International Civil Aviation Organization

THE NINTH MEETING OF PERFORMANCE BASED NAVIGATION IMPLEMENTATION COORDINATION GROUP (PBNICG/9)

Video Conference, 22 - 24 March 2022

Agenda Item 6: PBN OPS Approval

RNP AR Departure Operational Approval in Nepal

(Presented by Nepal)

SUMMARY

This paper presents Nepal's experience with regard to the PBN OPS approval for RNP AR Departure.

1. INTRODUCTION

1.1 Nepal has developed PBN Implementation Plan in 2011 and revised the Plan in 2016 in order to provide the continuity to the development of PBN and to implement the PBN activities in a planned, harmonized and coordinated way meeting the ICAO PBN guidelines.

1.2 PBN flight procedures have formally been implemented in Nepal since 2011 with the implementation of RNP AR Approach at Tribhuvan International Airport in Kathmandu, RNP APCH at Biratnagar Airport and associated RNP 1 STARs.

1.3 Implementation of PBN Flight Procedures are not just sufficient for effective implementation of PBN in the country, rather there should be effective operational approval guidance too for all PBN NAVSPECs.

1.4 Civil Aviation Authority of Nepal (CAAN) has developed PBN OPS Approval Manual in 2016, adopting the ICAO PBN OPS Approval Manual Doc 9997, which is a basic approval guidance that is being used by CAAN FOIs during the OPS Approval of PBN NAVSPECs. However, this did not cover the approval procedure of RNP AR Departure (RNP AR DP).

2. DISCUSSION

PBN OPS Approval Guidance for the operational approval of RNP AR Departure

2.1 Tribhuvan International Airport (TIA) is located in a bowl-shaped narrow valley surrounded by challenging terrain all around. As such, operators' demands for safer and more efficient departure flight procedures are being raised.

2.2 One of the operators formally demanded for RNP AR DP in foreign land claiming that it would be more efficient procedure to exit safely from the narrow valley and would be flown safely under the performance capability of their fleet.

2.3 ICAO has provided sufficient guidance for approval and implementation of all PBN NAVSPECs except RNP AR DP in PBN OPS Approval Manual (Doc 9997) and PBN Manual (Doc 9613) respectively.

2.4 As such without having sufficient guidance, approving and effectively implementing RNP AR DP as per operators' demand was a quite challenging task.

2.5 After having interaction with operators and other stakeholders and extensive research, CAAN developed a procedure for the OPS Approval of RNP AR DP (including the job aid), which is presented as an Attachment to this WP and incorporated this provision in CAAN PBN OPS Approval Manual in 2021.

2.6 Phased approach has been adopted as per Doc 9997 for the approval of RNP AR DP. All Pre-application, Formal application, Document evaluation, Demonstration and Approval phases have been completed for the approval of RNP AR DP, and will be completed in the future approvals too.

2.7 Some of the mandatory provisions for the approval are:

- Operator must have acquired approval of RNP AR APCH
- Operator's must have conducted RNP AR DP validation flight
- RNP AR DP Contingency/EOSID
- Dual aircraft system requirement
- Conditional authorization until completion of 100 trial operations

2.8 ATC flight planning. Following arrangement has been made for the approval of ATC Flight Plan.

Item 10a. G, R, Z

Item 18. PBN/T1 or T2 NAV/RNP AR DP

2.8 RNP AR DPs are going to be implemented at TIA within next three months. So, many more demands for operational approval of RNP AR DP will soon be raised from many operators doing RNP AR APCH at TIA, and the approval guidance that CAAN has developed will be highly supportive to its FOIs.

2.9 The provisions for authorization or approval of RNP AR DP as mentioned in the Attachment of this WP will be modified if Doc 9613 and/or Doc 9997 will incorporate the provisions for RNP AR DP in future, or at any time when it is deemed necessary in the interest of safety of aircraft operation.

3. ACTION REQUIRED BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;
b) provide necessary feedbacks or suggestions; and
b) discuss any relevant matters as appropriate.

– – – — – – – – – – –

ATTACHMENT

4.14 RNP AR DEPARTURE

4.14.1 General

4.14.1.1 Presently, RNP AR Manual, Doc 9905 contains the flight procedure design criteria for RNP AR Approach procedures only. However, it clearly mentions in its foreword that the similar design criteria for RNP AR departure procedures will be incorporated in the manual when developed. Similarly, the PBN Manual, Doc 9613 does not contain the provisions of RNP AR departure specification. PBN Operational Approval Manual, Doc 9997 also doesn't have any provisions for operational approval of such specification.

