

# INTERNATIONAL CIVIL AVIATION ORGANIZATION



## REPORT OF

### **Joint Meeting of the APIRG Performance Based Navigation and Global Navigation Satellite System Implementation Task Forces (Joint PBN & GNSS/I TFs) (PBN/TF/3, GNSS/TF/I/5)**

**(Nairobi, Kenya, 8 – 10 September 2009)**

**Prepared by the Joint Meeting of the PBN and GNSS Task Forces**

**The PBN/GNSS Task Force is a Task Force of the AFI Planning and Implementation Regional Group (APIRG).**

**Its Reports are therefore submitted to APIRG through the ATS/AIS/SAR Sub-Group for review and action.**

**The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of ICAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.**

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## **PART I – HISTORY OF THE MEETING**

### **1. Introduction**

1.1 The Joint Meeting of the APIRG Performance-Based Navigation Third Meeting and Global Navigation Satellite System Fifth Meeting Implementation Task Forces (Joint PBN & GNSS/TFs) (PBN/TF/3, GNSS/TF/I/5) was convened pursuant to APIRG 16 meeting Conclusion 16/2 by the ICAO ESAF Regional Office Nairobi, from 8 to 10 September 2009.

1.2 It was opened by Mr. Boitshoko Sekwati, Regional Officer, MET, ICAO ESAF Regional Office on behalf of Mr. Geoffrey P. Moshabesha, ICAO Regional Director, Regional Office ESAF. In his opening remarks, Mr. Sekwati welcomed the participants and highlighted the importance of their attendance. He recalled that the decision to convene a joint meeting of the PBN and the GNSS Implementation Task Forces was to enhance coordination and efficiency, and urged participants to work as experts on behalf of the whole AFI Region, not just as representatives of own States.

1.3 The meeting nominated Mr. Seboeso Machobane, Regional Officer, ATM/AIS/SAR ESAF, to facilitate the deliberations of the meeting. Mr. Machobane thanked the participants for the confidence they had in him and appealed for their full cooperation and support.

### **2. Officers and Secretariat**

2.1 Mr. Seboeso Machobane, Regional Officer, Air Traffic Management (ATM/AIS/SAR) from the ICAO ESAF Office, was the Secretary of the meeting, supported: by Mr. Erwin Lassooij, Technical Officer, ATM and PBN Programme Coordinator HQ; Mr. Doug Marek, ICAO HQ; Mrs. Mary Obeng, Regional Officer Communications/Navigation and Surveillance (RO/CNS) – ESAF; and Mr. Sadou Marafa, Regional Officer, Air Traffic Management, Western and Central African Office (RO/ATM WACAF Office).

### **3. Attendance**

3.1 The meeting was attended by 40 participants from 15 States and 7 international organizations. The list of participants is at Attachment 1A to the Report.

### **4. Working Language**

4.1 The meeting was conducted in the English language.

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## 5. AGENDA

### 5.1 The following Agenda was adopted:

1. Adoption of the Agenda and Election of Chairperson.
2. Review and follow up of Recommendations, Conclusions and Decisions applicable to the Task Forces.
3. Terms of Reference of the proposed PBN/GNSS Task Force.
4. Status of implementation of PBN in the AFI Region.
5. Development of PBN national implementation plans.
6. PBN Implementation Action Plan.
7. PBN and GNSS Regional Performance Objectives.
8. GNSS Strategy.
9. Date and Venue of the next meeting.
10. Any other business.

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## 6. List of Draft Conclusions and Draft Decisions:

No.	CONCLUSION/TITLE
<b>DRAFT DECISION 1/1:</b>	<p><b>DISSOLUTION OF THE GNSS IMPLEMENTATION AND PBN TASK FORCES AND ESTABLISHMENT OF THE PBN/GNSS TASK FORCE</b></p> <p>That the GNSS Implementation and PBN Task Forces are dissolved and the PBN/GNSS Task Force is established with the terms of reference in Appendix 3A to the report on agenda item 3.</p>
<b>DRAFT DECISION 1/2:</b>	<p><b>PBN ROUTE NETWORK DEVELOPMENT WORKING GROUP (PRND WG)</b></p> <p>That the AFI PBN Route Network Development Working Group (PRND WG) is established with the terms of reference, compositing and working arrangements as at Appendix 4B to the report on agenda item 4.</p>
<b>DRAFT DECISION 1/3:</b>	<p><b>REQUIREMENT FOR PBN IMPLEMENTATION SYSTEM SAFETY MONITORING AT REGIONAL LEVEL</b></p> <p>That APIRG assess the requirement for PBN implementation system safety monitoring at Regional level, as well as the nature of an appropriate body/entity to undertake such task, should the need be identified.</p>
<b>DRAFT CONCLUSION 1/4:</b>	<p><b>AIRSPACE PLANNING/EQUIPMENT SURVEY</b></p> <p><b>That:</b></p> <p>a) AFI States and Air Navigation Service Providers (ANSPs) are urged to support the ICAO/IATA Global Survey on aircraft equipment aimed at developing a database with accurate information on present and future avionics capabilities of airline fleets and ensure that initiatives for air navigation system enhancements are matched with fleets capabilities and readiness.</p> <p>Note: To this effect, ANSPs are advised to-make use of flight plan data (Field 10) on aircraft equipment .</p> <p>b) The survey results should be presented to the next meetings of the Task Force and APIRG.</p>
<b>DRAFT CONCLUSION 1/5:</b>	<p><b>AFI PBN IMPLEMENTATION REGIONAL PLAN</b></p> <p><b>That:</b></p> <p>a) The AFI Regional PBN Implementation Plan is updated as at Appendix 4A to the report on agenda item 4, to more accurately reflect PBN implementation goals in Assembly Resolution A36-23 and guidance in the PBN Manual (9613); and</p> <p>b) the Regional PBN Implementation plan be included in the AFI Doc 003.</p>

No.	CONCLUSION/TITLE
<b>DRAFT CONCLUSION 1/6:</b>	<p><b>PBN IMPLEMENTATION NATIONAL PLAN</b></p> <p><b>That States:</b></p> <ul style="list-style-type: none"> <li>a) use the national PBN implementation plan template at Appendix 4A to the report on agenda item 5, and consider the action planning provided by the Joint PBN/GNSS/I Task Forces meeting to support planning;</li> <li>b) provide feedback to the ESAF and WACAF Regional Offices by 30 October regarding progress in the development of their national plans, indicating any challenges, if any, that are delaying the development of the plan, as well as measures taken or to be taken to overcome such challenges; and</li> <li>c) complete their National PBN Plans as soon as possible, but not later than 31 December 2009.</li> </ul>
<b>CONCLUSION 1/7:</b>	<p><b>PBN IMPLEMENTATION TOOLS</b></p> <p><b>That States:</b></p> <ul style="list-style-type: none"> <li>a) are encouraged to use project management plans and implementation action plans such as provided in Appendices 5 to the report on agenda item 5, to support PBN implementation activities; and</li> <li>b) carry out a gap analysis using the project plan template attached to the report, or similar approach, in order to more accurately develop their PBN implementation plans.</li> </ul>
<b>DRAFT DECISION 1/8:</b>	<p><b>ESTABLISHMENT OF THE PBN IMPLEMENTATION PLANNING ADVISORY GROUP (PAG)</b></p> <p>That the PBN implementation Planning Advisory Group (PAG) is established with the terms of reference as at Appendix 5C to the report on Agenda Item 5.</p>
<b>CONCLUSION 1/9:</b>	<p><b>IMPLEMENTATION OF REDUCED LATERAL EN-ROUTE SEPARATION</b></p> <p>That recognizing that States should adequately comply with safety management provisions, the Regional Offices advise AFI States that further Regional implementation of reduced separation minima should only proceed in circumstances where implementing States can demonstrate an ability to comply with Annex 11, Chapter 2, safety management provisions for the continuous monitoring and regular assessment of the safety level achieved.</p>



