APPENDIX A-1

ADVISORY CIRCULAR

AC	**:**	**91-001**
DATE	**:**	**12/10/09**
VERSION	**:**	**Original**
ISSUED BY	**:**	**SRVSOP**

SUBJECT: AIRCRAFT AND OPERATORS APPROVAL FOR RNAV 1O OPERATIONS (DESIGNATED AND AUTHORIZED AS RNP 10)

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1. PURPOSE

This advisory circular (AC) establishes RNP 10 approval requirements for aircraft and operations in oceanic or remote airspace.

An operator may use alternate means of compliance, as far as those means are acceptable for the respective Civil Aviation Authority (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 equivalent

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
ICAO Doc 9613	Performance-based Navigation (PBN) manual
ICAO Doc 4444	Procedures for air navigation services – Air traffic management
ICAO Doc 7030	Regional Supplementary Procedures
ICAO Doc 8168	Aircraft operations
	Volume II – Parts I and II – General criteria
FAA Order 8400.12A	Required navigation performance 10 (RNP 10) operational approval
EASA AMC 20-12	Recognition of FAA Order 8400.12A for RNP-10 operations
España DGAC CO 01/01	Aprobación operacional y criterios de utilización de sistemas para la navegación en espacio aéreo designado RNP-10
Australia CAAP RNP 10-1	Required navigation performance 10 operational approval

4. DEFINITIONS AND ABBREVIATIONS

4.1 Definitions

a) **Aircraft-based augmentation system (ABAS).-** An augmentation system that augments and(or integrates the information obtained from other GNSS elements with information available on board the aircraft.

b) **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 limits of the capability of self-contained aids, or a combination of these.

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

c) **Area Navigation (RNAV) Specification**.- Area navigation specification 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 NM, with the requirement for on-board performance control and alerting as described in the PBN Manual (Doc 9613).*

d) **Display errors (screen protection system error).-** These errors may include error components contributed by any input, output or signal conversion equipment used by the display as it presents either aircraft position or guidance commands (e.g. course deviation or command heading) and by any course definition entry device employed. For systems in which charts are incorporated as integral parts of the display, the display system error necessarily includes charting errors to the extent that they actually result in errors in controlling the position of the aircraft relative to a desired path over the ground.

To be consistent, in the case of symbolic displays not employing integral charts, any errors in way-point definition, directly attributable to errors in the reference chart used in determining way-point positions, should be included as a component of this error. This type of error is virtually impossible to handle, and in general practice, highly accurate, published way-point locations are used to the greatest extent possible in setting up such systems to avoid such errors and reduce workload.

e) **Fault detection and exclusion (FDE).-** Is a function performed by some on board GNSS receivers, which can detect the presence of a faulty satellite signal and automatically exclude it from the position calculation. In addition to the total number of satellites needed for receiver autonomous integrity monitoring (RAIM), at least one more available satellite is required (6 satellites).

f) **Flight Management System (FMS)**.- An integrated system, consisting of an airborne sensor, a receiver and a computer containing both navigation and aircraft performance databases, capable of providing RNAV performance and guidance values to a display and automatic flight control system.

g) **Flight Technical Error (FTE).-** The FTE is 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.

Note.- *For aircraft that are not capable of autopilot or flight director coupling, an FTE of 3.7 km (2 NM) for oceanic operations must be taken into account in determining any limitations.*

h) **Global Navigation Satellite System (GNSS)**.- A generic term used by 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, at least in the immediate future, by GPS and GLONASS.

i) **Global Positioning System (GPS)**.- The United States global navigation satellite system (GNSS) is a satellite-based radio navigation system that uses precise distance measurements to determine position, speed, and time anywhere in the world. The GPS is made up by three elements: the spatial, control, and user elements. The GPS space segment is nominally made up by, 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.

j) **Navigation System Error (NSE).-** The difference between true position and estimated position.

k) **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:

l) **Oceanic Airspace**.- The airspace over the oceanic area is considered international airspace in which ICAO procedures and separations apply. The responsibility for providing air traffic services in this airspace is delegated to those States with the greatest geographic proximity and/or that have more resources available.

m) **Path definition error (PDE).-** The difference between the defined path and the desired path in a given place and time.

n) **Performance-based Navigation (PBN)**.- Performance-based navigation specifies system performance requirements for aircraft operating along an ATS route, on an instrument approach procedure, or in a designated airspace.

Performance requirements are defined in terms of the precision, integrity, continuity, availability, and functionality necessary to perform the proposed operation within the context of a particular airspace concept.

o) **Primary Means of Navigation.-** A navigation system approved for a given operation or flight phase, that must meet precision and integrity requirements but not full availability and continuity of service. Safety is guaranteed by limiting flights to specific time periods and through the establishment of timely restrictive procedures.

p) **Receiver Autonomous Integrity Monitoring (RAIM)**.- A technique used in a GNSS receiver/processor to determine the integrity of its navigation signals, using only GPS signals or GPS signals enhanced with barometric upper-air data. This determination is achieved by a consistency check between pseudo-range measurements. At least one additional available satellite is required with respect to the number of satellites that are needed to obtain the navigation solution.

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

r) **RNAV Operations**.- Aircraft operations that use area navigation for RNAV applications. RNAV operations include the use of area navigation for operations that are not performed in keeping with the PBN manual.

s) **RNAV System**.- An 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 these. An RNAV system may be included as part of a Flight Management System (FMS)

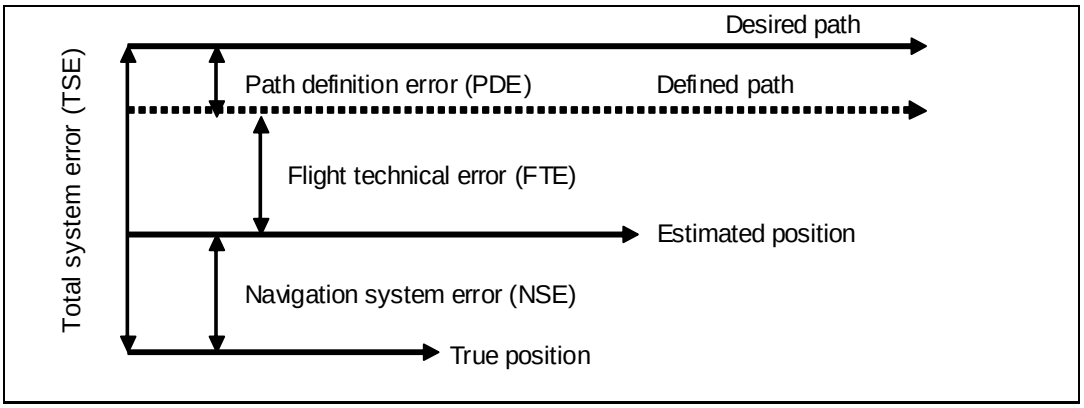
t) **Single means of navigation.**- A navigation system approved for a given operation or flight phase, and that allows the aircraft to meet the four navigation criteria: precision, integrity, availability, and continuity of service.

u) **Stand-alone Global Positioning System (Stand-alone GPS)**.- A GPS that is not connected to, or combined with, any other navigation system or sensor.

v) **Supplementary means of navigation.-** A navigation system that must be used together with a system considered to be a single means of navigation, and that must meet precision and integrity requirements but not availability and continuity conditions.

w) **Total System Error (TSE).-** Is the difference between the true position and the desired position. This error is equal to the vector sum of path definition error (PDE), flight technical error (FTE) and navigation system error (NSE).

