APPENDIX D-1

ADVISORY CIRCULAR

CA	**:**	**91-006**
DATE	**:**	**12/10/09**
REVISION	**:**	**Original**
ISSUED BY	**:**	**SRVSOP**

SUBJECT: AIRCRAFT AND OPERATOR APPROVAL FOR BASIC-RNP 1 OPERATIONS

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1. PURPOSE

This Advisory Circular (AC) establishes Basic-RNP 1 approval requirements for aircraft and operators.

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 CA.

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 6	Operation of aircraft
	Part I – International commercial air transport – Aeroplanes
	Part II – International general aviation - Aeroplanes
Annex 10	Aeronautical communications
	Volume I: Radio navigation aids
Annex 15	Aeronautical information services
ICAO Doc 9613	Performance based navigation (PBN) manual
ICAO Doc 4444	Procedures for air navigation services – Air traffic management (PANS-ATM)
ICAO Doc 8168	Aircraft operations
	Volume I: Flight procedures
	Volume II: Construction of visual and instrument flight procedures
FAA AC 90-105 Appendix 2	Qualification criteria for RNP 1 (terminal) operations

4. DEFINITIONS AND ABBREVIATIONS

4.1 Definitions

a) **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).

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 both methods.

Area navigation includes performance-based navigation as well as other operations that are not contemplated in the definition of performance-based navigation.

c) **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.

d) **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, at least in the immediate future, by GPS and GLONASS.

e) **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, the control, and the 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.

f) **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.- Area navigation specification that includes the performance control and alerting requirement, designated by the prefix RNP; *e.g.,* RNP 4, RNP APCH, RNP AR APCH.

Area Navigation (RNAV) Specification.- Area navigation specification that does not include the 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 of the International Civil Aviation Organization (ICAO) (Doc 9613).*

g) **Navigation system error (NSE).-** The difference between the true position and the estimated position.

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

i) **Performance-based navigation (PBN)**.- Performance-based area navigation requirements applicable to aircraft conducting operations on an ATS route, on an instrument approach procedure, or in a designated airspace.

Performance requirements are expressed in navigation specifications (RNAV and RNP specifications) in terms of the precision, integrity, continuity, availability, and functionality necessary to perform the proposed operation within the context of a particular airspace concept.

j) **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 a consistency check between redundant pseudo-range measurements. At least one additional available satellite is required with respect to the number of satellites that are needed for the navigation solution.

k) **RNP operations**.- Aircraft operations that use an RNP system for RNP applications.

l) **RNP system**.- An area navigation system that supports on-board performance control and alerting.

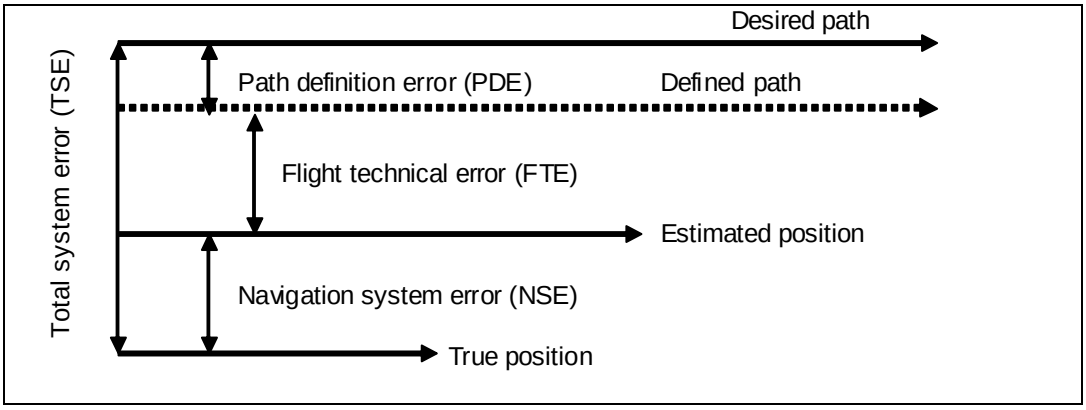
m) **Standard instrument arrival (STAR)**.- A designated instrument flight rule (IFR) arrival route linking a significant point, normally on an air traffic service (ATS) route, with a point from which a published instrument approach procedure can be commenced.

n) **Standard instrument departure (SID)**.- A designated instrument flight rule (IFR) departure route linking the aerodrome or a specified runway of the aerodrome with a specified significant point, normally on a designated ATS route, at which the en-route phase of a flight commences.

o) **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)



a) **Way-point (WPT).** A specified geographical location used to define an area navigation route or the flight path of an aircraft employing area navigation. Way-points area identified as either:

Fly-by way-point.- A way-point which requires turn anticipation to allow tangential interception of the next segment of a route or procedure.

Fly over way-point.- A way-point at which a turn is initiated in order to join the next segment of a route or procedure.

4.2 Abbreviations

a)	AAC	Civil Aviation Administration/Civil Aviation Authority
b)	ABAS	Aircraft-based augmentation system
c)	AC	Advisory circular (FAA)
d)	AFM	Aircraft flight manual
e)	VM	Heading of the aircraft to a normal termination
f)	AIP	Aeronautical information publication
g)	AIRAC	Aeronautical information regulation and control
h)	ANSP	Air navigation service providers
i)	AP	Automatic pilot
j)	APV	Approach procedure with vertical guidance
k)	ARP	Aerodrome reference point
l)	ATC	Air traffic control
m)	ATM	Air traffic management
n)	ATS	Air traffic service
o)	baro-VNAV	Barometric vertical navigation
p)	CA	Advisory circular (SRVSOP)
q)	CA	Course to an altitude
r)	CDI	Course deviation indicator
s)	CDU	Control display
t)	CF	Course to a fix
u)	Doc	Document
v)	DF	Direct to a fix
w)	DME	Distance-measuring equipment
x)	DV	Flight dispatcher
y)	EASA	*Agencia Europea de Seguridad Aérea* (European Air Safety Agency)
z)	EHSI	Enhanced vertical status indicator
aa)	FAA	United States Federal Aviation Administration
bb)	FAF	Final approach fix
cc)	FAP	Final approach point
dd)	FD	Flight director
ee)	FM	Course from a fix to a manual termination
ff)	Fly-by WPT	Fly-by way-point
gg)	Flyover WPT	Flyover way-point