No.	CONCLUSION/TITLE
<b>DECISION 1/10:</b>	<p><b>ASSIGNMENT OF TASKS</b></p> <p>That, in order to facilitate PBN implementation in the AFI Region:</p> <p>a) the Joint PBN and GNSS Implementation Task Forces (proposed PBN/GNSS/I/TF) are to deliver on the tasks in Appendix 6B to the Report of Agenda Item 6.; and</p> <p>b) the Working Groups of the Task Force are to utilize, to the extend practical, electronic means of communication and exchange of working material (documents), and use available ICAO website as necessary.</p> <p>(This Draft Decision supersedes the PBN TF/2 Decisions 2/2, 2/3, 2/4; ATIS/AIS/SAR/SG/10 Decision 10/07)</p>
<b>DRAFT CONCLUSION 1/11:</b>	<p><b>PERFORMANCE BASED APPROACH AND MEASUREMENT</b></p> <p>That, in accordance with Special AFI RAN (2008) Recommendation 3/3, the following PBN performance indicators are to form part of the regional performance framework forms (PFFs):</p> <p>(i) Efficiency: Number of PBN routes/Number of APV approaches to runway ends, reduction in track miles.</p> <p>(ii) Environment: CO2 burn, Noise reduction.</p> <p>(iii) Safety: reduction of CFIT (Ref. SP AFI RAN)</p>
<b>DRAFT ONCLUSION 1/12 :</b>	<p><b>GNSS STRATEGY</b></p> <p><b>That:</b></p> <p>a) the GNSS implementation strategy is aligned with the Regional PBN implementation plan to provide supplementary PBN implementation support, as at Appendix 8A to the report on agenda item 8, except for precision approach operations, which are currently not part of PBN; and</p> <p>b) the GNSS implementation strategy be integrated into the AFI Doc 003.</p>

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JOINT PBN & GNSS/I TFs  
Report on Agenda Item 1

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**PART II: REPORT ON AGENDA ITEMS**

**REPORT ON AGENDA ITEM 1: ADOPTION OF THE PROVISIONAL AGENDA**

1.1 The meeting reviewed the proposed agenda for the Joint Meeting of the APIRG Performance Based Navigation and Global Navigation Satellite System Implementation Task Forces, copy of which had been forwarded to States and international organizations as an attachment to the invitation State Letter. The agenda was adopted as indicated in paragraph 5 of the History of the Meeting.

1.2 The meeting noted that its business was going to be long and complex, and that the attendance from States was low. The meeting nominated Mr. Seboeso Machobane, Regional Officer ATM and SAR, from the ESAF Regional Office to facilitate the proceedings of the meeting as its chairperson.

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JOINT PBN & GNSS/I TFs  
Report on Agenda Item 2

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**REPORT ON AGENDA ITEM 2:                    REVIEW AND FOLLOW UP OF RECOMMENDATIONS,  
CONCLUSIONS AND DECISIONS APPLICABLE TO THE TASK  
FORCES**

2.1                    The meeting noted the Recommendations adopted by the Special AFI/RAN Meeting held in Durban, South Africa, 24-29 November 2008, Conclusions and Decisions formulated within the framework of APIRG, that were applicable to the work programme of the PBN Task Force and the GNSS/Implementation Task Force. In particular the meeting noted the Conclusions and Decisions formulated by APIRG/16 meeting (Rubavu, Rwanda, 19-23 November 2007), the ATS/AIS/SAR SG/10 meeting (Dakar 12-15 May 2009), the PBN/TF/2 meeting (Nairobi 4-6 November 2008), the GNSS/I/TF/4 meeting (Nairobi, from 8 -9 December 2008). In addition the meeting noted the follow up action proposed or taken on the same.

2.2                    The meeting agreed that the number of Conclusions and Decisions for implementation and follow up with respect to PBN had grown significantly in a short span of time, and that follow-up and coordination under the circumstances would be difficult for parties concerned, including States, international organizations and the Secretariat. Moreover, the meeting noted that in many cases there were no clear target dates for implementation of the Conclusions/Decisions under consideration.

2.3                    The meeting recalled that the ICAO Business Plan is designed to translate the Strategic Objectives of the Organization into action plans and to ensure a link between planned activities and performance assessment

2.4                    In this regard, the meeting recalled also that APIRG had adopted a follow-up action plan with regard to its Conclusions and Decisions. It was acknowledged that the approach adopted by APIRG in its meetings, to identify target dates for action related to implementation, would be similarly useful in the implementation of Conclusions and Decisions of PBN/TF and GNSS/I/TF. Moreover, besides being consistent with the ICAO Business Plan and the requirements for performance monitoring, such an approach would, amongst others, assist the Task Force in avoiding duplication and enhance efficiency.

2.5                    Based on the foregoing, the meeting agreed on the use of a standard template to record its conclusions and decisions, to identify specific action required and parties concerned, target dates, as well as follow-up action plan on its Conclusions/Decisions, as at Appendix 2A to the report on agenda item 2. The plan would be updated as and when required by the Secretariat and subsequent meetings.

2.6                    The meeting agreed in principle that in order to facilitate follow up and reduce redundancy or duplication in the Conclusions and Decisions, where appropriate, Conclusions or Decisions should be merged with those considered similar or closely related. Furthermore, that conclusions and decisions which are considered adequately addressed by other Conclusions, Decisions, procedures, activities, terms of reference and work programmes of relevant APIRG subsidiary bodies, as well as those that are adequately covered by provisions of the APIRG Handbook, should be considered obsolete.

2.7                    The meeting agreed that in order to reduce repeated discussions of the subjects, the Recommendations, Conclusions and Decisions would be considered in detail as part of the discussions under each of the relevant agenda items.

