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The Air Navigation Regulation Directorate has issued this guidance material to be used by ANSP to prepare procedure manuals and other working documents for implementation of ICAO SARPS and National Regulations.

It is important to note that this guidance material improve the safety of air navigation services within Ethiopian air space .


The Director General of Ethiopian Civil Aviation Authority has here by approved this guidance material on September 18,2017 to be used as a guidance to air navigation services provider..

Approved by



Date September, 2017 **Wosenyetch Hunegnaw (Col.)**
Director General



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1. PURPOSE

1.1 This guidance provides instruction on the development and review of the procedure for application & process Performance Based Navigation.

2. REFERENCE


- 2.1 ECARAS Part - 14;
- 2.2 Doc 9613-AN/937
- 2.3 Doc 9997-AN/498

3. Introduction

3.1 The implementation of Performance-based Navigation (PBN) is presently the global aviation community highest Air Navigation priority. It is also key to the implementation of ICAO Aviation System Block Upgrades and an important enabler for Continuous Descent and Continuous Climb operations. Recently in many states several PBN procedures with advanced functions and options have started to be developed which allow safer access to more airports and improved route efficiencies. As the number of PBN procedures increase, it also requires changes to the ATCO training to ensure that the Air Traffic Controllers (ATCOs) are aware of the new PBN concept and the on-board RNAV or RNP system capabilities in order to determine whether the performance of the RNAV or RNP system is appropriate for the specific airspace requirements.

3.2 PBN concept identifies three components:

- 3.2.1 The Navigation Application is achieved by the use of a NAVAID Infrastructure and associated Navigation Specification.
- 3.2.2 The **NAVAID Infrastructure** refers to ground- and space-based navigation aids (except the Non Directional Beacon (NDB) which is excluded from use in PBN).
- 3.2.3 The Navigation Specification is a technical and operational specification that identifies the navigation performance and functionality required of the

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RNAV system. It also identifies how the navigation equipment is expected to operate in the NAVAID Infrastructure to meet the operational needs identified in the Airspace Concept. There are two kinds of navigation specification: RNAV and RNP. The important difference between the two is that an RNP specification requires on-board performance monitoring and alerting as part of the avionics functionality. The Navigation Specification provides material which States can use as a basis for developing their certification and operational approval documentation.

4. GUIDANCE

4.1 GENERAL INFORMATION


4.1.1 The PBN concept specifies aircraft RNAV system performance requirements in terms of accuracy, integrity, availability, continuity and functionality needed for the proposed operations in the context of a particular Airspace Concept. The PBN implementation process represents a shift from sensor-based to performance-based navigation. PBN routes and procedures are designed to meet a required navigation performance (RNP) which is defined in terms of accuracy, integrity, availability, continuity and functionality for the proposed operations in the context of a particular airspace. Commercial air transport operators need to have an operational approval to fly PBN routes and procedures.

4.1.2 The primary difference between RNAV & RNP designations is—

- ❖ RNP specifications include a requirement for on-board performance monitoring and alerting.
- ❖ RNAV specifications do not include a requirement for on-board performance monitoring and alerting.

4.1.3 The designations for both RNP and RNAV are expressed as suffixes—

- ❖ RNP specification is designated as RNP X (e.g. RNP 4).


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- ❖ RNAV specification is designated as RNAV X (e.g. RNAV 1).
- ❖ If two navigation specifications share the same value for X, they may be distinguished by use of a prefix. E.g. Advanced-RNP 1 and Basic-RNP 1.
- ❖ RNP approach navigation specifications are designated using RNP as a prefix and an abbreviated textual suffix e.g. RNP APCH or RNP AR APCH.

4.1.4 In applying performance-based navigation, navigation specifications shall be prescribed by ECAA. When applicable, the navigation specification(s) for designated areas, tracks or ATS routes shall be prescribed on the basis of regional air navigation agreements.

4.1.5 The prescribed navigation specification shall be appropriate to the level of communications, navigation and air traffic services provided in the airspace concerned.

4.1.6 Navigation Specification is a set of aircraft and aircrew requirements needed to support performance-based navigation operations within a defined airspace. There are two kinds of navigation specification RNAV (Area Navigation) and RNP (Required Navigation Performance). RNAV and RNP systems are fundamentally similar. The key difference between them is the requirement for on-board performance monitoring and alerting systems. A navigation specification which includes a set of requirements for on-board navigation performance monitoring and alerting systems are referred to as an RNP specification. One not having such requirements is referred to as an RNAV specification. An area navigation system capable of achieving the performance requirement of an RNP specification is referred to as an RNP system.