hh)	FMS	Flight management system
ii)	FTE	Flight technical error
jj)	GBAS	Ground-based augmentation system
kk)	GNSS	Global navigation satellite system
ll)	GLONASS	Global navigation satellite system
mm)	GPS	Global positioning system
nn)	GS	Ground speed
oo)	HAL	Horizontal alerting limit
pp)	HSI	Vertical status indicator
qq)	IF	Initial fix
rr)	IFR	Instrument flight rules
ss)	IMC	Instrument meteorological conditions
tt)	LAAS	Local area augmentation system
uu)	LAR	Latin American Aeronautical Regulations
vv)	LNAV	Lateral navigation
ww)	LOA	Letter of authorisation/letter of acceptance
xx)	MCDU	Multi-function control display
yy)	MEL	Minimum equipment list
zz)	MIO	Manual of the operations inspector
aaa)	NM	Nautical miles
bbb)	MP	Monitoring pilot
ccc)	NAVAIDS	Navigation aids
ddd)	NOTAM	Notice to airmen
eee)	NPA	Non-precision approach
fff)	NSE	Navigation system error
ggg)	LNAV	Lateral navigation
hhh)	OACI	International Civil Aviation Organization
iii)	OM	Operations manual
jjj)	OEM	Original equipment manufacturer
kkk)	OpSpecs	Operations specifications
lll)	PA	Precision approach
mmm)	PANS-ATM	Procedures for Air Navigation Services - Air traffic management
nnn)	PANS-OPS	Procedures for Air Navigation Services - Aircraft Operations
ooo)	PBN	Performance-based navigation
ppp)	PDE	Path definition error
qqq)	PEE	Position estimation error
rrr)	PF	Pilot flying

sss)	PNF	Pilot not flying
ttt)	POH	Pilot operations handbook
uuu)	P-RNAV	Precision area navigation
vvv)	PSE	Path direction error
www)	RAIM	Receiver autonomous integrity monitoring
xxx)	RNAV	Area navigation
yyy)	RNP	Required navigation performance
zzz)	RNP APCH	Required navigation performance approach
aaaa)	RNP AR APCH	Required navigation performance authorisation required approach
bbbb)	RTCA	Radio Technical Commission for Aviation
cccc)	SBAS	Satellite-based augmentation system
dddd)	SID	Standard instrument departure
eeee)	SRVSOP	Regional Safety Oversight Cooperation System l
ffff)	STAR	Standard instrument arrival
gggg)	STC	Supplementary type certificate
hhhh)	TF	Track to a fix
iiii)	TO/FROM	To/from
jjjj)	TSE	Total system error
kkkk)	TSO	Technical standard order
llll)	VA	Heading to a given altitude
mmmm)	VI	Heading to an intercept
nnnn)	VM	Heading to a normal termination
oooo)	VMC	Visual meteorological conditions
pppp)	WAAS	Wide area augmentation system
qqqq)	WGS	World geodetic system
rrrr)	WPT	Waypoint

5. INTRODUCTION

5.1 According to Doc 8168 – Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) Volume II, the Basic-RNP 1 navigation specification is used in standard instrument departures and arrivals (SIDs and STARs) and in approaches to the final approach fix (FAF)/final approach point (FAP) with or without air traffic service (ATS) surveillance and with low to medium traffic density.

5.2 This AC does not establish all the requirements that may be specified for a given operation. These requirements are established in other documents, such as the aeronautical information publication (AIP) and ICAO Doc 7030 – Regional Supplementary Procedures.

5.3 Although the operational approval is normally related to airspace requirements, the operators and flight crews must consider the operational documents required by the CAA before conducting flights in Basic-RNP 1 airspace.

5.4 The material described in this CA has been developed based on the following document:

- ✓ ICAO Doc 9613, Volume II, Part C, Chapter 3 – Implementing Basic-RNP 1.

5.5 To the extent possible, this CA has been harmonised with the following guidance material:

- ✓ FAA AC 90-105 Appendix 2 - Qualification criteria for RNP 1 (terminal) operations

Note.- *Despite harmonisation efforts, operators shall take note of the differences between this CA and the aforementioned document when applying for an approval from the corresponding Administration.*

6. GENERAL CONSIDERATIONS

6.1 General information

a) **Performance-based navigation concept.-** The performance-based navigation (PBN) concept represents a change from sensor-based navigation to PBN. The PBN concept specifies the performance requirements of the aircraft RNP system in terms of the precision, integrity, availability, continuity, and functionality required for operations in a given airspace. Performance requirements are identified in the navigation specifications (*e.g.*, the requirements of this AC), which also identify options in terms of navigation sensors, navigation equipment, operating procedures, and training needs to meet performance requirements.

b) RNP procedures and routes require the use of RNP systems with onboard performance monitoring and alerting. A critical component of RNP is the ability that must have the aircraft navigation systems in combination with the pilot to monitor its achieved navigation performance, and to identify for the pilot whether the operational requirement is or is not met during an operation.

Note.- *Compliance with the performance control and alerting requirements does not imply automatic monitoring of the flight technical error (FTE). The on-board performance monitoring and alerting function should consist at least of a navigation system error (NSE) monitoring and alerting algorithm and a lateral navigation display that allow the flight crew to monitor the FTE. To the extent operational procedures are used to control the FTE, the flight crew procedures, equipment characteristics and the facilities are assessed for 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 and crew procedures.*

c) **Operations with RNP systems**.- RNP operations:

1) do not require the pilot to monitor the ground-based navigation aids (NAVAIDs) used for position updating, unless required by the aircraft flight manual (AFM);

2) base obstacle clearance assessments on the associated required system performance;

3) Rely on conventional compliance with descent profiles and altitude requirements;

Note.- *Pilots operating aircraft with an approved barometric vertical navigation (baro-VNAV) system can continue using said system while operating on routes SIDs, and STARs. Operators must ensure compliance with all altitude limitations as published in the procedure in reference to the pressure altimeter.*

4) all routes and procedures must be based on the world geodetic system (WGS) of coordinates 84; and

5) the navigation data published for the routes, procedures and supporting NAVAIDs must meet the requirements of Annex 15 to the Convention on International Civil Aviation.

6.2 Navigation aid infrastructure

a) The GNSS is the main navigation system that supports Basic-RNP 1 operations.

b) Although RNP systems based on DME/DME are capable of providing Basic-RNP 1 accuracy, the use of this navigation specification has been foreseen mainly for environments where DME infrastructure cannot support DME/DME area navigation with the required performance.

c) The increased complexity in the DME infrastructure requirements and assessment make Basic-RNP 1 operations based on DME/DME impractical and unprofitable for a general application.

d) Route design should take into account the navigation performance that can be achieved with the available navigation aid (NAVAID) infrastructure. Although the requirements of RNAV 1 and RNAV 2 navigation systems are identical, NAVAID infrastructure can affect the required performance.

e) Air navigation service providers (ANSPs) shall ensure that the operators of GNSS equipped aircraft have a means available to predict fault detection using an aircraft-based augmentation system (ABAS) [*e.g.*, receiver autonomous integrity monitoring (RAIM)].

f) When applicable, the ANSPs shall also ensure that the operators of aircraft equipped with a satellite-based augmentation system (SBAS) have a means to predict fault detection.

g) The prediction services may be provided by the ANSP, airborne equipment manufacturers other entities.

h) Prediction services can only be for receivers that meet the minimum performance of a technical standard order (TSO) or be specific to the receiver design. The prediction service shall use status information on GNSS satellites and a horizontal alerting limit (HAL) appropriate for the operation (1 NM within 30 NM from the aerodrome and 2 NM otherwise).

i) Outages shall be identified in the event of a predicted, continuous loss of ABAS fault detection of more than 5 minutes for any part of the Basic-RNP 1 operation.

j) ANSPs must undertake an assessment of the NAVAIDS infrastructure. It must be demonstrated that the assessment is sufficient for the proposed operations, including reversionary modes.

