIANCE DOCUMENTATION OF THE AIRCRAFT/NAVIGATION SYSTEMS**

\_\_\_\_ **OPERATING PROCEDURES AND POLICIES**

\_\_\_\_ **SECTIONS OF THE MAINTENANCE MANUAL RELATED TO LRNS (if not previously reviewed)**

**Note 1:** Documents may be grouped in a single binder or may be submitted as individual documents.

**PAGE LEFT BLANK INTENTIONALLY**

## PART 4: CONTENTS OF OPERATOR APPLICATION FOR RNP 10

| #  | Contents of the RNP 10 application by the operator  | Reference paragraphs<br>CA 91-001                 | In what Annexes/Documents of the operator can the application contents be located<br><br>Note: The operator must update this column to reflect the contents of the application | Comments and/or recommendations by the inspector | Follow-up by the inspector: Item status and date |
|----|---|---|--|--|--|
| 1  | <b>Operator request letter</b><br>Statement of intent to obtain RNP 10 authorization.   | Paragraph 9.1.1 b) 1)<br>Appendix 2, Paragraph e) | Annex A  |  |  |
| 2  | <b>Aircraft/ navigation system RNP 10 eligibility method</b><br>Airworthiness documents that establish the aircraft/navigation system eligibility method, its approval status, and, in a format acceptable to the inspector, a list of <del>airframes</del> <b>aircrafts</b> included in this method. | Paragraphs <del>8.2 and</del> 8.3                 | Annex B<br>Annex C   |  |  |
| 2a | <b>Dual LRNS requirement</b><br>At least two LRNS with displays and functions suitable for oceanic operations are required.   | Paragraph 8.1.1<br>Paragraph 10.2                 | Annex B<br>Annex C   |  |  |
| 3  | <b>Time limit only for aircraft equipped with INS or IRU</b><br>RNP 10 time limit proposed or approved for  | Paragraph 8.4                                     | Annex B<br>Annex C   |  |  |

| # | Contents of the RNP 10 application by the operator   | Reference paragraphs<br>CA 91-001  | In what Annexes/Documents of the operator can the application contents be located<br><br>Note: The operator must update this column to reflect the contents of the application | Comments and/or recommendations by the inspector | Follow-up by the inspector: Item status and date |
|---|--|--|--|--|--|
|   | aircraft with INS or IRU as the only source of long-range navigation (LRN). (Not applicable for aircraft equipped with GNSS.)  |  |  |  |  |
| 4 | <b>RNP 10 area of operation for aircraft equipped only with INS and IRU.</b> Documentation establishing the area of operation or RNP 10 routes for which the navigation system/aircraft is eligible. (Not applicable for aircraft equipped with GNSS.)   | Paragraphs 10.5 and 10.9 ( <del>Paragraphs 10.10 and 10.11, as applicable</del> )                    |  |  |  |
| 5 | <p><b>Training</b></p> <p><b>1. LAR 91 operators or equivalent: Training methods:</b> The following methods are acceptable for these operators: Training at home, LAR 142 training centres, or other training courses.</p> <p><b>2. LAR 121 or 135 operators or equivalent: Training programmes:</b> Operators will develop an initial and periodic training programme for flight crews, flight dispatchers, if applicable, and maintenance personnel.</p> | <p>Paragraphs 9.1.1 b) 5) (a) and 12 b)</p> <p>Paragraphs 9.1.1 b) 5) (a); 9.1.1 b) 9) and 12 a)</p> | Annex F  |  |  |

| # | Contents of the RNP 10 application by the operator   | Reference paragraphs<br>CA 91-001                          | In what Annexes/Documents of the operator can the application contents be located<br><br>Note: The operator must update this column to reflect the contents of the application | Comments and/or recommendations by the inspector | Follow-up by the inspector: Item status and date |
|---|--|--|--|--|--|
| 6 | <b>Operating policies and procedures</b><br><b>1. LAR 91 operators or equivalent:</b> Operations manual or section of the operator application documenting RNP 10 policies and procedures.<br><b>2. LAR 121 and/or 135 operators or equivalent:</b> Operations manual and checklists.              | Paragraph 9.1.1 b) 6) (b)<br><br>Paragraph 9.1.1 b) 6) (a) | Annex G  |  |  |
| 7 | <b>Maintenance practices</b> <ul style="list-style-type: none"> <li>• For aircraft with established LRNS maintenance practices, the operator will provide document references.</li> <li>• For newly installed LRNS systems, the operator will provide maintenance practices for review.</li> </ul> | Paragraphs 8.5 b) a) to d) and 9.1.1 b) 8)                 | Annex D  |  |  |
| 8 | <b>Minimum equipment list (MEL) update</b><br>Applicable to operators conducting operations according to a MEL.  | Paragraphs <del>8.5 a)</del> and 9.1.1 b) 7)               | Annex E  |  |  |
| 9 | <b>Past performance.</b> Performance record identifying previous problems, incidents,  | Paragraph 9.1.1 b) 10)                                     |  |  |  |

| #  | Contents of the RNP 10 application by the operator   | Reference paragraphs<br>CA 91-001 | In what Annexes/Documents of the operator can the application contents be located<br><br>Note: The operator must update this column to reflect the contents of the application | Comments and/or recommendations by the inspector | Follow-up by the inspector: Item status and date |
|----|--|-----------------------------------|--|--|--|
|    | track keeping errors and corrective actions.   |                                   |  |  |  |
| 10 | <b>Withdrawal of RNP 10 operating authority</b><br>Indication of the need for follow-up on the navigation error reports and the possibility of withdrawal of the RNP approval. | Paragraph <del>9-3</del> 14       | Annex H  |  |  |
| 11 | <b>Validation flight plan, only if required</b><br>The validation flight plan will be presented only if required.  | Paragraph 9.1.1 d)                |  |  |  |

## PART 5 – GUIDE FOR DETERMINING RNP 10 AIRCRAFT ELIGIBILITY

| #  | Topics  | Reference paragraphs<br>CA 91-001 | Location in<br>the Annexes<br>of the<br>operator | Comments and/or<br>recommendations<br>by the inspector | Follow-up by the<br>inspector: Item<br>status and date |
|----|---|-----------------------------------|--|--|--|
| 1  | <b>Group aircraft definition</b>  | Paragraph 8.2.1                   | Annex B  |  |  |
| 2  | <b>Dual long-range navigation system (LRNS)</b>   | Paragraphs 8.1.1 and 10.2         | Annex B  |  |  |
| 3  | <b>Eligibility Method 1.-</b> Eligibility of aircraft through RNP certification (RNP compliance documented in the AFM). | Paragraph 8.3.1 a)                | Annex B  |  |  |
| 4  | <b>Eligibility Method 2.-</b> Eligibility of aircraft through previous certification of the navigation system.          | Paragraph 8.3.1 b)                | Annex B  |  |  |
| 4a | INSs or IRUs approved according to LAR 121, Appendix G (time limit 6.2 hours)   | Paragraph 8.3.1 b) 4)             | Annex B  |  |  |
| 4b | INSs or IRUs approved for MNPS operations in the North Atlantic (time limit 6.2 hours)                                  | Paragraph 8.3.1 b) 6)             | Annex B  |  |  |
| 4c | Obtaining of approval with extended time limit for aircraft equipped with INS or IRU systems.                           | Paragraph 8.4                     | Annex B  |  |  |
| 4d | GNSS (e.g., GPS) approved as primary means of navigation (AC 20-138 or equivalent)                                      | Paragraph 8.3.1 b) 1)             | Annex B  |  |  |

| #  | Topics   | Reference paragraphs<br>CA 91-001 | Location in<br>the Annexes<br>of the<br>operator | Comments and/or<br>recommendations<br>by the inspector | Follow-up by the<br>inspector: Item<br>status and date |
|----|--|-----------------------------------|--|--|--|
| 4e | Multi-sensor systems into which the GNSS (e.g., GPS) is integrated (AC 20-130 or equivalent) | Paragraph 8.3.1 b) 2)             | Annex B  |  |  |
| 4f | Equipment with a single GNSS and another approved LRNS (e.g., INS or IRU)                    | Paragraph 8.3.1 b) 7)             | Annex B  |  |  |
| 4g | Aircraft which qualify for the /E Suffix as defined in the AIM of the United States.         | Paragraph 8.3.1 b) 3)             | Annex B  |  |  |
| 4g | Aircraft equipped with double INS or IRU   | Paragraph 8.3.1 b) 5)             | Annex B  |  |  |
| 5  | <b>Eligibility Method 3 – Eligibility through data collection</b>                            | Paragraph 8.3.1 c)                | Annex B  |  |  |
| 5a | Sequential method  | Paragraph 8.3.1 c) 2) (a)         | Annex B  |  |  |
| 5b | Periodic method  | Paragraph 8.3.1 c) 2) (b)         | Annex B  |  |  |

**PART 6 - BASIC PILOT PROCEDURES FOR RNP 10 OPERATIONS**

| Topics                      |   | Reference paragraphs<br>CA 91-001 | Location in the<br>Annexes of the<br>operator | Comments and/or<br>recommendations by the<br>CAA | Follow-up by the<br>Inspector: Item status and<br>date |
|-----------------------------|---|-----------------------------------|---|--|--|
| <b>Operating procedures</b> |   | Paragraph 11                      | Annex G                                       |  |  |
| 1                           | <b>Flight planning</b>  | Paragraph 11.1 a)                 |   |  |  |
|                             | Verifying if aircraft has been approved for RNP 10 operations   | Paragraph 11.1 a) 1)              |   |  |  |
|                             | Verifying that two LRNS are operational   | Paragraph 11.1 a) 2)              |   |  |  |
|                             | Verifying if the RNP 10 time limit has been taken into account (only aircraft equipped with INS or IRU)   | Paragraph 11.1 a) 3)              |   |  |  |
|                             | Verifying the requirements for GNSS, such as FDE, if applicable to the operation  | Paragraph 11.1 a) 4)              |   |  |  |
|                             | Verifying if the letter "R" has been inserted in Box 10 of the ICAO flight plan (also insert the letter Z in that same box, and NAV/RNP 10 in Box 18 for WATRS plus spaces) | Paragraph 11.1 a) 5)              |   |  |  |
|                             | If required, taking into account any operational restriction related to RNP 10 approval for a specific navigation system  | Paragraph 11.1 a) 6)              |   |  |  |

