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PBN Implementation in Tehran FIR

1. Purpose

The purpose of this circular is to provide information concerning implementation of PBN in En-route, Terminal and Approach phases in Tehran FIR.

2. Introduction

The Performance-based Navigation (PBN) concept specifies that aircraft RNAV or RNP system performance requirements be defined in terms of accuracy, integrity, continuity and functionality required for the proposed operations in the context of a particular airspace concept, when supported by the appropriate navigation aid (NAVAID) infrastructure. Compliance with WGS 84 and data quality prescribed in Annex 15 are integral into PBN.

The PBN concept represents a shift from sensor-based to performance-based navigation. Performance requirements are identified in navigation specifications, which also identify the choice of navigation sensors and equipment that may be used to meet the performance requirements. These navigation specifications provide specific implementation guidance for States and operators in order to facilitate global harmonization.

3. En-route phase

En-route phase refers to that portion of flight which is greater than or equal to 30 NM from departure or destination Aerodrome Reference Point (ARP).

Within Tehran FIR, RNAV 5 based on GNSS has been implemented for Airways listed under ENR 3.1 and 3.3 of AIP.

All aircraft, other than state aircraft (defined by ICAO as aircraft used by military, customs and police services), operating in RNAV 5 ATS routes are to be equipped with the appropriate navigation equipment that meets or exceeds RNAV 5 requirements in accordance with item 6.1 of this AIC. Aircraft not suitably equipped is required to operate on conventional (non-RNAV) ATS routes.

To be eligible for RNAV 5 operations on-board navigation equipment will be required to provide En-route lateral track keeping accuracy of +/- 5 NM or better for 95% of the flight time.

Where position information derived from GNSS is the only input to the RNAV system, it is incumbent upon operators to confirm that the necessary coverage from GNSS is provided for the intended flight (route and time). The availability of GNSS integrity (Receiver Autonomous Integrity Monitoring (RAIM)) should be obtained from an on-board equipment function.

4. Terminal phase

Terminal phase refers to that portion of flight including SIDs, STARs, initial and intermediate approaches less than 30 NM of the Aerodrome Reference Point (ARP).

The RNAV 1 navigation specification is primarily developed for RNAV operations in a radar environment (for SIDs, radar coverage is expected prior to the first RNAV course change). The Basic-RNP 1 navigation specification is intended for similar operations outside radar coverage. However, RNAV 1 may be used in a non-radar environment or below ATC surveillance minimum altitude clearance (ASMAC) if the implementing State ensures appropriate system safety and accounts for lack of performance monitoring and alerting.

5. Approach phase

Approach phase refers to that portion of flight including Final Approach and Missed Approach Procedures.

5.1 Description

5.1.1 APV provides vertical guidance for pilots to reduce the risk of Controlled Flights into Terrain (CFITs). Due to the reduced risk of APV operation in comparison with Non-Precision Approaches, the 36th Session of the ICAO Assembly adopted Resolution A36-23 urging all States to implement APV procedures to all runway ends serving aircraft with a maximum take-off mass of 5700 kg or more.

5.1.2 Barometric Vertical Navigation (Baro-VNAV) is a navigation system which presents computed vertical guidance to the pilot referenced to a specific Vertical Path Angle (VPA). The onboard avionics computer resolves vertical guidance data based on barometric altitude and is either computed as a geometric path between two waypoints or an angle from a single waypoint. Although the approaches provide vertical guidance they do not meet the more stringent standards of a precision approach.

5.1.3 The APV Baro-VNAV procedures has been designed in accordance with criteria for Area Navigation (RNAV) approach procedures using barometric vertical navigation as stipulated in the ICAO PANS-OPS (Doc 8168) Volume II.

5.1.4 Due to the fact that various Baro-VNAV systems exist and some of them do not have the possibility to correct the altitude for non-standard temperatures, the actual glide path angle is reduced for those systems. The errors are considered in the design of the Approach Obstacle Clearance Surface, thus a minimum temperature will be depicted on the Approach Chart.

5.1.5 APV Baro-VNAV procedures are not permitted when the aerodrome temperature is below the promulgated minimum aerodrome temperature for the procedure unless the RNAV system is equipped with approved cold temperature compensation for final approach.