6.3 Communications and ATS surveillance

a) The Basic-RNP 1 navigation specification is intended in environments where ATS surveillance is limited or not available and in low to medium traffic density.

b) Basic-RNP 1 SIDs and STARs are primary intended to be conducted in direct controller-pilot communication environments.

6.4 Obstacle clearance and horizontal separation

a) Doc 8168 (PANS OPS), Volume II, provides detailed guidance on obstacle clearance. The general criteria contained in Parts I and III of said document shall apply.

b) The obstacle clearance criteria for SIDs, STARs, initial and intermediate approach, final missed approach, holding pattern, and route of the basic RNP 1 navigation specification are described in Doc 8168 (PANS-OPS), Volume II, Part III, Section 1, Chapter 2 and Section 3, Chapters 1, 2, 7 and 8.

c) Obstacle clearance criteria for final approach and for initial and intermediate missed approach are specific to the classification of non-precision approaches (NPA), approaches with vertical guidance (APV) and precision approaches (PA).

d) En-route spacing for basic RNP 1 depends on route configuration, air traffic density, and intervention capacity. Horizontal separation standards are published in Doc 4444 – Procedures for air navigation services – Air traffic management (PANS-ATM).

6.5 Publications

a) SIDs, STARs and Basic-RNP 1 procedures must be based on normal descent profiles and must identify minimum altitude requirements of the segments.

b) The navigation information published in the AIP for support procedures and NAVAIDs must meet the requirements of Annex 15 - Aeronautical information services.

c) All procedures must be based on the coordinates of the world geodetic system - 84 (WGS-84).

d) The AIP should clearly indicate whether the navigation application is Basic-RNP 1.

e) The available navigation infrastructure shall be clearly designated in all the appropriate charts (*e.g.*, GNSS).

f) The required navigation standard (*e.g*., Basic-RNP 1) for all Basic-RNP 1 procedures shall be clearly designated in all the appropriate charts.

6.6 Additional considerations

a) For procedure design and infrastructure evaluation, it is assumed that 95% of the normal limit value of the FTE, defined in the operating procedures, is 0.5 NM for the Basic-RNP 1 navigation specification.

b) The default value of the alerting functionality of a TSO-C129a sensor (stand-alone or integrated) switches between terminal alerting (± 1 NM) and en-route alerting (± 2 NM) at 30 miles from the airport reference point (ARP).

7. AIRWORTHINESS AND OPERATIONAL APPROVAL

7.1 For a commercial air transport operator to be granted a Basic-RNP 1 approval, it must comply with two types of approvals:

a) the 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) the 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 whether or not the aircraft meets the applicable basic RNP 1 requirements and will issue the operational approval (*e.g*., letter of authorisation – LOA) (see Paragraph 2.5.2.2 of Annex 6 Part II).

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

8. AIRWORTHINESS APPROVAL

8.1 System and aircraft requirements

8.1.1 Description of the RNP navigation system

a) **Lateral navigation (LNAV)**

1) In LNAV, the RNP equipment allows the aircraft to fly in accordance with the appropriate route instructions along a path defined by waypoints (WPTs) contained in an on-board navigation database.

Note.- *LNAV is normally a mode of flight guidance systems, in which the RNP equipment provides path steering commands to the flight guidance system, which controls the FTE through the manual pilot control on a path deviation display or through the coupling of the flight director (FD) or automatic pilot (AP).*

2) For purposes of this AC, Basic-RNP 1 operations are based on the use of RNP equipment that automatically determines the position of the aircraft on the horizontal plane, using data input from the GNSS.

8.1.2 System performance, control, and alerting

a) **Accuracy.-** For operations in Basic-RNP 1 designated airspace or routes, total lateral system error must not exceed ± 1 NM during at least 95% of total flight time. Likewise, along-track error must not exceed ± 1 NM during at least 95% of total flight time. In order to meet the accuracy requirement, 95% of the flight technical error (FTE) must not exceed 0.5 NM.

Note.- *The use of a deviation indicator with a full-scale deflection of 1 NM constitutes an acceptable means of compliance. The use of a flight director (FD) or an automatic pilot (AP) also represents an acceptable means of compliance (roll stabilization systems do not meet the requirements).*

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 minor failure if the operator can revert to a different navigation system and proceed to an appropriate aerodrome.

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 (TSE) exceeds 2 NM is greater than 10^{-5}.

e) **Signal-in-space.-** If GNSS is used, the aircraft navigation equipment will provide an alert if the probability of signal-in-space errors causing a lateral position error greater than 2 NM exceeds 10^{-7} per hour (Annex 10, Volume I, Table 3.7.2.4.1).

8.1.3 **Aircraft eligibility requirements for Basic-RNP 1 operations in terminal area**

The following systems installed in the aircraft meet the requirements defined in this AC. This equipment requires evaluation by the manufacturer and operator against all the functional and performance requirement established in this AC.

a) Aircraft with E/TSO-C129a Class A1 system or E/TSO-C146 () system installed for IFR use in accordance with FAA AC 20-138 or AC 20-138A;

b) Aircraft with E/TSO-C129/C129a sensor (Class B or C) installed in a flight management system (FMS) that meets the criteria of TSO-C115b and installed for IFR use in accordance with AC 20-130A;

c) Aircraft with E/TSO-C145 () sensor installed in an FMS that meets TSO-C115b requirements and installed for IFR use in accordance with FAA AC 20-130A or AC 20-138A; and

d) Aircraft with certified RNP capability, or approved based on equivalent standards.

