International Civil Aviation Organization

MIDANPIRG Air Traffic Management Sub-Group

Eighth Meeting (ATM SG/8)
(Amman, Jordan, 7 – 10 November 2022)

Agenda Item 8: Any other Business

PBN SG OUTCOMES: REVISED MID REGION PBN IMPLEMENTATION PLAN (MID DOC 007)

(Presented by the Secretariat)

SUMMARY

The aim of this paper is to present the revised version of the MID Region PBN Implementation Plan (Doc 007) for the meeting review in particular parts related to en-route.

Action by the meeting is at paragraph 3.

REFERENCES

- MID Region PBN Implementation Plan (MID Doc 007)
- MIDANPIRG/19 Report

1. INTRODUCTION

1.1 The MID Region Performance Based Navigation (PBN) Implementation Plan (MID Doc 007) has been developed to harmonize PBN implementation in the MID Region and to addresses the strategic objectives of PBN based on clearly established operational requirements, avoiding equipage of multiple on-board or ground based equipment, avoidance of multiple airworthiness and operational approvals and explains in detail contents relating to potential navigation applications.

1.2 The MID Region PBN Implementation Plan was reviewed and endorsed by MSG/6 meeting (Cairo, Egypt, 3-5 December 2018).

1.3 In accordance, with the Resolutions of the 40th Session of the ICAO Assembly, particularly Resolution A40-1 "ICAO global planning for safety and air navigation", the ICAO Assembly urged States and PIRGs to utilize the guidance provided in the GANP for planning and implementation activities, which establish priorities, targets and indicators consistent with globally harmonized objectives, taking into account operational needs. In response to this, the MID Region developed the MID Region Air Navigation Strategy – Part 1, which is aligned with the GANP 6th Edition and ASBU Framework.

1.4 In order to keep pace with changes in MID Region Air Navigation Strategy (MID Doc 002) and to ensure alignment with the GANP 6th edition, the MID Region PBN Implementation Plan should be constantly updated and refined throughout the implementation process.

1.5 The meeting may wish to recall that MIDANPIRG/14 agreed that PBN Sub-Group will be responsible for PBN implementation for Terminal and Approach, while the ATM Sub-Group will be responsible for PBN implementation for Enroute.

2. DISCUSSIONS

2.1 The meeting may wish to note that MIDANPIRG/19 through DECISION 19/12 established the MID REGION PBN IMPLEMENTATION PLAN AD HOCWORKING GROUP (PBN IP AD-HOCWG) to review the MID Region PBN Implementation Plan (MID Doc 007) and develop a revised version for review by the PBN SG/7 and ATM SG/8 meetings and to the MIDANPIRG/20 meeting for subsequent endorsement, to keep pace with the developments, including the GANP 6th Edition and the MID Region Air Navigation Strategy (MID Doc 002, Edition February 2021); and

2.2 The MID REGION PBN IMPLEMENTATION PLAN AD HOCWORKING GROUP (PBN IP AD-HOCWG) reviewed and updated the PBN plan in particular the implementation phases and targets of each PBN navigation specification in the MID Region as follows:

2.3 The implementation phases of the MID Region PBN Implementation Plan was broadly split into short, medium-to- long-term dates for introduction:

- Short-term (up to Dec 2024)
- Medium-to Long-Term (2025-2030+)

2.4 The Table below summarizes the proposed implementation targets of each PBN navigation specification in the MID Region:

Airspace	Short Term (up to Dec 2024)		Medium-to Long-Term (2025-2030+)	
	Navigation Specification Preferred	**Performance Indicators/ Targets**	**Navigation Specification Acceptable**	**Performance Indicators/ Targets**
En-route – Oceanic and Remote continental	RNAV 10 or RNP 4*	70% by 2024	RNAV 10 RNP 4*	100% by 2030
En-route – Continental	RNAV 5 RNAV 1	70% by 2024	RNAV 5 RNAV 1	100% by 2030
En-route - Local / Domestic	RNAV 5 RNAV 1	70% by 2024	RNAV 5 RNAV 1	100% by 2030
TMA – Arrival	RNAV 1 or RNP 1	70% by 2022 and 100% by 2024 for STARs at International Aerodromes	RNAV 1 or RNP 1	100% by 2030 for STARs at all TMAs, as appropriate
TMA – Departure	RNAV 1 or RNP 1	70% by 2022 100% by 2024 for SIDs at International Aerodromes	RNAV 1 or RNP 1	100% by 2030 SIDs at all TMAs, as appropriate

Approach	RNP APCH to LNAV/VNAV and LNAV minima only, as required. (PBN Approaches with basic capabilities)	100% by 2022 for all instrument runway ends at the international aerodromes	RNP APCH to LNAV/VNAV and LNAV minima only, as required. (PBN Approaches with basic capabilities) for all instrument runway ends	100% by 2030
	RNP AR APCH (PBN Approaches with advanced capabilities)	100% by 2024 at selected Airports in MID	Widespread implementation of RNP AR APCH (PBN Approaches with advanced capabilities)	*W/A*
CCO and CDO	CDO (Basic) and CCO (Basic) at the defined TMAs	100% by 2022	CDO (Basic) and CCO (Basic) at all RWYs ENDs at International Aerodromes.	100 % by 2030

3. ACTION BY THE MEETING

3.1 The meeting is invited to review and update as deemed necessary the MID Region PBN Implementation Plan at **Appendix A** parts related to en-route.

INTERNATIONAL CIVIL AVIATION ORGANIZATION

MIDDLE EAST AIR NAVIGATION PLANNING AND IMPLEMENTATION REGIONAL GROUP (MIDANPIRG)

MID REGION PERFORMANCE BASED NAVIGATION IMPLEMENTATION PLAN

EDITION MAY, 2023

AMENDMENTS

The MID Region PBN Implementation Plan should be reviewed and updated by the PBN and/or the ATM Sub-Groups and presented to MIDANPIRG for endorsement.
Stakeholders shall submit their proposal for amendment to the Plan to the ICAO MID Regional Office at least three months prior the PBN or the ATM Sub-Groups meetings in order to ensure adequate time for appropriate coordination. The table below provides a means to record all amendments.
An up to date electronic version of the Plan will be available on the ICAO MID Regional Office website.

Amendment Number	Effective Date	Initiated by	Impacted pages	Remarks
1	April 2016	MSG/5		Based on PBN SG/2 outcome
2	December 2018	MSG/6		Based on PBN SG/3, CNS SG/8 and ATM SG/4 meetings
3	**May 2023 2022**	**MIDANPIRG/20**		**Based on PBN SG/7 and ATM SG/8 outcomes**

EXECUTIVE SUMMARY

The MID Region Performance Based Navigation (PBN) Implementation Plan has been developed to harmonize PBN implementation in the MID Region and to addresses the strategic objectives of PBN based on clearly established operational requirements, avoiding equipage of multiple on-board or ground based equipment, avoidance of multiple airworthiness and operational approvals and explains in detail contents relating to potential navigation applications.