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JOINT PBN & GNSS/I TFs  
Report on Agenda Item 3

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**REPORT ON AGENDA ITEM 3: TERMS OF REFERENCE OF THE PROPOSED PBN/GNSS TASK FORCE**

3.1 The meeting recalled that at its tenth meeting (Dakar, 12-15 May 2009), the ATS/AIS/SAR Sub-Group formulated Conclusion 10/26: *Renaming of the APIRG PBN Task Force*, proposing the merger of the PBN Task Force and the GNSS Implementation Task Force to establish the PBN/GNSS/I/TF.

3.2 The meeting recognized that this was the first time after the ATS/AIS/SAR SG/10 that a meeting comprising both the PBN and the GNSS experts was convened. The meeting reviewed the terms of reference proposed by the ATS/AIS/SAR SG/10 for the APIRG PBN/GNSS/I Task Force, and accordingly formulated the following Draft Decision:

***DRAFT DECISION 1/1:                   DISSOLUTION OF THE GNSS IMPLEMENTATION AND PBN TASK FORCES AND ESTABLISHMENT OF THE PBN/GNSS TASK FORCE.***

*That the GNSS Implementation and PBN Task Forces are dissolved and the PBN/GNSS Task Force is established with the terms of reference in **Appendix 3A** to the report on agenda item 3.*

*(This Draft Decision is to supersede ATS/AIS/SAR/SG/10 Conclusions 10/15 and 10/26)*

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JOINT PBN & GNSS/I TFs  
Report on Agenda Item 4

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**REPORT ON AGENDA ITEM 4: STATUS OF IMPLEMENTATION OF PBN IN THE AFI REGION**

4.1 The meeting recalled that Assembly Resolution A36-23 calls for, *inter alia*, the PIRGs and States to develop PBN Implementation plans by 2009. Accordingly, the APIRG/16 Meeting (Rubavu, Rwanda, 19-23 November 2007), Special AFI RAN Meeting (Durban, South Africa 24-29 November 2008), the PBN/TF/2 meeting in Nairobi, December 2008, and the ATS/AIS/SAR/SG/10 meeting (Dakar, May 2009) formulated a number of Recommendations, Conclusions and Decisions aimed at fostering the implementation of PBN through guidance and other forms of assistance.

4.2 The meeting reviewed the various actions emanating from the Recommendations from SP AFI/RAN 2008 as well as Conclusions and Decisions from within the framework of APIRG, to meet the provisions of Assembly Resolution A36-23, noted action taken and identified outstanding action.

4.3 **Flight Procedures Office (FPO):** The meeting recalled that the SP AFI/RAN had requested ICAO to disseminate a letter with supporting documentation, inviting interested States and international organizations to submit proposals for establishment and hosting of the FPO in the AFI Region. The meetings also noted that progress was being made in the establishment of the FPO in the APAC Region, and that it would be useful to benefit from the experience of that establishment. In this regard, the meeting noted that, it was advisable to put in abeyance the circulation of the letter required in SP AFI/RAN Recommendation 6/10 pending lessons learned from the establishment of the FPO in the APAC Region.

4.4 **Global developments:** The meeting was apprised on a number of global developments relating to the implementation of PBN. Amongst others, it was noted that in December 2008, at the invitation of ICAO and IATA, representatives of States, industry and international organizations came together for the first meeting of the Global PBN Task Force (GPBNTF) at ICAO HQ in Montreal, Canada (2-6 February 2009). The objectives were to build upon the global and regional structures, which have already been put in place for PBN implementation, and to produce tools and enablers to facilitate and expedite the work. This first meeting resulted in agreement among the participants on the need for a global effort such as this, and to divide the TF into Teams to work on specific plans and deliverables. The second meeting of the GPBNTF, (Montreal, 2-6 February 2009), was held to develop work plans for the teams.

4.4.1 **The Promotion Team.** The Promotion Team completed and sent out the second quarterly PBN Newsletter, Waypoints, in August 2009. This issue of Waypoints is available on the PBN web site, <http://www2.icao.int/en/pbn/Pages/default.aspx>. States and international organizations are encouraged to contribute to the newsletter.

4.4.2 **Implementation Support Team (IST):** The IST produced a consolidated model action plan and several model action plans directed at the enroute, terminal and approach phases of implementation. These model action plans are available on the PBN web site, <http://www2.icao.int/en/pbn/Pages/default.aspx>.

JOINT PBN & GNSS/I TFs  
Report on Agenda Item 4

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4.4.3 **Implementation Management (GO) Team: Promotion Team:** The GO Team discussed its concept which has been successfully used by IATA, and specific implementation activities that would serve to develop regional pockets of knowledge and expertise in various States, and that could serve as an example of successful implementation to other States in the region. The Team was working on a trial GO Team visit in the later in 2009.

4.4.4 **Amendment to PBN related provisions:** The meeting noted developments relating to amendment affecting a number of ICAO Annexes documents: **Helicopter flight procedures** amendments affecting Annex 4 and PANS-OPS, Volumes I and II, amendment proposal to PANS-OPS, Volume II regarding **quality assurance**, which explains the instrument flight procedure process and documentation requirements in more detail, **Alignment of RNAV Holding criteria with PBN**, the amendment proposals to PANS-OPS, Volume I concerning the use of **SBAS equipment** to fly APV/Baro-VNAV procedures, the amendment proposals relating to PANS-OPS, Volume II design criteria which include **instructions to the procedure designer** to allow a better interpretation of the design criteria by navigation database encoders.

4.4.5 **Flight Validation:** It was noted that ICAO with the support of the International Committee on Airspace Safety and Calibration (ICASC) is developing a new volume or volumes to be incorporated in the Quality Assurance Manual for Flight Procedure Design, Doc 9906, with Flight Validation guidance and Flight Validation Pilot Training requirements

4.4.6 **Separation and Airspace Safety Panel (SASP):** The meeting noted some of the significant progress on several fronts, reported by the 15th meeting of the SASP Working Group of the Whole that concluded on 5 June, 2009.

4.4.7 **Performance Based Navigation Study Group (PBN SG):** The PBN SG met in late April and worked on the next phase of PBN. Decisions were made on the direction to take with respect to new navigation specifications. Included in those decisions were:

- Development of a navigation specification for SBAS and its inclusion in the PBN Manual
- Development of an RNP 2 nav spec for enroute continental application, including remote continental
- Development of an advanced RNP nav spec for approach and terminal application
- Application of RF turns outside final approach in RNP APCH, advanced RNP and Basic-RNP 1 nav specs.

4.5 **ATS route network development:** The meeting acknowledged the need for development of an improved ATS route network in the AFI Region in the general context as well as from the context of the implementation of PBN. Furthermore, that the work involved would require resources besides the ATS/AIS/SAR SG. The meeting recalled that the SP AFI/RAN had agreed that the PBN Task Force was the most suitable body to address the ATS route structure in the AFI Region. The meeting concurred with the view of the SP AFI/RAN, noting the interrelationships between the concerned APIRG activities, however, was cognizant that the comprehensive review of the Regional ATS route network would require significant effort, which could be achieved by a specifically appointed body.