4.14.1.2 This manual has used RNP AR DP as the designator for RNP AR departure procedures which require further additional levels of scrutiny, control and authorization than that required for RNP AR APCH. Therefore, the provisions mentioned in this section 4.8 is additional over the provisions for the approval of RNP AR APCH. A very few States have implemented RNP AR departures. So, regulatory provisions for both operational as well as procedure approval of RNP AR departures are very limited. This section has been developed to support FOIs of CAA Nepal providing some basic guidelines for the authorization of RNP AR DP navigation application to the airline operators.

4.14.1.3 RNP AR DP applications can range from simple straight departures to a very complex curved approaches with RF legs used in some or many portions of the procedure, with a minimum track-keeping accuracy requirement from RNP 1 to RNP 0.3. RNP AR DP procedures designed basically according to RNP AR APCH criteria as mentioned in ICAO Doc 9905.

4.14.1.4 The RNP AR APCH and RNP AR DP operational approvals are separate approvals. Operators can hold a RNP AR APCH approval without holding a RNP AR DP approval. However, if the RNP AR DP approval is required, the operator must hold the RNP AR APCH approval or must be qualified for such approval.

4.14.1.5 To acquire the approval or authorization for RNP AR DP, operators must demonstrate that they are qualified for such navigation application. Operators can demonstrate their qualification in the RNP AR DP validation flight.

4.14.1.6 A simplified Job Aid for the approval and authorization of RNP AR departure has been mentioned at the end of this chapter.

4.14.2 Operators' qualification

4.14.2.1 Before authorizing operators for RNP AR DP application, FOIs must ensure that the following criteria are met:

a. Application for authorization of RNP AR DP procedure with RNP value not less than RNP 0.3
b. Aircraft must hold authorization for RNP AR APCH or be qualified for this NAVSPEC
c. Availability of RNP AR EOSID or RNP AR DP procedure capable to accommodate engine out performance
d. Aircraft qualification- AFM indicating the aircraft capability for RNP AR DP

e. Crew Qualification- Ground/SIM training for RNP AR DP
f. MEL concerning RNP AR DP
g. FOSA addressing the RNP AR DP

4.14.3 System requirement

4.14.3.1 Besides equipment required as mentioned in para 4.14.3.2, following system are required for RNP AR DP operations at minimum:

a. Use of aircraft performance tool(s) necessary to ensure compliance with take-off/climb performance demands of RNP AR DP
b. Able to loading and executing a flight plan where the RNP AR DP defined path begins at or just beyond the DER, including use of an RF leg
c. Able to provide lateral path guidance (i.e., engage LNAV) no later than 50FT above the DER during take-off
d. Capable of reversion to IRS-only navigation in case of the loss of GNSS at any point during the procedure

4.14.3.2 Equipment required

Following equipment are required for RNP AR DP operational approval:

a. 2 GNSS Receivers (TSO C129a or equivalent; TSO C145a/TSO C146a or equivalent)
b. 2 FMS (TSO C115b or equivalent)
c. 2 IRSs/IRUs
d. 2 ADSs
e. 2 FDs
f. 2 APs (RNP < 1)
g. 1 Class A TAWS/EGPWS
h. Duplicated PFDs/NDs
i. 2 Baro-VNAV system
j. 2 Flight Mode Annunciators
k. 2 Radio Altimeters

4.14.4 OM and Checklist

4.14.4.1 Operator's OM contains RNP AR DP procedure, which should at minimum contain the following:

a. Preflight procedure, including cockpit preparation
b. Take-off and climb-out procedure
c. RNP AR DP contingency
d. ATC flight planning
e. LNAV performance verification for close-in RF legs
f. Aircraft performance analysis for the take-off and climb-out phase

4.14.4.2 RNP AR DP checklist

Operators have developed the RNP AR DP Checklist.