The Plan was prepared in accordance with ICAO provisions related to PBN, the Global Air Navigation Plan, Aviation System Block Upgrades (ASBU) methodology, MID Region Air Navigation Plan and the MID Region Air Navigation Strategy. In addition to the Assembly Resolutions and the twelfth Air Navigation Conference (AN-Conf/12) Recommendations related to PBN.

The plan envisages pre- and post-implementation safety assessments and continued availability of conventional air navigation procedures during transition. The plan discusses issues related to implementation which include traffic forecasts, aircraft fleet readiness, adequacy of CNS infrastructure etc. Implementation targets for various categories of airspace for the short term (up to Dec 2024) and for − Medium-to Long-Term (2025-2030+) have been projected in tabular forms to facilitate easy reference.

This Document consolidates, updates and supersedes all previous MID Region PBN Plans.

The parts related to PBN implementation for En-route will be reviewed and updated by the ATM Sub-Group and those related to terminal and approach will be reviewed and updated by the PBN Sub-Group.

Explanation of Terms

The drafting and explanation of this document is based on the understanding of some particular terms and expressions that are described below:

MID Region PBN Implementation Plan - A document offering appropriate guidance for air navigation service providers, airspace operators and users, regulating agencies, and international organizations, on the evolution of navigation, as one of the key systems supporting air traffic management, and which describes the RNAV and RNP navigation applications that should be implemented in the short, medium and long term in the MID Region.

Navigation aid (NAVAID) infrastructure. NAVAID infrastructure refers to space-based and/or ground-based NAVAIDs available to meet the requirements in the navigation specification.

Navigation application. The application of a navigation specification and the supporting NAVAID infrastructure, to routes and procedures, within a defined airspace volume, in accordance with the intended airspace concept.

Note.— The navigation application is one element, along with communications, ATS surveillance and ATM procedures which meet the strategic objectives in a defined airspace concept.

Navigation specification. 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 specification. A navigation specification based on area navigation that does not include the requirement for on-board performance monitoring and alerting, designated by the prefix RNAV, e.g. RNAV 5, RNAV 1.

RNP navigation specification. A navigation specification based on area navigation that includes the requirement for on-board performance monitoring and alerting, designated by the prefix RNP, e.g. RNP 4, RNP APCH

Performance-based navigation. Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.

Note.— *Performance requirements are expressed in navigation specifications (RNAV specification, RNP navigation specification) in terms of accuracy, integrity, continuity and functionality needed for the proposed operation in the context of a particular airspace concept.*

REFERENCE DOCUMENTS

The below ICAO Documents provide Guidance related to the PBN implementation:

- Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM) (Doc 4444)
- Procedures for Air Navigation Services — Aircraft Operations, (PANS OPS), Volumes I and II, (Doc 8168)
- Performance-based Navigation (PBN) Manual (Doc 9613)
- Global Navigation Satellite System (GNSS) Manual (Doc 9849)
- Required Navigation Performance Authorization Required (RNP AR) Procedure Design Manual (Doc 9905)
- Continuous Descent Operations (CDO) Manual (Doc 9931)
- Continuous Climb Operations (CCO) Manual (Doc 9993)
- Manual on the Use of Performance-Based Navigation (PBN) in Airspace Design (Doc 9992)
- Quality Assurance Manual for Flight Procedure Design Manual (Doc 9906)
- Performance-based Navigation (PBN) Operational Approval Manual (Doc 9997)
- The Global Air Navigation Plan (GANP) (Doc 9750)
- The European PBN Implementation and Transition Planning Handbook

TABLE OF CONTENTS

ACRONYMS

The acronyms used in this document along with their expansions are given in the following List:

ABAS	Aircraft-Based Augmentation System
AIP	Aeronautical information publication
AIRAC	Aeronautical information regulation and control
AIS	Aeronautical Information System
ANSP	Air navigation service provider
APCH	Approach
APV	Approach Procedures with Vertical Guidance
A-RNP	Advanced RNP
AOC	Air operator certificate
ATC	Air Traffic Control
ASBU	Aviation System Block Upgrades
Baro VNAV	Barometric Vertical Navigation
CCO	Continuous Climb Operations
CDO	Continuous Decent Operations
CNS/ATM	Communication Navigation Surveillance/Air Traffic Management
CPDLC	Controller Pilot Data Link Communications
DME	Distance Measuring Equipment
FIR	Flight Information Region
FMS	Flight Management System
GBAS	Ground-Based Augmentation System
GNSS	Global Navigation Satellite System
GLS	GBAS Landing System
INS	Inertial Navigation System
IRU	Inertial Reference Unit
LNAV/VNAV	Lateral navigation/vertical navigation
LOA	Letter of authorization/letter of acceptance
MEL	Minimum equipment list
MID eANP	MID Region Air Navigation Plan
MIDANPIRG	Middle East Air Navigation Planning and Implementation Regional Group
PANS	Procedures for Air Navigation Services
PBN	Performance Based Navigation
RCP	Required Communication Performance
RNAV	Area Navigation
RNP	Required Navigation Performance
SARP	Standards and Recommended Practices
SBAS	Satellite-Based Augmentation System
SID	Standard Instrument Departure
SOP	Standard operating procedure
STAR	Standard Instrument Arrival
TAWS	Terrain awareness warning system
TMA	Terminal Control Area
VOR	VHF Omni-directional Radio-rangeWGS-84 World Geodetic System — 1984

CHAPTER 1

PERFORMANCE BASED NAVIGATION

1. INTRODUCTION

1.1 The Performance Based Navigation (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, when supported by the appropriate navigation infrastructure. In this context, the PBN concept represents a shift from sensor-based to performance based navigation.

1.2 The main tool for optimizing the airspace structure is the implementation of PBN, which will foster the necessary conditions for the utilization of RNAV and RNP capabilities by a significant portion of airspace users in the MID Region.

1.3 The MID Regional PBN Implementation Plan will serve as guidance for regional projects for the implementation of air navigation infrastructure, as well as for the development of national implementation plans.

1.4 The PBN Manual (Doc 9613) provides guidance on PBN navigation specifications and encompasses two types of approvals: airworthiness, exclusively relating to the approval of aircraft, and operational, dealing with the operational aspects of the operator. PBN approval will be granted to operators that comply with these two types of approval.

1.5 After the implementation of PBN as part of the airspace concept, the total system needs to be monitored to ensure that safety of the system is maintained. A system safety assessment shall be conducted during and after implementation and evidence collected to ensure that the safety of the system is assured.