| Topics |  | Reference paragraphs<br>CA 91-001 | Location in the Annexes of the operator | Comments and/or recommendations by the CAA | Follow-up by the Inspector: Item status and date |
|--------|--|-----------------------------------|---|--|--|
|        | Verifying the planned flight route, including the deviation to any alternate aerodrome, in order to identify the existing RNP types  | Paragraph 11.1 a) 7)              |   |  |  |
| 2      | <b>Pre-flight procedures</b>   | Paragraph 11.1 b)                 |   |  |  |
|        | Review flight technical records (maintenance logs) to ascertain the conditions of the equipment required for flight in RNP 10 airspace or route. Ensure that maintenance actions have been taken to correct defects in the required equipment  | Paragraph 11.1 b) 1)              |   |  |  |
|        | During the external inspection of the aircraft, check the condition of the navigation antennas and the condition of the fuselage skin around each of these antennas (this can be done by a competent and authorised person other than the pilot, like, for instance, an on-board mechanic or a maintenance person) | Paragraph 11.1 b) 2)              |   |  |  |
|        | Review the emergency procedures for operations in RNP 10 airspace or routes. These are not different from the normal oceanic emergency procedures, with one exception: crews must  | Paragraph 11.1 b) 3)              |   |  |  |

| Topics |   | Reference paragraphs<br>CA 91-001 | Location in the Annexes of the operator | Comments and/or recommendations by the CAA | Follow-up by the Inspector: Item status and date |
|--------|---|-----------------------------------|---|--|--|
|        | be capable of recognising, and the ATC must be notified, when the aircraft is no longer capable of flying at its capacity level according to the RNP 10 approval  |                                   |   |  |  |
| 3      | <b>En-route procedures</b>  | Paragraph 11.1 c)                 |   |  |  |
|        | At the oceanic point of entry, at least two LRNS must be capable of navigating in RNP 10, otherwise, the crew will consider using an alternate route or initiating a deviation to repair the systems  | Paragraph 11.1 c) 1)              |   |  |  |
|        | Before entering oceanic airspace, aircraft position must be checked as accurately as possible using external navigation aids. This may require DME/DME or VOR checks to identify navigation system errors by comparing displayed and actual positions. If it is necessary to update the system, the appropriate procedures must be followed with the assistance of a prepared checklist | Paragraph 11.1 c) 2)              |   |  |  |
|        | Operating procedures must include mandatory cross-check procedures in order to identify navigation errors in advance and  | Paragraph 11.1 c) 3)              |   |  |  |

| Topics   | Reference paragraphs<br>CA 91-001 | Location in the Annexes of the operator | Comments and/or recommendations by the CAA | Follow-up by the Inspector: Item status and date |
|--|-----------------------------------|---|--|--|
| prevent the aircraft from inadvertently deviating from the routes authorised by the ATC  |                                   |   |  |  |
| Crews must notify the ATC of any degradation or failure of the navigation equipment below the navigation performance requirements, or of any deviation required for a contingency procedure  | Paragraph 11.1 c) 4)              |   |  |  |
| Pilots must use a lateral deviation indicator, an FD or an AP in lateral navigation mode (LNAV) for RNP 10 operations. All pilots are expected to follow the route centreline, as represented on the on-board lateral deviation indicators and/or flight guidance, during all RNP 10 operations, unless authorised by the ATC to deviate or due to an emergency. For normal operations, the cross-track error/deviation (the difference between the path estimated by the RNP system and the position of the aircraft relative to the path) must be limited to $\pm \frac{1}{2}$ the navigation precision associated with the flight route (e.g., 5 NM). Small lateral deviations from this requirement are allowed (e.g., | Paragraph 11.1 c) 5)              |   |  |  |

|   | Topics  | Reference paragraphs<br>CA 91-001 | Location in the Annexes of the operator | Comments and/or recommendations by the CAA | Follow-up by the Inspector: Item status and date |
|---|---|-----------------------------------|---|--|--|
|   | <p>overshooting or undershooting the path) during or immediately after an en-route turn, up to a maximum of 1 times (1xRNP) the navigation precision (e.g., 10 NM).</p> <p><i>Note.- Some aircraft do not show or do not estimate a path during turns. Pilots of such aircraft may not be capable of meeting the <math>\pm \frac{1}{2}</math> precision requirement during en-route turns; however, they are expected to meet interception requirements after the turn or in the straight segments.</i></p> |                                   |   |  |  |
| 4 | <b>Update the LRNS position</b>   |                                   |   |  |  |
|   | Impact of en-route updates  | Paragraph 40.9 10.6               |   |  |  |
|   | Update the automatic position (as applicable).  | Paragraph 40.10 10.7              |   |  |  |

**PAGE LEFT BLANK INTENTIONALLY**

**PART 7 - PROCEDURES FOR IN-FLIGHT CONTINGENCIES, DEVIATIONS DUE TO WEATHER CONDITIONS AND STRATEGIC LATERAL DISPLACEMENT**

| <b>Topics</b>     |  | <b>CA 91-001<br/>Reference paragraphs<br/>Doc 4444, Paragraph 15.2</b>  | <b>Location in<br/>the Annexes<br/>of the<br/>operator</b> | <b>Comments and/or<br/>recommendations<br/>by the CAA</b> | <b>Follow-up by the<br/>Inspector: Item<br/>status and date</b> |
|-------------------|--|---|--|---|---|
| <b>Procedures</b> |  |   | Annex G  |   |   |
| 1                 | <b>Special procedures for in-flight contingencies in oceanic airspace</b>    | CA 91-001, Paragraph 11.1 d) 2) (a)<br>Doc 4444, Paragraph 15.2         |  |   |   |
|                   | Introduction   | CA 91-001, Paragraph 11.1 d) 2) (a) (1)<br>Doc 4444, Paragraph 15.2.1   |  |   |   |
|                   | General procedures   | CA 91-001, Paragraph 11.1 d) 2) (a) (2)<br>Doc 4444, Paragraph 15.2.2   |  |   |   |
|                   | Extended range operations by aeroplanes with two turbine power-units (ETOPS) | CA 91-001, Paragraph 11.1 d) 2) (a) (3)<br>Doc 4444, Paragraph 15.2.2.4 |  |   |   |
| 2                 | <b>Procedures for deviations due to weather conditions</b>                   | CA 91-001, Paragraph 11.1 d) 2) (b)<br>Doc 4444, Paragraph 15.2.3       |  |   |   |
|                   | General aspects  | CA 91-001, Paragraph 11.1 d) 2) (b) (1)<br>Doc 4444, Paragraph 15.2.3.1 |  |   |   |
|                   | Measures to be taken when controller-pilot communications are established.   | CA 91-001, Paragraph 11.1 d) 2) (b) (2)<br>Doc 4444, Paragraph 15.2.3.2 |  |   |   |
|                   | Measures to be taken in order to obtain a revised ATC clearing.              | CA 91-001, Paragraph 11.1 d) 2) (b) (3)                                 |  |   |   |

|   | <b>Topics</b>  | <b>CA 91-001<br/>Reference paragraphs</b><br>Doc 4444, Paragraph 15.2 | <b>Location in<br/>the Annexes<br/>of the<br/>operator</b> | <b>Comments and/or<br/>recommendations<br/>by the CAA</b> | <b>Follow-up by the<br/>Inspector: Item<br/>status and date</b> |
|---|--|---|--|---|---|
|   |  | Doc 4444, Paragraph 15.2.3.3  |  |   |   |
| 3 | <b>Procedures for strategic lateral displacement in oceanic airspace and remote continental areas.</b> | CA 91-001, Paragraph 11.1 d) 2) (c)<br>Doc 4444, Paragraph 15.2.4     |  |   |   |

## Contacts in the SRVSOP

Marcelo Ureña Logroño: SRVSOP Safety oversight specialist/Aircraft operations

e-mail: [murena@lima.icao.int](mailto:murena@lima.icao.int)

Job Aid RNAV 10 (designated and authorised as RNP 10)

Version: Original 1

Date: ~~12/10/2009~~ 01/06/2010

## **APPENDIX E**

### **RNAV 5 JOB AID**

#### **OPERATOR APPLICATION TO CONDUCT RNAV 5 OPERATIONS**

## RNAV 5 JOB AID

### OPERATOR APPLICATION TO CONDUCT RNAV 5 OPERATIONS

#### 1. Introduction

This job Aid was developed by the Regional Cooperation System for Safety Oversight (SRVSOP) to provide guidance to States, operators and inspectors on the process for operators to obtain an RNAV 5 authorization.

#### 2. Purposes of this Job Aid

- 2.1 Provide RNAV 5 reference documents for operators and inspectors.
- 2.2 Provide a series of tables that show: the content of an application, related reference paragraphs, location in operator application where RNAV 5 elements are addressed and columns for the inspector to comment on, and track the status of various RNAV 5 elements.

#### 3. Recommended inspector and operator actions

The following are suggestions on how the Job Aid can be used:

- 3.1 Inspector reviews the basic events in the RNAV 5 approval process in Part 1 with the operator in the pre-application meeting to provide an overview of approval process events.
- 3.2 Inspector reviews this Job Aid with the operator to establish the form and content of the operator application for RNAV 5 authority.
- 3.3 Operator uses the Job Aid as guide to assemble documents/exhibits for its application for RNAV 5.
- 3.4 Operator annotates Job Aid to show location of RNAV 5 program elements in the operator exhibits/documents.
- 3.5 Operator submits Job Aid and RNAV 5 operator application (exhibits/documents) to inspector
- 3.6 Inspector annotates Job Aid to show task or document “complete/satisfactory” or “open/further operator action required”.
- 3.7 Inspector informs the operator as soon as possible, when further operator action is required.
- 3.8 Operator provides inspector, when requested, with revised material.
- 3.9 The CAA issues the operations specifications (OpSpecs) or a letter of authorization (LOA) as applicable, to operator when required tasks and documents are completed.

#### 4. Job Aid organization

| <b>Parts</b> | <b>Subjects</b>  | <b>Page</b> |
|--------------|--|-------------|
| Part 1       | General information  | 4           |
| Part 2       | Operator and aircraft identification information                   | 6           |
| Part 3       | Operator application for RNAV 5 authority (Exhibits and documents) | 7           |
| Part 4       | Content of operator application for RNAV 5 authorization           | 10          |
| Part 5       | Guide for determining RNAV 5 aircraft eligibility                  | 13          |
| Part 6       | Basic flight crew procedures for RNAV 5 operations                 | 16          |

#### 5. Primary source of documents, information and contacts

For accessing to the Advisory Circular CA 91-002, enter to the ICAO/SAM Regional Office Webpage ([www.lima.icao.int](http://www.lima.icao.int)) under SRVSOP.