8.1.4 **System eligibility requirements for Basic-RNP 1 operations**

a) **Stand-alone systems.-** Stand-alone E/TSO-C129 Class A1 or A2 systems (without deviation from AC 91-008 functional requirements) or E/TSO-C146 Class 1, 2 or 3 systems (without deviation of functional requirements establish in this AC) meet aircraft qualification requirements for Basic-RNP 1 operations. GNSS systems must be approved in accordance with AC 20-138A.

b) **Multi-sensor systems.**- Multi-sensor systems using E/TSO-C129 Clase B o C sensors or E/TSO-C145 Class 1, 2 and 3 sensors, meet aircraft qualification requirements for Basic-RNP 1 operations, provided that the instalations comply with the criteria of this AC. RNP systems must be installed in accordance with AC 20-138A and the associated FMS must comply with E/TSO-C115b and AC 20-130A.

8.2 **Qualification documentation**

a) **Aircraft qualification documentation**

1) Aircraft or avionics manufacturers must produce aircraft qualification documentation showing compliance with the applicable criteria, as appropriate. For aircraft not approved for flying Basic-RNP 1 procedures, aircraft and avionics manufacturers must develop aircraft qualification documentation showing compliance with this AC, provided the equipment is properly installed and operated. The necessary documentation shall also define the appropriate maintenance procedures. This documentation is not required for aircraft that have an AFM or AFM supplement that explicitly states that the RNP system is approved for operations with values of RNP 1 or lower, and that the equipment meets the reliability and performance requirements of the following documents: AC 20-138A, AC 20-130A, E/TSO-C115b and AC 20-129, as applicable.

2) Operators will submit this documentation, together with the formal application, in Phase 2 of the approval process.

b) **Acceptance of documentation by the CAA**

1) *For new aircraft/equipment (capability shown in production)*.- The new aircraft/equipment qualification documentation may be approved as part of an aircraft certification project, and will be reflected in the AFM and related documents.

2) *For aircraft/equipment in use*.- Previous approvals to conduct RNAV 1 procedures using the GNSS (GPS), according to AC 91-003 or AC 90-100/AC 90-100A, do not require an additional assessment, provided it is shown that the RNAV equipment meets the on-board performance monitoring and alerting requirements. For installations/equipment that are not eligible for conducting Basic-RNP 1 procedures, the operator shall send the Basic-RNP 1 and aircraft qualification documentation to the corresponding bodies of the CAA (*e.g.*, Aircraft certification division or Airworthiness inspection division, or equivalents).

3) The corresponding bodies of the CAA, as appropriate, will accept the data package for Basic-RNP 1 operations. This acceptance will be documented in a letter to the operator.

8.3 **Aircraft and systems eligibility for Basic-RNP 1 operations in terminal area**

8.3.1 **Aircraft that have a statement of compliance with respect to the criteria of this AC.-** Aircraft that have a statement of compliance with respect to the criteria set forth in this AC or equivalent document (*e.g.*, FAA AC 90-105 Appendix 2) in the AFM, AFM supplement, pilot operating handbook (POH) or avionics operating manual, meet the performance and functional requirements of this CA.

8.3.2 **Aircraft with a statement by the manufacturer**.- Aircraft that have a statement by the manufacturer documenting compliance with the criteria set forth in this AC or equivalent meet the performance and functional requirements of this document. This statement must include the airworthiness basis for compliance. The aircraft or equipment manufacturer will determine compliance with sensor requirements, while the operator will determine, through inspection, compliance with the functional requirements of this document.

8.3.3 For modified aircraft, the original equipment manufacturer (OEM) or the holder of the aircraft installation approval, *e.g.,* the holder of a supplemental type certificate (STC), will demonstrate compliance to the CAA, and the approval can be submitted in the documentation of the manufacturer (*e.g.*, service letters).

8.3.4 Stand-alone GNSS systems must be approved according to E/TSO-C129a Class A1 or E/TSO-C146 and operational Class 1, 2 or 3 (with no deviation from the functional requirements described in this AC), and installed for IFR use in accordance with AC 20-138A.

8.3.5 Aircraft with E/TSO-C129a sensor(s) Class B or C or E/TSO-C145 sensor(s) and FMS that meet E/TSO-C115b requirements and are installed for IFR use according to FAA AC 20-130A.

8.3.6 Aircraft/equipment approved under SRVSOP AC 91-003 or equivalent (*e.g.,* FAA AC 90-100A) for the use of GNSS, are approved under this AC for Basic-RNP 1 operations.

8.3.7 RNP aircraft with P-RNAV approval based on GNSS capability meet the functional requirements of this AC for Basic-RNP 1 operations, such as SIDs y STARs. The GNSS system approved according to E/TSO-C129 and satisfying the step-detection and health word checking contained in E/TSO-C129A, meets P-RNAV performance requirements.

Note.- *Basic-RNP 1 operations are based on GNSS positioning. Positioning data from other navigation sensors can be integrated into GNSS data provided they do not cause position errors that exceed the total system error (TSE) budget. Otherwise, means to deselect or cancel the other types of navigation sensors must be provided.*

8.4 **Functional requirements**

Appendix 1 contains the functional requirements that meet the criteria of this document.

8.5 **Maintenance aspects**

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

The CAA must approve any revision to the minimum equipment list (MEL) that is necessary to incorporate Basic-RNP 1 provisions.

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

LAR 91, 121, and 135 operators must establish and maintain an approved maintenance programme.

9. OPERATIONAL APPROVAL

Airworthiness approval alone does not authorise an applicant or operator to conduct basic RNP 1 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 transport, the assessment of an application for Basic-RNP 1 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 equivalents) supported by the criteria described in this AC.

For general aviation, the assessment of an application for Basic-RNP 1 operational approval is carried out by the State of registry, in accordance with standing operating rules (*e.g.*, LAR 91.1015 and LAR 91.1640 or equivalents) supported by the criteria established in this AC.

9.1 Requirements to obtain operational approval

9.1.1 In order to obtain Basic-RNP 1 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 CA.

b) *Application*.- The operator shall submit the following documentation to the CAA:

1) *Basic-RNP 1 operational approval application;*

2) *Description of aircraft equipment*.- The operator shall provide a configuration list with details of the relevant components and the equipment to be used for Basic-RNP 1 operations. The list shall include each manufacturer, model, and equipment version of GNSS equipment and software of the installed FMS.

3) *Airworthiness documents related to aircraft eligibility*.- The operator shall submit relevant documentation, acceptable to the CAA, showing that the aircraft is equipped with RNP systems that meet the Basic-RNP 1 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.

4) *Training programme for flight crews and flight dispatchers (DV)*

(a) Commercial operators (*e.g.*, LAR 121 and LAR 135 operators) will present to the CAA the Basic-RNP 1 training curriculums to show that the operational procedures and practices and the training aspects described in Paragraph 11 have been included in the initial, upgrade or recurrent training curriculums for flight crews and DV.