5.2. Missed approach

5.2.1 The availability of RAIM-reinforced GPS for missed approach is higher than the availability required for final approach. As a matter of fact, the accuracy of navigation required for missed approach is 1 NM for 95% of time vs. 0.3 NM for 95% of time for final approach. Therefore, RAIM availability forecasts obtained through NOTAM or tools specific to operators are not representative of missed approach availability. The main event leading to a simultaneous loss of GNSS guidance during final approach and missed approach is interference due to jamming.

5.2.2 If the missed approach path is a RNAV procedure (not relying on conventional radio navigation means), after initiating a go-around or missed approach following loss of GNSS, the aircraft must automatically revert to another means of navigation that complies with the navigation accuracy.

6. Aircraft Requirements

6.1 RNAV 5 Specifications

RNAV 5 operations are based on the use of RNAV equipment which automatically determines the aircraft position using input from one or a combination of the following types of position sensors, together with the means to establish and follow a desired path:

a) VOR/DME;
b) DME/DME;
c) INS or IRS; if automatic radio updating is not carried out, a time limit of 2 hours usually applies from the last on ground position update;
d) GNSS; receivers must be approved in accordance with ETSO C129 (a),FAA TSO C129 (a) or later.(ETSO C129 or FAA TSO C129 is also applicable provided they include pseudo-range step detection and health word checking functions);

Note: For more details refer to ICAO PBN Manual (Doc 9613 - Part B Chapter 2) and PBN operational approval manual (Doc 9997 – Chapter 4 – 4.2)

6.2 RNAV 1 Specifications

RNAV 1 operations are based upon the use of RNAV equipment that automatically determines the aircraft position in the horizontal plane using input from the following types of position sensors (no specific priority):

a) GNSS; receivers must be approved in accordance with ETSO C129 (a), FAA TSO C129 (a) or later. (ETSO C129 or FAA TSO C129 is also applicable provided they include pseudo-range step detection and health word checking functions);
b) DME/DME; accuracy is based upon TSO-C66c, system must be capable of auto-tuning multiple DME facilities, obtaining a position update within 30 seconds of tuning, maintaining continuous updating and performing reasonableness checks;
c) DME/DME/IRU; IRU performance in accordance with US 14 CFR Part 121 Appendix G, automatic position updating from the DME/DME position and must not allow VOR inputs to affect position accuracy;

Note: For more details refer to ICAO PBN Manual (Doc 9613 - Part B Chapter 3) and PBN operational approval manual (Doc 9997 – Chapter 4 – 4.3)

6.3 Basic – RNP 1 Specifications

The following systems meet the accuracy, integrity and continuity requirements of these criteria:

a) aircraft with E/TSO-C129a sensor (Class B or C), E/TSO-C145 and the requirements of E/TSO-C115b FMS, installed for IFR use in accordance with FAA AC 20-130A;
b) aircraft with E/TSO-C129a Class A1 or E/TSO-C146 equipment installed for IFR use in accordance with FAA AC 20-138 or AC 20-138A;
c) aircraft with RNP capability certified or approved to equivalent standards.

Note: For more details refer to ICAO PBN Manual (Doc 9613 - Part C Chapter 3) and PBN operational approval manual (Doc 9997 – Chapter 4 – 4.5)

6.4 RNP Approach Specifications

See Doc 9613 - Part C Chapter 5 and PBN operational approval manual (Doc 9997 – Chapter 4 – 4.6)

7. Contingency procedures

The pilot must notify ATC of any loss of the RNAV/RNP capability, together with the proposed course of action. If unable to comply with the requirements of an RNAV/RNP procedure, pilots must advise ATS as soon as possible and expect receive instruction from ATC to continue conventional navigation. The loss of RNAV/RNP capability includes any failure or event causing the aircraft to no longer satisfy the RNAV/RNP requirements of the procedure.

8. GNSS Coverage

Operators are in charge of ensuring expected coverage and availability of GNSS for flights they schedule. For a RNAV(GNSS) approach leading to LNAV or LNAV/VNAV minima, the operator must ensure, upon flight preparation, availability of the RAIM function (or any equivalent function) at estimated time for arrival (ETA) +/-15 minutes using, either RAIM NOTAMs (included in Preflight Information Bulletin), or the forecast tool of onboard equipment (or a software with the same function as onboard equipment).In the latter case, information on possible unavailability of satellites shall be entered in forecast program. Furthermore, if the forecast tool uses a specific masking angle, the operator shall ensure that the masking angle chosen is consistent with that of onboard equipment.

