



## ASSEMBLY — 36TH SESSION

### TECHNICAL COMMISSION

#### Agenda Item 31: Continued evolution of a performance-based global air traffic management (ATM) system

#### IMPLEMENTATION OF THE CONCEPT OF PERFORMANCE BASED NAVIGATION

##### EXECUTIVE SUMMARY

This paper discusses the worldwide growing importance of PBN in respect of aviation safety and presents a plan to ensure a globally harmonized and coordinated transition to PBN by 2016 for international and domestic operations. The paper presents, in broad terms, the proposed responsibilities of ICAO, States and other stakeholders in the implementation of PBN. It also proposes the adoption of an Assembly resolution on performance based navigation global goals.

**Action:** The Assembly is invited to:

- a) agree that in the interest of safety and efficiency of air navigation, States should start to develop PBN implementation plans as a matter of importance; and
- b) adopt the resolution contained in the appendix to this working paper relating to performance based navigation.

<i>Strategic Objectives:</i>	This working paper relates to Strategic Objectives A and D with regard to all phases of flight, and especially in the approach through widespread implementation of approach procedures with vertical guidance. It also relates to Strategic Objectives C and D through the design of ATS routes that maximize efficiency while simultaneously minimizing the effect on the environment.
<i>Financial implications:</i>	Adequate financial support is essential to guarantee that aviation requirements are consistently met.
<i>References:</i>	Doc 9613, <i>Performance Based Navigation Manual</i> (final draft) Doc 9848, <i>Assembly Resolutions in Force (as of 8 October 2004)</i> AN-CONF/11 Report State letter AN 11/45-07/22

## 1. INTRODUCTION

1.1 The Eleventh Air Navigation Conference (Montreal, 22 September to 3 October 2003) recommended that ICAO, as a matter of urgency address and progress the issues associated with the introduction of required navigation performance (RNP) and area navigation (RNAV) (Recommendation 6/5 refers).

1.2 Furthermore, ICAO established a focal group to address a divergence of implementation that resulted in lack of harmonization between RNP applications and the significant confusion that had developed regarding concepts, terminology and definitions.

1.3 Based on the foregoing, ICAO developed the performance based navigation (PBN) concept. This concept includes two key “building block” elements: RNAV and RNP. PBN brings together, under one umbrella, a number of diverse RNAV and RNP applications encompassing all regimes of flight, from enroute to approach. PBN provides a framework of harmonized modern navigation operational approval requirements that make use of available navigation systems and aircraft capability. In addition to enhanced safety, it will provide significant benefits in terms of fuel savings, accessibility and flexibility in terminal areas and in addressing environmental problems (emissions and noise).

1.4 The discussions during the Worldwide Symposium on Performance of the Air Navigation System also identified a need to accelerate the implementation of PBN. Noting the significant demand expressed by States to commence implementation of air traffic services (ATS) routes and instrument flight procedures based on PBN, and in order to avoid proliferation of operational approval requirements, State letter AN 11/45-07/22, containing guidance material on implementing PBN, was distributed on 27 April 2007. This guidance material will become Volume II of the *Performance Based Navigation Manual* (Doc 9613) currently posted as final draft on the ICAO-NET.

1.5 Since the PBN concept is now established, this working paper discusses the need for ensuring a globally harmonized and coordinated transition to PBN by 2016 for international and domestic operations. The paper presents, in broad terms, the responsibilities of Contracting States, ICAO and other stakeholders in the implementation of PBN. In particular, it explains the need for ICAO to assume a leadership role through a coordinated effort to ensure harmonized implementation and that ICAO provisions maintain currency with operational demand.

## 2. STATE RESPONSIBILITIES

2.1 States are ultimately responsible for the safe and efficient operation of their national airspace systems including the provision for safe instrument flight procedures and safety oversight of their service providers and operators. In keeping with this responsibility and considering the benefits of PBN expressed in paragraph 1.3, States are urged to ensure that all RNAV and RNP operations and procedures are in accordance with the PBN concept as detailed in State letter AN 11/45-07/22 and the PBN manual. This is necessary in order to maintain global harmonization.