JOINT PBN & GNSS/I TFs  
Report on Agenda Item 4

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4.6 Based on the above, the meeting agreed on the establishment of a Working Group reporting to the PBN TF and accordingly formulated the following Draft Decision

***DRAFT DECISION 1/2: PBN ROUTE NETWORK DEVELOPMENT WORKING GROUP (PRND WG)***

*That the AFI PBN Route Network Development Working Group (PRND WG) is established with the terms of reference, composition and working arrangements as at Appendix 4B to the report on agenda item 4.*

4.7 **Safety assessments and monitoring:** The need for safety assessments and system safety monitoring at regional level as well as a regional body to monitor airspace safety related to implementation of PBN was discussed at length.

4.8 The meeting acknowledged the importance of safety assessments in the implementation of PBN, and that States were responsible for the safety assessments within their territories and the high seas FIRs in which they are providing air traffic services. In this regard, it was further recognized that, at regional level appropriate safety assessments could not be practical. As such, safety assessments need to be carried out during implementation by the States.

4.9 As regards the system safety monitoring at regional level as well as a regional body to monitor airspace safety related to implementation of PBN, the meeting acknowledged the likelihood of a degree of such need, albeit believed to be minimal, taking into consideration, *inter alia*, the technologies associated with the PBN concept itself. It was also recognized that safety monitoring was the responsibility of States. The meeting discussed the matter of a body to undertake such system safety monitoring, should the need be identified. In this regard, the approach of expanding the mandate of an existing body such as the AFI Regional Monitoring Agency (ARMA) or Tactical Action Group (TAG) to cover this aspect in order to avoid proliferation of bodies and related costs, were also discussed. Although it was generally believed that expanding the mandate of the ARMA would be more appropriate than that of the TAG in this regard, consensus could not be achieved on what body would be most appropriate.

4.10 The meeting agreed that the matter regarding the need for safety monitoring, as well the entity/ies to be assigned this responsibility, should the need be identified, be referred to an upper APIRG body. Accordingly, noting that the ATS/AIS/SAR SG would likely not be meeting before APIRG/17, the meeting agreed to refer the matter to APIRG, and accordingly formulated the following Decision:

***DRAFT DECISION 1/3: REQUIREMENT FOR PBN IMPLEMENTATION SYSTEM SAFETY MONITORING AT REGIONAL LEVEL***

*That, APIRG assess the requirement for PBN implementation system safety monitoring at Regional level, as well as the nature of an appropriate body/entity to undertake such task, should the need be identified..*

JOINT PBN & GNSS/I TFs  
Report on Agenda Item 4

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4.11 **Aircraft equipage data:** The meeting acknowledged that accurate data on aircraft equipage capabilities was essential to airspace planners, including planning for implementation of PBN. The meeting noted that, pursuant to global initiatives including the AFI ATS/AIS/SAR SG/10 Conclusion 10/2, IATA had conducted a survey to capture current and future communication, navigation and surveillance capabilities of member airlines' fleets, and that the Regional Offices had also requested States to assist with a similar survey, in particular, to capture information related to air operators that were not IATA members. Accordingly, the meeting agreed on the following Draft Conclusion:

***DRAFT CONCLUSION 1/4 : AIRSPACE PLANNING/EQUIPMENT SURVEY***

*That:*

- a) *AFI States and Air Navigation Service Providers (ANSPs) are urged to support the ICAO/IATA Global Survey on aircraft equipment aimed at developing a database with accurate information on present and future avionics capabilities of airline fleets and ensure that initiatives for air navigation system enhancements are matched with fleets capabilities and readiness.*

*Note: To this effect, ANSPs are advised to make use of flight plan data (Field 10) on aircraft equipment*

- b) *The survey results should be presented to the next meetings of the Task Force and APIRG.*

4.12 **AFI PBN implementation plan:** The meeting recalled that ICAO is transitioning from sensor based specifications, to performance based. In this regard, ICAO will no longer specify the GNSS systems (or combination of the systems) that should be used to support PBN requirements. In view of this approach, the meeting agreed that in the AFI Regional PBN Implementation Plan, the PBN requirements – where it indicates “RNP APCH with Baro-VNAV”, it should instead indicate “RNP APCH APV”, in order to be consistent with the PBN concept and Assembly Resolution A36-23. Accordingly, the meeting formulated the following Draft Conclusion:

***DRAFT CONCLUSION 1/5 : AFI PBN IMPLEMENTATION REGIONAL PLAN***

*That,*

- a) *The AFI Regional PBN Implementation Plan is updated as at **Appendix 4A** to the report on agenda item 4, to more accurately reflect PBN implementation goals in Assembly Resolution A36-23 and guidance in the PBN Manual (9613); and*
- b) *the Regional PBN Implementation plan be included in the AFI Doc 003.*

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JOINT PBN & GNSS/I TFs  
Report on Agenda Item 5

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**REPORT ON AGENDA ITEM 5: DEVELOPMENT OF PBN NATIONAL IMPLEMENTATION PLANS**

5.1 The meeting recalled that APIRG/16 meeting (Rubavu, Rwanda 19-23 November 2008), amongst others, formulated *Conclusion 16/3: Development of States' PBN Implementation Plans*, encourage States to proceed with the development of their PBN implementation national plans, which are to be completed by the end of 2009 pursuant to Assembly Resolution A36-23. The States' effort was to be in harmony with the development of the AFI Regional PBN implementation plan being coordinated by the AFI PBN Task Force.

5.2 **Regional PBN implementation plan:** The meeting noted also, that the PBN TF/2 meeting (2-4 December 2008) completed development of the PBN Implementation Regional Plan, titled the "AFI Region Performance Based Navigation Roadmap," and that the plan was subsequently endorsed by the ATS/AIS/SAR SG/10 meeting (May 2009).

5.3 In order to facilitate the States' development of national plans, the meeting noted that, due to the limited time to meet the 2009 goals provided in Assembly Resolution A36-23 for the development of the PBN implementation national plans, and to facilitate the desired harmonization between the Regional and national plans, coordination with States prior to adoption of the Plan by APIRG was necessary. Accordingly, the concurrence of States was sought (through ESAF State Letter Ref. ES AN 4/74 – 0319 dated 8 July 2009), for the PBN Implementation Regional Plan developed by the PBN Task Force to be used, prior to its formal adoption by APIRG, as the basis for development and implementation of national PBN plans, in the same capacity as material adopted by APIRG.

5.4 The meeting was apprised that the ESAF Regional Office, in coordination with the WACAF Regional Office, had requested from States, updated information regarding the development of national PBN implementation plans. It was noted that few States had responded and that from the responses received, in addition to encouragement to complete the plans, the need for further guidance was identified.

5.5 The meeting formed small working groups (SWG) to work on further guidance including examples of completed plans, in order to assist States to complete their national PBN implementation plans. In this regard, two States (Cameroon and Seychelles) represented at the meeting assisted by agreeing to use their national draft plans and other material developed during the meeting as examples of what could be followed by other States, with necessary adaptations. The examples were developed and refined during the meeting and are at **Appendices 5A and 5B** to the report on agenda item 5. Planning tools developed by other States in the AFI Region (including Seychelles and South Africa) were also made available (**Ref. report on agenda item 6**). The meeting acknowledged with thanks the contributions from States.