Note.- *It is not necessary to establish a separate training programme if the Basic-RNP 1 training identified in Paragraph 11 has already been included in the training programme of the operator. However, it must be possible to identify what aspects of Basic-RNP 1 are covered in the training programme.*

(b) Private operators (*e.g.*, LAR 91 operators) shall be familiar with and demonstrate that they will perform their operations based on the practices and procedures described in Paragraph 11.

5) *Operations manual and checklists*

(a) Commercial operators (*e.g.*, LAR 121 and 135 operators) must review the operations manual (OM) and the checklists in order to include information and guidance on the operating procedures detailed in Paragraph 10 of this AC. The appropriate manuals must contain the operating instructions for navigation equipment and contingency procedures. The manuals and checklists must be submitted for review along with the formal application in Phase 2 of the approval process.

(b) Private operators (*e.g.*, LAR 91 operators) must operate their aircraft based on the practices and procedures identified in Paragraph 10 of this CA.

6) *Minimum Equipment List (MEL)*.- The operator will send to the CAA for approval any revision to the MEL that is necessary to conduc Basic-RNP 1 operations. If a Basic-RNP 1 operational approval is granted based on a specific operational procedure, operators must modify the MEL and specify the required dispatch conditions.

7) *Maintenance*.- The operator will submit for approval a maintenance programme to conduct Basic-RNP 1 operations.

8) *Training programme for maintenance personnel*.- Operators will send the training curriculum that correspond to maintenance personnel.

9) *Navigation data validation programme*.- The operator will present the details about the navigation data validation programme as described in Appendix 2 to this AC.

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

e) *Issuance of the approval to conduct Basic-RNP 1 operations*.- Once the operator has successfully completed the operational approval process, the CAA will grant the operator the authorization to conduct Basic-RNP 1 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 basic RNP 1 approval.

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

10. OPERATING PROCEDURES

10.1 The operator and the flight crews will become familiar with the following operating and contingency procedures associated with Basic-RNP 1 operations.

a) **Pre-flight planning**

1) Operators and pilots intending to conduct Basic-RNP 1 SIDs and STARs must fill out the appropriate boxes in the ICAO flight plan.

2) On-board navigation data must be current and include appropriate procedures.

Note.- *It is expected that the navigation database will be up to date during the operation. If the AIRAC cycle expires during the flight, operators and pilots shall establish procedures to ensure the precision of navigation data, including the suitability of navigation facilities used to determine the routes and procedures for the flight. Normally, this is done comparing electronic data with written documents. An acceptable means of compliance is to compare aeronautical charts (new and old) to check navigation reference points before dispatch. If an amended chart is published for the procedure, the database must not be used to conduct the operation.*

3) The availability of the NAVAID infrastructure required for the intended routes, including any non-RNP contingency, must be confirmed for the period of intended operations, using all available information. Since Annex 10 Volume I requires GNSS integrity (RAIM or SBAS), it is also necessary to confirm apropiate availability of these devices. For aircraft that navigate with SBAS receivers [all TSO-C145 () / C146 () receivers], operators shall confirm appropriate availability of the GNSS RAIM in areas where the SBAS signal is not available.

4) RAIM (ABAS) availability

(a) RAIM levels required for Basic-RNP 1 can be verified either through NOTAMs (where available) or through prediction services. Operators must be familiar with the prediction information available for the intended route.

(b) For systems whose integrity is based on RAIM, RAIM prediction must be done before departure. This capability can be provided by a ground service or through the RAIM prediction capability of the aircraft on-board receiver.

(c) The prediction of RAIM availability must take into account the last NOTAMs of the GPS constellation and the avionics model (if available). The RAIM prediction service can be provided through the ANSPs, the avionics manufacturers, other entities, or through the RAIM prediction capability of the aircraft on-board receiver. RAIM availability can be confirmed using a model-specific RAIM prediction software.

(d) The predictive capability must account for known and predicted outages of GPS satellites or other effects on the navigation system sensors. The prediction programme should not use a mask angle below 5 degrees, since operational experience inicates that satellite signals on low elevations are not reliable. RAIM availability prediction should take into account the latest GPS constellation notices to airmen (NOTAMs) issued by the CAA or by the ANSPs, and use an identical algorithm to that used in the airborne equipment or an algorithm based on assumptions for RAIM prediction that provides a more conservative result.

(e) In the event that a continuous loss of the appropriate failure detection level is forecast for more than five (5) minutes for any portion of the Basic-RNP 1 operation, the flight plan shall be revised (*e.g.*, delaying the departure or planning a different departure procedure).

(f) The RAIM availability prediction software does not guarantee the service. This software is rather a tool for assessing the expected capacity to meet the required navigation performance. Due to unplanned failures of some GNSS elements, pilots and ANSPs must understand that both RAIM and GNSS navigation can be lost while the aircraft is on flight, which may require reversal to an alternate means of navigation. Therefore, pilots must assess their navigation capabilities (potentially to an alternate aerodrome) in case of failure of GNSS navigation. If system integrity needs to be verified, the RAIM prediction programme shall meet the criteria of FAA AC 20-138, Paragraph 12.

b) **General operating procedures**

1) The pilot shall comply with any instruction or procedure identified by the manufacturer, as necessary, to meet the performance requirements of this section.

Note.- *Pilots must adhere to any AFM limitation or operating procedure required to maintain Basic-RNP 1 performance.*

2) Operators and pilots shall not request or file Basic-RNP 1 routes, SIDs or STARs, unless they meet all the criteria set forth in this AC. If an aircraft that does not meet these criteria and is cleared by the ATC to conduct a Basic-RNP 1 procedure, the pilot will notify the ATC that it cannot accept such clearance and will request alternate instructions;

3) At system initialization, pilots must:

   (a) confirm that the navigation database is current;

   (b) verify that the aircraft position has been entered correctly;

   (c) verify the appropriate entry of the assigned ATC route once they receive the initial clearance, and of any subsequent change in route; and

   (d) ensure that the sequence of WPTs as depicted in their navigation system matches the route drawn in the appropriate charts and the assigned route.

4) Pilots shall not fly a Basic-RNP 1 procedure, unless it can be retrievable from the on-board navigation database by its name, and conforms with the procedure in the chart. However, the procedure can be modified afterwards by inserting or deleting specific WPTs in response to ATC clearance. Manual entry or the creation of new WPTs through manual insertion of latitude and longitude or rho/theta values is not permitted. Likewise, pilots must not change any type of WPT from a fly-by WPT to a flyover WPT or *vice versa*.

5) Flight crews shall cross-check the cleared flight plan by comparing charts or other applicable resources to the navigation system text displays and aircraft map displays, as applicable. If required, the exclusion of specific NAVAIDs must be confirmed. A procedure shall not be used if there are any doubts about the validity of the procedure in the navigation database.