#### 6. Primary documents of reference

| <b>Documents of reference</b> | <b>Subjects</b>   |
|-------------------------------|---|
| ICAO Doc 9613                 | Performance based navigation manual   |
| AMC 25-11                     | Electronic display system   |
| AMC 20-5                      | Acceptable means of compliance for airworthiness approval and operational criteria for the use of the NAVSTAR Global positioning system (GPS) |
| AC 20-121A                    | Airworthiness approval of LORAN C for use en the U.S National Airspace System   |
| AC 20-130()                   | Airworthiness approval of multi-sensor navigational system for use in the U.S. National Airspace System                                       |
| AC 20-138A                    | Airworthiness approval of Global navigation satellite system (GNSS) equipment   |
| AC 25-4                       | Inertial navigation system (INS)  |
| AC 25-15                      | Approval of FMS in transport category airplanes   |
| AC 90-45A                     | Approval of areas navigation systems for use in the U.S. National Airspace System   |
| ETSO-C115b                    | Airborne area navigation equipment using multi sensor input   |
| ETSO-C129A                    | Airborne supplemental navigation equipment using the Global positioning system (GPS)  |
| ETSO-C145                     | Airborne navigation sensors using the Global positioning system (GPS) augmented by wide area augmentation system (WAAS)                       |

|                       |   |
|-----------------------|---|
| ETSO-C146             | Stand-alone airborne navigation equipment using the Global positioning system (GPS) augmented by the wide area augmentation system (WAAS) |
| TSO-C115, any version | Airborne area navigation equipment using multi-sensor inputs  |
| TSO-C129/C129A        | Airborne supplemental navigation equipment using the global positioning system (GPS)  |
| TSO-C145A             | Airborne navigation sensors using the Global positioning system (GPS) augmented by the wide area augmentation system (WAAS)               |
| TSO-C146A             | Stand-alone airborne navigation equipment using the Global positioning system (GPS) augmented by the wide area augmentation system (WAAS) |
| RTCA/DO-200A          | Standards for processing aeronautical data  |
| RTCA/DO-201A          | Standards for aeronautical information  |
| RTCA/DO-208           | Minimum operational performance standards for airborne supplemental navigation equipment using Global positioning system (GPS)            |
| RTCA/DO-229C          | Minimum operational standards for Global positioning system/Wide area augmentation system airborne equipment                              |
| RTCA/DO-236A          | Minimum aviation system performance standards: Required navigation performance for area navigation  |
| RTCA/DO-178B          | Software consideration in airborne systems and equipment certification  |

**PAGE LEFT BLANK INTENTIONALLY**

**PART 1: GENERAL INFORMATION****Basic events in RNAV 5 approval process**

|   | <b>Operator actions</b>   | <b>CAA actions (inspectors)</b>   |
|---|---|---|
| 1 | Establishes the need to obtain the RNAV 5 authorization.  |   |
| 2 | Reviews AFM, AFM Supplement or Type Certificate Data Sheet (TCDS) or others appropriate documents (e.g., Service Bulletins, Service Letters) to determine Aircraft eligibility for RNAV 5. Operator contacts airplane or avionics manufacturer, if necessary, to confirm airplane eligibility for RNAV 5. |   |
| 3 | Contacts to the AAC to arrange a pre-application meeting to discuss requirements for operational approval. .  |   |
| 4 |   | During pre-application meeting, establishes: <ul style="list-style-type: none"> <li>• form and content of operator application;</li> <li>• the date when operator application should be submitted for evaluation</li> </ul> |
| 5 | Submits operator application to the AAC at least 60 days in advance of the planned start of RNAV 5 operations.  |   |
| 6 |   | Reviews operator application  |
| 7 | Once the amendments to the manuals, programs and documents have been accepted or approved, the operator provides training to the flight crew, flight dispatchers and maintenance personnel and performs a validation flight in case of that flight is required by the AAC.                                |   |
| 8 |   | Issues operational approval in the form of OpSpecs for LAR 121 and/or 135 or a letter of authorization (LOA) for LAR 91 operators.  |

**Notes related with the approval process**

1. **Responsible Authority.**
  - a. **Commercial Air Transport - LAR 121 and/or 135 or equivalent regulations operators.-** The **State of registry** makes the determination that the Aircraft meets the applicable RNAV 5 requirements. The State of operator issues operating authority (e.g., OpSpecs).
  - b. **General aviation - LAR 91 or equivalent regulations operators.-** The **State of registry** makes determination that aircraft meets the applicable RNAV 5 requirements and issues a LOA.
2. Sections related to the Latin American Aeronautical Regulations (LAR) or equivalents.
  - a. LAR 91      Section 91.1015 and 91.1640 or equivalents
  - b. LAR 121     Section 121.995 (b) or equivalent
  - c. LAR 135     Section 135.565 (c) or equivalent
3. Others related ICAO documents
  - a. Annex 2 – Rules of the air
  - b. Doc 4444 – Procedures for Air Navigation Services – Air Traffic Management.

**PART 2: AIRCRAFT AND OPERATORS IDENTIFICATION INFORMATION**

**OPERATOR NAME:** \_\_\_\_\_

| Aircraft make, model and series | Registration number(s) | Serial number(s) | RNAV navigation systems: Number, manufacturer and model | Navigation specification requested |
|---------------------------------|------------------------|------------------|---|------------------------------------|
|                                 |                        |                  |   |                                    |
|                                 |                        |                  |   |                                    |
|                                 |                        |                  |   |                                    |
|                                 |                        |                  |   |                                    |
|                                 |                        |                  |   |                                    |
|                                 |                        |                  |   |                                    |
|                                 |                        |                  |   |                                    |
|                                 |                        |                  |   |                                    |

DATE OF PRE-APPLICATION MEETING \_\_\_\_\_

DATE APPLICATION RECEIVED: \_\_\_\_\_

DATE OPERATOR PLANS TO START RNAV 5 OPERATIONS \_\_\_\_\_

¿IS THE NOTIFICATION TIME TO CAA ADEQUATE? YES \_\_\_\_\_ NO \_\_\_\_\_

**PAGE LEFT BLANK INTENTIONALLY**

## PART 3 – OPERATOR APPLICATION (EXHIBITS/DOCUMENTS)

| Exhibit | Document title  | Operator indication of inclusion | Inspector comments |
|---------|---|----------------------------------|--------------------|
| A       | <b>Operator letter requesting RNAV 5 authorization</b>  |                                  |                    |
| B       | <p><b>1. For aircraft manufactured RNAV 5 compliant: Airworthiness documents that show RNAV 5 approval:</b></p> <ul style="list-style-type: none"> <li>• AFM, AFM Supplement, TCDS o POH.</li> </ul> <p><b>2. For in-service aircraft which eligibility can not be determined based on the AFM, AFM Supplement; TCDS o POH:</b></p> <ul style="list-style-type: none"> <li>• Operator letter requesting assessment of aircraft RNAV equipment.</li> </ul> |                                  |                    |
| C       | <p><b>For INS or IRU only equipped aircraft: RNAV 5 time limit and area of operation.</b></p> <ul style="list-style-type: none"> <li>• Documentation establishing the RNAV 5 time limit and area of operations or routes for which the specific aircraft/navigation system is eligible. (Not applicable to GPS equipped aircraft).</li> </ul>   |                                  |                    |
| D       | <p><b>Maintenance program</b></p> <ul style="list-style-type: none"> <li>• For aircraft with established RNAV 5 or GPS stand-alone maintenance practices, provide list of document or program references.</li> </ul>  |                                  |                    |
| E       | <p><b>Minimum Equipment List (MEL) (Only for operators operating under an MEL):</b></p> <ul style="list-style-type: none"> <li>• MEL showing provisions for RNAV 5 equipment or GPS stand-alone.</li> </ul>   |                                  |                    |
| F       | <b>Training</b>   |                                  |                    |

| Exhibit | Document title  | Operator indication of inclusion | Inspector comments |
|---------|---|----------------------------------|--------------------|
|         | <ol style="list-style-type: none"> <li>1. <b>LAR 91 operators: Methods of training:</b> The following methods are acceptable for these operators: In-house training, LAR 142 training center or others courses of training.</li> <li>2. <b>LAR 121 or 135 operators: Training program:</b> The LAR 121 or 135 operators shall provide initial and recurrent training program for flight crew, flight dispatchers and maintenance personnel.</li> <li>3. <b>GPS stand-alone:</b> When the operator used a GPS stand-alone to conduct RNAV 5 operations, shall provide an initial and a recurrent training program for flight crew, flight dispatchers and maintenance personnel, if required.</li> </ol> |                                  |                    |
| G       | <p><b>Operational policies and procedures</b></p> <ol style="list-style-type: none"> <li>1. <b>LAR 91 operators:</b> Operations manual or sections of operator's application, documenting RNAV 5 operational policies and procedures.</li> <li>2. <b>LAR 121 and/or 135 operators:</b> Operations manual and check list.</li> <li>3. <b>GPS stand-alone used as a primary means of navigation:</b> Operations manual</li> </ol>   |                                  |                    |
| H       | <p><b>Removal of RNAV 5 operating authority</b></p> <p>Indication of the necessity to follow up action after navigation error reports, and the potential for removal of RNAV 5 operating authority.</p>   |                                  |                    |
| I       | <p><b>Plan for validation flight:</b> Only if required by the CAA</p>   |                                  |                    |

**APPLICATION CONTENT TO BE SUBMITTED BY THE OPERATOR**

\_\_\_\_\_ **AIRCRAFT/RNAV 5 SYSTEM COMPLIANCE DOCUMENTATION**

\_\_\_\_\_ **OPERATIONAL POLICY/PROCEDURES**

\_\_\_\_\_ **MAINTENANCE MANUAL SECTIONS RELATED TO RNAV 5 SYSTEM OR GPS STAND-ALONE (if not previously reviewed)**