Total system error (TSE)



4.2 Abbreviations

a)	CAA	Civil Aviation Administration/Civil Aviation Authority
b)	AC	Advisory circular (FAA)
c)	ACAS/TCAS	Airborne collision avoidance system
d)	AF	Flight manual
e)	AFM	Airplane flight manual
f)	AIP	Aeronautical information publication
g)	AP	Autopilot
h)	AIM	Aeronautical information manual
i)	AMC	Acceptable means of compliance
j)	ATC	Air traffic control
k)	ATS	Air traffic services
l)	BRG/DIS	Bearing/distance
m)	CA/AC	*Circular de asesoramiento* – SRVSOP in spanish/Advisory circular
n)	DME	Distance measuring equipment
o)	DV	Flight dispatcher (spanish abbreviation)
p)	EASA	European Aviation Safety Agency
q)	EUR	ICAO European Region
r)	FAA	United States Federal Aviation Administration
s)	FD	Flight director
t)	FDE	Fault detection and exclusion
u)	FIR	Flight Information Region
v)	FL	Flight level
w)	FMS	Flight management system
x)	FTE	Flight technical error
y)	GBAS	Ground-based augmentation system
z)	GNSS	Global navigation satellite system
aa)	GLONASS	Global navigation satellite system
bb)	GPS	Global positioning system
cc)	INS	Inertial navigation system
dd)	IRS	Inertial reference system
ee)	IRU	Inertial reference unit

ff)		
gg)	LAAS	Local area augmentation system
hh)	LAR	Latin American Regulations
ii)	LAT/LONG	Latitude/longitude
jj)	LNAV	Lateral navigation
kk)	LOA	Letter of authorisation/letter of acceptance
ll)	LRNS	Long-range navigation system
mm)	MEL	Minimum equipment list
nn)	NAV	Navigation
oo)	NAVAIDS	Navigation aids
pp)	NDB	Non-directional radio beacon
qq)	NM	Nautical mile
rr)	NSE	Navigation system error
ss)	ICAO	International Civil Aviation Organization
tt)	OM	Operations manual
uu)	OpSpecs	Operations specifications
vv)	PANS-OPS	Procedures for Air Navigation Services - Aircraft Operations
ww)	PBN	Performance-based navigation
xx)	PDE	Path definition error
yy)	POH	Pilot operating handbook
zz)	POI	Principal operations inspector
aaa)	RAIM	Receiver autonomous integrity monitoring
bbb)	RNAV	Area navigation
ccc)	RNP	Required navigation performance
ddd)	RNP APCH	Required navigation performance approach
eee)	RNP AR APCH	Required navigation performance authorisation required approach
fff)	SAM	ICAO South American Region
ggg)	SAT	South Atlantic
hhh)	SATMA	South Atlantic Monitoring Agency
iii)	SBAS	Satellite-based augmentation system
jjj)	SLOP	Strategic lateral offset procedure
kkk)	SRVSOP	Regional safety oversight cooperation system
lll)	SSR	Secondary surveillance radar
mmm)	STC	Supplementary type certificate
nnn)	TC	Type certificate

ooo)	TSE	Total system error
ppp)	TSO	Technical standard order
qqq)	UIR	Upper flight information region
rrr)	VMC	Visual meteorological conditions
sss)	VOR	Very high frequency omnidirectional radio range
ttt)	WAAS	Wide area augmentation system
uuu)	WATRS	West Atlantic route system
vvv)	WGS	World geodetic system
www)	WPT	Waypoint

5. INTRODUCTION

5.1 This AC is entitled RNAV 10 in order to be consistent with the criteria set forth in ICAO Doc 9613 – *Performance-based navigation (PBN) manual*. This new designation and version of this document does not change any requirement nor does it affect operators that have already obtained an RNP 10 approval by the Civil Aviation Authority (CAA).

5.2 The RNAV 10 navigation specification does not require on-board performance monitoring and alerting. However, the designation for airworthiness and operational approvals, as well as airspace and route designations will remain as RNP 10, in order to exempt this publication and the approvals on this matter from complying with the new RNAV 10 designation.

5.3 Recognising that there are airspaces, routes, and airworthiness and operational approvals designated as RNP 10, it is expected that the new denominations of airspace, routes, and aircraft and operator approvals will continue to use such term (RNP 10), while the PBN application will be known as RNAV 10.

5.4 This AC provides orientation and guidance on aspects related to airworthiness and operational approvals. These approvals will allow an operator to obtain a RNP 10 authorisation to operate in oceanic or remote airspaces. Furthermore, this document provides criteria for operators to extend any navigation time limit associated with the RNP 10 approval.

5.5 The implementation of the 50-NM lateral and longitudinal separation minima for oceanic or remote RNP 10 airspaces will result in benefits for the operators in terms of having a greater number of optimum routes, reduced delays, increased flexibility, and cost reduction, without reducing safety. ATS providers will obtain benefits from the efficient use of airspace and increased air traffic flow.

5.6 RNP 10 operations in oceanic or remote areas with no ground-based navigation aids, except for isolated areas, require aircraft navigation to be based on long-range navigation capability with inertial navigation and/or global positioning systems.

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

- ✓ ICAO Doc 9613, Volume II, Part B, Chapter 1 – Implementing RNAV 10 (designated and authorized as RNP 10).

5.8 This AC has been harmonised with the following documents:

- ✓ FAA Order 8400.12A - Required navigation performance 10 (RNP 10) operational approval.
- ✓ EASA AMC 20-12 - Recognition of FAA Order 8400.12A for RNP-10 operations
- ✓ España DGAC Circular Operativa 01/01 – Aprobación operacional y criterios de utilización de sistemas para la navegación en espacio aéreo designado RNP-10

6. GENERAL INFORMATION

6.1 Navigation aid infrastructure

a) RNP 10 was developed for operations in oceanic and remote areas and does not require any ground-based navigation infrastructure or assessment.

6.2 ATS communications and surveillance

a) This AC does not address communication or air traffic services (ATS) surveillance requirements that may be specified for operation on a particular route or area. These requirements are specified in other documents, such as the aeronautical information publications (AIP) and ICAO Regional Supplementary Procedures (Doc 7030). Operators and flight crews shall take into account all the operational documents related to RNP 10 airspace required by the CAA before conducting flights in said airspace.

6.3 Obstacle clearance and route spacing

a) Doc 8168 (PANS OPS), Volume II – Procedures for Air Navigation Services: Aircraft Operations provides detailed guidance on obstacle clearance. The general criteria in Parts I and III shall be applied.

b) The rationale for having choosen the RNP 10 value was to support reduced lateral and longitudinal separation minima for aplication in oceanic and remote areas where the availability of navigation aids, communication, and surveillance is limited.

c) The minimum route spacing where RNP 10 is utilized is 50 NM.

6.4 Publications

a) The AIP should clearly indicate that the navigation application is RNP 10, where reference is to existing routes. The route should identify the minimum segments altitude requirements.

b) The navigation data published in the AIP for routes and navigation aids must meet the requirements established in Annex 15 – Aeronautical Information Services. All routes must be based on the coordinates of the world geodetic system (WGS-84).

7. AIRWORTHINESS AND OPERATIONAL APPROVAL

7.1 To obtain RNP 10 authorisation, a commercial air transport operator must comply with two types of approvals:

a) the airworthiness approval granted 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) the operational approval, granted 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 whether or not the aircraft meets the applicable RNP 10 requirements and will issue the operation authorisation (*e.g.*, a letter of authorisation– LOA) (see Paragraph 2.5.2.2 of Annex 6 Part II).