   Note.- *Pilots may note a small difference between the navigation information described in the chart and the primary navigation display. Differences of 3° or less may result from applying the magnetic variation to the equipment of the manufacturer, and these are operationally acceptable.*

6) A cross-check is not required for conventional NAVAIDs, since the absence of integrity alert is considered sufficient to meet integrity requirements. However, it is suggested that the navigation reasonableness be checked, and any loss of RNP capability must be reported to the ATC.

7) For Basic-RNP 1 procedures, pilots must use a lateral deviation indicator, an FD or an AP in lateral navigation mode (LNAV). Pilots of aircraft with a 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 Basic-RNP 1).

8) All pilots are expected to follow the route centreline, as represented on the on-board lateral deviation indicators and/or flight guidance, during all Basic-RNP 1 operations, unless cleared 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, *e.g.* FTE) must be limited to $\pm$ ½ the navigation precision associated with the procedure (*e.g.*, 0.5 NM for basic RNP 1). Small lateral deviations from this requirement are allowed (*e.g.*, overshooting or undershooting the path) during or immediately after a turn, up to a maximum of 1 times the navigation precision (1xRNP) (*e.g.*, 1 NM for basic RNP 1).

   Note.- *Some aircraft do not display or do not estimate a path during turns. Pilots of such aircraft may not be capable of meeting the $\pm$ ½ precision requirement during en-route turns; however, they are expected to meet interception requirements after the turn or in straight segments.*

9) If the ATC issues a course assignment that places the aircraft out of the route, the pilot shall not modify the flight plan in the RNP system until a new clearance is received allowing the aircraft to return to the route or until the controller confirms a new route

clearance. When the aircraft is not on the published Basic-RNP 1 route, the specified precision requirements do not apply.

10) Manual selection of functions that limit the banking angle of the aircraft can reduce the ability of the aircraft to maintain its desired track and is not recommended. Pilots should acknowledge that manual selection of functions that limit the banking angle of the aircraft could reduce their ability to meet ATC path expectations, especially when turns with large banking angles are performed. This cannot be construed as a requirement to deviate from AFM procedures. Pilots must be encouraged to select such functions only within accepted procedures.

11) Pilots operating aircraft that have a barometric vertical navigation system (baro-VNAV) can continue using said system while conducting Basic-RNP 1 SID and STAR procedures. Operators must ensure compliance with all altitude limitations, as published in the procedure, using the barometric altimeter as reference. Use of the barometric vertical navigation capability of the aircraft will be subject to the level of familiarisation and training of the flight crew, and on any other operational approval requirement.

12) Before starting a Basic-RNP 1 procedure, flight crews must:

(a) confirm that the correct procedure has been selected. This process includes verifying WPT sequence, the reasonableness of track angles, distances, and of any other parameter that can be modified by the pilot, such as altitude or speed constraints; and

(b) for multi-sensor systems, verify that the correct sensor is being used for position computation.

c) **Aircraft with RNP selection capability**

Pilots of aircraft with the capability of selecting RNP input must select RNP 1 or lower for Basic-RNP 1 SIDs, STARs or procedures.

d) **Basic-RNP 1 SID specific requirements**

1) Before beginning take-off, the pilot must verify that the airborne Basic-RNP 1 system is available and operating correctly, and that the appropriate aerodrome and runway data have been loaded. Before the flight, pilots must verify that the airborne navigation system is operating correctly and that the appropriate runway and departure procedure (including any applicable en-route transition) have been loaded and are properly displayed. Pilots assigned to a Basic-RNP 1 departure procedure and subsequently receive a change of runway, 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.

2) *Altitude for engagement the RNAV equipment*.- The pilot must be capable of connecting the RNP equipment in order to follow the flight guidance in the RNP lateral navigation mode before reaching 153 m (500 ft) above the aerodrome elevation.

3) Pilots must use an authorised method (lateral deviation indicator/navigation map display/FD/AP) to achieve an appropriate level of performance for Basic-RNP 1.

4) *GNSS aircraft.*- When a GNSS is used, the signal must be obtained before starting the take-off roll. For aircraft using E/TSO-C129a equipment, the take-off aerodrome must be loaded into the flight plan in order to achieve the appropriate navigation system monitoring and sensitivity. For aircraft using E/TSO-C145 ()/C146 () equipment, if the departure starts at a runway waypoint (WPT), then the departure aerodrome does not need to be in the flight plan in order to obtain the appropriate monitoring and sensitivity mentioned above. If a Basic-RNP 1 SID extends beyond 30 NM from the aerodrome and a lateral deviation indicator is used, its full-scale sensitivity must be set to a value not

greater than 1 NM between 30 NM from the aerodrome and the termination of the Basic-RNP 1 SID.

5) For aircraft using a lateral deviation display (*e.g.*, a navigation map display), the scale must be adjusted for the Basic-RNP 1 SID and FD or AP must be used.

e) **Basic-RNP 1 STAR specific requirements**

1) Before the arrival phase, the flight crew shall verify that the correct terminal route has been loaded. The active flight plan shall be checked, comparing the charts to the map display (if applicable) and the multi-function control display unit (MCDU). This includes confirmation of WPT sequence, the reasonableness of track angles and distances, any altitude or speed contraints, and, whenever possible, which are fly-by WPTs and which are flyover WPTs. If required by a route, a check will need to be made to confirm that updating will exclude a particular NAVAID. A route will not be used if there are doubts about its validity in the navigation database.

Note.- *As a minimum, verifications in the arrival phase could consist of a simple inspection of a suitable map display that will meet the objectives of this paragraph.*

2) The creation of new WPTs by the flight crew through manual entries into the Basic-RNP 1 system will invalidate any route, and is not permitted.

3) When contingency procedures require reverting to a conventional arrival route, the flight crew must make the necessary preparations before starting the Basic-RNP 1 procedure.

4) Modification made to a route in the terminal area may take the form of radar headings or “direct to” clearances. In this sense, the flight crew must be capable of reacting in time. This may include the insertion of tactical WPTs loaded from the database. The flight crew is not allowed to make manual entries or to modify a loaded route, using temporary WPT or fixes not provided in the database.

5) Pilots must verify that the aircraft navigation system is operating properly and that the correct arrival procedure and runway are properly entered and displayed.

6) Although a particular method is not mandated, any published altitude and speed constraints must be observed.

7) Aircraft with E/TSO-C129a GNSS RNP systems: If a Basic-RNP 1 STAR begins beyond 30 NM from the aerodrome and a lateral deviation indicator is used, its full-scale sensitivity must be set to a value not greater than 1 NM before commencing the STAR. For aircraft that use a lateral deviation display (*e.g.*, a navigation map display), the scale must be adjusted to the Basic-RNP 1 STAR and the FD or AP must be used.

f) **Contingency procedures**

1) The pilot must notify the ATC of any loss of RNP capability (integrity alerts or loss of navigation), together with the proposed course of action. If, for any reason, it is not possible to meet the requirements of a Basic-RNP 1 SID or STAR, pilots must notify the ATS as soon as possible. Loss of RNP capability includes any failure or event that causes the aircraft to be unable to meet the Basic-RNP 1 requirements of the route.