**Note 1: Exhibits/documents may be included in a binder or submitted as a stand-alone documents**

**PAGE LEFT BLANK INTENTIONALLY**

## PART 4: CONTENT OF OPERATOR APPLICATION FOR RNAV 5

| # | Content of operator application for RNAV 5  | Reference paragraphs<br>CA 91-002                  | Where found in operator exhibit/documents<br><br>Note: operator should update this column to reflect the content of its application | Inspector recommendation and /or comments | Inspector Tracking: Item status and date |
|---|---|--|---|---|--|
| 1 | <b>Operator request letter</b><br>Statement of intent to obtain RNAV 5 authorization  | Paragraph 9.1 b) 1)<br>Appendix 3,<br>Paragraph e) | Exhibit A   |   |  |
| 2 | <b>Airworthiness documents to determine Aircraft eligibility</b><br><br>Airworthiness documents that establish the aircraft and the navigation system have been approved for RNAV 5 operations.   | Paragraphs 8.1, 8.2 y 8.3                          | Exhibit B<br>Exhibit C  |   |  |
| 3 | <b>RNAV 5 system requirements</b><br>Documents that show the aircraft equipment.<br><br>1. One (1) RNAV system comprising of:<br><ul style="list-style-type: none"><li>• one or a combination of the following navigation sensors: VOR/DME, DME/DME, INS o IRS, LORAN C y GNSS o GPS;</li><li>• an area navigation (RNAV) computer;</li></ul> | Paragraph 8.5 b)                                   | Exhibit B<br>Exhibit C  |   |  |

| # | Content of operator application for RNAV 5   | Reference paragraphs<br><br>CA 91-002            | Where found in operator exhibit/documents<br><br>Note: operator should update this column to reflect the content of its application | Inspector recommendation and /or comments | Inspector Tracking: Item status and date |
|---|--|--|---|---|--|
|   | <ul style="list-style-type: none"> <li>• a control display unit (CDU); and</li> <li>• a navigation display(s) or instrument(s) (e. g., navigation display (ND), heading situation indicator (HSI) or course deviation indicator (CDI).</li> </ul>  |  |   |   |  |
| 4 | <p><b>Availability of the conventional navigation equipment on board the aircraft when the GPS stand-alone is used</b></p> <p>Documents that show the availability of the conventional navigation equipment on board the aircraft when the GPS stand-alone is used.</p> <p>When GPS stand-alone equipment is used, the traditional navigation equipment (e. g., VOR, DME, TACAN or ADF), must be installed and operational in the aircraft, so as to provide an alternative means of navigation.</p> | Paragraph 8.4 e) 1) iv d) 1) (d) and 10.4 b) 2). | Exhibit B<br>Exhibit C  |   |  |
| 5 | <p><b>Training</b></p> <p><b>1. LAR 91 operators: Methods of training:</b> The following methods</p>   | Paragraphs 8.7 e); 9.1                           | Exhibit F   |   |  |

| # | Content of operator application for RNAV 5   | Reference paragraphs<br>CA 91-002   | Where found in operator exhibit/documents<br><br>Note: operator should update this column to reflect the content of its application | Inspector recommendation and /or comments | Inspector Tracking: Item status and date |
|---|--|---|---|---|--|
|   | <p>are acceptable for these operators: In-house training, LAR 142 training center or others courses of training.</p> <p><b>2. LAR 121 or 135 operators: Training program:</b> The LAR 121 or 135 operators shall develop an initial and recurrent training program for flight crew, flight dispatchers and maintenance personnel.</p> <p><b>3. GPS stand-alone:</b> When the operator uses a GPS stand-alone to conduct RNAV 5 operations, shall developed an initial and a recurrent training program for flight crew, flight dispatchers and maintenance personnel, if required.</p> | <p>b) 6) <del>9.1 e)</del> and 12<br/>Paragraph 11</p> <p>Paragraph 8.4 e) <del>d)</del> 2)</p> |   |   |  |
| 6 | <p><b>Operational policies and procedures</b></p> <p><b>1. LAR 91 operators:</b> Operations manual or sections of operator's application, documenting RNAV 5 operational policies and procedures.</p> <p><b>2. LAR 121 and/or 135 operators:</b></p>   | <p>Paragraph 9.1 b) 2)</p> <p>Paragraph 10</p>  | Exhibit G   |   |  |

| #  | Content of operator application for RNAV 5  | Reference paragraphs<br>CA 91-002 | Where found in operator exhibit/documents<br>Note: operator should update this column to reflect the content of its application | Inspector recommendation and /or comments | Inspector Tracking: Item status and date |
|----|---|-----------------------------------|---|---|--|
|    | Operations manual and check list.<br><b>3. GPS stand-alone used as a primary means of navigation:</b><br>Operations manual  | Paragraph 10. b)                  |   |   |  |
| 7  | <b>Maintenance practices</b><br><ul style="list-style-type: none"> <li>• For Aircraft with established RNAV or GPS stand-alone maintenance practices, the operator shall provide document references.</li> <li>• For newly installed RNAV or GPS stand-alone, the operator shall provide maintenance practices for review.</li> </ul> | Paragraphs 8.7 d) and 9. b) 3)    | Exhibit D   |   |  |
| 8  | <b>Minimum equipment list (MEL) updates, if applicable</b><br>Only applicable if operator conducts operations under an MEL  | Paragraph 9. b) 5)                | Exhibit E   |   |  |
| 9  | <b>Continued airworthiness</b>  | Paragraph 8.7                     | Exhibit H   |   |  |
| 10 | <b>Removal of RNAV 5 operating authority</b><br>Indication of the necessity to follow up action after navigation error reports,   | Paragraph 42 11                   | Exhibit H   |   |  |

| # | Content of operator application for RNAV 5                   | Reference paragraphs<br>CA 91-002 | Where found in operator exhibit/documents<br>Note: operator should update this column to reflect the content of its application | Inspector recommendation and /or comments | Inspector Tracking: Item status and date |
|---|--|-----------------------------------|---|---|--|
|   | and the potential for removal of RNAV 5 operating authority. |                                   |   |   |  |

## PART 5 – GUIDE FOR DETERMINING AIRCRAFT ELIGIBILITY

| #  | Subjects  | Reference paragraphs<br><br>CA 91-002                                  | Location in operator exhibits | CAA Recommendations and comments | Inspector tracking item status and date |
|----|---|--|-------------------------------|----------------------------------|---|
| 1  | RNAV system requirement   | Paragraphs 5.7, 6.2, 6.1 c) 8.1 a) y 8.5 b).                           | Exhibit B                     |                                  |   |
| 2  | Aircraft eligibility<br>1. For aircraft manufactured RNAV 5 compliant<br>2. For in-service aircraft which eligibility can not be determined based on the AFM, AFM Supplement; TCDS o POH: | Paragraphs 8.2<br><br>Paragraph 8.3 a)                                 | Exhibit B                     |                                  |   |
| 3  | <del>GPS stand alone used as a primary means of navigation</del><br><b>Limitation on the design and/or use of navigations systems</b>   | <del>Paragraph 8.4 e) 1) iii. (first paragraph)</del><br>Paragraph 8.4 | Exhibit B                     |                                  |   |
| 3a | <b>Inertial navigation systems/Inertial reference systems (INS/IRS)</b>   | Paragraph 8.4 a)   |                               |                                  |   |
| 3b | <b>VHF Omnidirectional radio range (VOR)</b>  | Paragraph 8.4 b)   |                               |                                  |   |
| 3c | <b>Distance measuring equipment (DME)</b>   | Paragraph 8.4 c)   |                               |                                  |   |
| 3d | <b>Global navigation satellite system (GNSS)</b><br><b>a. Global positioning system (GPS)</b>   | Paragraph 8.4 d)<br>Paragraph 8.4 d) 1)                                |                               |                                  |   |

| # | Subjects   | Reference paragraphs<br><br>CA 91-002         | Location in operator exhibits | CAA Recommendations and comments | Inspector tracking item status and date |
|---|--|---|-------------------------------|----------------------------------|---|
|   | <ul style="list-style-type: none"> <li>➤ Multi-sensor navigation system that incorporate GPS with integrity provided by RAIM or equivalent means</li> <li>➤ GPS stand-alone with RAIM that includes the following additional functions:               <ul style="list-style-type: none"> <li>• Pseudorange step detection; and</li> <li>• Health word checking</li> </ul> </li> </ul> <p>b. Stand-alone GPS equipments</p> | Paragraph 8.4 d) 2)                           |                               |                                  |   |
| 4 | <del>Multi-sensor navigation system that incorporate GPS with integrity provided by RAIM or equivalent means</del>   | <del>Paragraph 8.4 e) 1) ii.</del>            | Exhibit B                     |                                  |   |
| 5 | <del>GPS stand-alone with integrity provided by RAIM</del>   | <del>Paragraph 10. b) 2.</del>                | Exhibit B                     |                                  |   |
| 6 | <del>GPS stand-alone that include the following functions:</del> <ul style="list-style-type: none"> <li><del>• Pseudorange step detection; and</del></li> <li><del>• Health word checking</del></li> </ul>   | <del>Paragraph 8.4 e) 1) ii.</del>            | Exhibit B                     |                                  |   |
| 4 | Availability of conventional navigation equipments when GPS stand-alone is used  | <del>Paragraph 8.4 e) 1) iv.</del> 10.4 b) 2) | Exhibit B                     |                                  |   |

| # | Subjects   | Reference paragraphs<br><b>CA 91-002</b> | Location in operator exhibits | CAA Recommendations and comments | Inspector tracking item status and date |
|---|--|--|-------------------------------|----------------------------------|---|
| 8 | <del>Aircraft requirements: RNAV 5 navigation systems</del>  | Paragraph 8.4                            | Exhibit B                     |                                  |   |
| 5 | RNAV 5 system requirement <ul style="list-style-type: none"> <li>• Precision</li> <li>• Availability and integrity</li> </ul>                      | Paragraph 8.5                            | Exhibit B                     |                                  |   |
| 6 | RNAV 5 system functional requirements <ul style="list-style-type: none"> <li>• Required functions</li> <li>• RNAV 5 navigation displays</li> </ul> | Paragraph 8.6                            | Exhibit B                     |                                  |   |
| 7 | Navigation data base   | Paragraph 10. — d) 10.2 b) and 13        | Exhibit B                     |                                  |   |

**PAGE LEFT BLANK INTENTIONALLY**

## PART 6 – BASIC PILOT PROCEDURES FOR RNAV 5 OPERATIONS

| Subjects  | Reference paragraphs<br><br>CA 91-002 | Locations in operator exhibit | CAA recommendations and/or comments | Inspector tracking: Item status and date |
|---|---------------------------------------|-------------------------------|-------------------------------------|--|
| <b>Operating procedures</b>   | Paragraph 10                          | Exhibit G                     |                                     |  |
| <b>Flight planning</b>  | Paragraph 10.1                        |                               |                                     |  |
| Verify aircraft is approved for RNAV 5 operation  | Paragraph 10.1 a) 1)                  |                               |                                     |  |
| <del>Verify RNAV 5 system required to meet RNAV 5 navigation specifications for the route and area are operational</del><br>Verify that necessary equipment to operate RNAV 5 work correctly and are not degraded | Paragraph 10.1 a) 2)                  |                               |                                     |  |
| Verify that space-based or ground-based navigation aids required for RNAV 5 operations are available  | Paragraph 10.1 a) 3)                  |                               |                                     |  |
| Revise contingencia procedures  | Paragraph 10.1 a) 4)                  |                               |                                     |  |
| Indicate approval for RNAV 5 operations by annotating block 10 (Equipment) of the ICAO flight plan as defined within ICAO Doc 7030 for these operations   | Paragraph 10. c)                      |                               |                                     |  |
| Verify the availability of GPS integrity RAIM for the intended flight (route and time), through the use of a prediction program   | Paragraph 10 b)                       |                               |                                     |  |

