Subpart B – Performance-based navigation (PBN) operations

GM1 SPA.PBN.100   PBN operations

GENERAL

(a)   There are two kinds of navigation specifications: area navigation (RNAV) and required navigation performance (RNP). These specifications are similar. The key difference is that a navigation specification that includes a requirement to have an on-board performance monitoring and alerting system is referred to as an RNP specification. An RNAV specification does not have such a requirement. The performance-monitoring and alerting system provides some automated assurance functions to the flight crew. These functions monitor system performance and alert the flight crew when the RNP parameters are not met, or cannot be guaranteed with a sufficient level of integrity. RNAV and RNP performance is expressed by the total system error (TSE). This is the deviation from the nominal or desired position and the aircraft's true position, measured in nautical miles. The TSE should remain equal to or less than the required accuracy expected to be achieved at least 95 % of the flight time by the population of aircraft operating within the airspace, route or procedure.

(b)   The structure of RNAV and RNP navigation specifications can be classified by phases of flight as detailed in Table 1. Some of these special approvals are in current use, some are under development, and some apply to emerging standards for which AMC-20 material has yet to be defined.

(c)   The following RNAV and RNP navigation specifications are considered:

(1)   Oceanic/Remote, RNAV10 (designated and authorised as RNP10)

Acceptable means of compliance for RNAV10 (RNP10) are provided in EASA AMC 20-12, "Recognition of FAA order 8400.12a for RNP10 Operations". Although RNAV10 airspace is, for historical reasons, also called RNP10 airspace, there is no requirement for on-board monitoring and alerting systems. RNAV10 can support 50 NM track spacing. For an aircraft to operate in RNAV10 (RNP10) airspace it needs to be fitted with a minimum of two independent long range navigation systems (LRNSs). Each LRNS should in principle have a flight management system (FMS) that utilises positional information from either an approved global navigation satellite system (GNSS) or an approved inertial reference system (IRS) or mixed combination. The mix of sensors (pure GNSS, pure IRS or mixed IRS/GNSS) determines pre-flight and in-flight operation and contingencies in the event of system failure.

(2)   Oceanic/Remote, RNP4

Guidance for this RNP standard is provided in ICAO Doc 9613. RNP4 is the oceanic/remote navigation specification to support 30 NM track spacing with ADS-C and CPDLC required. To meet this more accurate navigation requirement, two independent LRNS are required for which GNSS sensors are mandatory. If GNSS is used as a stand-alone LRNS, an integrity check is foreseen (fault detection and exclusion).Additional aircraft requirements include two long range communication systems (LRCSs) in order to operate in RNP4 designated airspace. The appropriate air information publication (AIP) should be consulted to assess coverage of HF and SATCOM. The additional

requirements may include use of automatic dependent surveillance (ADS) and/or controller pilot data link communication (CPDLC).

(3)   RNAV5 (B-RNAV)

Acceptable means of compliance for RNAV5 are provided in AMC 20-4, "Airworthiness Approval and Operational Criteria for the Use of Navigation Systems in European Airspace Designated for the Basic-RNAV Operations". No specific approval required.

(4)   RNAV2

This is a non-European en-route standard. Guidance for this RNP standard is provided in ICAO Doc 9613.

(5)   RNAV1 (P-RNAV)

Acceptable means of compliance for RNAV1 (P-RNAV) are provided in JAA TGL-10 'Airworthiness and Operational approval for precision RNAV operations in designated European Airspace', planned to be replaced by AMC 20 material.

(6)   Basic–RNP1

This is a future standard yet to be implemented. Guidance material is provided in ICAO Doc 9613.

(7)   RNP APCH (RNP Approach)

Non-precision approaches supported by GNSS and APV (approach procedure with vertical guidance) which are themselves divided in two types of APV approaches: APV Baro and APV SBAS.

RNP APCH is charted as RNAV (GNSS). A minima line is provided for each of the available types of non-precision approaches and the APV procedure at a specific runway:

-     non-precision approach – lateral navigation (LNAV) or localiser performance (LP) minima line;

-     APV Baro - LNAV/VNAV (vertical navigation) minima line; and

-     APV SBAS - localiser performance with vertical guidance (LPV) minima line.

Non-precision approaches to LNAV minima and APV approaches to LNAV/VNAV minima are addressed in AMC 20-27, "Airworthiness Approval and Operational Criteria for RNP approach (RNP APCH) operations including APV Baro VNAV operations".

APV approaches to LPV minima are addressed in AMC 20-28 "Airworthiness Approval and. Operational Criteria for RNAV GNSS approach operation to LPV minima using SBAS".

Non-precision approaches to LP minima have not yet been addressed in AMC 20.

(8)   RNP AR APCH (approach)

RNP AR criteria have been developed to support RNP operations to RNP minima using RNP less than or equal to 0.3 NM or fixed radius turns (RF). The

vertical performance is defined by a vertical error budget based upon Baro VNAV. Equivalent means of compliance using SBAS may be demonstrated.

RNP AR APCH is charted as RNAV (RNP). A minima line is provided for each available RNP value.

Acceptable Means of Compliance for RNP AR are provided in AMC20-26 'Airworthiness Approval and Operational Criteria for RNP Authorisation Required (RNP AR) Operations'.

Each RNP AR approach requires a special approval.

(d) Guidance material for the global performances specifications, approval process, aircraft requirement (e.g. generic system performances, accuracy, integrity, continuity, signal-in-space, RNP navigation specifications required for the on-board performance monitoring and alerting system), requirements for specific sensor technologies, functional requirements, operating procedures, flight crew knowledge and training and navigation databases integrity requirements, can be found in:

(1)   ICAO Doc 9613 Performance-Based Navigation (PBN) Manual; and

(2)   Table 1.

Table 1: Overview of PBN specifications

FLIGHT PHASE

	En-route		Arrival	Approach				Departure	EASA AMC
	Oceanic/ Remote	Continental		Initial	Intermediate	Final	Missed		
RNAV10	10								AMC 20-12
RNP 4	4								To be developed
RNAV 5		5	5						AMC 20-4
RNAV2		2	2					2	To be developed
RNAV1 (P-RNAV)			1	1	1		1	1	To be developed
BASIC-RNP 1			1	1	1		1	1	To be developed
RNP APCH (LNAV & LNAV/VNAV)				1	1	0.3	1		AMC 20-27
RNP APCH (LPV)						0.3	1		AMC 20-28
RNP AR APCH				1-0.1	1-0.1	0.3-0.1	1-0.1		AMC 20-26