2. BENEFITS OF PERFORMANCE BASED NAVIGATION

PBN offers a number of advantages over the sensor-specific method of developing airspace and obstacle clearance criteria. For instance, PBN:

a) reduces the need to maintain sensor-specific routes and procedures, and their associated costs. For example, moving a single VOR ground facility can impact dozens of procedures, as VOR can be used on routes, VOR approaches, missed approaches, etc. Adding new sensor-specific procedures will compound this cost, and the rapid growth in available navigation systems would soon make sensor-specific routes and procedures unaffordable;

b) avoids the need for development of sensor-specific operations with each new evolution of navigation systems, which would be cost-prohibitive. The expansion of satellite navigation services is expected to contribute to the continued diversity of RNAV and RNP systems in different aircraft. Some augmentations support PBN operations, and the introduction of new core-constellations and signals will further improve GNSS performance. The use of GNSS/inertial integration is also expanding;

c) allows for more efficient use of airspace (route placement including the use of free routing, fuel efficiency, noise abatement, etc.);

d) clarifies the way in which RNAV and RNP systems are used; and

e) facilitates and harmonizes the operational authorization process for operators by providing a limited set of navigation specifications intended for global use.

3. DRIVERS AND OBJECTIVES OF PBN IMPLEMENTATION

3.1. The PBN Implementation has two main drivers:

- ICAO Resolution 37/11: Urges all States to implement RNAV and RNP air traffic services (ATS) routes and approach procedures in accordance with the ICAO PBN concept laid down in the Performance-based Navigation (PBN) Manual (Doc 9613). This resolution covers all phases of flight, and only specifies the kind of specification for the final approach phase.
- ICAO Doc 9750, the Global Air Navigation Plan (GANP) identifies PBN as the "highest priority" and outlines implementation issues involving PBN planning and implementation as part of the Aviation System Block Upgrades (ASBUs;

3.2. The MID Region PBN Implementation Plan has been developed in line with ICAO Resolution 37/11: adopted by ICAO Assembly in its 37th Session held in September 2010 and has the following strategic objectives:

a) ensure that implementation of the navigation element of the MID CNS/ATM system is based on clearly established operational requirements;

b) avoid unnecessarily imposing the mandate for multiple equipment on board or multiple systems on ground;

c) avoid the need for multiple airworthiness and operational approvals for intra and inter-regional operations; and

d) avoid an eclipsing of ATM operational requirements by commercial interests, generating unnecessary costs to States , and airspace users.

3.3. Furthermore, the Plan is being updated to provide a high-level strategy for the evolution of the navigation applications to be implemented in the MID Region for the short term (up to Dec 2024) and for Medium-to Long-Term (2025-2030+).

3.4. The plan is intended to assist the main stakeholders of the aviation community to plan the future transition and their investment strategies. For example, Operators can use this Regional Plan to derive future equipage and additional navigation capability investment; Air Navigation Service Providers can plan a gradual transition for the evolving ground infrastructure, Regulating Agencies will be able to anticipate and plan for the criteria that will be needed in the future.

4. PLANNING PRINCIPLES

4.1. The implementation of PBN in the MID Region shall be based on the following principles:

a) implementation of PBN navigation specification and granting operational approvals should be in compliance with ICAO provisions;

b) Pre- and post–implementation safety assessments will be conducted in accordance with ICAO provisions to ensure the application and maintenance of the established target level of safety;

c) continued application of conventional air navigation procedures during the transition period, to guarantee the operation by users that are not PBN capable;

d) Airspace users' consultation, dedicated studies and safety cases are required to mitigate the withdrawal of existing ground networks.

e) Strategy for rationalization of conventional radio navigation aids and evolution toward supporting performance-based navigation should be guided by the Guidelines and Principles as at attachment H, Annex 10, Vol I

f) Users/operational requirements should be taken into consideration while planning

for PBN implementation;

g) States should assess the benefit accrued from the implementation of PBN procedures and ATS Routes, and to report the environmental benefits to the ICAO MID Regional Office.

5. PBN OPERATIONAL REQUIREMENTS AND IMPLEMENTATION STRATEGY

5.1. Introduction of PBN should be consistent with the Global Air Navigation Plan. Moreover, PBN Implementation shall be in full compliance with ICAO SARPs and PANS.

En-route

5.2. Considering the traffic characteristic and CNS/ATM capability of the Region, the en-route operations can be classified as oceanic, remote continental, continental, and local/domestic. In principle, each classification of the en-route operations should adopt, but not be limited to single PBN navigation specification. This implementation strategy should be applied by the States in coordination with airspace users and as coordinated at regional level to ensure harmonization.

5.3. For that MIDANPIRG established the PBN Sub-group to develop a PBN implementation plan for the MID Region and to address related regional PBN implementation issues. Accordingly, States are encouraged to work cooperatively bilaterally, multilaterally and with the PBN Sub-group to ensure regional harmonization of PBN implementation.

5.4. In areas where operational benefits can be achieved and appropriate CNS/ATM capability exists or can be provided for a more accurate navigation specification, States are encouraged to introduce more accurate navigation specification on the basis of coordination with stakeholders and affected neighbouring States.

5.5. Similarly, in circumstances where affected States are agreeable to completing an implementation in advance of the timelines specified in this plan, early implementation is encouraged on the basis of coordination between affected States and airspace users.

Terminal

5.6. Terminal operations have their own characteristics, taking into account the applicable separation minima between aircraft and between aircraft and obstacles. It also involves the diversity of aircraft, including low-performance aircraft flying in the lower airspace and conducting arrival and departure procedures on the same path or close to the paths of high-performance aircraft.

5.7. In this context, the States should develop their own national plans for the implementation of PBN in Terminal Control Areas (TMAs), based on the MID Region PBN Implementation Plan, seeking the harmonization of the application of PBN and avoiding the need for multiple operational approvals for intra- and inter-regional operations, and the applicable aircraft separation criteria.

5.8. Improved management of climb/descent flight profiles, together with the use of PBN, provides safer and more cost-effective operations in terminal areas. PBN procedures contribute to the increased use of CCO/CDO, which improves flight efficiency and reduces fuel consumption, CO2 emissions and noise. MID States are encouraged to implement CCO and CDO, where appropriate, as part of their PBN implementation plans, in line with the provisions of the Continuous Descent Operations (CDO) Manual (Doc 9931) and the Continuous Climb Operations (CCO) Manual (Doc 9993) , and in accordance with the MID Region Air Navigation Strategy (Doc002).

Approach

5.9. ICAO Assembly Resolution 37-11 calls for an ‘implementation of approach procedures with vertical guidance (APV) (Baro-VNAV and/or augmented GNSS), including LNAV-only minima, for all instrument runway ends, either as the primary approach or as a back-up for precision approaches …’,

5.10. It is not foreseen that SBAS or GBAS augmentation systems will be available in the MID Region for the development of approach procedures in the period considered herein.