2) In case of a communication failure, the flight crew must continue with the established procedure for loss of communication.

11. TRAINING PROGRAMMES

11.1 The training programme for flight crews and flight dispatchers (DV) shall provide sufficient training (*e.g.*, using flight training devices, flight simulators and aircraft) on the RNP system to the extent necessary. The training programme will include the following topics:

a) information about this AC;

b) the meaning and proper use of aircraft equipment and navigation suffixes;

c) the procedures characteristics as determined from chart depiction andtextual description;

d) the depiction of WPTs types (fly-by and flyover) and ARINC 424 path terminators provided in Appendix 1 to this AC and any other types used by the operator, as well as those associated with the aircraft flight paths;

e) the navigation equipment required to conduct Basic-RNP 1 SIDs and STARs.

f) specific information on the RNP system:

1) levels of automation, annunciation modes, changes, alerts, interactions, reversals, and degradation;

2) integration of functions with other aircraft systems;

3) the meaning and appropriateness of route discontinuities as well as related flight crew procedures;

4) pilot procedures consistent with the operation;

5) types of navigation sensors (*e.g.*, GNSS) used by the RNP system and associated system prioritization, weighting and logic;

6) turns anticipation, taking into account the effects of speed and altitude;

7) interpretation of electronic displays and symbols;

8) understanding aircraft configuration and operational conditions required to support Basic RNP 1 operations; *e.g.*, appropriate selection of the lateral deviation indicator (CDI) scaling;

g) operating procedures for RNP equipment, as applicable, including how to perform the following:

1) verify currency and integrity of aircraft navigation data;

2) verify the successful completion of RNP system selft-tests;

3) initialize RNP system position;

4) retrieve and fly a Basic-RNP 1 SID or STAR with the appropriate transition;

5) adhere to speed and altitude constraints associated with a Basic-RNP 1 SID or STAR;

6) select the appropriate Basic-RNP 1 SID or STAR for the active runway and become familiar with the procedures to deal with a runway change;

7) verify WPTs and flight plan programming;

8) fly direct to a WPT;

9) fly a course/track to a WPT;

10) intercept a course/track;

11) fly radar vectors and rejoining a Basic-RNP 1 route from a “heading” mode;

12) determine cross-track errors and deviations; specifically, the maximum allowable deviations to support Basic-RNP 1 must be understood and respected;

13) resolve route discontinuities (insert and delete/eliminate en-route discontinuities);

14) remove or reselect the navigation sensor inputs;

15) when required, confirm the exclusion of a specific NAVAID or a type of navigation aid;

16) change the arrival and alternate erodromes;

17) perform parallel offset if that capability is available. Pilots must know how to apply offsets, the functionality of the particular RNP system, and the need to advise the ATC if this functionality is not available; and

18) perform RNP holding pattern functions (*e.g.*, insert or delete a holding pattern).

h) levels of automation recommended by the operator for each flight phase and workload, including the methods to minimise cross-track error that will permit the aircraft to follow the route centreline;

i) radiotelephony phraseology used for RNP applications; and

j) RNP failure contingency procedures.

12. NAVIGATION DATABASE

a) The operator must obtain the navigation database from a supplier that complies with RTCA (Radio Technical Commission for Aeronautics) document DO 200A/EUROCAE ED 76 – Standards for aeronautical data processing. Navigation data must be compatible with the foreseen function of the equipment (see Annex 6 Part I paragraph 7.4.1). A letter of acceptance (LOA) issued by the appropriate regulatory authority to each participant in the data chain shows compliance with this requirement (*e.g.*, FAA LOA issued in accordance with FAA AC 20-153 or EASA LOA issued in accordance with EASA IR 21 Subpart G).

b) The operator must advise the navigation data supplier of discrepancies that invalidate a SID or STAR, and prohibit their use through a notice to flight crews.

c) Operators should consider the need to check the navigation database periodically in order to maintain the requirements of the existing quality system or safety management system.

Note.- *In order to minimise the path definition error (PDE), the database shall comply with DO 200A or there must be an equivalent operational means available to ensure database integrity for the Basic-RNP 1 SIDs or STARs.*

13. OVERSIGHT, INVESTIGATION OF NAVIGATION ERRORS, AND WITHDRAWAL OF BASIC-RNP 1 APPROVAL

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

b) Information indicating a potential for repetitive errors may require the modification of the training programme of the operator.

c) Information attributing multiple errors to a pilot in particular may call for additional training or a license revision for that pilot.

d) Repetitive navigation errors attributed to the equipment or a specific part of the navigation equipment or to operating procedures can be the cause of cancellation of an operational approval (withdrawal of Basic-RNP 1 OpSpecs authorisation or withdrawal of the LOA in the case of private operators).

APPENDIX 1

FUNCTIONAL REQUIREMENTS

Paragraph	Functional requirements	Explanation
a)	Navigation data, including the to/from indication and a failure indicator, must be displayed on a lateral deviation display [*e.g.,* a course deviation indicator (CDI), an enhanced horizontal situation indicator (E)HIS) and/or a navigation map display]. These lateral deviation displays will be used as primary flight instruments for the navigation of the aircraft, for manoeuvre anticipation, and for indication of failure/status/integrity. They must meet the following requirements:	1) Non-numeric lateral deviation display (e.g. CDI, (E)HSI)), with a to/from indication and a failure annunciation, for use as primary flight instruments for navigation of the aircraft, for manoeuvre anticipation, and for failure/status/integrity indication, with the following five attributes: (a) The displays must be visible to the pilot and located in the primary field of view (±15 degrees from the pilot's normal line of sight) when looking forward along the flight path. (b) The lateral deviation display scaling should agree with any alerting and annunciation limits, if implemented. (c) The lateral deviation display must also have a full-scale deflection suitable for the current phase of flight and must be based on the required total system accuracy. (d) The display scaling may be set automatically by default logic or set to a value obtained from a navigation database. The full-scale deflection value must be known or must be available for display to the pilot commensurate with en-route, terminal, or approach values. (e) The lateral deviation display must be automatically slaved to the RNP computed path. The course selector of the deviation display should be automatically slewed to the RNP computed path. ***Note.-*** *The normal functions of the autonomous GNSS meet this requirement.* 2) As an alternate means, a navigation map display should give equivalent functionality to a lateral deviation display as described in Paragraph a) 1) from (a) to (e), with appropriate map scales which may be set manually by the pilot. ***Note.-*** *A number of modern aircraft eligible for this specification use a map display as an acceptable means to meet the prescribed requirements.*