5.6 Based on the above, the meeting formulated the following Draft Conclusions:

***DRAFT CONCLUSION 1/6 : PBN IMPLEMENTATION NATIONAL PLAN***

*That States:*

- a) *use the national PBN implementation plan template at **Appendix 5A** to the report on agenda item 5, and consider the action planning provided by the Joint PBN/GNSS/I Task Forces meeting to support planning;*

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- b) *provide feedback to the ESAF and WACAF Regional Offices by **30 October 2009** regarding progress in the development of their national plans, indicating challenges, if any, that are delaying the development of the plan, as well as measures taken or to be taken to overcome such challenges; and*
- c) *complete their National PBN Plans as soon as possible, but not later than **31 December 2009**,*

**CONCLUSION I/7: PBN IMPLEMENTATION TOOLS**

*That States:*

- a) *are encouraged to use project management plans and implementation action plans such as provided in **Appendices 5B** to the report on agenda item 5, to support PBN implementation activities; and*
- b) *carry out a gap analysis using the project plan template attached to the report, or similar approach, in order to more accurately develop their PBN implementation plans.*

5.7 **En-route part of the national plan:** The meeting recognized that the national PBN implementation plans include the en-route portions that form part of the Regional Air Navigation Plan (ANP) and were thus subject to regional agreements. In this regard, the meeting agreed that, with respect to the en-route network which forms or will form part of the regional ATS route network (AFI Basic ANP Table ATS 1), in order to achieve consistency and harmonized plans, the following text should be considered for insertion into the national PBN implementation plans, where it relates to the en-route part thereof:

- *En-route structure will be reviewed to achieve optimization of the route network in terms of reduction of route lengths/flying times, and this will entail:*
  - a) *change of the existing non-RNAV routes into PBN routes where operational requirement is identified;*
  - b) *change of the existing RNAV routes without PBN Navigation specification requirement to routes with PBN Navigation specification; and*
  - c) *development of an ATS route network structure characterized by minimized city pair lengths.*
- *The following implementation on the en-route network is envisaged/foreseen (e.g.) subject to CDM processes:*
  - *ATS routes within the XXXX (insert name of FIR/s) FIR*
    - *RNAV 5 in continental routes (where there is surveillance by 2010).*
    - *RNAV 10 in remote continental and oceanic airspace by 2010 (depending on the structure of the FIRs concerned).*
- *Full implementation plan will be developed in coordination with the PBN TF route network development work group and proposed for amendment of the AFI ANP.*

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5.8 **Assistance to complete plans:** The meeting recognized that in order for all the AFI States to meet the deadline of 31 December 2009 with regard to development of the PBN implementation national plans, some States might require further assistance. In this regard, the meeting established a Planning Advisory Group (PAG) to assist States as necessary, and accordingly formulated the following Draft Decision:

***DRAFT DECISION 1/8: ESTABLISHMENT OF THE PBN IMPLEMENTATION PLANNING ADVISORY GROUP (PAG)***

*That, the PBN implementation Planning Advisory Group (PAG) is established with the terms of reference as at **Appendix 5C** to the report on Agenda Item 5.*

5.9 **Language used in guidance material:** The meeting acknowledged that the availability of the PBN implementation documents from the Task Force, in the English language only, was a constraint for many States in the AFI region, to make full use of the material, and that this was adding to the delay in implementation. In this regard, ICAO was requested to assist by making as much material as practical, available in the French language.

5.10 The meeting noted with appreciation the offer from IATA to assist in translating the immediately required guidance material, specifically, national PBN implementation templates and the implementation action plan. IATA envisaged that these would be completed within two weeks from date of receipt by IATA.

5.11 **Reduced en-route lateral separation:** The meeting acknowledged the importance of the continued safety in the implementation of PBN, and noted that, *inter alia*, this could be achieved through the implementation of ICAO provisions, in particular Annex 11, Chapter 2. Accordingly the meeting formulated the following Draft Conclusion:

***CONCLUSION 1/9 –IMPLEMENTATION OF REDUCED LATERAL EN-ROUTE SEPARATION***

*That, recognizing that States should adequately comply with safety management provisions, the Regional Offices advise AFI States that further regional implementation of reduced separation minima should only proceed in circumstances where implementing States can demonstrate an ability to comply with Annex 11, Chapter 2, safety management provisions for the continuous monitoring and regular assessment of the safety level achieved.*

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JOINT PBN & GNSS/I TFs REPORT  
Report on Agenda Item 6

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**REPORT ON AGENDA ITEM 6: PBN IMPLEMENTATION ACTION PLAN**

6.1 The meeting recalled that the ATS/AIS/SAR SG/10 meeting (May 2009) had adopted Draft Conclusion 10/7: *AFI Regional PBN Performance Objectives and Action Plans*, which called for the PBN Task Force to finalize the development of the AFI PBN performance objectives and Action Plans based on the performance framework forms (PFFs), and report to APIRG.

6.2 The meeting also recalled that the PBN TF/2 meeting had formulated Decisions 2/2 and 2/3 which established two Working Groups: Working Group on En-Route Operations (WG-EO) and of the Working Group on Terminal and Approach Operations (WG-TAO). The Working Groups were to develop the Regional Performance Objectives related to PBN implementation and the PBN Implementation Action Plan.

6.3 The meeting noted that due to unavoidable circumstances, including certain changes in the report of the PBN TF/2 meeting, it had been difficult for the WGs to achieve progress in their respective assignments. The other contributing difficulty was the lack of response from States that were members of the WGs, to respond to communication from the Rapporteurs of the respective WGs.

6.4 The meeting noted, with appreciation, that the Rapporteurs of the WGs, had developed some material for consideration by the meeting. The meeting reviewed and adopted the PBN implementation action plans developed by Seychelles as well as the planning tools (project management and gap analysis) developed by South Africa, and agreed that these planning tools, provided at **Appendix 6A** to the report on agenda item 6, could be used by States.

6.5 The meeting recognized that the above WGs as originally composed had not been effective, and accordingly agreed to reestablish them (**Ref. report on agenda item 7**).