9. Phraseology

9.1 RNAV (GNSS) approaches will be handled by Air Traffic Service Units in the same way as other NPAs.

9.2 The RTF phraseology to be used when flying a RNAV (GNSS) approach is detailed below:

Checking if aircraft able to accept RNAV SID/STAR. **ATC: Advise if able (designator) DEPARTURE [or ARRIVAL]**
Pilots should request clearance to fly the procedure using the phraseology:(In any case, ATC shall not initiate a RNAV approach procedure) **Pilot: request [type of RNAV approach], via (Initial Approach Fix Designator), runway xx**
Where traffic conditions permit, ATC clear the pilot to follow the procedure using the following phraseologies: **ATC: Clear to (Initial Approach Fix Designator) via (name of RNAV STAR) expect [type of RNAV approach], runway xx** **ATC: Cleared direct (Initial Approach Fix Designator) for [type of RNAV approach] runway xx**
Aircraft should normally be cleared to an Initial Approach Fix (IAF). Controllers should not issue, and pilots should not accept vectors to any point inside the Intermediate Fix (IF) at any time. When necessary for operational or traffic reasons, aircraft may be vectored to a point not later than the IF using the phraseology: **Pilot: request radar vector for [type of RNAV approach], runway xx** **ATC: vectoring for [type of RNAV approach], runway xx**

For traffic sequencing and to aid situational awareness, air traffic controllers may request the pilot to report when established on final approach track or to report at any other relevant point in the procedure using the phraseology:

ATC: report established on final approach track

ATC: report 3 miles from final approach fix

ATC: report final approach fix

After reaching the final approach fix, the pilot will continue to fly the procedure towards the next waypoint (normally the runway threshold). At the appropriate time, the pilot will either continue with the air traffic clearance received or will execute the Missed Approach Procedure (MAP)

When Air Traffic Control is aware of problems with the GNSS system, the following phraseology shall be used:

ATC: GNSS REPORTED UNRELIABLE (or GNSS MAY NOT BE AVAILABLE [DUE TO INTERFERENCE]);

i) IN THE VICINITY OF (location) (radius) [BETWEEN (levels)]

or

ii) IN THE AREA OF (description) (or IN (name) FIR) [BETWEEN (levels)]

ATC: GNSS UNAVAILABLE FOR (specify operation) [FROM (time) TO (time) (or UNTIL FURTHER NOTICE)]

A RAIM alert indicates to the pilot that the GNSS system is unavailable either due to insufficient satellites in view or a fault in the system; in these cases the pilot will break off the approach. Following a RAIM indication, pilots shall inform the controller of the event together with their intentions.

Pilot: GNSS UNAVAILABLE (DUE TO [reason, e.g. LOSS OF RAIM or RAIM ALERT]) (intentions)

Pilot: Loss of RAIM or RAIM alert (intentions)

Pilot: UNABLE RNAV [DUE TO (reason, e.g. LOSS OF RAIM or RAIM ALERT)] (intentions)

10. Separation

10.1 En-route

When Radar service is available. Details are found in AIP ENR 1.6

When Radar service is not available. For aircraft cruising, climbing or descending on the same track, the following separation minimum may be used:

Separation minimum	NAV Specification	Communication requirement	Surveillance requirement	Distance verification requirements
50 NM	RNAV 5	Direct controller-pilot communications	Procedural position reports	At least every 32 minutes

10.2 TMAs and CTRs

When Radar service is available. Details are found in AIP ENR 1.6

When Radar service is not available. *Under Development*

11. Flight Planning. Details are found in AIP ENR 1.10

12. Additional Information

Further information on planning and implementation issues for PBN can be obtained from:

- Procedure Design Office:
  Tel: +98 21 44544104
  Tel fax: +98 21 44544111
  Email: p.design@airport.ir

- Civil Aviation Organization-Deputy of flight standard

  Tel: +98 21 61022120, 66025045
  Fax: +98 21 66036552
  Email: standard@cao.ir

AIC 6/08 Cancelled

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