

International Civil Aviation Organization
Eastern and Southern African Office

**Eleventh Meeting of the Air Traffic Services/Aeronautical Information
Service/Search and Rescue Sub-Group (ATS/AIS/SAR SG/11)
(Nairobi, Kenya, 26 - 30 April 2010)**

Agenda Item 3: APIRG Performance Objectives

Agenda Item 6: Performance – Based Navigation (PBN) and AFI ATS Route Network

Review of Draft Amendment to AFI Regional PBN Roadmap:

RNP APCH with Baro-VNAV Navigation Specification versus RNP APCH APV

(Presented by the International Air Transport Association)

SUMMARY
<p>This working paper analyzes an amendment proposal developed by the First Joint Meeting of the APIRG PBN and GNSS Task Forces, aimed to replace RNP APCH with Baro-VNAV specification by RNP APCH APV, and recommends further assessment of the proposal.</p> <p>It proposes that, meanwhile, the AFI Regional PBN Roadmap Edition endorsed by the 10th Meeting of APIRG ATS/AIS/SAR Sub-group should remain applicable.</p>
<p>REFERENCES:</p> <ul style="list-style-type: none">• Report of the ICAO Special AFI RAN Meeting (2008)• Report of the First Joint Meeting of the APIRG PBN and GNSS Implementation Task Forces.• Report of the 10th Meeting of APIRG ATS/AIS/SAR Sub-group.

1. INTRODUCTION

1.1. This working paper analyses a draft amendment to the AFI Regional PBN Roadmap proposed by the First Meeting of the Joint PBN and GNSS Implementation Task Forces Meetings (Nairobi, Kenya 8-10 September 2009) under Draft Conclusion 1/5, and recommends further assessment of the proposed amendment.

2. DISCUSSION

2.1. The proposed amendment which is intended to “more accurately reflect PBN implementation goals in Assembly Resolution A36-23 and guidance in the PBN Manual (Doc 9613)” consists in replacing the ICAO concept of RNP APCH with Baro-VNAV which is in the PBN Manual by a new concept termed “RNP APCH APV”. It is based on the statement that ICAO will no longer specify the GNSS systems (or combination of the systems) that should be used to support PBN requirements.

RNP APCH with Baro-VNAV

2.2. Assembly Resolution A36-23 explicitly refers to APV (with Baro-VNAV and/augmentation systems) (see **Attachment A** to this paper) and Baro-VNAV is clearly defined in ICAO Annexes 6 and 10, PANS-OPS (Doc 8168) and PBN Manual (Doc 9613) which provide detailed guidance.

2.3. Like other ICAO Regions, the AFI Region has included a requirement for RNP APCH with Baro-VNAV in the following reference documents:

- a) Report of the ICAO Special AFI RAN (2008) : A copy of the regional and national performance objectives for vertically guided RNP approaches adopted by the SP AFI RAN 2008 is shown in **Attachment B** to this paper;
- b) AFI Regional PBN Roadmap and State PBN Plan Template: These documents were developed by the 2nd Meeting of the PBN Task Force (Nairobi, December 2008), and endorsed by the 10th Meeting of the ATS/AIS/SAR Sub-group (Dakar, May 2009);
- c) AFI State PBN Action Plan Template for Approach: This document is consistent with the Sample Action Plan developed by the Global PBN Task Force specifying RNP approaches with Baro-VNAV under Process 3.

2.4 An example of promulgation of APV/Baro-VNAV in EUR Region is *AIC IFR 3 of 12 February 2009* published by the Federal Republic of Germany on the Implementation of Approach Procedures with Vertical Guidance (APV) by means of Barometric Navigation (Baro-VNAV) in German airspace ([German AIC IFR 3.pdf](#)). The FAA AC No. 90-105 of 23 January 2009 on Approval Guidance for RNP Operations and Barometric Vertical Navigation in the U.S. National Airspace System is another example in NAM Region ([FAA AC 90-105.pdf](#)).

2.5 If the proposed amendment is meant to include APV/SBAS (LPV)¹, the meeting may recall that an amendment proposal to PANS-OPS, Volume I concerning the use of SBAS equipment to fly APV/Baro-VNAV procedures, is being processed by ICAO as stated in the Report of the 2nd Joint Meeting of AFI PBN and GNSS/I Task Forces.

¹ APV/SBAS (LPV) is currently out of the scope of ICAO PBN Manual.

2.6 Additionally, Attachment to the ICAO PBN Manual, Volume II contains specifications on Baro-VNAV aimed to:

- a) Provide guidance to States implementing instrument flight procedures where Barometric VNAV is authorized for RNP APCH approaches and RNP AR APCH, where approved;
- b) Provide the air navigation service provider with a consistent ICAO recommendation on what to implement;
- c) Reflect for the operator airworthiness guidance material that has existed for over 20 years;
- d) Facilitate operational approval for existing Barometric VNAV systems that have demonstrated their capabilities and obtained regulatory approval for usage. An operational approval based upon this standard allows an operator to conduct Barometric VNAV operations globally; and
- e) Provide airworthiness and operational criteria for the approval of an RNAV system using barometric altimetry as a basis for its vertical navigation capability.