7.3 Before submitting the application, operators shall review all aircraft qualification requirements. Compliance with airworthiness requirements or the installation of the equipment alone does not constitute operational approval.

8. AIRWORTHINESS APPROVAL

8.1 Aircraft requirements

8.1.1 **Navigation systems**.- The RNP 10 navigation specification requires that aircraft operating in oceanic and remote areas be equipped with at least *two independent and serviciable long range navigation systems (LRNS),* comprising an inertial navigation system (INS), an inertial reference system/flight management system (IRS/FMS), or a global navigation satellite system (GNSS) (*e.g*., the global positioning system (GPS)), with an integrity such that the navigation system does not provide an unacceptable probability of misleading information.

8.1.2 System performance, monitoring and alerting

a) **Accuracy.-** During operations in airspace or on routes designates as RNP 10, the lateral total system error must not exceed ± 10 NM for at least 95% of the total flight time. This includes positioning error, flight technical error (FTE), path definition error and display error.

The along-track error must also not exceed ± 10 NM for at least 95% of the total flight time.

Note 1.- *For RNP 10 operational approval of aircraft capable of coupling the RNAV system to the flight director (FD) or autopilot (AP), the navigation position error is the main contributing factor to transverse and longitudinal error. FTE, the path definition error, and display errors are considered insignificant for purposes of RNP 10 approval.*

Nota 2.- *When data collection method described en Appendix 1 of FAA Order 8400.12A is used as the basis for an RNP 10 operations approval, these error types are included in the analysis. However, when the data collection method described in Appendix 6 of FAA Order 840012.A is used, these errors are not included since that method is more consevative. The Appendix 6 nethod uses radial error instead of cross-track and along-track error.*

b) **Integrity.-** Malfunctioning of the aircraft navigation equipment is classified as a major failure condition according to airworthiness regulations (*e.g*., 10^{-5} per hour).

c) **Continuity.-** The loss of this function is classified as a major failure condition for oceanic and remote navigation. The continuity requirement is met by carrying two independent LRNS systems on board (excluding signal-in-space).

d) **Signal-in-space.-** If GNSS is used, the aircraft navigation equipment must provide an alert if the probability of signal-in-space errors cause a lateral position error greater than 20 NM to exceed 10^{-7} per hour (Annex 10, Volume I, Table 3.7.2.4.1).

8.2 Aircraft groups (aircraft fleets)

8.2.1 **Aircraft group.-** For an aircraft to be considered part of a group for purposes of RNP 10 airworthiness approval, it must meet the following conditions:

a) the aircraft must have been built following a nominally identical design and must have been approved for the same type certificate (TC), an amendment to a TC, or a supplemental type certificate (STC), as applicable;

Note.- *For derivative aircraft, data from the original configuration could be used to minimise the amount of additional information needed to indicate conformity. The extent of the additional information needed will depend on the category of the differences between the original aircraft and the derivative one, when an INS/IRU is used to meet RNP 10 requirements.*

b) For the navigation system installed in each aircraft to meet the minimum RNP 10 airworthiness approval, it must have been built with the same manufacturer specifications and have the same part numbers.

c)

d) When approval is requested for a group of aircraft, the data package must contain the following information:

1) a list of the group of aircraft to which the information package applies;

2) a list of the routes to be operated and the maximum estimated navigation time in navigation from alignment to the time in which the flight will leave Class II navigation airspace;

3) the compliance procedures to be used to ensure that all aircraft sent for approval meet RNP 10 navigation capabilities for the RNP 10 approved time duration; and

4) the engineering data to be used in order to ensure continuity of RNP 10 service for the RNP 10 approved time duration.

Note.- *Aircraft with INS/IRU systems from different manufacturers or with different part numbers may be considered part of the group if it is demostrated that the navigation equipment provides an equivalent navigation performance.*

8.2.2 **Non-group aircraft**.- Aircraft for which an approval is requested based on the unique characteristics of the navigation system and structure to be used instead of the characteristics common to the group aircraft.

Note.- *The information gathered by one or more operators in accordance with Appendix 6 to FAA Order 8400.12A can be used as the basis for the approval of another operator and may reduce the number of tests required for approval. Appendix 6 to FAA Order 8400.12A contains an example of the data collection procedure and samples of the forms to be used for collecting such information.*

8.3 **Determining aircraft eligibility for RNP 10 operations**

8.3.1 **Aircraft eligibility**

Many of the aircraft and navigation systems currently used for oceanic and remote operations are eligible for RNP 10 operations, based on one or more of the provisions included in the current certification criteria. Therefore, an additional aircraft certification may not be needed for most RNP 10 operational approvals. In these cases, a new aircraft certification will only be needed if the applicant chooses to request additional performance, beyond the original certification or the certification declared in the aircraft flight manual (AFM), and when the desired performance cannot be shown through data collection methods. The following three methods for determining aircraft eligibility have been defined:

a) **Method 1 – Aircraft eligibility through RNP certification (aircraft with RNP airworthiness declaration in the AFM)**

1) This method can be used to approve aircraft that have officially been certified and approved for RNP operations.

2) RNP Compliance (conformity or capability) will be documented in the AFM or in its approved supplement and normally is not limited to RNP 10. The AFM will indicate the RNP levels that have been demonstrated and any related provision applicable to their use (for example, navaid sensor requirements). Operational approval of these aircraft will be based on the performance declared in the AFM.

3) An airworthiness approval that specifically indicates RNP 10 performance can be obtained. The following wording can be used in the AFM, when RNP 10 approval is granted by the CAA aircraft certification office for a modification to the INS/IRU certified performance:

"It has been shown that the XXXX navigation system meets the criteria set forth in (State document or guidelines) as primary means of navigation for flights up to XXXX hours with no update. Determination of the duration of the flight begins when the system is set on navigation mode. For flights that include on-board navigation position update, the operator must address the effect that such update has on the precision of the position and of any time limit associated with RNP operations, relative to updates to NAVAIDS used and to the area, routes, and procedures, which shall be used for the flight. Proof of performance according to the provisions set forth in (State document or guidelines) does not entail approval for conducting RNP operations".

Note.- *The AFM wording described above is based on the performance approval by the CAA and is only one of the elements in the approval process. Aircraft whose AFM includes this text shall be eligible for approval through the issuance of OpSpecs or a Letter of Authorisation (LOA), provided all other criteria have been met. The XXXX hours specified in the AFM do not include updates. When the operator proposes to credit the update, the proposal must indicate the effect that the update has on the accuracy of the position and on any time limit associated to RNP operations, relative to the updates of NAVAIDS used and the area, routes, or procedures to be used for the flight.*

b) **Method 2 – Aircraft eligibility through prior navigation system certification (aircraft that do not have RNP declaration in the AFM)**

Method 2 can be used to grant approval to aircraft whose level of performance, by virtue of other standards or previous standards, can be used as equivalent to the RNP 10 criteria. The standards listed in Paragraphs a) through g) can be used to classify an aircraft. Other standards can also be used if they are sufficient to ensure that the RNP 10 requirements are met. Should other standards be used, the applicant must propose acceptable means of compliance:

1) **Aircraft equipped with dual GNSS approved as a primary means of navigation in oceanic and remote areas**

(a) aircraft approved to use GNSS as a primary means of navigation for oceanic and remote operations, in accordance with the appropriate requirements of the CAA, meet RNP 10 requirements without time limitations;

(b) FAA AC 20-138A or equivalent documents provide an acceptable means of compliance with installation requirements for aircraft that use GNSS, but do not integrate this system with other sensors.