6.6 The meeting recognized that there were several tasks that still had outstanding action or for which specific action had not been identified. These tasks were not necessarily in the form of individual Conclusions/Decisions nor should they be. In order to follow up on the various tasks relating to the implementation of PBN, the meeting agreed that the tasks should be listed in task list that clearly indicates the actions, parties responsible and target dates. Accordingly, the meeting formulated the following Draft Decision:

**DRAFT DECISION 1/10:                    ASSIGNMENT OF TASKS**

*That, in order to facilitate PBN implementation in the AFI Region:*

- a) the Joint PBN and GNSS Implementation Task Forces (proposed PBN/GNSS/I/TF) are to deliver on the tasks in **Appendix 6B** to the Report of Agenda Item 6; and*

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- b) the Working Groups of the Task Force are to utilize, to the extent practical, electronic means of communication and exchange of working material (documents), and use of available ICAO website as necessary.*

*(This Draft Decision supersedes the PBN TF/2 Decisions 2/2, 2/3, 2/4; ATS/AIS/SAR/SG/10 Decision 10/07)*

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Report on Agenda Item 7

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**REPORT ON AGENDA ITEM 7: PBN AND GNSS REGIONAL PERFORMANCE OBJECTIVES**

7.1 The meeting reviewed the work of the Working Group on En-Route Operations (WG-EO) and of the Working Group on Terminal and Approach Operations (WG-TAO) presented by their respective Rapporteurs.

7.2 The meeting was of the view that for the immediate future, the PBN performance objectives developed by the SP AFI RAN (November 2008) would be adequate. However, further development of these Performance Objectives was necessary in terms of establishing realistic target dates, responsible parties and status related to each task.

7.3 The meeting noted that the coordination process between the Rapporteurs and members in their WGs was largely unsuccessful. However, the meeting agreed not to abandon the approach, rather, to encourage States to be in the membership only if they intend to actively participate. Furthermore, that the secretariat should increase efforts to secure details regarding the PBN National States Programme Managers (NPM) and points of contacts (POCs) in order to facilitate communication. The secretariat should also assist the Rapporteurs as necessary. In order to improve effectiveness of communication and participation, membership of the WGs was reconstituted is listed below. Furthermore, the meeting agreed to establish one Rapporteur for both WGs in order to enhance coordination:

<b>Working Group on En-Route Operations (WG-EO)</b>	<b>Working Group on Terminal and Approach Operations (WG-TAO)</b>
<b>Rapporteur - Seychelles</b>	<b>Rapporteur - Seychelles</b>
Cameroon Kenya Senegal Seychelles South Africa  ASECNA IATA IFALPA IFATCA	Chad Ethiopia Cameroon Kenya Senegal Seychelles South Africa Uganda  ASECNA IATA IFALPA IFATCA

7.4 **Functional communicating of the WGs:** The meeting agreed that unless the member States provide names of officials who will be in the above WGs, communication between the Rapporteur and members of the WGs will be carried out with NPM of the respective State/organization, or PBN POC or any of the officials who attended the Joint PBN & GNSS/I Task Forces meeting (Nairobi, 8-10 September 2009). Member States/organizations are requested to respond to **ALL** communication from the Rapporteur and make their contributions; at the least indicate if they have no objection to a proposal, but in any case, respond.

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7.5 **Performance based approach and measurement.** The meeting recalled that the Special AFI/RAN Meeting (Durban, South Africa 2008) adopted Recommendation 3/3: *Performance-based approach and measurement*, calling on APIRG and Regional safety groups to develop indicators that are specific, measurable, achievable, realistic and time-bound (SMART) as part of the development of Regional Performance Framework.

7.6 Based on the above, the meeting agreed on PBN efficiency-related indicators and accordingly formulated the following Draft Conclusion:

***DRAFT CONCLUSION I/II: PERFORMANCE BASED APPROACH AND MEASUREMENT***

*That, in accordance with Special AFI/RAN (2008) Recommendation 3/3, the following PBN performance indicators are to form part of the regional performance framework forms (PFFs):*

- i. Efficiency: Number of PBN routes/Number of APV approaches to runway ends, reduction in track miles*
- ii. Environment: CO2 burn, Noise reduction*
- iii. Safety: reduction of CFIT (Ref. SP AFI RAN)*

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JOINT PBN & GNSS/I TFs  
Report on Agenda Item 8

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**REPORT ON AGENDA ITEM 8: GNSS STRATEGY**

8.1 The meeting formed a small working group (SWG) comprising States, international organizations and some members of the Secretariat to specifically review and update as necessary the GNSS implementation strategy for the AFI Region. The SWG presented the outcome of its deliberations to the plenary of the Joint meeting of the PBN and GNSS/I Task Forces. The AFI GNSS Implementation Strategy was discussed at length at both the SWG and the plenary stages.

8.2 The meeting agreed that the objectives of the AFI GNSS Task Force are now intrinsically limited by the need for the GNSS Strategy to be coherent with the AFI PBN implementation plan (agreed at the previous PBN Task Force meeting). Thus, the use of GNSS shall be compliant with the PBN requirements for all the phases of flight concerned by PBN, except precision approach CAT I/II/III which is currently not covered by the PBN concept, and for all the PBN requirements evolution (short, medium and long term).

8.3 The meeting recalled that ICAO's policy is to move away from the sensor-specific requirements to performance-based requirements. Accordingly, navigation requirements will no longer specify supporting GNSS systems (or combination of the systems). In this regard, the meeting agreed that the AFI PBN Implementation Plan and the GNSS Implementation Strategy should be amended and aligned respectively (**Ref. report on agenda item 4**).

8.4 Based on the above, the meeting formulated the following Draft Conclusion:

***DRAFT CONCLUSION 1/12 : GNSS STRATEGY***

*That:*

- a) the GNSS implementation strategy is aligned with the Regional PBN implementation plan to provide supplementary PBN implementation support, as at **Appendix 8A** to the report on agenda item 8, except for precision approach operations, which are currently not part of PBN; and*
- b) the GNSS implementation strategy be integrated into the AFI Doc 003.*

8.5 The meeting was apprised, by the European Space Agency (ESA), on the Inter-regional Space Based Augmentation System (SBAS) for AFI (ISA) cost benefit analysis (CBA). The meeting noted that the CBA had been updated according to all comments received from APIRG/16 and that it was presented for final review and validation by the GNSS/I TF/5. The CBA however, was still at draft stage and had not yet included all AFI States. The meeting also recalled that its deliberations were in the context of an air navigation concept which is in transition from sensor-specific requirements to performance-based, and agreed that further developments with regard to the CBA should take this context into account.

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JOINT PBN & GNSS/I TFs  
Report on Agenda Item 9

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**REPORT ON AGENDA ITEM 9: DATE AND VENUE OF THE NEXT MEETING**

9.1 The meeting recalled that, in accordance with the APIRG Procedural Handbook, it (the meeting) was expected to decide on the tentative dates and venue of its next meeting. In discussing this subject, the meeting recognized the need to convene in the near future, particularly in view of the work programme regarding PBN implementation and current status of the development of national PBN implementation plans. The meeting however, was mindful that for many States, attendance had, for various reasons become difficult.

9.2 In view of the above, the meeting agreed that the next meeting should be held in late February 2010 at the WACAF Regional Office in Dakar. It was noted however, that the final scheduling of the meeting would take into consideration the overall scheduling of activities with the Regional Offices.

9.3 The meeting agreed to the tentative agenda of the next Joint PBN and GNSS/I Task Forces as at **Appendix 9A** to the report on agenda item 9.