5.11. Approach procedures with vertical guidance (APV) should be implemented for all Instrument Runway End, with the purpose of increasing safety with stabilized approaches and reducing the possibility of CFIT. Priority will be given to their implementation at international airports and other controlled airports as determined by the competent authority of each State. The navigation specifications to be applied will be RNP APCH and A-RNP, with baro-VNAV for vertical guidance.

5.12. Sates are encouraged to plan for the implementation of RNP AR procedures, which can provide significant operational and safety advantages over other area navigation (RNAV) procedures by incorporating additional navigational accuracy, integrity and functional capabilities to permit operations using reduced obstacle clearance tolerances that enable approach and departure procedures to be implemented in circumstances where other types of approach and departure procedures are not operationally possible or satisfactory. Procedures implemented in accordance with RNP AR Procedure Design Manual (Doc 9905) allow the exploitation of high-quality, managed lateral and vertical navigation (VNAV) capabilities that provide improvements in operational safety and reduced un-stabilized approaches and Controlled Flight Into Terrain (CFIT) risks.

5.13. The design of RNP APCH procedures with RF leg will be encouraged, with a view to shortening approach paths, with the corresponding fuel and CO2 savings.

5.14. ATC workload should be taken into account while developing PBN Approach Procedures. One possible way to accomplish this would be by co-locating the Initial Approach Waypoint (IAW) for PBN with the Initial Approach Fix (IAF) of the conventional approaches. States should phase-out conventional non-precision approach procedures at a certain point when deemed operationally suitable and taking in consideration GNSS integrity requirements.

CHAPTER 2

CNS INFRASTRUCTURE

Within an airspace concept, PBN requirements will be affected by the communications, ATS surveillance and ATM services, the NAVAID infrastructure, and the functional and operational capabilities needed to meet the ATM application. PBN requirements also depend on what reversionary, conventional navigation techniques are available and what degree of redundancy is required to ensure adequate continuity of functions.

States (ANSPs) shall ensure that the navigation, surveillance and communications infrastructure has the capabilities needed to support the intended PBN operation.

1. NAVIGATION INFRASTRUCTURE

1.1. The NAVAID infrastructure refers to ground- or space-based NAVAIDs. Conventional ground-based NAVAIDs include DME and VOR. The PBN concept requires that NAVAID Infrastructure provides position information to the aircraft through an on-board area navigation system. Space-based NAVAIDS include GNSS elements.

1.2. Performance Based Navigation provides procedures that can be flown with a variety of navigation aids and airborne sensors. Each navigation specification stipulates which positioning sensor may be used for a particular navigation application as indicated in the PBN Manual Doc 9613, Volume II table (II-A-1-4).

1.3. As such, each combination of navigation aid and sensor needs to be assessed to see if the requirements to support a specific procedure are met. Consequently, an ANSP can declare which navigation infrastructures are available to support the navigation specification in a given airspace.

1.4. Detailed guidance on the relationship between navigation infrastructure, navigation specifications and their application in a specific airspace are contained in ICAO Doc 9613, Performance Based Navigation Manual.

Global Navigation Satellite System (GNSS)

1.5. PBN procedures should always allow the use of GNSS.

1.6. Because GNSS (and ABAS using RAIM in particular) is available on a worldwide basis, infrastructure assessment for GNSS differs significantly from terrestrial navigation aids. Relevant aspects such as safety assessment and GNSS performance assessment are described in the GNSS Manual, ICAO Doc 9849 (2017 edition, especially chapters 7.5 and 7.8.2). In addition to considering constellation performance, the ANSP should assess that the space weather and radio frequency interference environment is satisfactory for the planned procedures, and implement vulnerability mitigation measures, if appropriate (chapter 5 and appendix F of the GNSS Manual). Further guidance on assessing and measuring GNSS interference is contained in ICAO Doc 8071, Testing of Radio Navigation Aids. During outages of GNSS and depending on available NAVAID facilities, ANSPs may find it useful to consider suspending planned routine maintenance activities to ensure the availability of an alternate source of navigation.

1.7. The processes in the Performance Based Navigation (PBN) Manual are defined with the aim to either identify which navigation specification can be applied in order to serve the operational requirements given by the constraints of a particular airspace environment. This involves lining up a navigation application with the appropriate navigation specification and navigation infrastructure.

1.8. States need to evaluate the navigation infrastructure both in the initial process of

identifying which navigation specification can support the application given the infrastructure, as well as in the final implementation once it has been agreed which specification to use. For each navigation specification, there are specific requirements on the infrastructure. The infrastructure assessment determines if these requirements are met.

1.9. Appropriate tools should be used to assess navigation infrastructure. While the assessment could be conducted using manual analysis and flight inspection, the use of a software tool is recommended in order to make the assessment more efficient. The software tool should be tailored to allow evaluating the infrastructure in light of the requirements imposed by a specific navigation specification. Such a tool could, but does not have to be integrated with procedure design tools.

1.10. In general, RNAV assessment tools should include a 3D terrain model with sufficient resolution and accuracy to allow predicting the line of sight visibility of NAVAIDS along a procedure service volume, including an analysis of their respective subtended angles and a variety of other geometric constraints.

1.11. Closely related to RNAV infrastructure assessment is RNAV instrument flight procedure validation, which looks at flyability and other operational aspects. It differs from RNAV flight inspection, which focuses on signal in space compliance with ICAO Annex 10 only. Guidance on instrument flight procedure validation is contained in ICAO DOC 9906 (Quality Manual, esp. Vol 5). Guidance on ground analysis and flight testing for PBN is discussed in chapter 8 of ICAO DOC 8071 Manual on Testing of Radio Navigation Aids, Volume 1 (2018 edition). Further context on the evolution of conventional navigation aids as a complementary infrastructure to GNSS in support of PBN can be found in ICAO Annex 10, Attachment H.

1.12. Note: Guidance material concerning for RNAV 1 Infrastructure Assessment is contained Doc EUROCONTROL- -GUID-114 accessible through the link : https://www.eurocontrol.int/sites/default/files/2021-07/eurocontrol-guidelines-rnav-1-infrastructure-assessment-20.pdf. .

2. SURVEILLANCE INFRASTRUCTURE

2.1. For RNAV operations, States should ensure that sufficient surveillance coverage is provided to assure the safety of the operations. Because of the on-board performance monitoring and alerting requirements for RNP operations, surveillance coverage may not be required. Details on the surveillance requirements for PBN implementation can be found in the ICAO PBN Manual (Doc 9613) and ICAO PANS-ATM (Doc 4444), and information on the current surveillance infrastructure in the MID can be found in the MID eANP and in the MID Region Surveillance Plan.

3. COMMUNICATION INFRASTRUCTURE

3.1. Implementation of RNAV and RNP routes includes communication requirements. Details on the communication requirements for PBN implementation can be found in ICAO PANS-ATM (Doc 4444), ICAO RCP Manual (Doc 9869), and ICAO Annex 10. Information on the current communication infrastructure in the MID can also be found in MID eANP.

