



International Civil Aviation Organization  
Western and Central African Office

**First Meeting of the APIRG Performance Based Navigation/Global Navigation Satellite System Task Force (PBN/GNSS TF/1)  
(Nairobi, Kenya, 12 - 14 October 2010)**

---

**Agenda Item 4: Status of implementation of PBN in the AFI Region**

**PBN IMPLEMENTATION IN THE AFI REGION**

(Presented by the Secretariat)

**SUMMARY**

The 36th Session of the ICAO Assembly resolved that States and planning and implementation regional groups (PIRGs) should complete a PBN implementation plan by 2009.

A regional implementation plan was completed under ICAO coordination, through the APIRG process with a view to assisting States in developing and implementing their national PBN plans. Related regional performance objectives were also developed by the ICAO Special AFI RAN Meeting (2008) and APIRG/17 Meeting (2010).

This working paper reviews the status of implementation of PBN in the AFI Region, calls for States' commitment to PBN implementation targets and requests them to provide ICAO with updates on progress made.

Action by the meeting is at **paragraph 3**.

**REFERENCES**

- ICAO PBN Manual, Doc 9613
- Assembly Resolution A36-23
- ICAO Special AFI RAN 08 Report, Doc 9930
- APIRG/17 Meeting

This Working Paper is related to Strategic Objectives: **A** and **D**

**1. INTRODUCTION**

1.1 Performance-based navigation (PBN) provides the global framework of harmonized modern navigation requirements, which did not exist previously or existed on a regional basis only, and provides the platform to implement and benefit from existing and future area navigation technologies. It includes two key "building blocks": area navigation (RNAV) and required navigation performance (RNP), the application of which encompasses all phases of flight from en-route to approach. PBN enhances safety by

providing improved flight guidance to pilots. It enables operational improvements including shortened routes, continuous climb and descent operations and enhanced approach procedures, all of which reduce fuel consumption thereby reducing aviation's environmental impact and improving safety.

## **2. DISCUSSION**

### **PLANNING OF PBN IMPLEMENTATION IN THE AFI REGION**

2.1 ICAO SARPs provide the necessary legal framework under the Chicago Convention (1944) and the referenced manuals provide support to States and stakeholders in the PBN implementation process.

2.2 The ICAO regional offices have been coordinating with States with a view to completing implementation plans through the previous PBN task force meetings, joint meetings of the PBN and GNSS task forces and meetings of APIRG ATM and CNS Sub-groups. To assist in implementation efforts, educational tools aimed at increasing awareness and understanding of PBN among all operational stakeholders have been offered in the form of PBN implementation seminar (Nairobi, Kenya, 1-4 December 2008), PBN procedure design course/Special implementation project (Dakar, Senegal, 19-30 July 2010) and PBN airspace and operational approval workshop (Johannesburg, South Africa, 6-9 September 2010).

2.3 The AFI Region has approved, through the APIRG process, a regional implementation plan for PBN (WP/4 refers). Based on this regional plan, some States have developed their national plans. All member States, including AFI States were expected to have completed these plans by the end of 2009 but due to resource and expertise shortages, the target date could not be met.

### **IMPLEMENTATION OF PBN IN THE AFI REGION**

2.4 **Appendices A, B and C** to this working paper contains the performance framework forms (PFFs) associated with agreed regional/national performance objectives for PBN, as adopted by APIRG/17 Meeting. These include:

- a) optimization of the ATS route structure in en-route airspace;
- b) optimization of the ATS route structure in terminal airspace; and
- c) optimization of vertically guided RNP approaches.

2.5 **Appendix D** to this working paper contains an action plan that indicates the following:

- d) the current status of implementation by States, the Secretariat and APIRG of the SP AFI/08 RAN Meeting recommendations;
- e) specific target dates for implementation in relation to each recommendation;
- f) categorization of the recommendations in terms of short- (2010-2011), medium- (2010-2015) and long-term (ongoing) projects;
- g) challenges being encountered in the implementation of recommendations; and
- h) identified accountability for each recommendation.