2.2 Proper planning is required in order to maximize the chances of success in achieving the benefits of PBN. Plans are built around achieving goals or objectives. At a global level, to reduce controlled flight into terrain (CFIT), to increase efficiency, capacity, aerodrome access and address environmental issues, the following performance objectives and intermediate milestones for implementation of international and domestic PBN operations are proposed:

- a) where RNAV operations are required, enroute (oceanic and continental) and terminal ATS routes should be implemented according to PBN by 2016, with intermediate milestones as follows:

- 1) enroute oceanic and remote airspace (RNAV 10 or RNP 4): 100 per cent implementation by 2010;
  - 2) enroute continental airspace (RNAV 5, 2 and 1): 70 per cent by 2010, 100 per cent by 2014; and
  - 3) terminal area (RNAV 1 and 2, and basic RNP 1): 30 per cent by 2010, 60 per cent by 2014, 100 per cent by 2016; and
- b) all instrument runway ends should have an approach procedure with vertical guidance (APV), either as the primary approach or as a back-up for precision approaches by 2016 with intermediate milestones as follows: 30 per cent by 2010, 70 per cent by 2014.

2.3 ICAO proposes that all States should have a PBN implementation plan in place by 2009, geared towards achieving the global PBN implementation performance objectives. Guidance on developing the PBN implementation plan is contained in Doc 9613. The plan should be developed in full cooperation and coordination with all stakeholders, including regulators, air navigation service providers (ANSPs), aerodrome operators, air operators and others, as appropriate. Some States may wish to implement PBN sooner than the performance objectives stated above, in order to more quickly take advantage of the benefits that PBN has to offer. Other States might not be able to comply with all aspects of the performance objectives (e.g. operational constraints); however, this should be clearly substantiated in the implementation plan.

### **3. ICAO'S LEADERSHIP ROLE IN PBN**

3.1 In order to achieve the targets set under paragraph 2 above, ICAO needs to be actively involved in assisting States in PBN implementation. This is especially important as PBN is a complex matter and expertise in States might not be readily at hand. A coordinated effort that includes the involvement of the ICAO Air Navigation and Technical Cooperation Bureaux, the Regional Offices and the Planning and Implementation Regional Groups (PIRGs) should facilitate the uniform implementation of PBN by States.

3.2 Such a coordinated effort would support Global Planning Initiatives (GPIs) as defined in the latest edition of the ICAO Global Air Navigation Plan, and Global Safety Initiatives (GSIs) as defined in the latest edition of the ICAO Global Aviation Safety Plan. It would also constitute an expansion of the programme envisaged by the 33rd Session of the Assembly when adopting Resolution A33-16, *ICAO Global Aviation Safety Plan (GASP)* that requested the Council "to develop a programme to encourage States to implement approach procedures with vertical guidance (APV) utilizing such inputs as GNSS or DME/DME, in accordance with ICAO provisions."

3.3 The coordinated effort should include the following tasks:

- a) facilitate the implementation of PBN by States in the enroute, terminal and approach phases of flight, with special emphasis on approach procedures with vertical guidance through:

- 1) familiarization with the PBN concept through ICAO seminars;
  - 2) coordination and assistance to States, using existing processes, regarding development of their PBN implementation plans; and
  - 3) coordination and assistance to States, using existing processes, regarding execution of their implementation plans; and
- b) ensure development and/or maintenance of globally harmonized PBN-related Standards and Recommended Practices (SARPs) and guidance material to maintain currency with operational demands by:
- 1) aligning current ICAO SARPs and guidance material with the PBN concept; and
  - 2) monitoring the need for new operational requirements and develop new guidance material and SARPs as necessary to address these new requirements.

#### 4. **RESPONSIBILITIES OF OTHER STAKEHOLDERS**

4.1 To maximize success and to capitalize on the benefits, it is crucial that stakeholders, including industry, ANSPs, aerodromes, air operators, environmental organizations, aviation-related organizations and others, are encouraged to cooperate with States in their implementation and to commit the resources necessary to carry out their part of the strategy.