4. PERFORMANCE-BASED COMMUNICATION AND SURVEILLANCE (PBCS)

4.1 The performance-based communication and surveillance (PBCS) concept provides objective operational criteria to evaluate emerging communication and surveillance technologies suited for the evolving needs of ATM functions. Once these criteria are established and accepted, the implementation of a specific ATM function, including its performance in technical and human terms, can be assessed against these operational criteria to determine its feasibility.

4.2 The PBCS concept is aligned with that of PBN. While the PBN concept applies required navigation Performance (RNP) and area navigation (RNAV) specifications to the navigation element,

the PBCS concept applies the required communication performance (RCP) and required surveillance performance (RSP) specifications to communication and surveillance elements, respectively. Each RCP/RSP specification includes criteria attributed to the components of the communication and surveillance systems involved.

4.3 Where beneficial, the RCP, RNP/RNAV and RSP specifications may be applied to the communication, navigation and surveillance elements to ensure the operational system and its components perform in accordance with the specifications.

CHAPTER 3

IMPLEMENTATION OF PBN

1. ATM OPERATIONAL REQUIREMENTS

1.1. The Global ATM Operational Concept (Doc 9854) makes it necessary to adopt an airspace concept able to provide an operational scenario that includes route networks, minimum separation standards, assessment of obstacle clearance, and a CNS infrastructure that satisfies specific strategic objectives, including safety, access, capacity, efficiency, and environment.

1.2. During the planning phase of any implementation of PBN, States should gather inputs from all aviation stakeholders to obtain operational needs and requirements. These needs and requirements should then be used to derive airspace concepts and to select appropriate PBN navigation specification

1.3. In this regard, the following should be taken into consideration:

a) Traffic and cost benefit analyses
b) Necessary updates on automation
c) Operational simulations in different scenarios
d) ATC personnel training
e) Flight plan processing
f) Flight procedure design training to include PBN concepts and ARINC-424 coding standard
g) Enhanced electronic data and processes to ensure appropriate level of AIS data accuracy, integrity and timeliness
h) WGS-84 implementation in accordance with ICAO Annex 15 provisions
i) Uniform classification of adjacent and regional airspaces, where practicable
j) RNAV/RNP applications for SIDs and STARs
k) Coordinated RNAV/RNP routes implementation
l) RNP approach with vertical guidance
m) Establish PBN approval database

1.4. The implementation of PBN additional functionalities/path terminator should be considered while planning/designing new procedures such as:

- the Radius to Fix (RF) for approach;
- Fixed Radius Transition (FRT) for En-route; and

2. AIRSPACE CONCEPT

2.2. The PBN Manual describes the Airspace Concept as a formal way to set out and respond to operational airspace change requirements. As such, the development of the Airspace Concept is a key step in PBN implementation because PBN ATS routes, SIDs/STARs are the backbone of the airspace organisation.

2.3. During the planning phase of any implementation of PBN routes, States should gather inputs from all aviation stakeholders to obtain operational needs and requirements. These needs and requirements should then be used to derive airspace concepts and to select appropriate PBN navigation specification.

3. IMPLEMENTATION ROADMAP:

En-route

Short Term (up to Dec 2024):

Oceanic Airspace and remote continental
RNP10 (RNAV10) is applied in certain airspaces, such as oceanic airspace of Muscat and Sana'a FIRs over Arabian Sea. This navigation specification and its applications rely primarily on GNSS to support the navigation element of the airspace concept.

Continental en-route
RNAV 5 implementation should be completed by December 2024.

Based on operational requirements, States may choose to implement RNAV 1 routes to enhance efficiency of airspace usages and support closer route spacing, noting that appropriate communication and surveillance coverage is provided. Details of these requirements are provided in the PBN manual (Doc 9613) and PANS-ATM (Doc 4444).

Medium-to Long-Term (2025-2030+):

Oceanic and remote continental
Migration to RNP4 to support 30 NM lateral and the 30 NM longitudinal distance-based separation minima in a procedural oceanic or remote area airspace. It does not require any ground-based NAVAID infrastructure. GNSS is the primary navigation sensor to support RNP 4, either as a stand-alone navigation system or as part of a multi-sensor system.

Continental en-route
RNAV 5 specifications are applicable to all ATS routes in MID region.
RNAV 1 would be considered for implementation for en-route continental/local domestic operations.

Terminal

Short Term (up to Dec 2024)::

RNAV 1 or RNP 1 SIDs and STARs consistent with APTA-B0/2 should be completed at all RWYs ENDs at International Aerodromes.

Improved management of climb/descent flight profiles, together with the use of PBN, provides safer and more cost-effective operations in terminal areas. PBN procedures contribute to the increased use of CCO/CDO, which improves flight efficiency and reduces fuel consumption, CO2 emissions and noise. States should take into account CCO/CDO operations in the design of SIDs/STARs, within the possibilities of each scenario considered. CCO and CDO consistent with APTA B0/4 and APTA B0/5 should be implemented at the defined TMAs, in accordance with the State PBN implementation Plans, the MID Region Air Navigation Strategy and the MID ANP.

Medium-to Long-Term (2025-2030+):

RNAV 1or RNP 1 SIDs and STARs consistent with APTA-B0/2 will be implemented in all TMAs, as appropriate.

CCO and CDO consistent with APTA B0/4 and APTA B0/5 should be implemented at all RWYs ENDs at International Aerodromes.

Approach

Short Term (up to Dec 2024)::

Implementation of PBN Approaches (with basic capabilities) consistent with APTA-B0/1 for all instrument runway ends at the international aerodromes listed in the MID ANP except where approach procedures with vertical guidance (APV) is not feasible. RNP APCH with LNAV minima only should be deployed.

The introduction of PBN Approaches (with advanced capabilities) consistent with APTA-B1/1 would be limited to selected airports, to allow for the introduction of more flexible approaches including the use of RF legs within the Final Approach Segment where operational benefits can be obtained.

Medium-to Long-Term (2025-2030+):

Implementation of PBN Approaches (with basic capabilities) consistent with APTA-B0/1 for all instrument runway ends except where approach procedures with vertical guidance (APV) is not feasible. RNP APCH with LNAV minima only should be deployed.

Widespread implementation of PBN Approaches (with advanced capabilities) consistent with APTA-B1/1 continue for airports where there are operational benefits.