## **National PBN Plans**

Twenty-two (22) States have provided their national PBN plans for their aerodromes and their terminal airspace (SIDs and STARs) directly or through their air navigation service providers. These are:

1. Benin
2. Burkina Faso
3. Cameroon
4. Central African Republic
5. Chad
6. Comoros
7. Cote d'Ivoire
8. Equatorial Guinea
9. Gabon
10. Guinea Bissau
11. Madagascar
12. Malawi
13. Mali
14. Mauritania
15. Mauritius
16. Niger
17. Rwanda
18. Senegal
19. South Africa
20. Togo
21. Uganda
22. Zimbabwe

## **PBN implementation for terminal airspace and aerodrome operations**

2.6 A very limited number of States have reported PBN implementation for terminal and/or aerodrome operations. However, RNAV/GNSS procedures continue to be developed for SIDs and STARs and non-precision approaches (NPA), based on non-PBN criteria.

## **PBN implementation for en-route operations**

2.7 Thirty-one (31) user-required routes meeting RNAV 10 specifications are being implemented, based on the target date of October 2010, under the coordination of the performance-based navigation route network development working group (PRND/WG) of the PBN/GNSS task force. At the time of writing this working paper, twenty one (21) of these new routes have been published by the States concerned. These achievements are to be added to the existing "Red Carpet" and "Gold Carpet" RNAV 10 routes.

## **3. CONCLUSION**

3.1 The meeting is invited to:

- a) Review the performance framework forms provided in Appendices A, B and C, provide comments and propose changes as required;

- b) Request those States that have not yet done so, to complete the development of national implementation plans and ensure compliance with the dates indicated in the plans; and accordingly inform ICAO of progress made on a regular basis;
- c) Note the current status of implementation by States, the Secretariat and APIRG of the SP AFI/08 RAN Meeting recommendations pertaining to PBN, and the challenges being encountered in the implementation of recommendations; and
- d) Request ICAO to pursue its efforts towards establishing an effective PBN programme with a view to assisting States in overcoming PBN implementation challenges, and ensuring implementation success

— — — END — — —

**APPENDIX A**  
**AFI REGIONAL PERFORMANCE OBJECTIVES/  
 NATIONAL PERFORMANCE OBJECTIVES FOR PBN**

**OPTIMIZATION OF THE ATS ROUTE STRUCTURE IN EN-ROUTE AIRSPACE**

<b>Benefits</b>				
<b>Environment</b>	• reduction in gas emissions			
<b>Efficiency</b>	• ability of aircraft to conduct flight more closely to preferred trajectories			
<b>Safety</b>	<ul style="list-style-type: none"> <li>• increase in airspace capacity</li> <li>• facilitate utilization of advanced technologies (e.g., FMS-based arrivals) and ATC decision support tools (e.g., metering and sequencing), thereby increasing efficiency</li> </ul>			
<b>Strategy</b>				
ATM OC COMPO+ NENTS	TASKS	TIMEFRAME START-END	RESPONSIBILITY	STATUS
<b>AOM</b>	<i>En-route airspace</i>	2008		
	• develop regional implementation plan	2008-2009	AFI PBN TF	Completed
	• develop regional action plan	2009-2010	AFI PBN TF	Completed
	• develop airspace concept based on AFI PBN regional implementation plan, in order to design and implement a trunk route network, connecting major city pairs in the upper airspace and for transit to/from aerodromes, on the basis of PBN, e.g. RNAV 10 and RNAV 5, and taking into account interregional harmonization	2009-2012	AFI PBN TF/States	In progress
	• harmonize national and regional PBN implementation plans	2010-2016	AFI PBN TF/States	On-going
	• develop performance measurement plan	2010-2012	States	In progress
	• formulate safety plan	2010-2012	States	To be developed
	• establish collaborative decision making (CDM) process	2010	States	In progress
	• publish national regulations for aircraft and operators approval using PBN manual as guidance material	2010-2011	States	To be developed
	• identify training programmes and develop corresponding guidelines	2010-2011	AFI PBN TF/States	Not started
	• identify training needs and develop corresponding guidelines	2010-2011	States	In progress
	• formulate system performance monitoring plan	2010	AFI PBN TF/States	To be developed
	• implementation of ATS routes en-route	2010-2012	AFI PBN TF/States	In progress
		• monitor implementation progress in accordance with AFI PBN implementation plan and State implementation plan.	2010 and beyond	AFI PBN TF/States