(c) operators who intend to use GNSS as the only navigation system (without INS or IRS) for RNP 10 routes or airspaces must also comply with the regulations and advisory documentation related to the CAA. The applicant or operator must also comply with the specific requirements described in this AC. This includes the use of a GNSS approved as a primary means of navigation for oceanic and remote areas.

(d) the AFM must indicate that a particular GNSS facility meets the appropriate CAA requirements. The authorised dual GNSS equipment must be installed by virtue of a technical standard order (TSO) and an approved programme for FDE availability prediction must be used. The maximum allowable time in which it is forecast that FDE capability will not be available is 34 minutes. The maximum service interruption time must be included as a condition for RNP approval.

Note.- *If the FDE service interruption time for the expected RNP operation is expected to be exceeded, the operation must be re-scheduled for a time when FDE is available or conduct the RNP 10 operation based on an alternate means of navigation.*

2) **Multi-sensor systems integrating GNSS with RAIM, FDE or equivalent system functionality**

(a) multi-sensor systems to which GNSS is integrated with the RAIM, FDE or equivalent system, that have been approved by virtue of the guidance contained in FAA AC 20-130A or equivalent documents, meet the RNP 10 requirements without any limitations of time. In this case, INS or IRU must have been approved in accordance with LAR 121 Appendix G.

3) **Transport aircraft eligible for /E suffix, as defined in the United States aeronautical information manual (AIM)**

(a) Aircraft equipped with INS or IRU, with radio navigation position update and electronic map display, that classify for /E equipment suffix as defined in the United States AIM, meet all of the RNP 10 requirements for up to 6.2 hours of flight time. Timing starts when the system is set on navigation mode or at the last point where the systems were updated. If the systems are updated en route, the RNP time limit of 6.2 hours must be adjusted after the update to account for the update precision.

Note.- *The 6.2-hour flight time is based on an inertial system with a 95% radial position error index (circular error index) of 3.7 km/h (2.0 NM/H), which is statistically equivalent to specific 95% cross-track error indices of 2,9678 km/h (1,6015 NM/h) and 95% along-track position error indices (orthogonal error indices) of 18.5 km (10 NM) each, and 95% cross-track and along-track position error limits of 18.5 km (10 NM) each (for example, 18.5 km (10NM) /2,9678 km/h (1,6015 NM/h) = 6,2 hours).*

(b) Aircraft equipment with /E suffix is a designation used by the United States; it is not an ICAO designation and should only be used for flights in the continental United States. Only the suffix in this place is defined in order to determine the requirements to meet that stated in this paragraph.

4) **Aircraft equipped with INS or IRU that have been approved in accordance with LAR 121 Appendix G or equivalent documents**

(a) inertial systems approved in accordance with LAR 121 Appendix G or equivalent documents meet the RNP 10 requirements for up to a flight time of 6.2 hours. Timing begins when the systems are set on navigation mode or at the last point where the systems were updated. If the systems are updated en route, the operator must show the impact that update accuracy has on the time limit. INS accuracy, reliability, and maintenance, as well as flight crew training required according to LAR 121 Appendix G, are applicable to the RNP 10 authorisation.

5) **Aircraft equipped with dual INS or IRU**

(a) When dual INS or IRU is provided as the only long-range means of navigation, the systems must be installed in accordance with CAA standards. A basic time limit of 6.2 hours for RNP 10 is applicable after the systems are set on navigation mode (NAV). The basic time limit of 6.2 hours can be extended based on the methods described in paragraph 8.4.

6) **Aircraft equipped with dual INS or IRU approved for minimum navigation performance specifications (MNPS) operations or approved for RNAV operations in Australia**

(a) aircraft equipped with dual INS or IRU that have been approved for MNPS or RNP operations in Australia meet the RNP 10 requirements up to 6.2 hours after the systems have been set on navigation mode or after an en-route update. If systems are updated en route, the operator must show the impact that accuracy has on the time limit.

7) **Aircraft equipped with a single INS/IRU and a single GNSS approved as primary means of navigation in oceanic and remote areas**

(a) aircraft equipped with a single INS or IRU and a single GNSS are considered to meet RNP 10 requirements without any time limitations. INS or IRU must be approved in accordance with LAR 121 Appendix G. GNSS must be authorised in accordance with TSO-C129 and must have an approved programme for predicting fault detection and exclusion (FDE) availability. The maximum allowable time in which it is expected that FDE will not be available is 34 minutes. The maximum service interruption time must be included as a condition for RNP 10 approval. The AFM must indicate that the specific INS/GNSS facility meets the appropriate CAA requirements.

c) **Method 3 – Eligibility of aircraft through data collection**

1) This method requires operators to collect data during a specified period of time in order to obtain RNP 10 approval. The data collection programme must indicate the navigation accuracy requirements appropriate for RNP 10. Data collection must ensure that applicant can prove to the CAA that the aircraft and the navigation system provide the flight crew with navigation awareness concerning the foreseen RNP 10 route. Data collection must also provide a clear understanding of navigation system status and that the indications and procedures in case of failure are consistent with the continuing required navigation performance.

2) There are two data collection methods:

(a) **The sequential method.-** This method is a data collection programme that meets the provisions set forth in FAA Order 8400.12A Appendix 1. The sequential method allows operator to collect and plot data in “pass-fail” graphs in order to determine if the aircraft system of the operator will meet RNP 10 requirements as long as needed by the operator; and

(b) **The periodic method.-** This data gathering method requires a GNSS manual receiver as the basis for INS data collection, this is described in FAA Order 8400.12A Appendix 6. The collected data are immediately analysed in order to determine whether or not the system is capable of maintaining RNP 10 as long as needed by the operator.

3) The operator must submit documents relevant to the chosen qualification method so that the CAA can determine if the aircraft is equipped with LRNS that meet RNP 10 requirements (for example, the AFM). The applicant must submit a configuration list with details on the relevant components and equipment to be used for long-range navigation and for RNP 10 operations, and will describe the relationships between such components and equipment. The applicant must indicate the proposed time limit for INS or IRU for RNP 10 operations, and must consider the effect of head winds on the area where RNP 10 operations will be carried out in order to determine the feasibility of the proposed operation.

8.4 Obtaining approval with extended time limit for aircraft equipped with INS or IRU systems

a) The baseline RNP 10 time limit for aircraft equipped with INS and/or IRU systems, once the equipment is set on navigation mode, is *6. 2 hours*, according to the details contained in Paragraphs 8.3.1 b), 3), 4), 5), and 6). The time limit may be extended using any of the following methods:

1) an extended time limit may be established when RNP is integrated to an aircraft navigation system through the documented airworthiness statement in the AFM or its supplement, as described in Paragraph 8.3.1 a). The applicant must submit to the aircraft certification office or equivalent, aircraft certification data showing that the time limit extension for RNP 10 is justified;

2) when an INS or IRU has been approved using an existing approval standard, as detailed in Paragraphs 8.3.1 b), 3), 4), 5), and 6), an extended time limit can be established by an applicant who submits supporting data to the CAA aircraft certification office. Aircraft group approvals will be granted with the appropriate restrictions during aircraft certification, if the data collected show that the approval is warranted; and

3) an applicant may establish an extended time limit using multiple navigation sensors, by showing that the mixed or average navigation position error justifies such extension (for example, triple mixed INS). If the applicant uses a mixed time limit, then the mixed capacity availability must be operational from the take-off (flight dispatch) for flights in RNP 10 airspace or routes. If the mixed or average functionality is not available at the time of take-off, then the applicant must use a time limit that is not mixed. The extended time limit must be validated through a data collection programme and analysis as specified in the next paragraph;

4) when an INS or IRU has been approved using an existing approval standard, operators can establish an extended time limit by applying a data collection programme in accordance with the guidance provided in Appendixes 1 and 6 of FAA Order 8400.12A.