#### 5. **CONCLUSION**

5.1 Strong ICAO leadership is essential in order to produce a coordinated work programme with support of States and all stakeholders, to achieve the performance objectives for PBN implementation. As a matter of high importance, States should develop an implementation plan and ensure compliance with the dates indicated in the plan. This will be a significant step toward a global performance based air navigation system for the future.

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## APPENDIX

### A36 – DRAFT RESOLUTION

A36-xx:	Performance based navigation global goals
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*Whereas* a primary objective of ICAO is that of ensuring the safe and efficient performance of the global Air Navigation System;

*Whereas* the improvement of the performance of the Air Navigation System on a harmonized, worldwide basis requires the active collaboration of all stakeholders;

*Whereas* the Eleventh Air Navigation Conference recommended that ICAO, as a matter of urgency, address and progress the issues associated with the introduction of area navigation (RNAV) and required navigation performance (RNP);

*Whereas* the Eleventh Air Navigation Conference recommended that ICAO develop RNAV procedures supported by global navigation satellite system (GNSS) for fixed wing aircraft, providing high track and velocity-keeping accuracy to maintain separation through curves and enable flexible approach line-ups;

*Whereas* the Eleventh Air Navigation Conference recommended that ICAO develop RNAV procedures supported by GNSS for both fixed and rotary wing aircraft, enabling lower operating minima in obstacle rich or otherwise constrained environments;

*Whereas* Resolution A33-16 requested the Council to develop a programme to encourage States to implement approach procedures with vertical guidance (APV) utilizing such inputs as GNSS or distance measuring equipment (DME)/DME, in accordance with ICAO provisions and *recognizing* that implementation of approach with vertical guidance (APV) is still not widespread;

*Recognizing* that the Global Aviation Safety Plan has identified Global Safety Initiatives (GSIs) to concentrate on developing a safety strategy for the future that includes the effective use of technology to enhance safety, consistent adoption of industry best practices, alignment of global industry safety strategies and consistent regulatory oversight;

*Recognizing* that the Global Air Navigation Plan has identified Global Plan Initiatives (GPIs) to concentrate on the incorporation of advanced aircraft navigation capabilities into the air navigation system infrastructure, the optimization of the terminal control area through improved design and management techniques, the optimization of the terminal control area through implementation of RNP and RNAV SIDs and STARs and the optimization of terminal control area to provide for more fuel efficient aircraft operations through FMS-based arrival procedures; and

*Recognizing* that the continuing development of diverging navigation specifications would result in safety and efficiency impacts and penalties to States and industry;

*The Assembly:*

1. *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 Manual* (Doc 9613);

2. *Resolves that:*

a) States and/or regions develop an implementation plan by 2009 to achieve the following goals:

i) where RNAV operations are required, enroute (oceanic and continental) and terminal ATS routes should be implemented according to PBN by 2016, with intermediate milestones as follows:

1) enroute oceanic and remote airspace (RNAV 10 or RNP 4): 100 per cent implementation by 2010;

2) enroute continental airspace (RNAV 5, 2 and 1): 70 per cent by 2010, 100 per cent by 2014; and

3) terminal area (RNAV 1 and 2, and basic RNP 1): 30 per cent by 2010, 60 per cent by 2014, 100 per cent by 2016; and

ii) all instrument runway ends should have an approach procedure with vertical guidance (APV), either as the primary approach or as a back-up for precision approaches by 2016 with intermediate milestones as follows: 30 per cent by 2010, 70 per cent by 2014.

b) ICAO develop a coordinated action plan to assist States in the implementation of PBN and to ensure development and/or maintenance of globally harmonized SARPs and guidance material to keep pace with operational demands;

3. *Instructs* the Council to provide a progress report on PBN implementation to the next ordinary session of the Assembly; and

4. *Requests* the Planning and Implementation Regional Groups (PIRG) to include in their work programme the review of status of implementation of PBN by States according to the defined implementation plans and report to ICAO any deficiencies that may occur.

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