| Subjects  | Reference paragraphs<br><br>CA 91-002 | Locations in operator exhibit | CAA recommendations and/or comments | Inspector tracking: Item status and date |
|---|---------------------------------------|-------------------------------|-------------------------------------|--|
| <p>either ground-based or provided as an equipment function or from an alternative method that is acceptable to the authority, in the following cases:</p> <ul style="list-style-type: none"> <li>• when any GPS satellites are scheduled to be out of service; or</li> <li>• more than one satellite is scheduled to be out of service for GPS equipment that incorporate pressure altitude aiding.</li> </ul> |                                       |                               |                                     |  |
| <p>The operator shall not dispatch or release a flight in the event of predicated continuous loss of RAIM of more than 5 minutes for any part of the intended flight. In this case the flight may be delayed, cancelled or re-routed.</p>   | Paragraph 10 b) 7) 8)                 |                               |                                     |  |
| <p><b>Pre-flight procedures at the aircraft</b></p>   |                                       |                               |                                     |  |
| <p>Review maintenance logs and forms for RNAV 5 status.</p>   | Paragraph 10.2 a)                     |                               |                                     |  |
| <p>Verify navigation data base currency (current AIRAC cycle), if this data base is installed.</p>  | Paragraph 10.2 b)                     |                               |                                     |  |
| <p>Verify the route of flight correspond to the clearance. Flight crews must cross-check the cleared flight plan by comparing charts or other applicable resources with the</p>   | Paragraph 10.2 c)                     |                               |                                     |  |

| Subjects   | Reference paragraphs<br><br>CA 91-002 | Locations in operator exhibit | CAA recommendations and/or comments | Inspector tracking: Item status and date |
|--|---------------------------------------|-------------------------------|-------------------------------------|--|
| navigation system textual display and the aircraft map display, if applicable. If required, the exclusion of specific navigation aids must be confirmed.   |                                       |                               |                                     |  |
| <b>En route procedures</b>   |                                       |                               |                                     |  |
| Verify RNAV equipment required for RNAV 5 operation has not been degraded in flight  | Paragraph 10.3 a) 1)                  |                               |                                     |  |
| Verify the route of flight correspond to the clearance.  | Paragraph 10.3 a) 2)                  |                               |                                     |  |
| Verify aircraft precision navigation is suitable for RNAV 5 operations through pertinent cross-checks.   | Paragraph 10.3 a) 3)                  |                               |                                     |  |
| Verify others navigation aids (e. g., VOR, DME and ADF) are selected, so as to allow immediate cross-checking or reversion in the event of loss of GPS navigation capability.  | Paragraph 10.3 a) 4)                  |                               |                                     |  |
| For RNAV 5, pilots must use a lateral deviation indicator, flight director or autopilot in lateral navigation mode. Pilots may use a navigation map display as described in Paragraph 8.6 b), without a flight director or autopilot. Pilots of aircraft with a lateral deviation display must ensure that lateral deviation scaling is suitable for the | Paragraph 10.3 a) 5)                  |                               |                                     |  |

| Subjects  | Reference paragraphs<br><br>CA 91-002 | Locations in operator exhibit | CAA recommendations and/or comments | Inspector tracking: Item status and date |
|---|---------------------------------------|-------------------------------|-------------------------------------|--|
| navigation accuracy associated with the route/procedure (e.g. full-scale deflection: $\pm$ 5 NM).   |                                       |                               |                                     |  |
| <p>All pilots are expected to maintain route centrelines, as depicted by on-board lateral deviation indicators and/or flight guidance, during all RNAV 5 operations, unless authorized to deviate by ATC or under emergency conditions. For normal operations, cross-track error/deviation (the difference between the RNAV system-computed path and the aircraft position relative to the path) must be limited to <math>\pm</math> 1/2 the navigation accuracy associated with the procedure or route (2.5 NM). Brief deviations from this standard (e.g. overshoots or undershoots) during and immediately after procedure/route turns, up to a maximum of one-times the navigation accuracy (5 NM), are allowable.</p> <p><i>Note.- Some aircraft do not display or compute a path during turns; pilots of these aircraft may not be able to adhere to the <math>\pm</math>1/2 accuracy standard during route turns, but are still expected to satisfy the standard during intercepts of the final track following the turn and on straight segments.</i></p> | Paragraph 10.3 a) 6)                  |                               |                                     |  |
| If ATS issues a heading assignment taking the aircraft off a route, the pilot must not modify the flight plan in the RNAV system until a clearance is received to rejoin the  | Paragraph 10.3 a) 7)                  |                               |                                     |  |

| Subjects  | Reference paragraphs<br><br>CA 91-002 | Locations in operator exhibit | CAA recommendations and/or comments | Inspector tracking: Item status and date |
|---|---------------------------------------|-------------------------------|-------------------------------------|--|
| route or the controller confirms a new clearance. When the aircraft is not on the published route, the specified accuracy requirement does not apply.   |                                       |                               |                                     |  |
| <b>Contingency procedures</b>   | Paragraph 10.4                        |                               |                                     |  |
| The aircraft must not enter or continue operations in an airspace designated as RNAV 5, in accordance with a current clearance of ATC, if due to a failure or degradation, the navigation system is downgraded under the RNAV 5 requirements, in this event, the pilot will obtain when it is possible a amended clearance. | Paragraph 10.4 a) 1)                  |                               |                                     |  |
| In accordance with ATC instructions, the operations may continue in compliance with ATC current authorization or when it is not possible, the pilot may request an amended clearance to return to conventional VOR/DME navigation.  | Paragraph 10.4 a) 2)                  |                               |                                     |  |
| In the event of communications failure, the flight crew must continue with the flight plan, in accordance with the published lost communication procedures  | Paragraph 10.4 a) 3)                  |                               |                                     |  |
| In all cases, the flight crew must follow the contingency procedures establish for each region and obtain an ATC clearance as   | Paragraph 10.4 a) 4)                  |                               |                                     |  |

| Subjects   | Reference paragraphs<br><br>CA 91-002 | Locations in operator exhibit | CAA recommendations and/or comments | Inspector tracking: Item status and date |
|--|---------------------------------------|-------------------------------|-------------------------------------|--|
| soon as possible.  |                                       |                               |                                     |  |
| <b>Contingency procedures in the event of loss of Stand-alone GPS navigation capability</b>  | Paragraph 10.4 b)                     |                               |                                     |  |
| <b>In case of loss of the RAIM detection function.-</b> The flight crew may continue navigating with the GPS equipment. The flight crew should attempt to cross-check the aircraft position with the information provided for the ICAO conventional nav aids: VOR, DME and ADF, in order to confirm the existence of a required level of precision. In other case, the crew must revert to an alternative navigation means | Paragraph 10.4 b) 1) (a)              |                               |                                     |  |
| In the event of an observed failure (including the failure of a satellite impacting the performance of the navigation systems based on GPS), the flight crew must revert to an alternative means of navigation   | Paragraph 10.4 b) 1) (b)              |                               |                                     |  |
| <b>In case of exceedance of the alarm limit.-</b> The flight crew must revert to an alternative means of navigation.   | Paragraph 10.4 b) 1) (c)              |                               |                                     |  |
| <b>On-board equipment availability VOR, DME or ADF.-</b> The operator must have installed on the aircraft the VOR, DME or ADF on-board equipment capacity according to the applied rules of operation  | Paragraph 10.4 b) 2)                  |                               |                                     |  |

| Subjects  | Reference paragraphs<br><br>CA 91-002 | Locations in operator exhibit | CAA recommendations and/or comments | Inspector tracking: Item status and date |
|---|---------------------------------------|-------------------------------|-------------------------------------|--|
| LAR 91, 121 and 135. This capacity must be available along the intended route of flight to assure the availability of navigation alternative means in case of a GPS/RNAV system failure |                                       |                               |                                     |  |
| Whatever contingency registered in flight must be notify to the AAC within 72 hours, unless the delay is justify.   | Paragraph 10.4 c)                     |                               |                                     |  |

**SRVSOP Contact**

Marcelo Ureña Logroño

SRVSOP Safety oversight specialist/Aircraft operations

[murena@lima.icao.int](mailto:murena@lima.icao.int)

Job Aid: RNAV 5

Revision: 4 2

Date: 12/10/2009 01/06/2010

## **APPENDIX F**

### **RNAV 1 AND RNAV 2 JOB AID**

#### **APPLICATION TO CONDUCT RNAV 1 AND RNAV 2 OPERATIONS**

## **RNAV 1 AND RNAV 2 JOB AID**

### **APPLICATION TO CONDUCT RNAV 1 AND RNAV 2 OPERATIONS**

#### **1. Introduction**

This Job Aid was developed by the Latin American Regional Safety Oversight Cooperation System (SRVSOP) to provide States, operators, and inspectors with guidance on the process to be followed by an operator in order to obtain an RNAV 1 and RNAV 2 authorization.

#### **2. Purpose of the Job Aid**

- 2.1 To give operators and inspectors information on the main RNAV 1 and RNAV 2 reference documents.
- 2.2 To provide tables showing the contents of the application, the associated reference paragraphs, the place in the application of the operator where RNAV 1 and RNAV 2 elements are mentioned and columns for inspector comments and follow-up on the status of various RNAV 1 and RNAV 2 elements.

#### **3. Actions Recommended for the Inspector and Operator**

Some recommendations for use of the Job Aid follow:

- 3.1 At the pre-application meeting with the operator, the inspector reviews the “basic events of the RNAV 1 and RNAV 2 approval process” described in Part 1 of this Job Aid, in order to provide an overview of the approval process events.
- 3.2 The inspector reviews this Job Aid with the operator in order to establish the form and content of the RNAV 1 and RNAV 2 approval application.
- 3.3 The operator uses this Job Aid as a guide to collect the documents/annexes of the RNAV 1 and RNAV 2 application.
- 3.4 The operator inserts in the Job Aid references showing in what part of its documents are the RNAV 1 and RNAV 2 programme elements located.
- 3.5 The operator submits the Job Aid and the application to the inspector (documents/annexes).
- 3.6 The inspector indicates in the Job Aid whether an item is in compliance or needs corrective action.
- 3.7 The inspector informs the operator as soon as possible when a corrective action by the operator is required.
- 3.8 The operator provides the inspector with the revised material when so requested.
- 3.9 The CAA provides the operator with the operational specifications (OpSpecs) or a letter of authorisation (LOA), as applicable, once the tasks and documents have been completed.

#### 4. Structure of the Job Aid

| Parts  | Topics   | Page |
|--------|--|------|
| Part 1 | General information  | 3    |
| Part 2 | Information on aircraft and operator identification              | 5    |
| Part 3 | Operator application (Annexes and documents)                     | 7    |
| Part 4 | Contents of the operator application for RNAV 1 and RNAV 2       | 9    |
| Part 5 | Guide to determine the eligibility of RNAV 1 and RNAV 2 aircraft | 13   |
| Part 6 | Basic pilot procedures for RNAV 1 and RNAV 2 operations          | 15   |

#### 5. Main sources of documents, information, and contacts

To access the RNAV 1 and RNAV 2 Job Aid, enter to the Web page of the ICAO/SAM Regional Office ([www.lima.icao.int](http://www.lima.icao.int)) under the SRVSOP link.