2.1. Table 3-2 summarizes the implementation targets of each PBN navigation specification in the MID Region:

Table 3-2. SUMMARY TABLE AND IMPLEMENTATION TARGETS

Airspace	Short Term (up to Dec 2024)		Medium-to Long-Term (2025-2030+):	
	Navigation Specification Preferred	**Performance Indicators/ Targets**	**Navigation Specification Acceptable**	**Performance Indicators/ Targets**
En-route – Oceanic and Remote continental	RNAV 10 or RNP 4*	70 % by 2024	RNAV 10 RNP 4*	100% by 2030
En-route – Continental	RNAV 5 RNAV 1	70 % by 2024	RNAV 5 RNAV 1	100% by 2030
En-route - Local / Domestic	RNAV 5 RNAV 1	70 % by 2024	RNAV 5 RNAV 1	100% by 2030
TMA – Arrival	RNAV 1 or RNP 1	70% by 2022 and 100% by 2024 for STARs at International Aerodromes	RNAV 1 or RNP 1	100% by 2030 for STARs at all TMAs, as appropriate
TMA – Departure	RNAV 1 or RNP 1	70% by 2022 100% by 2024 for SIDs at International Aerodromes	RNAV 1 or RNP 1	100% by 2030 SIDs at all TMAs, as appropriate
Approach	RNP APCH to LNAV/VNAV and LNAV minima only, as required. (PBN Approaches with basic capabilities)	100% by 2022 for all instrument runway ends at the international aerodromes	RNP APCH to LNAV/VNAV and LNAV minima only, as required. (PBN Approaches with basic capabilities) for all instrument runway ends	100% by 2030
	RNP AR APCH (PBN Approaches with advanced capabilities)	100% by 2024 at selected Airports in MID	Widespread implementation of RNP AR APCH (PBN Approaches with advanced capabilities)	*W/A*
CCO and CDO	CDO (Basic) and CCO (Basic) at the defined TMAs	100% by 2022	CDO (Basic) and CCO (Basic) at all RWYs ENDs at International Aerodromes.	100 % by 2030

- *W/A: where applicable/defined Airspace, in accordance with State PBN implementation Plans, the MID Region Air Navigation Strategy and the MID ANP.*
- ** would be considered for implementation at the identified Airspace/TMAs*
- *When no month is specified means by the end of the year.*

CHAPTER 4

SAFETY ASSESSMENT AND MONITORING

1. NEED FOR SAFETY ASSESSMENT

4.1. To ensure that the introduction of PBN en-route applications within the MID Region is undertaken in a safe manner and in accordance with relevant ICAO provisions, implementation shall only take place following the conduct of a safety assessment that has demonstrated that an acceptable level of safety will be met. This assessment may also need to demonstrate levels of risk associated with specific PBN en-route implementation. Additionally, ongoing periodic safety reviews shall be undertaken where required in order to establish that operations continue to meet the target levels of safety

2. ROLES AND RESPONSIBILITIES

4.2. To demonstrate that the system is safe, it will be necessary that the implementing agency – a State or group of States - ensures that a safety assessment and, where required, ongoing monitoring of the PBN en-route implementation are undertaken.

4.3. In undertaking a safety assessment to enable en-route implementation of PBN, a State or the implementing agency shall:

a) establish and maintain a registry of PBN approvals;

b) monitor aircraft horizontal-plane navigation performance and the occurrence of large navigation errors and report results;

c) conduct safety and readiness assessments;

d) monitor operator compliance with State approval requirements after PBN implementation; and

e) initiate necessary remedial actions if PBN requirements are not met.

CHAPTER 5
OPERATIONAL APPROVAL

1. OPERATIONAL APPROVAL REQUIREMENTS

5.1. Operational approval is usually the responsibility of the regulatory authority of the State of the Operator for commercial air transport operations and the State of Registry for general Aviation (GA) operations. For certain operations, GA operators may not be required to follow the same authorization model as commercial operators.

5.2. The operational approval assessment must take account of the following:

a) aircraft eligibility and airworthiness compliance;

b) operating procedures for the navigation systems used;

c) control of operating procedures (documented in the OM);

d) flight crew initial training and competency requirements and continuing competency requirements;

e) dispatch training requirements; and

f) control of navigation database procedures. Where a navigation database is required, operators need to have documented procedures for the management of such databases. These procedures will define the sourcing of navigation data from approved suppliers, data validation procedures for navigation databases and the installation of updates to databases into aircraft so that the databases remain current with the AIRAC cycle. (For RNP AR applications, the control of the terrain database used by TAWS must also be addressed.)

Aircraft eligibility

5.3. An aircraft is eligible for a particular PBN application provided there is clear statement in:

a) the Type Certificate (TC); or
b) the Supplement Type Certificate (STC); or
c) the associated documentation — Aircraft Flight manual (AFM) or equivalent document; or
d) a compliance statement from the manufacturer that has been approved by the State of Design and accepted by the State of Registry or the State of the Operator, if different.

5.4. The operator must have a configuration list detailing the pertinent hardware and software components and equipment used for the PBN operation.

5.5. The TC is the approved standard for the production of a specified type/series of aircraft. The aircraft specification for that type/series, as part of the TC, will generally include a navigation standard. The aircraft documentation for that type/series will define the system use, operational limitations, equipment fitted and the maintenance practices and procedures. No changes (modifications) are permitted to an aircraft unless the CAA of the State of Registry either approves such changes through a modification approval process, STC or accepts technical data defining a design change that has been approved by another State.

5.6. For recently manufactured aircraft, where the PBN capability is approved under the TC, there may be a statement in the AFM limitations section identifying the operations for which the aircraft

is approved. There is also usually a statement that the stated approval does not itself constitute an approval for an operator to conduct those operations. Alternate methods of achieving the airworthiness approval of the aircraft for PBN operations is for the aircraft to be modified in accordance with approved data. (e.g. STC, minor modification, etc.)

5.7. One means of modifying an aircraft is the approved Service Bulletin (SB) issued by the aircraft manufacturer. The SB is a document approved by the State of Design to enable changes to the specified aircraft type and the modification then becomes part of the type design of the aircraft. Its applicability will normally be restricted by the airframe serial number. The SB describes the intention of the change and the work to be done to the aircraft. Any deviations from the SB require a design change approval; any deviations not approved will invalidate the SB approval. The State of Registry accepts the application of an SB and changes to the maintenance programme, while the State of the Operator accepts changes to the maintenance programme and approves changes to the MEL, training programmes and Operations specifications. An Original Equipment Manufacturer (OEM) SB may be obtained for current production or out of production aircraft.

5.8. In respect of PBN, in many cases for legacy aircraft, while the aircraft is capable of meeting all the airworthiness requirements, there may be no clear statement in the applicable TC or STC or associated documents (AFM or equivalent document). In such cases, the aircraft manufacturer may elect to issue an SB with appropriate AFM update or instead may publish a compliance statement in the form of a letter, for simple changes, or a detailed aircraft type specific document for more complex changes. The State of Registry may determine that an AFM change is not required if it accepts the OEM documentation. **Table 5-1** lists the possible scenarios facing an operator who wishes to obtain approval for a PBN application, together with the appropriate courses of action.