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JOINT PBN & GNSS/I TFs  
Report on Agenda Item 10

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**REPORT ON AGENDA ITEM 10: ANY OTHER BUSINESS**

10.1 Concern was raised that in some of the recent meetings, including the Joint PBN & GNSS/I TFs, working/information papers have not been availed to States and international organizations as early as expected, in order to permit review and preparation by the participants.

10.2 The ROs were urged to address this matter in order to enable States and concerned international organizations to participate more effectively in the business of the Task Forces.

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**Joint Meeting of the APIRG Performance Based Navigation and Global  
Navigation Satellite System Implementation Task Forces  
(Joint PBN & GNSS/I TFs) (PBN/TF/3, GNSS/TF/I/5)  
(Nairobi, 8 - 10 September 2009)**

**LIST OF PARTICIPANTS**

STATE		NAME	DESIGNATION E-MAIL
1.	Angola	Amilcar Soeiro Do Nascimento	Chief of Airspace Division Tel:+00-244-923308525/00-244-222-651047 <b>E-mail:amilcarnascimento@hotmail.com</b>
2.	Cameroon	Ms. Essimi Leopoldine	Air Navigation Coordinator Cameroon Civil Aviation Authority Tel:+237-2230-3090 Fax:+237-2230-3362 <b>E-mail:leo.essimi@yahoo.com</b>
3.	Cameroon	Mr. Ngoue Célestin S.	Operations Director Cameroon Civil Aviation Authority Tel:+237-964-77533 Fax:+237-2230-3362 <b>E-mail:cngoue@hotmail.com</b>
4.	Chad	Mr. SARAHAOUBAYE TRAOGUÍNGUE	Chef Division CNS/ATM Tel :+235-525414 Fax:+235-252-5414 <b>E-mail:sarabaye_kk@yahoo.fr</b>
5.	Côte d'Ivoire	Mr. N'ZEBO OI N'ZEBO Sylvain	Chief AIS-MAP/PBN Focal Point Tel :+225-03-300932 Fax:+225-21-27-6346 <b>E-mail :snzebo@yahoo.fr</b> <b>E-mail:adac@intnet.td</b>
6.	Ethiopia	Mr. Lulseged Gulilat Desta	Deputy Director General Air Navigation Tel:+251-116650-265 Mobile:+255-911-201267 Fax:+251-116650-281 <b>E-mail:caa.airnav@ethionet.et</b> <b>E-mail:luelsegdt@yahoo.com</b>
7.	Ethiopia	Amb. Fisseha Yimer	Advisor to the Minister of Foreign Affairs
8.	Ghana	Mr. Samuel Kwabena Asante	Watch Manager Tel:+233-21-773283 Mobile:+233-244-644872 <b>E-mail:skasante57@yahoo.com</b>
9.	Kenya	Mr. Hitler Adikiny Olwenge	Chief Air Traffic Control Kenya Civil Aviation Authority (KCAA) P.O. Box 30163 – Nairobi <b>E-mail:holwenge@kcaa.or.ke</b>
10.	Kenya	Mr Patrick M. Kinuthia	Chief Air Navigation Services Kenya Civil Aviation Authority (KCAA) P.O. Box 30163 - Nairobi Tel:+254-20-827817 Fax:+254-20-827101 <b>E-mail:pkinuthia@kcaa.or.ke</b> <b>E-mail:info@kcaa.or.ke</b>

STATE		NAME	DESIGNATION E-MAIL
11.	Republique Democratique du Congo (DRC)	Mr. Eldonny MBUYI NYEMBUE	Head of Air Navigation Division Tel:+243-81-526-3542 Tel:+00243-990-756-309 <b>E-mail:eldonnymbuyi@yahoo.fr</b> <b>E-mail:eldonnymbuyi@gmail.com</b>
12.	Senegal	Madame Ndoumbé NIANG THIOUNE	Chef Service Normes Aerodrome Tel:+221-33-8695335 Fax :+221-33-8200403 <b>E-mail:ndoumbe_thioune@yahoo.fr</b>
13.	Seychelles	Mr. David Labrosse	General Manager - Air Navigation Services Seychelles Civil Aviation Authority Tel:+248-527204 Fax:+248-384032 <b>E-mail:secretariat@scaa.sc</b> <b>E-mail:dlabrosse@scaa.sc</b>
14.	Seychelles	Mr. Marlon Orr	Head of Flight Operations Tel:+248-527-202 Fax:+248-384033 <b>E-mail:morr@scaa.sc</b>
15.	Somalia (CACAS)	Mr. Humphrey Mwachoki	FIC Supervisor <b>CACAS - Somalia</b> Tel:254-20-7622785 Fax:254-20-7122340 <b>E-mail:Humphrey.mwachoki@icao.unon.org</b>
16.	Somalia (CACAS)	Mr. Ali Jama Abdi	Senior Air Traffic Controller <b>CACAS - Somalia</b> Tel:7622785 Fax:7122340 <b>E-mail:CALIBARAF@YAHOO.COM</b>
17.	Somalia (CACAS)	Mr. Peter Mbugua	Chief, AIS <b>CACAS - Somalia</b> Tel:+254-20-7622785 Fax:+254-20-7122340 <b>E-mail:Peter.Mbugua@icao.unon.org</b>
18.	Somalia (CACAS)	Mr. Abdillahi Ali Shire	Senior AIS Officer <b>CACAS - Somalia</b> Tel:254-20-7622-775 Fax:+020-762-2775 <b>E-mail:Abdillahi.Shire@icao.unon.org</b>
19.	Somalia (CACAS)	Mr. Moses Lusambili	Maintenance Engineer <b>CACAS - Somalia</b> Tel:254-20-7622785 <b>E-mail:Moses.Lusambili@icao.unon.org</b>
20.	Somalia (CACAS)	Mr. James Nganga	<b>CACAS - Somalia</b> Tel:254-20-7622785 <b>E-mail:James.Nganga@icao.unon.org</b>
21.	South Africa	Mr. Wayne Lessard	ATM Specialist Air Traffic & Navigation Services (ATNS) Tel:+011-961-0121 Tel: +27-11-961-0121 Fax: +27 11 392-3946 <b>E-mail: waynel@atns.co.za</b>
22.	South Africa/ATNS	Mr. Harry Roberts	ATM Specialist Tel:27-11-961-0123 Fax:27-11-961-0403 <b>E-mail:harryr@atns.co.za</b>
23.	South Africa/ATNS	Mr. Leon Nel	Project Engineer Air Traffic & Navigation Services (ATNS) Tel:+27-11-961-0229 Fax:+27-11-392-3969 <b>E-mail:leonn@atns.co.za</b>