#### 6. Main reference documents

| Reference document  | Title   |
|---------------------|---|
| Annex 6             | Operation of aircraft   |
| ICAO Doc 9613       | Performance-based navigation (PBN) manual   |
| FAA AC 90-100A      | U.S. Terminal and en route area navigation (RNAV) operations  |
| TGL 10              | Airworthiness and operational approval for precision RNAV operations in designated European airspace  |
| Spain DGAC CO 03/01 | <i>Aprobaciones de aeronavegabilidad y operacionales para operaciones RNAV de precisión (P-RNAV) en el espacio aéreo Europeo designado</i>    |
| AMC 20-5            | Acceptable means of compliance for airworthiness approval and operational criteria for the use of the NAVSTAR Global positioning system (GPS) |
| AC 20-130()         | Airworthiness approval of multi-sensor navigational system for use in the U.S. National Airspace System                                       |
| AC 20-138A          | Airworthiness approval of Global navigation satellite system (GNSS) equipment   |
| AC 25-4             | Inertial navigation system (INS)  |
| AC 25-15            | Approval of FMS in transport category airplanes   |
| AC 90-45A           | Approval of areas navigation systems for use in the U.S. National Airspace System   |

**PART 1: GENERAL INFORMATION****Basic events in the RNAV 1 and RNAV 2 approval process**

|   | <b>Action by the operator</b>  | <b>Action by the CAA</b>  |
|---|--|---|
| 1 | Establishes the need to obtain RNAV 1 and RNAV 2 authorization.  |   |
| 2 | Reviews the AFM, AFM supplement or Type Certificate Data Sheet (TCDS), or other appropriate documents (e.g., service bulletins (SB), service letters (SL), etc.) to determine the eligibility of the aircraft for RNAV 1 and RNAV 2 operations. The operator contacts the aircraft or avionics manufacturer, if necessary, to confirm RNAV 1 and RNAV 2 or higher eligibility of the aircraft. |   |
| 3 | Contacts the CAA to schedule a pre-application meeting to discuss the operational approval requirements.   |   |
| 4 |  | During the pre-application meeting, establishes: <ul style="list-style-type: none"> <li>• the form and contents of the application;</li> <li>• the documents that support RNAV 1 and RNAV 2 approval</li> <li>• the date in which the application will be submitted for evaluation</li> <li>• if necessary, conducts a validation flight observed by the CAA</li> </ul> |
| 5 | Submits the application at least 60 days before the start-up of RNAV 1 and RNAV 2 operations.  |   |
| 6 |  | Reviews the request of the operator.  |
| 7 | Once the amendments to manuals, programmes, and documents have been approved, provides training to flight crews, flight dispatchers, and maintenance personnel, and conducts a validation flight, if required by the CAA.  | Only if required, participates in the validation flight.  |
| 8 |  | Once the operational and airworthiness requirements have been met, issues the operational approval in the form of OpSpecs for LAR 121 or 135 or equivalent operators, or an LOA for LAR 91 or equivalent operators, as appropriate.   |

**Notes related to the approval process****1. Responsible authority**

- a. **Commercial air transport (LAR 121 and/or 135 or equivalent regulations).**- The **State of Registry** determines that the aircraft meets the airworthiness requirements. The **State of the Operator** issues the RNAV 1 and RNAV 2 approval (e.g., OpSpecs).
- b. **General Aviation (LAR 91 or equivalent regulations).**- The **State of Registry** determines that the aircraft meets the airworthiness requirements and issues the operational approval (e.g., an LOA).

2. The CAA does not need to issue an LOA or an equivalent document for each individual area of operation in the case of LAR 91 operators.

3. LAR 121 and/or 135 operators with RNAV 1 and RNAV 2 approval must list this approval in the OpSpecs.

4. Related sections of the Latin American Aeronautical Regulations (LAR) or equivalent regulations

- a. LAR 91        Sections 91.1015 and 91.1640 or equivalents
- b. LAR 121      Section 121.995 (b) or equivalent
- c. LAR 135      Section 135.565 (c) or equivalent

5. Related ICAO Documents

- a. Annex 6 to the Convention on International Civil Aviation – Operation of Aircraft
- b. Annex 10 to the Convention on International Civil Aviation – Aeronautical Telecommunications
- c. Annex 15 to the Convention on International Civil Aviation – Aeronautical Information Services
- d. ICAO Doc 9613 – Manual on performance-based navigation (PBN)
- e. ICAO Doc 7030 – Regional supplementary procedures

**PART 2: INFORMATION ON THE IDENTIFICATION OF AIRCRAFT AND OPERATORS**

**NAME OF THE OPERATOR:** \_\_\_\_\_

| Aircraft manufacturer, model, and series | Registration numbers | Serial numbers | Area navigation systems (RNAV) Number, manufacturer, and model | RNAV specification |
|--|----------------------|----------------|--|--------------------|
|  |                      |                |  |                    |
|  |                      |                |  |                    |
|  |                      |                |  |                    |
|  |                      |                |  |                    |
|  |                      |                |  |                    |
|  |                      |                |  |                    |
|  |                      |                |  |                    |

DATE OF PRE-APPLICATION MEETING \_\_\_\_\_

DATE ON WHICH THE APPLICATION WAS RECEIVED \_\_\_\_\_

DATE ON WHICH THE OPERATOR INTENDS TO BEGIN RNAV 1 and RNAV 2 OPERATIONS \_\_\_\_\_

IS THE CAA NOTIFICATION DATE APPROPRIATE? YES \_\_\_\_\_ NO \_\_\_\_\_

**PAGE LEFT BLANK INTENTIONALLY**

## PART 3 – OPERATOR APPLICATION (ANNEXES AND DOCUMENTS)

| Annex | Title of Annex/document   | Indication of inclusion by the operator | Comments by the Inspector |
|-------|---|---|---------------------------|
| A     | <b>Operator letter requesting RNAV 1 and RNAV 2 authorization</b>   |   |                           |
| B     | <p><b>Airworthiness documents showing aircraft eligibility for RNAV 1 and RNAV 2</b><br/>AFM, AFM revision, AFM supplement, or Type certificate data sheet (TCDS) showing that RNAV systems are eligible for RNAV 1 and RNAV 2 or RNP 1 or above.</p> <p>Statement by the manufacturer.- Aircraft that have a statement by the manufacturer documenting compliance with the criteria of SRVSOP CA 91-003 or equivalent meet the performance and functional requirements of said document.</p> |   |                           |
| C     | <p><b>Aircraft modified to meet RNAV 1 and RNAV 2 standards. Documentation on aircraft inspection and/or modification, if applicable.</b> Maintenance records documenting the installation or modification of aircraft systems (e.g., FAA Form 337 – major repairs and alterations).</p>  |   |                           |
| D     | <p><b>Maintenance programme</b></p> <ul style="list-style-type: none"> <li>• For aircraft with established RNAV 1 and RNAV 2 system maintenance practices, the list of references of the document or programme.</li> <li>• For recently installed RNAV 1 and RNAV 2 systems, the maintenance practices for their review.</li> </ul>   |   |                           |
| E     | <p><b>Minimum equipment list (MEL) (only for operators conducting operations based on a MEL):</b><br/>MEL showing provisions for RNAV 1 and RNAV 2.</p>   |   |                           |
| F     | <p><b>Training</b></p> <p>1. <b>LAR 91 operators or equivalent: Training method:</b> Training at home, LAR</p>  |   |                           |

|   |  |  |  |
|---|--|--|--|
|   | 142 training centres, or other training courses, course completion records.<br><b>2. LAR 121 and/or 135 operators or equivalent:</b> Training programmes (training curriculums) for flight crews, flight dispatchers, and maintenance personnel.   |  |  |
| G | <b>Operating policies and procedures</b><br><b>1. LAR 91 operators or equivalent:</b> Operations manual (OM) or sections to be attached to the application, corresponding to RNAV 1 and RNAV 2 operating procedures and policies.<br><b>2. LAR 121 and/or 135 operators or equivalent:</b> Operations manual and checklists. |  |  |
| H | <b>Navigation database</b><br>Details of the navigation data validation programme.   |  |  |
| I | <b>Withdrawal of RNAV 1 and RNAV 2 approval</b><br>Indication of the need to follow up on navigation error reports submitted and the possibility of withdrawal of RNAV 1 and RNAV 2 approval.  |  |  |
| J | <b>Validation flight plan:</b> Only if required by the CAA.  |  |  |

#### CONTENTS OF THE APPLICATION TO BE SUBMITTED BY THE OPERATOR

\_\_\_ **DOCUMENTATION SHOWING RNAV 1 AND RNAV 2 COMPLIANCE BY AIRCRAFT/NAVIGATION SYSTEMS**

\_\_\_ **OPERATING PROCEDURES AND POLICIES**

\_\_\_ **SECTIONS OF THE MAINTENANCE MANUAL RELATED TO RNAV SYSTEMS (if not previously reviewed)**

**Note 1:** Documents may be grouped in a single folder or may be sent as individual documents.

## PART 4: CONTENTS OF OPERATOR APPLICATION FOR RNAV 1 AND RNAV 2

| # | Contents of the RNAV 1 and RNAV 2 application by the operator  | Reference paragraphs<br>CA 91-003  | In what Annexes/Documents of the operator can the application contents be located | Comments and/or recommendations by the inspector | Follow-up by the inspector: Item status and date |
|---|--|--|---|--|--|
| 1 | <b>Operator request letter</b><br>Statement of intent to obtain RNAV 1 and RNAV 2 authorization.   | Paragraph 9.1.1 b) 1)<br>Appendix 5, Paragraph e)  | Annex A   |  |  |
| 2 | <b>Aircraft equipment description</b>  | Paragraph 9.1.1 b) 2)  |   |  |  |
| 3 | <b>RNAV 1 and RNAV 2 systems eligibility</b><br>Airworthiness documents establishing the eligibility of RNAV navigation systems, their approval status, and a list of the aircraft for which the approval is being requested.  | Paragraphs 8.2 and 8.3<br>Paragraph 9.1.1 b) 3)  | Annex B<br>Annex C  |  |  |
| 4 | <b>Training programmes</b><br><b>1. LAR 121 or 135 operators or equivalent: Training programmes:</b> Operators will develop an initial and recurrent training programme for flight crews, flight dispatchers, if applicable, and maintenance personnel.<br><b>2. LAR 91 operators or equivalent: Training methods:</b> The following methods are acceptable for these operators: Training at home, LAR | Paragraph 9.1.1 b) 4) (a)<br>Paragraph 11<br>For maintenance<br>Paragraphs 9.1.1 b) 8) and 8.5 e)<br>Paragraph 9.1.1 b) 4) (b)<br>Paragraph 11 | Annex F   |  |  |