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4.1.7 Navigation Infrastructure is NAVAID infrastructure refers to space-based and or ground-based navigation aids available to meet the requirements in the navigation specification.

5. ADVANTAGES OF PERFORMANCE BASED NAVIGATION

- 5.1 Reduces need to maintain sensor-specific routes and procedures, and their associated costs.
- 5.2 Avoids need for development of sensor-specific operations with each new evolution of navigation systems, which would be cost-prohibitive.
- 5.3 Allows more efficient use of airspace (route placement, fuel efficiency, noise abatement).
- 5.4 Clarifies the way in which RNAV systems are used.
- 5.5 Facilitates the operational approval process for operators by providing a limited set of navigation specifications intended for global use.

6. NAVIGATION SPECIFICATIONS

6.1 RNP and RNAV SPECIFICATIONS

- 6.1.1 RNP specifications includes a requirement for on-board performance monitoring and alerting
- 6.1.2 RNAV specifications does not require for on-board performance monitoring and alerting.

6.2. LIST OF NAVIGATION SPECIFICATIONS

6.2.1. The following navigation specifications will require approval by the ECAA before entry into airspace defined for the navigation performance requirements—



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- ❖ RNAV 10 (RNP 10)
- ❖ RNAV 5
- ❖ RNAV 2
- ❖ RNAV 1
- ❖ RNP 4
- ❖ RNP 2
- ❖ RNP 1
- ❖ Advanced RNP
- ❖ RNP APCH
- ❖ RNP 0.3
- ❖ RNP AR APCH

6.2.2. The latest edition of PBN Manual, ICAO Doc 9613 contains detailed information with respect to the navigation specifications. This table lists all PBN navigation specifications, along with their typical intended usage. For example RNAV 1 is typically used for SIDs, STARs, and the initial, intermediate and missed approach segments of an approach.

Navigation Specification	Flight Phases							Departure
	En-route Oceanic/ Remote	En-route Continental	Arrival	Approach				
				Initial	Intermediate	Final	Missed approach	
RNAV 10	10							
RNAV 5		5	5					
RNAV 2		2	2					2
RNAV 1		1	1	1	1		1	1
RNP 4	4							
RNP 2	2	2						
RNP 1			1	1	1		1	1
Advanced RNP	2	2 or 1	1	1	1	0.3	1	1

PLEASE MAKE SURE THAT THIS IS THE CORRECT ISSUE BEFORE USE

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RNP APCH				1		0.3	1	
RNP AR APCH				1 - 0.1	1 - 0.1	0.3 - 0.1	1 - 0.1	
RNP 0.3		0.3	0.3	0.3	0.3		0.3	0.3

Table 6.1. Application of navigation specification by flight phase

6.3 Implementation of the navigation specification

6.3.1. The navigation specification shall be selected to meet the required and developed air space concept.

6.3.2. NAVAID infrastructure

After selecting the appropriate navigation specification listed in table 6.1, the appropriate NAVAID infrastructure should be fulfilled that satisfies the selected navigation specification. It should also meet the required air space concept.

6.3.2.3. ATS surveillance and communications


Along with considering the aircraft performance requirements of the navigation specification and the available NAVAID infrastructure planned for implementation, the necessary ATS surveillance and communications to achieve the required level of safety for a desired route spacing, must be considered.

6.3.4. Obstacle clearance and route spacing

The appropriate level of obstacle clearance and route spacing shall be provided in accordance with the guidance provided in the Procedures as for Air Navigation Services — Aircraft Operations (PANS-OPS) (Doc 8168), Volume II and PBN manual DOC-9613.

6.3.5. Publication

The AIP should clearly indicate the navigation specification applied for the route and the procedure implemented in the air space. The data published for all routes must be based upon WGS-84 coordinates.

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6.3.6. Air traffic controller training

The air traffic controllers providing control service in airspace where PBN is implemented shall have completed training in the following areas:

6.3.6.1. Core training

a) How area navigation systems work (in the context of navigation specification):

- i) Functional capabilities and limitations of this navigation specification;
- ii) Accuracy, integrity, availability and continuity; and
- iii) GPS receiver, RAIM and integrity alerts;

b) Flight plan requirements;

c) ATC procedures:

- i) ATC contingency procedures;
- ii) Separation minima;
- iii) Mixed equipage environment
- iv) Transition between different operating environments; and
- v) Phraseology

6.3.6.2 Training specific to a navigation specification

The training shall include the navigation specification selected for the air space concept