Paragraph	Functional requirements	Explanation
b)	The following functions of the basic RNP 1 system are required as a minimum:	1) The capability to continuously display to the pilot flying (PF), on the primary flight navigation instruments (primary navigation displays), the RNP calculated desired path and the position of the aircraft relative to that path. For operations where the minimum flight crew consists of two pilots, the means for the pilot not flying (PNF) the aircraft or monitoring pilot (MP) to verify the desired path and the aircraft position relative to that path must also be provided; 2) A navigation database containing current navigation data officially issued for civil aviation, which can be updated in accordance with the aeronautical information regulation and control (AIRAC) cycle and from which ATS routes can be retrieved and loaded into the RNP system. The resolution of the stored data must be sufficient to achieve an insignificant path definition error (PDE). The database must be protected against any modification of the stored data by the flight crew; 3) The means to display to the flight crew the period of validity of the navigation database; 4) The means to retrieve and display the data stored in the navigation database relating to individual waypoints and NAVAIDs, to enable the flight crew to verify the route to be flown; and 5) The capability to load on the Basic-RNP 1 system, from the navigation database, the complete RNP segment of the SIDs or STARs to be flown. ***Note.-*** *Due to the variability of RNP systems, this document defines the RNP segment from the first occurrence of a named WPT, track or course up to the last occurrence of a named WPT, track or course. Legs or segments prior to the first named WPT or after the last named WPT must not be loaded from the navigation database. Heading legs prior to the first named WPT or after the last named WPT do not have to be loaded from the navigation database. The complete SID will be considered in the Basic-RNP 1 procedure.*
c)	The means to display the following items, either on the primary field of view of the pilots, or on a readily accessible display page [*e.g.*, on a multi-function control display unit	1) The active navigation sensor type; 2) The identification of the active (to) waypoint; 3) The ground speed or time to the active (to) waypoint; and

Paragraph	Functional requirements	Explanation
	(MCDU)]:	4) The distance and bearing to the active (to) waypoint.
d)	The capability of execute a "direct to" function.	
e)	The capability for automatic leg sequencing with the display of sequencing to the flight crew.	
f)	The capability to execute Basic-RNP 1 terminal procedures extracted from the on-board database, including the capability to execute flyover and fly-by turns.	
g)	The aircraft must have the capability to automatically execute leg transitions and maintain tracks consistent with the following ARINC 424 path terminators or their equivalent: ➢ Initial fix (IF); ➢ Course to a fix (CF); ➢ Direct to a fix (DF); and ➢ Track to a fix (TF).	***Note 1.-*** *Path terminators are defined in the ARINC 424 specification, and their application is described in more detail in RTCA documents DO-236B and DO-201A and in EUROCAE ED-75B and ED-77* ***Note 2.****- Numeric values for courses and tracks must be automatically loaded from the RNP system database.*
h)	The aircraft must have the capability to automatically execute leg transitions consistent with the following ARINC 424 path terminators: heading to an altitude (VA), heading to a manual termination (VM) and heading to an intercept (VI), or must be able to be manually flown on a heading to intercept a course or to fly direct to another fix after reaching an altitude of a specific procedure.	
i)	The aircraft must have the capability to automatically execute leg transitions consistent with the following ARINC 424 path terminators: course to an altitude (CA) and course from a fix to a manual	

Paragraph	Functional requirements	Explanation
	termination (FM), or the RNP system must permit the pilot to readily designate a waypoint and select a desired course to or from a designated waypoint.	
j)	The capability to load an Basic-RNP 1 procedure from the database into the RNP system by its name.	
k)	The capability to display an indication of the Basic-RNP 1 system failure in the pilot´s primary field of view.	
l)	Database integrity	The navigation database suppliers must comply with RTCA DO-200/EUROCAE document ED 76 - Standards for processing aeronautical data. A Letter of acceptance (LOA) issued by the appropriate regulatory authority to each of the participants in the data chain demonstrates compliance with this requirement. Discrepancies that invalidate a route must be reported to database suppliers and the affected routes must be prohibited through a notice from the operator to its flight crews. Aircraft operators must consider the need to conduct periodic checks of the navigation databases in order to meet existing safety system requirements.

APPENDIX 2

NAVIGATION DATA VALIDATION PROGRAMME

1. INTRODUCTION

The information stored in the navigation database defines the lateral and longitudinal guidance of the aircraft for Basic-RNP 1 operations. Navigation database updates are carried out every 28 days. The navigation data used in each update are critical to the integrity of every basic RNP 1 procedure, SID and STAR. This appendix provides guidance on operator procedures to validate the navigation data associated with the Basic-RNP 1 operations.

2. DATA PROCESSING

a) The operator will identify in its procedures the person responsible for the navigation data updating process.

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 every Basic-RNP 1 procedure, SID and STAR before flying under instrument meteorological conditions (IMC) to ensure compatibility with the aircraft and to ensure that the resulting paths are consistent with the published procedures, SIDs and STARs. As a minimum, the operator must:

a) compare the navigation data of Basic-RNP 1 procedures, SIDs, and STARs to be loaded into the FMS with valid charts and maps containing the published procedures, SIDs, and STARs.

b) validate the navigation data loaded for Basic-RNP 1 procedures, SIDs, and STARs, either on the flight simulator or on the aircraft, under visual meteorological conditions (VMC). Basic-RNP 1 procedures, SIDs, and STARs outlined on a map display must be compared to the published procedures, SIDs, and STARs. Complete Basic-RNP 1 procedures, SIDs, and STARs 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, SIDs, and STARs.

c) Once the Basic-RNP 1 procedures, SIDs, and STARs are validated, a copy of the validated navigation data shall 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 procedures, SIDs or STARs. 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 procedures, SIDs and STARs) in any part of the procedure, SID, and STAR, and if those changes are verified through the initial data, the operator must validate the amended route in accordance with the initial validation data.

5. NAVEGATION 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 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 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 Basic-RNP 1 operations is modified (*e.g*., change of software), the operator is responsible for validating the Basic-RNP 1 procedures, SIDs, and STARs with the navigation database and the modified system. This can be done without any direct assessment if the manufacturer confirms that the modification has no effect on the navigation database or on path calculation. If there is no such confirmation by the manufacturer, the operator must perform an initial validation of the navigation data with the modified system.

APPENDIX 3

BASIC-RNP 1 APPROVAL PROCESS

a) The Basic-RNP 1 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 make sure that the 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 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) conditions under which the Basic-RNP 1 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 flight, if required.

h) In *Phase five* - Approval, the CAA issues the Basic-RNP 1 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.

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