| # | Contents of the RNAV 1 and RNAV 2 application by the operator   | Reference paragraphs<br>CA 91-003  | In what Annexes/Documents of the operator can the application contents be located | Comments and/or recommendations by the inspector | Follow-up by the inspector: Item status and date |
|---|---|--|---|--|--|
|   | 142 training centres, or other training courses.  |  |   |  |  |
| 5 | <p><b>Operating procedures</b></p> <p><b>1. LAR 121 and/or 135 operators or equivalent:</b> Operations manual and checklists.</p> <p><b>2. LAR 91 operators or equivalent:</b> Operations manual or section of the operator application documenting RNAV 1 and RNAV 2 policies and procedures.</p>  | <p>Paragraph 9.1.1 b) 5) (a)</p> <p>Paragraph 10</p><br><p>Paragraph 9.1.1 b) 5) (b)</p> <p>Paragraph 10</p> | Annex G   |  |  |
| 6 | <p><b>Maintenance practices</b></p> <ul style="list-style-type: none"> <li>• For aircraft with established RNAV 1 and RNAV 2 maintenance practices, the operator will provide references of the documents.</li> <li>• For newly installed RNAV 1 and RNAV 2 systems, the operator will provide maintenance practices for review.</li> </ul> | <p>Paragraph 8.5 b) <del>d)</del></p> <p>Paragraph 9.1.1 b) 7)</p>   | Annex D   |  |  |
| 7 | <p><b>Update of the minimum equipment list (MEL)</b></p> <p>Applicable to operators conducting operations according to a MEL.</p>   | <p>Paragraphs <del>8.5 a) and</del> 9.1.1 b) 6)</p>  | Annex E   |  |  |

| #  | Contents of the RNAV 1 and RNAV 2 application by the operator  | Reference paragraphs<br>CA 91-003   | In what Annexes/Documents of the operator can the application contents be located | Comments and/or recommendations by the inspector | Follow-up by the inspector: Item status and date |
|----|--|-------------------------------------|---|--|--|
| 8  | <b>Navigation data validation programme</b>  | Paragraph 9.1.1 b) 9)<br>Appendix 4 | Annex F   |  |  |
| 9  | <b>Withdrawal of RNAV 1 and RNAV 2 approval</b><br><br>Indication of the need for follow-up on the navigation error reports and the possibility of withdrawal of the RNAV 1 and RNAV 2 approval. | Paragraph 13                        | Annex H   |  |  |
| 10 | <b>Validation flight plan, only if required</b><br><br>The validation flight plan will be presented only if required.  | Paragraph 9.1.1 d)                  | Annex I   |  |  |

**PAGE LEFT BLANK INTENTIONALLY**

## PART 5 – GUIDE TO DETERMINE RNAV 1 AND RNAV 2 AIRCRAFT ELIGIBILITY

| #  | Topics   | Reference paragraphs<br>CA 91-003  | Location<br>in the<br>Annexes<br>of the<br>operator | Comments and/or<br>recommendations by<br>the inspector | Follow-up by the<br>inspector: Item<br>status and date |
|----|--|--|---|--|--|
| 1  | <b>RNAV system requirement</b><br>The RNAV system use inputs from the following types of sensors (not listed in a specific order of priority):   | Paragraph 8.1.1 a) 2)  | Annex B   |  |  |
| 1a | GNSS according to TSO-C145 (), TSO-C146 () and TSO-C129()  | Paragraph 8.1.1 a) 2) (a)  |   |  |  |
| 1b | DME/DME  | Paragraph 8.1.1 a) 2) (b)  |   |  |  |
| 1c | DME/DME/IRU  | Paragraph 8.1.1 a) 2) (c)  |   |  |  |
| 2  | <b>Performance, monitoring and alerting requirements</b>   | Paragraph 8.1.2  | Annex B   |  |  |
| 3  | <b>Aircraft eligibility</b><br>1. Aircraft that have a statement of compliance with SRVSOP CA 91-003 criteria.<br>2. Aircraft approved under TGL-10 and AC 90-100A.<br>3. Aircraft that meet TGL-10.<br>4. Aircraft that comply with AC 90-100A. | Paragraph 8.2<br>Paragraph 8.2.1<br><br>Paragraph 8.2.2<br><br>Paragraph 8.2.3 | Annex B   |  |  |

| #  | Topics  | Reference paragraphs<br>CA 91-003                     | Location<br>in the<br>Annexes<br>of the<br>operator | Comments and/or<br>recommendations by<br>the inspector | Follow-up by the<br>inspector: Item<br>status and date |
|----|---|---|---|--|--|
|    | 5. Aircraft with a statement by the manufacturer.<br>6. Information to be included in the AFM, POH or avionics operating manual | Paragraph 8.2.4<br>Paragraph 8.2.5<br>Paragraph 8.2.6 |   |  |  |
| 4  | <b>Criteria for RNAV 1 and RNAV 2 systems</b>   | Paragraph 8.3   | Annex B   |  |  |
| 4a | GNSS RNAV system  | Paragraph 8.3.1                                       | Annex B   |  |  |
| 4b | DME/DME RNAV system   | Paragraph 8.3.2<br>Appendix 1 Paragraph 2             | Annex B   |  |  |
| 4c | Confirmation of the performance of RNAV systems that use DME  | <del>Paragraph 8.3.3</del><br>Appendix 1 Paragraph 3  | Annex B   |  |  |
| 4d | DME/DME/IRU RNAV system   | Paragraph 8.3.3<br>Appendix 2 Paragraph 2             | Annex B   |  |  |
| 5  | <b>Functional requirements and their explanation</b>  | Paragraph 8.4<br>Appendix 3                           | Annex B   |  |  |
| 6  | <b>Maintenance requirements</b>   | Paragraph 8.5   | Annex B   |  |  |
| 7  | <b>Navigation database</b><br>Details of the navigation data validation programme.  | Paragraph 12<br>Appendix 4                            | Annex B   |  |  |

## PART 6 - BASIC PILOT PROCEDURES FOR RNAV 1 AND RNAV 2 OPERATIONS

| Topics                      |  | Reference paragraphs<br>CA 91-003 | Location in the<br>Annexes of the<br>operator | Comments and/or<br>recommendations by<br>the CAA | Follow-up by the<br>Inspector: Item<br>status and date |
|-----------------------------|--|-----------------------------------|---|--|--|
| <b>Operating procedures</b> |  | Paragraph 10                      | Annex G                                       |  |  |
| 1                           | <b>Pre-flight planning</b>   | Paragraph 10.1 a)                 |   |  |  |
|                             | Operators and pilots intending to conduct RNAV 1 and RNAV 2 operations must fill in the appropriate boxes of the ICAO flight plan.   | Paragraph 10.1 a) 1)              |   |  |  |
|                             | On-board navigation data must be current and be appropriate for the intended operating region, and will include NAVAIDS, WPTs, and the relevant ATS route codes for departures, arrivals and alternate aerodromes. RNAV STAR procedures may be designated using multiple runway transitions. Operators that do not have this function will provide an alternate means of compliance (for example, a navigation database adjusted to these operations). If there is no alternate means of compliance to fly an RNAV procedure containing multiple runway transitions, the operators will not submit or accept an approval for these procedures. | Paragraph 10.1 a) 2)              |   |  |  |
|                             | Using all the information available, the availability of the required navigation infrastructure for the projected routes, including any non-RNAV contingency, must be confirmed for the foreseen period of operation. Since Annex 10 Volume I requires GNSS (RAIM or SBAS) integrity, it must be determined that the availability of these devices   | Paragraph 10.1 a) 3)              |   |  |  |

|          | Topics   | Reference paragraphs CA 91-003 | Location in the Annexes of the operator | Comments and/or recommendations by the CAA | Follow-up by the Inspector: Item status and date |
|----------|--|--------------------------------|---|--|--|
|          | is also appropriate.   |                                |   |  |  |
|          | Aircraft not equipped with GNSS.- Aircraft not equipped with GNSS must be capable of updating the DME/DME and DME/DME/IRU position for RNAV 1 and RNAV 2 routes, as well as for SIDs and STARs.  | Paragraph 10.1 a) 4)           |   |  |  |
|          | If only the TSO-C129 equipment is used to meet RNAV 1 and RNAV 2 requirements, RAIM availability for the intended route of flight (route and time) must be confirmed using current GNSS satellite information.   | Paragraph 10.1 a) 5)           |   |  |  |
|          | If TSO-C145/C146 equipment is used to meet the RNAV requirement, the pilot/operator does not need to do the prediction if it is confirmed that the coverage of the wide area augmentation system (WAAS) will be available throughout the flight route. | Paragraph 10.1 a) 6)           |   |  |  |
|          | Availability of RAIM (ABAS)  | Paragraph 10.1 a) 7)           |   |  |  |
|          | Availability of DME  | Paragraph 10.1 a) 8)           |   |  |  |
| <b>2</b> | <b>General operating procedures</b>  | Paragraph 10.1 b)              |   |  |  |
|          | Operators and pilots shall not request, or present in the flight plan, RNAV 1 and RNAV 2 routes, SIDs or STARs, unless they meet all the CA 91-003 criteria. If an aircraft that does not meet these criteria receives an authorisation from the       | Paragraph 10.1 b) 1)           |   |  |  |

| Topics  | Reference paragraphs<br>CA 91-003 | Location in the Annexes of the operator | Comments and/or recommendations by the CAA | Follow-up by the Inspector: Item status and date |
|---|-----------------------------------|---|--|--|
| ATC to conduct an RNAV procedure, the pilot will notify the ATC that it cannot accept the authorisation and will request alternate instructions;  |                                   |   |  |  |
| The pilot shall follow any instruction or procedure identified by the manufacturer, as necessary, to meet the performance requirements of this section;   | Paragraph 10.1 b) 2)              |   |  |  |
| At system initialization, pilots must:<br>(a) confirm the validity of the navigation database;<br>(b) verify the current position of the aircraft;<br>(c) verify the proper entry of the assigned ATC route once the initial clearance is received, and of any subsequent route changes; and<br>(d) ensure that the WPT sequence displayed on the navigation system coincides with the route shown in the appropriate charts and with the assigned route. | Paragraph 10.1 b) 3)              |   |  |  |
| Pilots shall not fly an RNAV 1 or RNAV 2 SID or STAR unless it can be retrieved from the on-board navigation database using the procedure name and is consistent with the procedure in the chart. However, the route can be modified afterwards by inserting or deleting specific WPTs based on an ATC clearance. Manual entry or the creation of new WPTs by manually entering latitude and longitude or rho/theta values is not allowed.                | Paragraph 10.1 b) 4)              |   |  |  |

