International Civil Aviation Organization

Thirteenth Meeting of The Performance Based Navigation Implementation Coordination Group (PBNICG/13)

(Bangkok, Thailand, 14-16 October 2026)

Agenda Item 3: States' PBN Implementation Progress and challenges/lessons learnt

PBN IMPLEMENTATION STATUS IN PAKISTAN

(Presented by Pakistan)

SUMMARY

This paper presents the current status of PBN implementation in Pakistan, ongoing activities and challenges being faced in conducting PBN operations.

1. INTRODUCTION

1.1 The implementation of Performance-Based Navigation (PBN) has provided significant operational benefits to the aviation community, including improved safety, enhanced airspace capacity, increased predictability of flight paths, improved access to airports, greater route flexibility and more efficient arrival, departure and approach operations. PBN is therefore an important element of modern air navigation planning and continues to support the objectives of the ICAO Global Air Navigation Plan and the relevant Aviation System Block Upgrades (ASBUs).

1.2 Recognizing the operational and safety benefits of PBN, and taking into consideration its obligations under the Convention, Pakistan initiated PBN implementation at an early stage and has progressively expanded its application to terminal, approach and en-route operations.

1.3 This paper provides an update on the progress achieved by Pakistan in PBN implementation, highlights the operational initiatives undertaken, identifies the challenges encountered, and lessons learned.

2. DISCUSSION

National PBN Implementation Planning

2.1 Based on ICAO Assembly Resolutions A36/23 and relevant APANPIRG Conclusion, Pakistan developed 1st National PBN Implementation Plan in May 2009. The plan covers phase wise PBN implementation with target to cover RNP APCH and terminal procedures for instrument runways at all international airports by end 2016 as per timelines of ICAO Assembly Resolution. A PBN Working Group comprising relevant stakeholders from the aviation industry, air navigation service provider, regulator and other concerned organizations was constituted to identify operational requirements and coordinate implementation activities.

2.2 To facilitate industry awareness, engagement and preparedness, PBN seminars and workshops were conducted in 2009 and 2011. Based on the study of the working group, PBN Plan was reviewed and new version was issued in 2012. The plan comprises specific short-term, medium-term and long-term targets. Implementation commenced with the first RNP APCH procedure for the former Islamabad International Airport, in May 2012. The implementation of RNP APCH and associated terminal procedures subsequently progressed to other airports and runway ends. The target for implementation of PBN approach procedures at the applicable instrument runway ends identified in the Regional Air Navigation Plan was subsequently achieved in 2018.

2.3 In addition to the runway ends identified in the Regional Air Navigation Plan, Pakistan developed and implemented RNP APCH procedures for three runway ends designated as non-instrument. These implementations demonstrated the flexibility of PBN in providing runway-aligned instrument approach capability in circumstances where conventional navigation-based procedures were constrained by the surrounding airspace or terrain environment. RNP ILS integration was also ensured for all runways where ILS was installed and serving as primary approach procedure to acquire PBN benefits.

2.4 PBN implementation plan was subsequently reviewed in 2017 and 2020 to reflect the status and update future plans. As the RNP APCH procedures have already been implemented at the airports included in earlier plan, the short-term target only covers RNP 1 SIDs at domestic airports. The long-term planning includes exploring the possibility of RNP AR operations at northern airports where normal RNP APCH was not practicable and future work for SBAS implementation with LPV minima in RNP APCH procedures.

PBN Deployment

Terminal / Approach Implementation

2.5 There are 10 Pakistani airports identified in the ICAO Regional Air Navigation Plan, comprising 23 instrument runway ends while 03 runway ends of these airports are designated non-instrument. RNP1 STARs, where operationally required, and RNP APCH procedures have been published for all 23 runway ends of 9 airports included in Regional Air Navigation Plan Volume II.

2.6 Standard Instrument Departures (SIDs) have also been published for these airports using RNP 1 navigation specification for 23 runway ends. In addition, RNP APCH procedures and RNP-1 SIDs have also been developed for other operational airports in Pakistan with regular aircraft operations, where such procedures provide operational benefits and are technically feasible, which are not covered in Regional Air Navigation Plan.

2.7 Pakistan has progressively expanded the use of PBN-based departure and arrival procedures to improve connectivity between the en-route structure and terminal airspace. The implementation has been undertaken with consideration of aircraft equipage, traffic demand, surveillance availability, airspace constraints and the need to accommodate mixed-mode operations.