RNP APCH APV

2.7 The amendment proposal does not define the concept of RNP APCH APV. Currently, approach with vertical guidance (APV) can only be related to two PBN Navigation Specifications:

- a) RNP APCH with Baro-VNAV; and
- b) RNP AR APCH. Early implementations thereof utilize Baro-VNAV and design criteria only support Baro-VNAV guidance systems (ICAO Doc 9905 refers).

2.8 As such, the proposed amendment is tantamount to limit APV procedures to RNP APCH with Baro-VNAV only.

PBN Implementation Targets

2.9 The AFI Roadmap implementation targets are summarized as follows:

Short-Term (2008-2012)

- a) RNP APCH (with Baro-VNAV) in 30% of instrument runways by 2010 and 50% by 2012 and priority given to airports with operational benefits.
- b) RNAV-1 SID/STAR for 30% of international airports by 2010 and 50% by 2012 and priority given to airports with RNP Approach.

- c) Review existing conventional and RNAV routes to transition to PBN RNAV-5 or where operationally required RNAV-2/1 by 2012.

Medium-Term (2013-2016)

- a) RNP APCH (with Baro-VNAV) or APV in 100% of instrument runways by 2016.
- b) RNAV-1 or RNP-1 SID/STAR for 100% of international airports by 2016.
- c) RNAV-1 or RNP-1 SID/STAR for 70% of busy domestic airports where there are operational benefits
- d) Implementation of additional RNAV/RNP Routes as required.

3 ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) Note the above analysis of the amendment proposed to the AFI PBN Regional Roadmap under Draft Conclusion 1/5 of the 1st Joint Meeting of AFI PBN and GNSS Implementation Task Forces;
- b) Assess the relevance of the proposed amendment in the light of Assembly Resolution 36-23 and existing ICAO global and regional guidance relating to RNP APCH with Baro-VNAV and accordingly advise on the course of action to be taken thereon;
- c) Confirm that the AFI Regional PBN Roadmap Edition endorsed by the 10th Meeting of APIRG ATS/AIS/SAR Sub-group remains applicable; and
- d) Accordingly engage States to meet the PBN implementation targets set in the AFI Regional PBN Roadmap.

ATTACHMENT A

ASSEMBLY RESOLUTION A36-23

(Extract)

Performance based navigation global goals

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 planning and implementation regional groups (PIRGs) complete a PBN implementation plan by 2009 to achieve:
 - 1) implementation of RNAV and RNP operations (where required) for en route and terminal areas according to established timelines and intermediate milestones; and
 - 2) implementation of approach procedures with vertical guidance (APV) (Baro-VNAV and/or augmented GNSS) for all instrument runway ends, 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; and
 - 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, Procedures for Air Navigation Services (PANS) and guidance material including a global harmonized safety assessment methodology to keep pace with operational demands;
3. *Urges* that States include in their PBN implementation plan provisions for implementation of approach procedures with vertical guidance (APV) to all runway ends serving aircraft with a maximum certificated take-off mass of 5700 kg or more, according to established timelines and intermediate milestones;
4. *Instructs* the Council to provide a progress report on PBN implementation to the next ordinary session of the Assembly; and
5. *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.

ATTACHMENT B

Extract from Appendix D to ICAO SP AFI RAN 2008 Report Regional Performance Objectives/National Performance Objectives Optimization of Vertically Guided RNP Approaches				
Benefits				
Safety	<ul style="list-style-type: none"> increased safety 			
Environment	<ul style="list-style-type: none"> reduction in gas emissions 			
Efficiency	<ul style="list-style-type: none"> increased accessibility to aerodromes, including continuity of access increased runway capacity reduced pilot workload availability of reliable lateral and vertical navigation capability 			
Strategy				
ATM OC COMPONENTS	TASKS	TIMEFRAME START-END	RESPONSIBILITY	STATUS
AOM	<i>Approach airspace</i>	2008		
	<ul style="list-style-type: none"> develop regional implementation plan 	1Q 2008 – 1Q 2009	PBN TF	In progress
	<ul style="list-style-type: none"> develop regional action plan 	1Q 2009	PBN TF	Not started
	<ul style="list-style-type: none"> develop State PBN implementation 	1Q 2009 – 4Q 2009	State	
	<ul style="list-style-type: none"> develop airspace concept based on AFI PBN implementation plan, in order to design and implement RNP APCH with Baro-VNAV in accordance with Assembly resolution A36-23, and RNP AR APCH where beneficial 			
	<ul style="list-style-type: none"> develop performance measurement plan 			
	<ul style="list-style-type: none"> formulate safety plan 			
	<ul style="list-style-type: none"> establish collaborative decision making (CDM) process 			
	<ul style="list-style-type: none"> publish national regulations for aircraft and operators approval using PBN manual as guidance material 			
	<ul style="list-style-type: none"> identify training needs and develop corresponding guidelines 			
	<ul style="list-style-type: none"> implementation of APV procedures 	present – 2016	State	
	<ul style="list-style-type: none"> Formulate system performance monitoring plan 			
linkage to GPIs	GPI/5: performance-based navigation; GPI/7: dynamic and flexible ATS route management; GPI/8: collaborative airspace design and management; GPI/10: terminal area design and management; GPI/11: RNP and RNAV SIDs and STARs; GPI/12: FMS-based arrival procedures			