| Topics   | Reference paragraphs CA 91-003 | Location in the Annexes of the operator | Comments and/or recommendations by the CAA | Follow-up by the Inspector: Item status and date |
|--|--------------------------------|---|--|--|
| Furthermore, pilots must not change an RNAV SID or STAR WPT from a fly-by WPT to a flyover WPT or <i>vice versa</i> .  |                                |   |  |  |
| Whenever possible, RNAV 1 or RNAV 2 routes must be obtained from the database as a whole, instead of loading route WPTs individually from the database to the flight plan. However, designated WPTs and fixes can be individually selected and inserted from the navigation database provided all the fixes along the published route to be flown are inserted. Furthermore, the route can be modified afterwards by inserting or deleting specific WPTs based on ATC clearances. Manual entry or the creation of new WPTs by manually entering latitude and longitude or rho/theta values is not allowed. | Paragraph 10.1 b) 5)           |   |  |  |
| Flight crews must verify the cleared flight plan by comparing the charts or other applicable resources to the navigation system text displays and aircraft chart displays, as applicable. If required, the exclusion of specific NAVAIDs must be confirmed. A procedure must not be used if there is any doubt about the validity of the procedure in the navigation database.   | Paragraph 10.1 b) 6)           |   |  |  |
| During the flight, when feasible, the flight crew must use the information available from ground NAVAIDs to confirm that navigation is reasonable.   | Paragraph 10.1 b) 7)           |   |  |  |
| For RNAV 2 routes, pilots must use a lateral deviation indicator, an FD or an AP in lateral navigation mode. Pilots may use a navigation chart   | Paragraph 10.1 b) 8)           |   |  |  |

| Topics  | Reference paragraphs CA 91-003 | Location in the Annexes of the operator | Comments and/or recommendations by the CAA | Follow-up by the Inspector: Item status and date |
|---|--------------------------------|---|--|--|
| display with a functionality equivalent to a lateral deviation indicator without an FD or AP.   |                                |   |  |  |
| For RNAV 1 routes, pilots must use a lateral deviation indicator, an FE or an AP in the lateral navigation mode.  | Paragraph 10.1 b) 9)           |   |  |  |
| Pilots of aircraft with lateral deviation display must make sure that the lateral deviation scale is appropriate for the navigation precision associated to the route/procedure (e.g., full-scale deflection: $\pm 1$ NM for RNAV 1, $\pm 2$ NM for RNAV 2 o $\pm 5$ NM for TSO-C129() equipment in RNAV 2 routes.  | Paragraph 10.1 b) 10)          |   |  |  |
| All pilots are expected to maintain the route centrelines represented on the on-board lateral deviation indicators and/or flight guide during all RNAV 1 and RNAV 2 operations, unless cleared by the ATC to deviate or in response to an emergency. For normal operations, the cross-track error/deviation (the difference between the path calculated by the RNAV system and the position of the aircraft relative to the path) shall not exceed $\pm \frac{1}{2}$ the navigation precision associated to the route or flight procedure (e.g., 0.5 NM for RNAV 1 and 1.0 NM for RNAV 2). Small lateral deviations from this requirement are allowed (e.g., overshooting or undershooting the path) during or immediately after an en-route turn/procedure, up to a maximum of 1 times the navigation precision (1xRNP) (e.g., 1 NM for RNAV 1 and 2 NM for RNAV 2). | Paragraph 10.1 b) 11)          |   |  |  |
| If the ATC assigns a course that places the aircraft  | Paragraph 10.1 b)              |   |  |  |

|   | <b>Topics</b>   | <b>Reference paragraphs CA 91-003</b> | <b>Location in the Annexes of the operator</b> | <b>Comments and/or recommendations by the CAA</b> | <b>Follow-up by the Inspector: Item status and date</b> |
|---|---|---------------------------------------|--|---|---|
|   | outside the route, the pilot shall not modify the flight plan in the RNAV system, until a new clearance is received that allows the aircraft to resume the route or the controller confirms a new route clearance. When the aircraft is not in the published route, the specified precision requirements do not apply.  | 12)                                   |  |   |   |
|   | Manual selection of functions that limit the bank angle of the aircraft may reduce the ability of the aircraft to maintain its desired track and is not recommended. Pilots should recognise that manual selection of functions that limit the bank angle of the aircraft could reduce its ability to meet ATC path expectations.   | Paragraph 10.1 b) 13)                 |  |   |   |
|   | Pilots operating aircraft with RNP approval according to the CA 91-003 provisions do not need to modify the pre-determined RNP values of the manufacturer, as established in the FMC.   | Paragraph 10.1 b) 14)                 |  |   |   |
| 3 | <b>Specific RNAV SID requirements</b>   | Paragraph 10.1 c)                     |  |   |   |
|   | Prior to commencing take-off, the pilot must verify that the RNAV system of the aircraft is available, is operating properly, and that the appropriate aerodrome and runway data have been loaded. Before the flight, pilots must verify that the navigation system of the aircraft is operating properly and that the appropriate departure procedure (including any applicable en-route transition) has been entered and is duly displayed. Pilots assigned to an RNAV departure procedure and subsequently receive a change of runway, | Paragraph 10.1 c) 1)                  |  |   |   |

| Topics  | Reference paragraphs CA 91-003 | Location in the Annexes of the operator | Comments and/or recommendations by the CAA | Follow-up by the Inspector: Item status and date |
|---|--------------------------------|---|--|--|
| <p>procedure or transition, must verify that the appropriate changes have been entered and are available for navigation before take-off. A final check of proper runway entry and correct route depiction, shortly before take-off, is recommended.</p>   |                                |   |  |  |
| <p><b>RNAV equipment engagement altitude.-</b> The pilot must be able to connect the RNAV equipment in order to follow the flight guide in the RNAV lateral navigation mode before reaching 153 m (500 ft) over the aerodrome elevation. The altitude at which the RNAV guide starts in a given route can be higher (e.g., climb to 304 m (1 000 ft) then straight to...)</p> | Paragraph 10.1 c) 2)           |   |  |  |
| <p>Pilots must use an authorised method (lateral deviation indicator/navigation map display/FD/AP) to reach an appropriate level of performance for RNAV 1.</p>   | Paragraph 10.1 c) 3)           |   |  |  |
| <p><b>DME/DME aircraft.-</b> Pilots of aircraft without GNSS, that use DME/DME sensors without inertial input, cannot use their RNAV systems until the aircraft has entered the appropriate DME coverage. The ANSP will make sure that there is appropriate DME coverage available in each RNAV SID (DME/DME).</p>  | Paragraph 10.1 c) 4)           |   |  |  |
| <p><b>DME/DME/IRU aircraft.-</b> Pilots or aircraft without GNSS, that use DME/DME RNAV systems with an IRU (DME/DME/IRU), must make sure that the position of the inertial navigation system (INS) is confirmed within 304 m (1 000 ft/0.17 NM), from a</p>  | Paragraph 10.1 c) 5)           |   |  |  |

|   | Reference paragraphs<br>CA 91-003 | Location in the Annexes of the operator | Comments and/or recommendations by the CAA | Follow-up by the Inspector: Item status and date |
|---|-----------------------------------|---|--|--|
| <p>know position, at the starting point of the take-off roll. This is usually achieved by using a manual or automatic runway update function. A navigation chart can also be used to confirm the position of the aircraft, if the pilot procedures and display resolution permit compliance with the 304 m (1 000 ft) tolerance requirement.</p>  |                                   |   |  |  |
| <p><b>GNSS aircraft.-</b> When a GNSS is used, the signal must be obtained before commencing the take-off roll. For aircraft using TSO-C129/C129a equipment, the take-off aerodrome must be loaded in the flight plan in order to achieve the appropriate navigation system monitoring and sensitivity. For aircraft using TSO-C145a/C146a avionics, if the departure begins at a runway waypoint, then the departure airport does not need to be in the flight plan to obtain appropriate monitoring and sensibility.</p>  | Paragraph 10.1 c) 6)              |   |  |  |
| <p>4 <b>Specific RNAV STAR requirements</b></p>   | Paragraph 10.1 d)                 |   |  |  |
| <p>Before the arrival phase, the flight crew must check that the correct terminal route has been loaded. The active flight plan shall be checked, by comparing the charts to the map display (if applicable) and the MCDU. This includes confirmation of WPT sequence, the reasonableness of track angles and distances, any altitude or speed restriction, and, when feasible, which are fly-by WPTs and which are flyover WPTs. If the route so requires, a check must be done to confirm that the update will exclude a particular NAVAID. A route will not be used if there</p> | Paragraph 10.1 d) 1)              |   |  |  |

| Topics   |   | Reference paragraphs CA 91-003 | Location in the Annexes of the operator | Comments and/or recommendations by the CAA | Follow-up by the Inspector: Item status and date |
|----------|---|--------------------------------|---|--|--|
|          | is any doubt about its validity in the navigation database.   |                                |   |  |  |
|          | The creation of new WPTs by the flight crew through manual entry in the RNAV system will invalidate any route and is not allowed.   | Paragraph 10.1 d) 2)           |   |  |  |
|          | Where contingency procedures require reversion to a conventional arrival route, the flight crew must complete the necessary preparations before commencing the RNAV route.  | Paragraph 10.1 d) 3)           |   |  |  |
|          | Route modifications in the terminal area may take the form of radar headings or "direct to" clearances. In this regard, the flight crew must be capable of reacting in time. This may include entering tactical WPTs from the database. The flight crew is not allowed to enter manually or modify a loaded route using provisional WPTs or fixes not provided in the database. | Paragraph 10.1 d) 4)           |   |  |  |
|          | Pilots must verify that the aircraft navigation system is operating properly and the correct arrival procedure and runway are properly entered and depicted.  | Paragraph 10.1 d) 5)           |   |  |  |
|          | Although no particular method is mandated, any publish altitude and speed constraints must be observed.   | Paragraph 10.1 d) 6)           |   |  |  |
| <b>5</b> | <b>Contingency procedures</b>   | Paragraph 10.1 e)              |   |  |  |
|          | The pilot must notify the ATC of any loss of RNAV   | Paragraph 10.1 e) 1)           |   |  |  |

| Topics   | Reference paragraphs CA 91-003 | Location in the Annexes of the operator | Comments and/or recommendations by the CAA | Follow-up by the Inspector: Item status and date |
|--|--------------------------------|---|--|--|
| capability, and the proposed course of action. If the requirements of an RNAV route cannot be met, pilots must notify the ATS as soon as possible. Loss of RNAV capability includes any failure or event that causes the aircraft to be unable to meet the RNAV requirements of the route. |                                |   |  |  |
| In case of a communication failure, the flight crew must continue with the RNAV route, in accordance with the procedure established for lost communications.   | Paragraph 10.1 e) 2)           |   |  |  |

## SRVSOP contacts:

Marcelo Ureña Logroño:

SRVSOP Safety oversight specialist/Aircraft operations

e-mail: [murena@lima.icao.int](mailto:murena@lima.icao.int)

Job Aid

RNAV 1 and RNAV 2

Version:

Original 1

Date:

12/10/2009 01/06/2010