8.5 Maintenance aspects

a) **Minimum equipment list (MEL)**

If RNP 10 approval is granted based on a given operational procedure, (such as, credit for triple mix), operators must adjust the MEL and specify the required dispatch conditions through the CAA certification and inspection office or equivalent.

b) **Continuing airworthiness (maintenance requirements)**

The operator must establish and implement a maintenance programme for individual navigation systems. For installed navigation systems, the operator will send the appropriate changes to its existing maintenance manual for review and acceptance.

8.6 Certification measures related to RNP 10

8.6.1 The operator may choose to certify the aircraft navigation performance in accordance with a new standard in order to take advantage of aircraft functions. Credit can be given to an aircraft performance improvement by collecting operational data, in which case certification would not be necessary.

8.6.2 Guidance on the different types of navigation systems is provided in the following paragraphs. The operator will propose an acceptable means of compliance regarding any of the systems that are not indicated below.

a) **Aircraft with INS.-** Aircraft with INS equipment certified under LAR 121 Appendix G or equivalent document, only need a new certification in the case of operators that choose to certify INS accuracy as better than a radial error of 3.7 km (2 NM) per hour. However, the following conditions must apply:

1) the INS performance certification must address all matters concerning continuing required accuracy, including precision and reliability, acceptance trial procedures, maintenance procedures, and training programmes; and

2) the applicant must determine the standard to be used to demonstrate INS performance. It could be a regulation (*i.e.,* LAR 121 Appendix G or equivalent document) or a specification exclusive to the industry or operator. A statement to the AFM must be added, stating the precision standard used for the certification.

b) **Aircraft to which GNSS is added.-** Both U.S.A. FAA AC 20-138A and Australia CAAP 35-1 provide acceptable means of compliance of installation requirements for aircraft that use GNSS, but to which other sensors are not added. FAA AC 20-130A or equivalent describes the acceptable means of compliance for multi-sensor navigation systems to which GNSS is added. Operators who wish to use GNSS in their aircraft as single means of navigation (for example, without INS or IRS) along RNP 10 routes or airspace must also comply with CAA regulations and corresponding advisory documentation, except for some GNSS requirements described in this AC.

8.6.3 **Equipment configuration**

a) The configuration of the equipment used to show the required accuracy must be identical to the configuration specified in the MEL.

b) The configuration of the equipment used to show the required accuracy must be consistent with RNP 10 oceanic and remote airspace. For example, the statistical benefit of estimating position using INS position data filtered with DME data will not be taken into account.

c) The installation design must meet the design standards applicable to the aircraft being modified.

9. OPERATIONAL APPROVAL

Airworthiness approval alone does not authorise an applicant or operator to conduct RNP 10 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 a given piece of equipment.

Concerning commercial air transportation, the evaluation of an application for RNP 10 operational approval is done by the State of the operator, in accordance with standing 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, the evaluation of an application for RNP 10 operational approval is done by the State of registry, in accordance with standing operating rules (*e.g.*, LAR 91.1015 and LAR 91.1640 or equivalent), supported by the criteria described in this AC.

9.1 Operational approval requirements

9.1.1 In order to obtain RNP 10 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 must 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) *RNP 10 operational approval application*;

2) *airworthiness documents concerning aircraft eligibility*.- Documentation showing that the equipment of the proposed aircraft meets the requirements of this AC, as described in Paragraph 8. The operator will submit relevant documentation showing that the aircraft is equipped with long-range navigation systems (LRNS) that meet RNP 10 requirements, for example those 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 in RNP 10 operations. The list must include the manufacturer, model and version of each GNSS, INS/IRU equipment and software of the installed FMS.

4) *time limit for RNP 10 with INS/IRU (if applicable)*.- The operator must submit documentation that justifies the proposed RNP 10 time limit in connection with the specified INS or IRU. The applicant will take into account the effect of head winds on the area where it plans to conduct RNP 10 operations in order to determine whether or not the proposed operations are viable.

5) *Training Programme for flight crews and flight dispatchers (DV), procedures, and operating practices*

(a) Commercial operators must submit the training curriculum and other appropriate material to the CAA in order to show that the operational procedures and practices and the training aspects identified in Paragraph 12, related to RNP 10 operations, have been included in the training programmes, where applicable (for example, initial, upgrade or recurrent training programmes for flight crews and flight dispatchers). The operator will develop and standardise procedures and practices according to the guidelines established in Paragraph 11, in the following areas: flight planning, aircraft pre-flight procedures for each flight, procedures before entering an RNP 10 route or airspace and in-flight, contingency, and flight crew qualification procedures.

Note.- *It is not necessary to establish a separate training programme if RNP 10 training, identified in Paragraph 12, has already been included in the operator training programme. However, it should be possible to identify what RNP 10 aspects are covered in a training programme.*

(b) General aviation operators must be familiar and show that they will conduct their operations applying the practices and procedures described in Paragraph 11.

6) *Operations manual and checklist*

(a) LAR 121 and 135 operators.- Commercial operators must review the operations manual (OM) and the checklists in order to include information and guidance on standard operational procedures (SOP) detailed in Paragraph 11 of this AC. The appropriate manuals must contain the operation instructions for navigation equipment and any other procedure established in order to operate in a given operations area (e.g., contingency procedures). The manuals and checklists must be submitted for review along with the formal application in Phase two of the approval process.

(b) LAR 91 operators.- General aviation operators must develop operating instructions for navigation equipment and contingency procedures. This information must be available to crews in the OM or in the pilot operations handbook (POH). These manuals and the manufacturer's instructions for the operation of the aircraft navigation equipment, as appropriate, must be submitted as attachments to the formal application for review of the CAA.

7) *Minimum equipment list (MEL)*.- The operator will send any revision to the MEL that is necessary to conduct RNP 10 operations (*e.g.*, if the approval is based on a "triple mix", the MEL must include the three navigation units that must be operational).

8) *Maintenance*.- All operators must establish, maintain, and submit to the CAA the maintenance programme for each navigation system. For other installations, the operator must submit any change to its maintenance manual for review and acceptance. The operator will provide a procedure to withdraw and then restore RNP 10 operational capability to an aircraft.

9) *Maintenance personnel training programme.*- The operators will send the corresponding maintenance staff training curricula.

10)

11) Past performance.- The application will include the operating history of the operator. The applicant will include the events or incidents in relation to navigation errors in Class II airspace, which have been corrected through changes in the training programmes, procedures, maintenance or aircraft navigation systems used.

12) *Navigation data validation programme*.- If a database is used, the operator will present details about the navigation data validation programme as described in Appendix 1 to this AC.

c) *Training programme*.- 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 perform a validation flight before granting the operational approval. Such validation can be performed on commercial flights. The validation flight will be carried according to the provisions of Chapter 13, Volume II, Part II of the SRVSOP Operations Inspector Manual (MIO).

e) *Issuance of an authorisation to conduct RNP 10 operations*.- Once the operator has successfully completed the operational approval process, the CAA will grant the operator the authorisation to conduct RNP 10 operations.