**APPENDIX B**  
**AFI REGIONAL PERFORMANCE OBJECTIVES/  
 NATIONAL PERFORMANCE OBJECTIVES FOR PBN**

<b>OPTIMIZATION OF THE ATS ROUTE STRUCTURE IN TERMINAL AIRSPACE</b>				
<b>Benefits</b>				
<b>Environment Efficiency Safety</b>	<ul style="list-style-type: none"> <li>• reduction in gas emissions</li> <li>• ability of aircraft to conduct flight more closely to preferred trajectories</li> <li>• increase in airspace capacity</li> <li>• improved availability of procedures</li> <li>• facilitate utilization of advanced technologies (e.g., FMS based arrivals) and ATC decision support tools (e.g., metering and sequencing), thereby increasing efficiency</li> </ul>			
<b>Strategy</b>				
ATM OC COMPO- NENTS	TASKS	TIMEFRAME START-END	RESPONSIBILITY	STATUS
<b>AOM</b>	<i>Terminal airspace</i>	2008		
	<ul style="list-style-type: none"> <li>• develop regional implementation plan</li> </ul>	2009	AFI PBN TF	Completed
	<ul style="list-style-type: none"> <li>• develop regional action plan</li> </ul>	2009-2010	AFI PBN TF	Completed
	<ul style="list-style-type: none"> <li>• develop State PBN implementation plan</li> </ul>	2009-2010	States	In progress
	<ul style="list-style-type: none"> <li>• develop airspace concept based on AFI PBN roadmap, in order to design and implement an optimized standard instrument departures (SIDs), standard instrument arrivals (STARs), holding and associated instrument flight procedures, on the basis of PBN and, in particular RNAV 1 and Basic-RNP 1</li> </ul>	2009-2012	PBN TF/States	In progress
	<ul style="list-style-type: none"> <li>• develop performance measurement plan</li> </ul>	2010-2012	States	In progress
	<ul style="list-style-type: none"> <li>• formulate safety plan</li> </ul>	2010-2012	States	To be developed
	<ul style="list-style-type: none"> <li>• establish collaborative decision making (CDM) process</li> </ul>	2010	States	In progress
	<ul style="list-style-type: none"> <li>• publish national regulations for aircraft and operators approval using PBN manual as guidance material</li> </ul>	2010-2011	States	To be developed
	<ul style="list-style-type: none"> <li>• identify training programmes and develop corresponding guidelines</li> </ul>	2010-2011	AFI PBN TF	To be developed
	<ul style="list-style-type: none"> <li>• identify training needs and develop corresponding guidelines</li> </ul>	2010-2011	States	In progress
	<ul style="list-style-type: none"> <li>• formulate system performance monitoring plan</li> </ul>	2010-2012	AFI PBN TF/States	In progress
	<ul style="list-style-type: none"> <li>• develop a regional strategy and work programme implementation of SIDs and STARs</li> </ul>	2009-2012	AFI PBN TF/States	In progress
<ul style="list-style-type: none"> <li>• monitor implementation progress in accordance with AFI PBN implementation roadmap and State implementation plan</li> </ul>	2010	AFI PBN TF/States	To be developed	