Table 5-1

Scenario	Aircraft certification status	Actions by operator/owner
1	Aircraft designed and type certificated for PBN application. Documented in AFM, TC or the STC	No action required, aircraft eligible for PBN application
2	Aircraft equipped for PBN application but not certified. No statement in AFM. SB available from the aircraft manufacturer	Obtain SB (and associated amendment pages to the AFM) from the aircraft manufacturer
3	Aircraft equipped for PBN application. No statement in AFM. SB not available. Statement of compliance available from the aircraft manufacturer	Establish whether the statement of compliance is acceptable to the regulatory authority of the State of Registry of the aircraft
4	Aircraft equipped for PBN application. No statement in AFM. SB not available. Statement of compliance from the aircraft manufacturer not available	Develop detailed submission to State of Registry showing how the existing aircraft equipment meets the PBN application requirements
5	Aircraft not equipped for PBN application	Modify aircraft in accordance with the aircraft manufacturer's SB or develop a major modification in conjunction with an approved design organization in order to obtain an approval from the State of Registry (STC).

Operating procedures

5.9. The Standard operating procedure (SOP) must be developed to cover both normal and non-normal (contingency) procedures for the systems used in the PBN operation. The SOP must address:

a) preflight planning requirements including the MEL and, where appropriate, RNP/RAIM prediction;
b) actions to be taken prior to commencing the PBN operation;
c) actions to be taken during the PBN operation; and
d) actions to be taken in the event of a contingency, including the reporting of significant incidents

GA pilots must ensure that they have suitable procedures/checklists covering all these areas

Control of operating procedures

5.10. The SOP must be adequately documented in the OM and checklists

Flight crew and dispatch training

5.11. A flight crew and dispatch training programme for the PBN operation must cover all the tasks associated with the operation and provide sufficient background to ensure a comprehensive understanding of all aspects of the operation. The operator must have adequate records of course completion for flight crew, flight dispatchers and maintenance personnel.

Control of navigation database procedures

5.12. If a navigation database is required, the procedures for maintaining currency, checking for errors and reporting errors to the navigation database supplier must be documented in the maintenance manual by commercial operators

2. DOCUMENTATION OF OPERATIONAL APPROVAL

2.1. Operational approval may be documented as an endorsement of the Air operator certificate (AOC) through:

a) Operations specification, associated with the AOC; or
b) amendment to the OM; or
c) LOA.

2.2. During the validity of the operational approval, the CAA should consider any anomaly reports received from the operator or other interested party. Repeated navigation error occurrences attributed to a specific piece of navigation equipment may result in restrictions on use or cancelation of the approval for use of that equipment. Information that indicates the potential for repeated errors may require modification of an operator’s training programme. Information that attributes multiple errors to a particular pilot or crew may necessitate remedial training and checking or a review of the operational approval.

2.3. The State may determine that a GA aircraft may operate on a PBN route/procedure provided that the operator has ensured that the aircraft has suitably approved equipment (is eligible), the navigation database is valid, the pilot is suitably qualified and current with respect to the equipment, and adequate procedures (checklists) are in place.

3. STATE REGULATORY MATERIAL

3.1. Individual States must develop national regulatory material which addresses the PBN applications relevant to their airspace or relevant to operations conducted in another State by the State's operators or by aircraft registered in that State. The regulations may be categorized by operation, flight phase, area of operation and/or navigation specification. Approvals for commercial operations should require specific authorization.

4. APPROVAL PROCESS

General

3.2. Since each operation may differ significantly in complexity and scope, the project manager and the operational approval team need considerable latitude in taking decisions and making recommendations during the approval process. The ultimate recommendation by the project manager and decision by the DGCA regarding operational approval should be based on the determination of whether or not the applicant:

a) meets the requirements established by the State in its air navigation regulations;
b) is adequately equipped; and
c) is capable of conducting the proposed operation in a safe and efficient manner.

3.3. The complexity of the approval process is based on the inspector's assessment of the applicant's proposed operation. For simple approvals, some steps can be condensed or eliminated. Some applicants may lack a basic understanding of what is required for approval. Other applicants may propose a complex operation, but may be well prepared and knowledgeable. Because of the variety in proposed operations and differences in an applicant's knowledge, the process must be thorough enough and flexible enough to apply to all possibilities.

Phases of the approval process

Step 1 — Pre-application phase

3.4. The operator initiates the approval process by reviewing the requirements; establishing that the aircraft, the operating procedures, the maintenance procedures and the training meet the requirements; and developing a written proposal to the regulator. A number of regulators have published "job aids" to assist the operator in gathering the necessary evidence to support the approval application. At this stage a pre-application meeting with the regulator can also be very beneficial. If the proposed application is complex, the operator may need to obtain advice and assistance from OEMs or other design organizations, training establishments, data providers, etc.

Step 2 — Formal application phase

3.5. The operator submits a formal, written application for approval to the CAA, which appoints a project manager either for the specific approval or generally for PBN approvals.

Step 3 — Document evaluation phase

3.6. The CAA project manager evaluates the formal, written application for approval to determine whether all the requirements are being met. If the proposed application is complex, the project manager may need to obtain advice and assistance from other organizations such as regional agencies or experts in other States.

Step 4 — Demonstration and inspection phase

3.7. During a formal inspection by the project manager (assisted as necessary by a CAA team), the operator demonstrates how the requirements are being met.

Step 5 — Approval phase

3.8. Following a successful formal inspection by the CAA, approval is given through:

a) Operations specification, associated with the AOC; or
b) amendment to the OM; or
c) LOA.

Some PBN applications may not require formal approval for GA operations — this will be determined by the State of Registry.

Note.— The approval procedure described above consists of a simplified process of the certification guidance contained in Part III of the Manual of Procedures for Operations Inspection, Certification and Continued Surveillance *(Doc 8335).*

5. FOREIGN OPERATIONS

5.1. A State undertakes, in accordance with Article 12 to the Convention, to ensure that every aircraft flying over or maneuvering within its territory shall comply with the rules and regulations relating to the flight and maneuver of aircraft there in force. Article 33 to the Convention provides that certificates of airworthiness and certificates of competency and licenses issued, or rendered valid, by the State in which an aircraft is registered, shall be recognized by other States, provided that the requirements under which such certificates or licenses were issued or rendered valid are equal to or above the minimum standards which may be established by ICAO. This requirement for recognition is now extended by Annex 6, Part I and Part III, Section II, such that Contracting States shall recognize as valid an AOC issued by another Contracting State, provided that the requirements under which the certificate was issued are at least equal to the applicable Standards specified in Annex 6, Part I and Part III.

5.2. States should establish procedures to facilitate the application by foreign operators for approval to operate into their territory. States should be careful in their requirements for applications, to request only details relevant to the evaluation of the safety of the operations under consideration and their future surveillance. When evaluating an application by an operator from another State to operate within its territory a State will examine both the safety oversight capabilities and record of the State of the Operator and, if different, the State of Registry, as well as the operational procedures and practices of the operator. This is necessary in order for the State, in the terms of Article 33 to the Convention, to have confidence in the validity of the certificates and licenses associated with the operator, its personnel and aircraft, in the operational capabilities of the operator and in the level of certification and oversight applied to the activities of the operator by the State of the Operator.