1) LAR 121 and/or 135 operators.- For LAR 121 and/or LAR 135 operators, the CAA will issue the corresponding operations specifications (OpSpecs) that will reflect the RNP 10 authorisation.

2) LAR 91 operators.- For LAR 91 operators, the CAA will issue a letter of authorisation (LOA).

10. OPERATIONAL REQUIREMENTS

10.1 Navigation performance

a) All aircraft must meet a lateral and longitudinal precision equal to or better than ± 10 NM for 95% of the flight time in RNP 10 airspace.

10.2 Navigation equipment

a) All aircraft performing RNP 10 operations in oceanic and remote airspace must be equipped with *two LRNS*, independent and operational, made up by one INS, one IRS/FMS or one GNSS (*e.g.*, a GPS), with such an integrity that will prevent the navigation system from providing error-inducing information.

b) The CAA may approve the use of a single LRNS under specific circumstances (*e.g.*, in the North Atlantic MNPS airspace).

10.3 Flight plan designation

a) Operators must indicate their capability to meet RNP 10 for the route or airspace, in accordance with the *Procedures for Air Navigation Services – Rules of the Air and Air Traffic Services (PANS-RAC Doc 4444),* Appendix 2, Box 10: equipment. The letter “R” must be inserted in Box 10 of ICAO flight plan to indicate that the pilot has:

1) reviewed the foreseen flight route, including the routes to the alternate aerodrome in order to determine the types of RNP involved;

2) confirmed that operator and aircraft have been approved by the CAA for RNP operations; and

3) confirmed that the aircraft can operate in accordance with RNP (RNAV) requirements in the foreseen flight route, including the routes to the alternate aerodrome.

b) Operators applying to use WATRS plus airspace will also insert the letter “Z” in Box 10 and “NAV/RNP 10” in Box 18.

10.4 **Availability of navigation aids (NAVAIDS)**

At the time of dispatch or during flight planning, the operator must ensure NAVAIDS are available en route to enable the aircraft to navigate to RNP 10 for the duration of the planned RNP 10 operation.

10.5 **Evaluation of routes for RNP 10 time limits - Aircraft equipped only with INS or IRU**

a) An RNP 10 time limit must be established for aircraft equipped only with INS or IRU. When planning operations in areas where RNP 10 is applied, the operator must establish that the aircraft will comply with the time limits along the routes to be flown.

b) When performing this evaluation, the operator must take into account the effect of headwinds and, in the case of aircraft not capable of coupling the navigation system or the FD to the AP, the operator may choose to make this evaluation each time or for every flight. During the evaluation, the operator must take into account the following items:

1) **Route evaluation.-** The operator must establish that the aircraft can meet RNP time limits for dispatch or departure to RNP10 airspace.

2) **Star point for calculation.-** The calculation must start when the system is set on navigation mode or at the last point where the system is expected to be updated.

3) **Stop point for calculation.-** The stop point for calculation may be one of the following:

(a) the point where the aircraft will begin to navigate by reference to ICAO standard navigation aids (VOR, DME, non-directional beacon (NDB)) or will enter into radar surveillance of an air traffic control (ATC); or

(b) the first point where the system is expected to be updated.

4) **Sources of wind component data**

The headwind component to be considered for the route can be obtained from any source deemed acceptable by the CAA. The following sources of wind data are deemed acceptable: the meteorological office of each State, the national weather service, an industry source, such as Boeing winds on world air routes and historical data provided by the operator.

5) **One-time calculation, based on 75 per cent probability wind components**

Some sources of wind data indicate the annual probability of a given wind component occurring along the routes between pair cities. If an operator decides to make RNP 10 time limit compliance calculations every time, the operator may apply the 75% annual probability to calculate the effect of head winds (it has been shown that this level is a reasonable estimation of the intensity of wind components).

6) **Calculation of the time limit for each specific flight**

The operator may decide to evaluate each specific flight, applying flight plan winds to determine whether or not an aircraft will comply with the specified time limit. If it is determined that it will exceed such time limit, the aircraft must then fly an alternate route or delay the flight until it can meet the established time limit. This evaluation is a flight planning or dispatch task.

10.6 **Effect of en-route updates (increased duration of RNP 10 navigation capability)**

a) Operators may increase the duration of the RNP 10 navigation capability through position updating procedures. Approvals for various updating procedures are based upon the baseline for which they have been approved minus the time factors shown below:

1) automatic update using dual distance-measuring equipment (DME/DME) = baseline minus 0.3 hours (for example, an aircraft that has been approved for 6.2 hours can gain another 5.9 hours after an automatic DME/DME update);

2) automatic update using distance-measuring equipment and very high frequency omnidirectional radio beacon (DME/VOR) = baseline minus 0.5 hours; and

3) manual update using a CAA-approved method = baseline minus 1 hour. A method similar to the one shown in Appendix 7 to FAA Order 8400.12A can be used.

10.7 **Conditions under which automatic radio position update is considered acceptable for flights in RNP 10 airspace**

a) The automatic updating is any updating procedure that does not require the flight crew to manually insert coordinates. Automatic update is considered acceptable for operations in RNP 10 airspace, provided:

1) automatic updating procedures are included in the training programme of the operator;

2) fight crews are familiar of the update procedures and the effect of the update on the navigation solution; and

3) an acceptable procedure for automatic update can be used as the basis for an RNP 10 approval with extended time, as indicated by the data submitted to the leader of the CAA team responsible for the approval or to the principal operations inspector (POI). These data must clearly indicate the accuracy of the update and the effect of the update on the navigation capabilities for the remaining flight time.

10.8 **Condition under which manual radio position update is considered acceptable for flights in RNP 10 airspace**

a) If manual updating has not specifically been approved, manual radio position updates are not allowed for RNP 10 operations. Manual radio position updates may be considered acceptable for RNP 10 airspace operations, provided that:

1) the CAA examines the manual update procedures on a case by case basis. FAA Order 8400.12A Appendix 7describes an acceptable manual update procedure and may be used as the basis for RNP 10 approval for an extended time when the update is supported by acceptable data;

2) operators show that their updating procedures and training procedures include measures/crosschecking to prevent human factors errors, and the CAA determines that the flight crew qualification segment provides them with effective training; and

3) operators provide data to determine the accuracy with which the aircraft navigation system can be updated using manual procedures and navigation aids. Data showing the accuracy achieved during operations must be provided. This factor must be taken into account when establishing the RNP 10 time limit, with INS or IRU.

11. OPERATING PROCEDURES

11.1 In order to meet the requirements for RNP 10 operations in oceanic or remote areas, an operator must comply with the relevant requirements contained in Annex 2 – Rules of the Air, to the Convention on International Civil Aviation.

a) **Flight planning.-** During flight planning, flight crews and flight dispatchers must pay particular attention to conditions that may affect operations in RNP 10 airspace or routes, including:

1) verifying if aircraft has been approved for RNP 10 operations;

2) verifying that two LRNS are operational;

3) verifying if the RNP 10 time limit has been taken into account (only aircraft equipped with INS or IRU);

4) verifying the requirements for GNSS, such as FDE, if applicable to the operation;

5) 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);

6) if required, taking into account any operational restriction related to RNP 10 approval for a specific navigation system; and

7) verifying the planned flight route, including the deviation to any alternate aerodrome, in order to identify the existing RNP types.

b) **Pre-flight procedures.-** The following actions must be completed during pre-flight:

1) 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;

2) 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); and

3) 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 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.

c) **En-route procedures.-** The following must be observed:

1) 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;

2) 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;

3) operating procedures must include mandatory cross-check procedures in order to identify navigation errors in advance and prevent the aircraft from inadvertently deviating from the routes authorised by the ATC;

4) 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; and

5) 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 ± ½ the navigation precision associated with the flight route (*e.g.*, 5 NM). Small lateral deviations from this requirement are allowed (*e.g.*, 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).