4.14.5 Conditions of operation

a. The operators must conduct RNP AR DP validation flight for getting authorization or approval.
b. Operators will initially get conditional authorization until completion of 100 trial operations.
c. At all times during the departure, the pilot in command must ensure that the departure is flown in accordance with the current approved navigation database and the navigation performance scales showing the ANP are displayed to both pilots.
d. Before the trial begins for an aerodrome, operators must give CAAN a study, acceptable to CAAN, of:
   - the likely environmental effects of the conduct of the trial at the aerodrome; and
   - the measures that would be taken by Operator to mitigate those effects.
e. Operators must ensure that all RNP AR departures are monitored by its Quality Assurance program, which must record at least the following events and inform to CAAN at every three months:
   - UNABLE RNP Messages (NAV accuracy downgrade information);
   - Cross track error appropriate to the RNP value of the departure;
   - Vertical deviation of 100 ft above or 50 ft below the VNAV path;
   - EGPWS or TAWS warning;
   - AP disconnect;
   - NAVDATA errors
   - Pilot report of nay anomaly

Note 1: The provisions for authorization or approval of RNP AR DP mentioned in this section 4.14 have been developed taking into reference of the following:

a. ICAO Doc 9613, Doc 9905 and Doc 9997
b. the discussions in the ICAO forums
c. the procedures adopted by the States who have already implemented RNP AR DP and
d. Industry practices.

Note 2: The provisions for authorization or approval of RNP AR DP as mentioned in this section will be modified if Doc 9613 and/or Doc 9997 will incorporate the provisions for RNP AR DP in future, or at any time when it is deemed necessary in the interest of safety of aircraft operation.

RNP AR DP Job Aid

#	*Topic*	***Supporting Document Reference numbers***	***Operator compliance description***	***Inspector disposition/ comments***	***Follow-up by inspector (optional)***
		CAAN PBN OPS Approval Manual Procedures & Policies etc	*Document reference/ method*	*Accepted/not accepted*	*Status and date*
1	**Authorization request** Statement of intent to obtain authorization for RNP AR DP.	4.14.2.1 a.			
2	**RNP AR APCH capability** Aircraft holding authorization for RNP AR APCH or be qualified for this NAVSPEC	4.14.2.1 b.			
3	**Availability of EOSID** Availability of RNP AR EOSID or RNP AR DP procedure capable of accommodating engine out performance	4.14.2.1 c.			
4	**Aircraft system eligibility** AFM endorsement for RNP AR DP.	4.14.2.1 d.			
5	**Crew Qualification/Training** Details of courses/training completed including SIM Training programmes addressing RNP AR DP	4.14.2.1 e.			
6	**MEL** MEL update concerning RNP AR DP	4.14.2.1 f.			
7	**Safety assessment** FOSA addressing RNP AR DP related risks	4.14.2.1 g.			

8	**System requirement** 8.1 Use of performance tool(s) necessary to ensure Compliance with take-off/ climb performance demands of RNP AR DP 8.2 Able to loading and executing a flight plan where the RNP AR DP defined path begins at or just beyond the DER, including use of an RF leg 8.3 Able to provide lateral path guidance (i.e., engage LNAV) no later than 50FT above the DER during take-off 8.4 Capable of reversion to IRS-only navigation in case of the loss of GNSS at any point during the procedure 8.5 Equipment required for RNP AR DP as mentioned in para 4.8.3.2	4.14.3.1 a. 4.14.3.1 b. 4.14.3.1 c. 4.14.3.1 d. 4.14.3.2			
9	**Operating Policies and Procedures** Procedures in OM and checklists concerning RNP AR DP 9.1 OM should at minimum contains: a. Pre-flight procedure, including cockpit preparation b. Take-off/Climb procedure c. RNP AR DP contingency d. ATC flight planning especially considering Field 10 a and Field 18 e. LNAV performance verification for close-in RF legs f. Aircraft performance analysis for take-off/climb-out phase 9.2 RNP AR DP checklist Operators have developed the RNP AR DP Checklist	4.14.4.1 4.14.4.1 a. 4.14.4.1 b 4.14.4.1 c. 4.14.4.1 d. 4.14.4.1 e. 4.14.4.1 f. 4.14.4.2 .			

Summary of the paper to be included in the meeting report-

Nepal presented the detailed OPS Approval Guidance that they developed for the operational approval of RNP AR DP. They also shared their experiences of granting the RNP AR DP OPS Approval and the flight planning arrangement they made. Nepal further called for a meeting to note the concept and requested meeting to provide necessary feedbacks or suggestions to improve the guidance.