2.8 Quetta International Airport presents particular challenges due to the surrounding terrain and airspace constraints. As a result, one of the runway end i.e., RWY 13L had historically been operated without an associated SID. The efforts have now resulted in design of RNP 1 SIDs which are in approval phase after flight validation while possibility of using RNP AR access to RWY31R is being worked out for instrument operations.

2.9 PBN has also enabled Pakistan to provide instrument approach capability to four runway ends at three international airports where conventional instrument approach procedures were previously unavailable due to airspace limitations. The implementation of RNP APCH procedures at these runway ends has provided runway-aligned instrument approaches and improved accessibility, safety and operational efficiency.

2.10 As the provision of RNP APCH based on LNAV or LNAV/VNAV are being used in Pakistan, ILS where installed remains the primary approach. Pakistan has therefore provided RNP ILS connectivity to acquire PBN implementation benefits. RNP1 initial segments followed by ILS precision segment are available for all ILS approach procedures.

RNP AR operations feasibility

2.11 Pakistan's topography is highly diverse, featuring towering northern mountains, extensive river plains, arid deserts, and rugged plateaus. The high terrain in surroundings of northern airports has made the implementation of Performance Based Navigation using normal provisions of RNP 1 and RNP APCH impracticable.

2.12 To address this challenge, Pakistan initiated a feasibility study, supported by international consultancy, for the potential introduction of RNP AR operations at three northern airports. The study indicated that RNP AR procedure design may be technically feasible at some locations; however, operational performance, aircraft capability, operator authorization requirements and other associated factors require further assessment before implementation can be considered. Pakistan will continue to coordinate this work with relevant stakeholders and ensure that any future implementation is supported by the applicable ICAO criteria, safety assessment and regulatory approval framework.

En-route Operations

2.13 Pakistan is at the boundary of the ICAO Asia/Pacific Region interfacing with ICAO MID Region with adjoining airspace of Oman and Iran where RNAV 5 is being used. RNP10 has been implemented on major flows within APAC region in neighboring airspace of India and Afghanistan. Pakistan transformed number of ATS Routes serving major traffic flows into PBN ATS routes with navigation specification of RNP10 and RNAV5 for enroute phase to support regional harmonization. While Pakistan intends to implement RNP 2 in accordance with APAC seamless ANS Plan, the current status of non-availability of air traffic services in Afghanistan airspace as well geopolitical situation towards Middle East restricted further coordination with relevant stakeholders.

2.14 Due to limited demand for domestic operations, establishment of parallel route structure using PBN concept was not included in the current work. The use of PBN navigation specification RNP2 for enroute phase of flight over entire Pakistan airspace will be considered in harmony with the adjacent states as and when required to achieve PBN goals.

Challenges

2.15 During the implementation of Performance Based Navigation for terminal and approach operations, challenges were faced which include:

- ❖ Airspace limitations to segregate arrival and departure trajectories and optimize terminal airspace;
- ❖ Mixed mode operation to accommodate non- PBN aircraft alongside PBN capable aircraft;

- ❖ Air traffic control clarity of understanding and consistent application of published procedures;
- ❖ Different separation minima in PBN RNP Navigation specification and practicing enroute surveillance-based separation;

2.16 During last few years, GNSS RFI has also emerged as a big challenge during the conduct of PBN terminal and approach operations.

Lesson learned

2.17 The following key lessons have been learnt through the experience of PBN implementation:

- ❖ Continuous coordination among the regulator, ANSP, aircraft operators, procedure designers, military/other airspace users and relevant technical stakeholders is essential for successful implementation.
- ❖ PBN should be introduced where it provides identifiable safety, efficiency, accessibility, capacity or environmental benefits rather than being treated solely as a technology-upgrade programme.
- ❖ PBN procedures and airspace concepts should be designed to accommodate PBN and Non-PBN aircraft during the transition period while minimizing additional ATC workload.
- ❖ Publication of PBN procedures yielding real benefit to qualifying aircraft results in motivation for non-qualifying operators to acquire benefit through upgradation of fleet capability.
- ❖ PBN implementation should include arrangements to cater for GNSS interference, including monitoring, reporting, dissemination of information and availability of suitable alternative/contingency navigation procedures.
- ❖ Appropriate training for air traffic control and air crew is fundamental for PBN implementation.

3. ACTION REQUIRED BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper; and
b) discuss any relevant matters as appropriate.

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