**APPENDIX C**  
**AFI REGIONAL PERFORMANCE OBJECTIVES/  
 NATIONAL PERFORMANCE OBJECTIVES FOR PBN**

**OPTIMIZATION OF VERTICALLY GUIDED RNP APPROACHES**

<b>Benefits</b>				
<b>Environment Efficiency Safety</b>	<ul style="list-style-type: none"> <li>• reduction in gas emissions</li> <li>• increased accessibility to aerodromes, including continuity of access</li> <li>• increased runway capacity</li> <li>• reduced pilot workload</li> <li>• availability of reliable lateral and vertical navigation capability</li> </ul>			
<b>Strategy</b>				
<b>ATM OC COMPO- NENTS</b>	<b>TASKS</b>	<b>TIMEFRAME START-END</b>	<b>RESPONSIBILITY</b>	<b>STATUS</b>
<b>AOM</b>	<i>Terminal airspace</i>	2008		
	• develop regional implementation plan	2008 – 2009	AFI PBN TF	Completed
	• develop regional action plan	2009-2010	AFI PBN TF	Completed
	• develop State PBN implementation plan	2009 – 2010	States	Implementation on a continuous basis
	• 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	2009 – 2012	AFI PBN TF/States	Implementation on a continuous basis
	• develop performance measurement plan	2010-2012	States	Implementation on a continuous basis
	• formulate safety plan	2010-2012	States	To be developed
	• establish collaborative decision making (CDM) process	2010	States	Implementation on a continuous basis
	• publish national regulations for aircraft and operators approval using PBN manual as guidance material	2010-2011	States	To be developed
	• identify training programmes and develop corresponding guidelines	2010-2011	AFI PBN TF/States	To be developed
	• identify training needs and develop corresponding guidelines	2010-2011	States	Implementation on a continuous basis
	• implementation of APV procedures	2010 - 2016	AFI PBN TF/States	Implementation on a continuous basis
	• Formulate system performance monitoring plan	2010	AFI PBN TF/States	To be developed





**APPENDIX D**  
**ACTION PLAN FOR IMPLEMENTATION OF SP AFI/08 RAN RECOMMENDATIONS**

SP AFI/08 RAN Rec./Task		Action taken/planned	Outcome	Challenges	Responsible Stakeholder	Target Date
No.	Title					
6/9	Performance-based navigation (PBN) performance objectives  Near-term project	PBN performance objectives updated by the Joint Meeting of the PBN and GNSS Task Forces have been endorsed by the ATS/AIS/SAR SG/11 in April 2010.	Performance-based regional air navigation planning and implementation	Lack of understanding of the concept and resistance to go beyond traditional ATS routes systems  States are not participating in PBN Seminars and/or sending inappropriate participants  Limited funds for Seminars, etc  Lack of training	ROs APIRG and States	2011  Update PFFs at APIRG/17 meeting
6/10	Support for establishment of an Africa ICAO flight procedures office  Short-term project	ICAO will issue a letter inviting proposals for establishment of the AFI flight procedure programme (FPP) (APIRG Conclusion 17/52)	Establishment of AFI FPO	Limited resources in the PBN programme	ICAO HQ	2011
6/13	Publication of GNSS-based RNP approach procedures Short term project	The ROs and the PBN Task Force have taken up the initiative to encourage States to bring the GNSS-based approaches into operation.	GNSS-based RNP approach procedures	Funds to be provided for hands-on guidance to States  Lack of confidence on GNSS supported	ROs APIRG States	2010  Update at APIRG/17 meeting

SP AFI/08 RAN Rec./Task		Action taken/planned	Outcome	Challenges	Responsible Stakeholder	Target Date
No.	Title					
				navigation		
6/14	ICAO assistance with legal and regulatory issues associated with implementation of GNSS approach procedures  Short- to medium-term project	A survey will be conducted by the PBN/GNSS Task Force to ascertain the level of implementation for each State in order to determine the scope of the project.	Guidance on regulatory issues related to GNSS based approach procedures	Lack of funds to provide for hands-on guidance to States	ICAO HQ	2010  Update at APIRG/17 meeting
6/28	Implementation of a Global ATM System ICAO technical cooperation project  Long-term project	States were encouraged to join ICAO TC project for implementation of performance-based air navigation plan.  A project for assistance to States in the implementation of PBN has been developed and the draft presented at APIRG/17 meeting.	Regional project for assistance to States in the implementation of performance-based air navigation systems	Need to sensitize States to understand and implement the programme	ICAO States	Implementation on continuous basis  Update at APIRG/17 meeting

— END —