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 ± ½ precision requirement during en-route turns; however, they are expected to meet interception requirements after the turn or in the straight segments.*

d) Contingency procedures

1) Flight crews and flight dispatchers must become familiar with the following general provisions:

(a) if an aircraft cannot continue the flight in accordance with the current ATC authorisation or cannot mantain RNP 10 precision, it will not enter, or continue operations in RNP 10 airspace. In this case, the pilot will obtain a revised authorisation, whenever possible, before beginning any action.

(b) in all cases, the flight crew must follow the contingency procedures established for each region or area of operation (*e.g.*, South Atlantic (SAT), West Atlantic Route System (WATRS), Pacific, etc.) and obtain an authorisation from the ATC as soon as possible.

2) *Procedures for in-flight contingencies, deviations due to weather, and strategic lateral offset*.- The operator will develop procedures for in-flight contingencies, deviations due to weather conditions, and strategic lateral offset (SLOP), in accordance with Paragraph 15.2 of ICAO Doc 4444 – Special procedures for In-flight contingencies in oceanic airspace. These procedures are of general application in oceanic and remote continental areas of operations. As a minimum, the following aspects will be included:

(a) Special procedures for in-flight contingencies in oceanic airspace.

(1) Introduction.

(2) General procedures.

(3) Extended range operations by aeroplanes with two turbine power-units (ETOPS).

(b) Deviation procedures due to weather conditions.

(1) General.

(2) Measures to be adopted when establishing pilot-controller communications.

(3) Measures to be adopted if a revised ATC authorisation cannot be obtained.

(c) Strategic lateral offset procedure in oceanic and remote continental airspaces.

12. TRAINING PROGRAMME

12.1 The following aspects must to be standardised and included in the training programmes for flight crews and flight dispatchers. Some aspects may have already been duly standardised in the existing training programmes. The new technologies may also eliminate the need for certain actions by the flight crew. If this is the case, this paragraph can be deemed fulfilled.

a) Commercial operators (LAR 121 and 135 or equivalents).- Commercial operators must make sure that flight crews and flight dispatchers are trained on the following aspects:

1) General

(a) RNP definition relative to RNP 10 requirements.

(b) Knowledge of the airspace where RNP 10 is required.

(c) Aeronautical charts and documents that reflect RNP 10 operations.

(d) Required equipment and their operation for operations in RNP 10 airspace.

(e) Limitations associated with navigation equipment.

(f) Impact of updating navigation systems.

(g) Use of MEL.

2) Operational procedures

(a) Flight planning.

(b) Pre-flight procedures.

(c) En-route operations.

(d) Contingency procedures.

(e) Aspects contained in this AC.

b) Private operators (LAR 91 or equivalent).- Private operators must provide evidence to the CAA that the pilots have knowledge about RNP 10 operations. When determining whether or not the training of a private operator is appropriate, the CAA may:

1) accept a certificate issued by a training centre without any further evaluation;

2) assess a training programme before accepting a certificate issued by a given training centre;

3) accept a statement in the application of the operator indicating that the operator guarantees and will continue to guarantee that the flight crews have knowledge about RNP 10 operational practices and procedures; and

4) accept a statement from the operator in the sense that it has already performed or will perform a specific RNP 10 training programme.

13. NAVIGATION DATABASE

13.1 If there is an on-board database, it must be valid and appropriate for operations and must include navigation aids and waypoints (WPT) required for the route.

a) The operator must obtain the navigation database from a qualified provider.

b) Navigation database providers must have a letter of acceptance (LOA) in order to process navigation information (*e.g.*, FAA AC 20-153 or document on conditions for the issuance of letters of acceptance to navigation data providers by the European Aviation Safety Agency (EASA IR 21 Subpart G) or equivalent documents). A LOA recognises as data provider one whose information quality, integrity, and quality management practices are consistent with the criteria in document DO-200A/ED-76. The provider 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 an LOA issued to navigation data providers or may issue its own LOA.

c) The operator must report to the navigation data provider any discrepancies that invalidate a route, and prohibit the use of the affected procedures affected through a notice to the flight crews.

d) Operators must consider the need to conduct periodic checks of the navigation databases in order to maintain the existing quality system or safety management system requirements.

14. OVERSIGHT, INVESTIGATION OF NAVIGATION ERRORS AND WITHDRAWAL OF RNP 10 AUTHORISATION

a) The operator will establish a procedure to receive, analyse, and follow up on navigation error reports in order to determine appropriate corrective actions.

b) Information showing the potential of repeated errors may require changes to the training programme of the operator.

c) Information attributing multiple errors to a specific pilot may indicate that that pilot needs additional training or a revision of his/her license.

d) Repeated navigation errors attributed to a piece of equipment or a specific part of that piece of equipment or to operational procedures can entail the cancellation of an operational approval (withdrawal of RNP 10 authorisation from the OpSpecs or withdrawal of the LOA in the case of private operators).

APPENDIX 1

NAVIGATION DATA VALIDATION PROGRAMME

1. INTRODUCTION

The information stored in the navigation database defines the lateral and longitudinal guidance of the aircraft for RNP 10 operations. Navigation database updates are carried out every 28 days. Navigation data used in each update are critical for the integrity of each RNP 10 route. This appendix provides guidance on the procedures applied by the operator to validate the navigation data associated with RNP 10 operations.

2. DATA PROCESSING

a) The operator will identify in its procedures, the person responsible for the update of the navigation data.

b) The operator must document a process for accepting, checking, and loading navigation data to the aircraft.

c) The operator must put its documented data process under configuration control.

3. INITIAL DATA VALIDATION

3.1 The operator must validate each RNP 10 route before flying under instrument meteorological conditions (IMC) to ensure compatibility with its aircraft and to ensure that the resulting paths correspond to the published routes. As a minimum, the operator must:

a) compare the navigation data of the routes to be loaded in the FMS with a current map containing the published routes.

b) validate the navigation data loaded for the routes, whether in the flight simulator or in the aircraft, under visual meteorological conditions (VMC). The routes outlined in a map display must be compared to the published routes. The complete routes must be flown to ensure that the paths can be used, that there are no apparent lateral or longitudinal path disconnections, and that they are consistent with the published routes.

c) after validating the routes, a copy of the validated navigation data must be kept and stored in order to compare them to subsequent data updates.

4. DATA UPDATE

Once the operator receives a navigation data update and before using such data in the aircraft, the operator must compare said update with the validated routes. This comparison must identify and solve any discrepancy in the navigation data. If there are significant changes (any change affecting the path or performance of the routes) in any part of a route, and said changes are checked with 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 (for example: FAA AC 20-153 or the document on conditions for the issuance of letters of acceptance for navigation data providers by the European Air Safety Agency– EASA (EASA IR 21 Subpart 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. An operator´s supplier (for example, an FMS company) must have a Type 2 LOA and their respective suppliers must have a Type 1 or 2 LOA. The CAA may accept a LOA issued to navigation data suppliers or may issue its own LOA.