5.3. The operator will need to make applications to each State into or over which it is intended to operate. The operator will also need to keep its own CAA, as the authority of the State of the Operator, informed of all applications to operate in other States. Applications should be made direct to the CAAs of the States into which it is intended to operate. In some cases it will be possible to download information and instructions for making an application and the necessary forms from a website maintained by the CAA in question.

5.4. Because functional and performance requirements are defined for each navigation specification, an aircraft approved for an RNP specification is not automatically approved for all RNAV

specifications. Similarly, an aircraft approved for an RNP or RNAV specification having a stringent accuracy requirement (e.g. RNP 0.3 specification) is not automatically approved for a navigation specification having a less stringent accuracy requirement (e.g. RNP 4).

CHAPTER 6

NATIONAL PBN IMPLEMENTATION STRATEGY & PLAN

1. INTRODUCTION

6.1 The ICAO Assembly Resolution 37-11 stressed the need for a National PBN Implementation Plan.

6.2 In order to assist States to achieve the ICAO objectives set out in Resolution 37-11, this chapter provides step-by-step guidance to States on how to establish their own national plan in a standard consistent way in relation to Assembly Resolutions, ICAO SARPs, GANP, GASP, Regional plans and other related documents.

6.3 Whilst it is not possible to provide a tailor made PBN implementation plan, and even less desirable to create a 'one-size fits all' plan, what is possible is to provide a generic architecture showing one example of such a PBN Implementation Plan and suggests what such a plan could contain.

6.4 This chapter provides a skeleton 'architecture' or 'outline' which could assist States and ANSPs formulate an ICAO National PBN Implementation Plan.

2. PLANNING PRINCIPLES

6.5 The following principles should be applied in drawing up the State PBN implementation plan.

Global harmonization: all regulations, navigation requirements, and flight procedures designs should comply with ICAO's PBN Manual, SARPs, PANS, and other international standards

Regional harmonization: there should be no conflict with MID region's PBN implementation plan.

Smooth transition: continued application of conventional air navigation procedures during the transition period, to guarantee availability by users that are not RNAV- and/or RNP-equipped;

CBA: conduct of cost-benefit analyses to justify the implementation of the RNAV and/or RNP concepts in each particular airspace;

Safety Assessment: conduct of pre- and post-implementation safety assessments to ensure the application and maintenance of the established target levels of safety.

Collaborative Consultation: collaborative consultation is critical between the regulatory authority, the service provider, other stakeholders, and the users of the air navigation services.

3. STATES' UPDATE ON PBN IMPLEMENTATION

6.6 States should provide the ICAO MID Regional Office with their updated PBN Implementation Plans on an annual basis (by end of December) in accordance with MSG Conclusion 4/11. The States' National PBN Implementation Plan should be published on the MID Office website as per MSG Conclusion 6/21, to facilitate consultation and planning of airspace users.

4. STATE PBN IMPLEMENTATION STRATEGY

6.7 It is expected that the State (CAA) will develop the policy and PBN Implementation Strategy and the Service Provider will define a deployment plan to deliver the policy goals. The PBN Implementation Plan should be completed in collaborative-partnership approach.

6.8 To ensure the civil aviation authority's (CAA's) plans are complementary to the ANSP and industry plans, they should begin with a shared broad strategic direction. This could start in the form of PBN Implementation Strategy that evolves into a State PBN implementation plan

6.9 A Sample State PBN Implementation Strategy is provided at the PBN Portal through the link https://pbnportal.eu/epbn/main/Implementing-PBN/Implementation-Considerations/Sample-State-PBN-Implementation-Strategy.html

5. NATIONAL PBN IMPLEMENTATION PLAN-CONTENT

The National PBN Implementation Plan should contain the following:

a) Executive Summary

The ANSP may elect to explain why a PBN implementation plan is being developed. It is highly likely that the NSPs will want to highlight why the changes are required and what the expected benefits will be for the airspace users.

b) Drivers for PBN Implementation

Within this section, the ANSP could identify the specific reasons why an airspace change is needed.

c) Analysis of Current Operations

Detailing the current operations would provide the Service Providers with the initial input to the PBN implementation. This detailing of current operations is known as the Reference Scenario is described in Activity 4 of the Manual on the Use of Performance-Based Navigation (PBN) in Airspace Design (Doc 9992). The Reference Scenario includes all existing ATS Routes, SIDs/STARs, airspace volumes, ATC sectorization, air traffic data and as well as all the existing coordination agreements. Description and analysis of the Reference Scenario is a crucial exercise. The Reference Scenario provides a 'baseline' to understand and analyze the current operations, within the national airspace and airports could cover the following elements:

Airspace:

a. Structure
b. Airspace Classification
c. Sectorisation
d. TMA and CTR
e. Route Structure

Aircraft Fleet

f. Fleet Equipage Assessment
g. Categories of Airspace Users
h. Aircraft certification
i. Crew operational approval

Communication Infrastructure

j. Communications coverage and limitations

Navigation Infrastructure

k. Conventional Navigation Aids
l. Precision Approach Landing Aids
m. GNSS status

Surveillance Infrastructure

n. Surveillance coverage and limitations

ATM capabilities (existing and planned)

WGS-84 implementation

d) PBN Operational Requirements & Implementation Strategy

Selection of applicable Navigation Specifications

- Based on National Objectives
- Ensuring Regional Harmonization
- Aligned with ICAO implementation strategies / policies

Realistic Near / Medium / Long term implementation roadmaps for:

- Enroute Operations
    - Key traffic flows and City Pairs Identified
    - Harmonization and interoperability across FIR
- Terminal Operations
    - Specific terminal areas selected for implementation
- Instrument Approaches
    - Designation of airports eligible for RNP APCH and APV
    - Selection of airports requiring RNP AR APCH (based on operational justification

e) Transition Strategies

Considerations for mandate or phased update of procedures or equipage

Infrastructure

- NAVAID phase-out and replacement strategy (VOR / DME / NDB / ILS)
- Requirements for continued application of conventional navigation procedures to accommodate non-RNAV / RNP users
- Provisions for contingency operations

Procedure

- Strategy for mixed-mode operations

- Integration with ATM system

Personnel

- Promotion and training for ATC, Designers and Inspectors

f) Safety Assessment & Monitoring Requirements

Need for a safety assessment

Pre and Post safety assessment in accordance with ICAO provisions

Periodic safety reviews undertaken by the State or group of States where required

Required Metrics

g) Expected Operational Benefits - specific implementations

High-level business case for implementation near / mid long-term)

- END -