6. AIRCRAFT MODIFICATIONS (DATA BASE UPDATE)

If an aircraft system required for RNP 10 operations is modified (for example, change of software), the operator is responsible for the validation of the RNP 10 routes based on the navigation data and on the modified system. This can be done without any direct evaluation if the manufacturer verifies that the modification has no effect on the navigation database or on path calculations. If there is no such verification by the manufacturer, the operator must carry out an initial validation of the navigation data with the modified system.

APPENDIX 2

RNP 10 APPROVAL PROCESS

a) The RNP 10 approval process consists of two kinds of approvals: the airworthiness and the operational approvals. Although both have different requirements, they must be considered under a single process.

b) This process is an organised 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 invites the applicant or operator to the pre-application meeting. At this meeting, the CAA informs the applicant or operator about all the operational and airworthiness requirements it must meet 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) the conditions under which the RNP 10 approval could be cancelled.

e) In *Phase two – Formal application*, the applicant or operator submits the formal application, together with all the relevant documentation, as established in paragraph 9.1.1 b) of this CA.

f) In *Phase three – Documentation evaluation,* the CAA analyses all the documentation and the navigation system in order to determine its eligibility and what approval method is to be applied regarding the aircraft. As a result of this analysis and evaluation, the CAA may accept or reject the formal application together with the documentation.

g) In *Phase four – Inspection and demonstration*, the operator will provide training for its personnel and perform the validation flights, if so required.

h) In *Phase five - Approval*, the CAA issues the RNP 10 authorisation, 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, it will issue an LOA.

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APPENDIX 3

EXAMPLE OF AN RNP 10 APPROVAL APPLICATION FORM

(company letterhead)

[*Date]*
Mr./Ms. [*Name of DCA*]
[*Position of DCA*]

Dear Mr./Ms.,

This letter is to request RNP 10 operational approval for the South Atlantic (SAT) Corridor based on compliance with the requirements established in CA 91-001. Below you will find detailed information for the requested approval.

a) Aircraft

Make/Model/Series	Registration	Hexadecimal SSR code	Description of RNP 10 equipment (number, make, model, etc). Indicate if aircraft belongs to a group or no group

b) Time limit requested for RNP 10 operation: Hours. ……. No limit ……

(attach supporting documentation)

c) Time interval where no FDE will be provided for GNSS equipment (maximum allowed time: 34 minutes)

Minutes…….. Not applicable…….

d) The following documentation is attached:

- ❑ Flight Manual/ Supplement containing the RNP 10 airworthiness statement, or equivalent.
- ❑ Request for approval of MEL revision that includes the necessary systems for RNP 10 operations; or
- ❑ MEL that includes the systems necessary for RNP 10 operations, with the approval of the corresponding revision.
- ❑ Proposed modification of the operations manual that includes the RNP 10 operation in the SAT corridor; or
- ❑ Operations manual that includes the operation in the SAT corridor, with the approval of the corresponding revision.
- ❑ Proposed approval of the training programme for the flight crew, flight dispatchers, and maintenance personnel that includes the RNP 10 operation in the SAT corridor; or
- ❑ Training programme for the flight crew, flight dispatchers, and maintenance personnel that includes the RNP 10 operation in the SAT corridor, with the approval of the corresponding revision.
- ❑ Copy of the documentation showing that a maintenance programme has been established for the equipment necessary for the RNP 10 operation.

Note.- This form is only an example. To complete all the documentation required by this AC, please see Paragraph 9.1.1

(Signature)
(Name and position)
Operations Director

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APPENDIX 4

EXAMPLE OF A LETTER OF RNP 10 OPERATIONAL APPROVAL

(CAA letterhead)

RNP 10 OPERATIONAL APPROVAL FOR THE EUROPE/SOUTH AMERICA (EUR/SAM) CORRIDOR

[*Date]*
Mr. /Ms. [*Name of operator representative*]
[*Title*]

Dear Mr./Ms.

Upon evaluation of your request, this CAA grants RNP 10 operational approval for the EUR/SAM corridor, pursuant to SRVSOP CA 91-001 dated 18 August 2009 and to ICAO Regional Supplementary Procedures (Doc 7030/4). This approval is only valid for the following aircraft.

Operator	Company
Fleet	Model
Serial number	Serial number
Registration	Registration number
Associated equipment	
Time limit	

(Signature)
(Name and position)

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APPENDIX 5

FORM FOR REPORTING NAVIGATION ERRORS IN EUR/SAM CORRIDOR

<table>
<tr><th colspan="6">NAVIGATION ERROR INVESTIGATION FORM</th></tr>
<tr><td colspan="6">Type of report PILOT – Flight:
ATC CONTROLLER:</td></tr>
<tr><td colspan="2">Date/UTC time</td><td colspan="4">Type of error LATERAL (A to G) (*)
LATERAL (A to O)</td></tr>
<tr><td colspan="6">Reasons METEOROLOGY (see 2 G):
Other (Specify):</td></tr>
<tr><td colspan="6">Conflict alerting systems:</td></tr>
<tr><td>DATA</td><td colspan="2">First aircraft</td><td colspan="3">Second aircraft (only vertical error)</td></tr>
<tr><td>Identification</td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td>Operator</td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td>Type</td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td>Origin</td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td>Destination</td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td>Route segment</td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td rowspan="2">Flight level</td><td>Assigned</td><td>Current</td><td>Assigned</td><td colspan="2">Current</td></tr>
<tr><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Magnitude and direction of the deviation (NM lateral; feet vertical)</td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td>Duration</td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td>Position where the error was observed
(BGR/DIS to fix or LAT/LONG)</td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td>Action by the crew/ATC</td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td>Other comments</td><td colspan="2"></td><td colspan="3"></td></tr>
</table>

(*) See deviation classification

Send to the South Atlantic Monitoring Agency (SATMA)

Fax: + 34-928-577052 e-mail: satma@aena.es

APPENDIX 5 (Continued)

INSTRUCTIONS FOR COMPLETING THE FORM

- As many boxes as possible must be filled.
- Complementary data may be attached to the form.
- The navigation error notifications, as much as possible, will have the following classification:

1. Altitude (vertical) deviations

A. Contingency due to engine failure

B. Contingency due to pressurisation failure

C. Contingency due to other reasons

D. Failure in the assigned climb/descent

E. Climb/descent without ATC assignment

F. Entry into airspace at an incorrect flight level

G. ATC reallocation of flight level (FL) with loss of longitudinal/lateral separation

H. Deviation due to the airborne collision avoidance system (ACAS II/TCAS II)

I. Impossibility to maintain FL

J. Other

2. Lateral deviations

A. Aircraft without RNP approval

B. ATC system loop error

C1. Control equipment error, including unnoticed waypoint (WPT) error

C2. WPT insertion error due to incorrect position input

D. Other, with sufficient pre warning to ATC to receive corrective instructions

E. Other, without enough pre warning to ATC

F. Other, with failure reported/received by the ATC

G. Lateral deviations due to weather, with no possibility of receiving ATC authorisation.

Note.- The EUR/SAM corridor includes the Recife (Atlantic), Oceanic Dakar, Oceanic Sal, and the Canary Islands Flight Information Regions/Upper Information Regions (FIRs/UIRs).