STATE		NAME	DESIGNATION E-MAIL
24.	South Africa/Civil Aviation Authority	Mr. Ronnie Mothusi	ATS Inspector Tel:+27-11-5451065 Fax:+27-11-545-1282 <b>E-mail:mothusir@caa.co.za</b>
25.	South Africa/Civil Aviation Authority	Mr. Gary Newman	Manager Procedure Design & Cartography/South African Civil Aviation Authority Tel:+27-11-545-1202 <b>E-mail:newmang@caa.co.za</b>
26.	Sudan	Fathelrahman Nasir Khamis	Navigation Engineer Tel:+249-83-777-121 Tel:+249-912-507340 Fax:+249-83-77001 <b>E-mail:fatah-ins@gmail.com</b>
27.	Sudan	Mr. Ahmed Eisa Ahmed	Air Traffic Controller Tel:+00183-773632 Fax:+773632 <b>E-mail:eisaats.caa@gmail.com</b>
28.	Tanzania	Mr. Solomon M. Mwang'onda	Officer-in-Charge – ATM Julius Nyerere International Airport <b>TANZANIA</b> Tel:255-754-322324 Fax:255-2221-0264 <b>E-mail:smwangonda@tcaa.go.tz</b>
29.	Uganda	Mr. Moses Sezibwa	Principal Air Traffic Management Officer Uganda Civil Aviation Authority Tel:256-712-320907 Fax:256-414-320964 <b>E-mail:msezibwa@caa.co.ug</b>
30.	Uganda	Mr Geoffrey Okot	Supervisor ATM Uganda Civil Aviation Authority Tel:+256-414-320907 Fax:256-414-320964 <b>E-mail:ge_okot@yahoo.com</b> <b>E-mail:gokot@caa.co.ug</b>
<b>ORGANIZATION</b>			
31.	ASECNA	Mr. Sidy Gueye	ATS Manager of Dakar Tel:+100-221-33-869-2305 Fax:+00-221-33-820-0656 <b>E-mail:sgueye@yahoo.fr</b>
32.	ASECNA	Mr. Diallo Amadou Yoro	Chef Bureau ATM et Programmes Tel:+221-33-869-5661 <b>E-mail:dialloamad@asecna.org</b>
33.	ASECNA	Mr. Gueye Hamath	Expert PANS/OPS Tel :+00221-338-695673 <b>E-mail:gueyeham@asecna.org</b>
34.	European Space Agency	Ms. Nina Costa	Consultant Tel:+39-347-223-1770 Fax:+39-011-912-406 <b>E-mail:nina.costa@ndconsult.eu</b>
35.	European Space Agency	Mr. Giorgio Solari	Institutional Relations Tel:+33-1-5369-7256 Fax:+33-1-5369-7445 <b>E-mail:GIORGIO.SOLARI@ESA.INT</b>
36.	European GNSS Supervisory Authority	Mr. Emiliano Spaltro	Consultant Tel:+00-39-348-5257541 <b>E-mail:E.SPALTRO@GMAIL.COM</b>
37.	European Commission	Mr. Stefano Scarda	Policy Officer Tel:+32-229-87715 <b>E-mail:stefano.scarda@ec.europa.eu</b>

STATE		NAME	DESIGNATION E-MAIL
38.	IATA	Mr. Prosper ZO'O-MINTO'O	Assistant Regional Director Africa/Indian Ocean - <b>IATA</b> Tel:+27-82-74-6713/27-11-5232724 Fax:+27-11-523-2701 <b>E-mail:ZooMintooP@iata.org</b>
39.	IFALPA	Captain Arif Jinnah	Regional Vice President for AFI/EAST <b>IFALPA</b> Tel:255-785-000011 Fax:255-22-2119742 <b>E-mail:ARIF@ARIF.CO.TZ</b>
40.	IFATCA	Ms. Keziah Ogutu	Regional Representative <b>IFATCA</b> Phone:+254-722386001 Fax:+254-20827102 <b>E-mail:Kezogutu@yahoo.com</b>
<b>SECRETARIAT</b>			
	ICAO - Montreal	Mr. Erwin Lassoij	PBN Implementation Resource Development Coordinator - ICAO Montreal Tel:1-514-954-8219-6719 <b>E-mail:ELASSOIJ@ICAO.INT</b>
	ICAO - Montreal	Mr. Doug Marek	Tel:+1-514-954-8219 Ext.6659 <b>E-mail:DMarek@icao.int</b>
	ICAO - Dakar	Mr. Sadou MARAFA	Regional Officer ATM/SAR Tel:+221-33-839-9390 Fax:+221-33-823-6926 Mobile:+221-76-683-7843 <b>E-mail:smarafa@dakar.icao.int</b>
	ICAO - Nairobi	Mr. Seboeso Machobane	Regional Officer/Air Traffic Management (RO/ATM) – <b>ICAO – NAIROBI</b> Tel:254-20-7622372/7622374 Fax:254-20-7621092 <b>E-mail:seboeso.machobane@icao.unon.org</b> <b>E-mail:icao@icao.unon.org</b>
	ICAO - Nairobi	Ms. Mary Obeng	Regional Officer/CNS (RO/CNS) – ICAO – Nairobi Tel:254-20-7622367 Fax:+254-20-7621092 <b>E-mail:mary.obeng@icao.unon.org</b> <b>E-mail:icao@icao.unon.org</b>
	ICAO - Nairobi	Mr. Brou Konan	Regional Officer/Air Traffic Management (RO/ATM) <b>ICAO – NAIROBI</b> Tel:254-20-7622373/7622374 Fax:254-20-7621092 <b>E-mail:konan.brou@icao.unon.org</b> <b>E-mail:icao@icao.unon.org</b>

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**DRAFT FOLLOW-UP ACTION PLAN**

**Joint Meeting of the APIRG Performance Based Navigation and Global Navigation Satellite System Implementation Task Forces (Joint PBN & GNSS/I TFs) (PBN/TF/3, GNSS/TF/I/5)**

CONCL DEC NO. --- STRATEGIC OBJECTIVE A & D	TITLE OF CONCLUSION/DECISION	TEXT OF CONCLUSION/DECISION	FOLLOW-UP ACTION	TO BE INITIATED BY	DELIVERABLE	TARGET DATE
<b>DRAFT DECISION 1/1:</b>	<b>DISSOLUTION OF THE GNSS IMPLEMENTATION AND PBN TASK FORCES AND ESTABLISHMENT OF THE PBN/GNSS TASK FORCE.</b>	That the GNSS Implementation and PBN Task Forces are dissolved and the PBN/GNSS Task Force is established with the terms of reference in <b>Appendix 3A</b> to the report on agenda item 3.	Present proposal to APIRG.	ATS/AIS/SAR/SG	Establishment of PBN/GNSS TF	APIRG/17
<b>DRAFT DECISION 1/2:</b>	<b>PBN ROUTE NETWORK DEVELOPMENT WORKING GROUP (PRND WG)</b>	That, the AFI PBN Route Network Development Working Group (PRND WG) is established with the terms of reference, compositing and working arrangements as at <b>Appendix 4B</b> to the report on agenda item 4.	WG meetings.	PRND WG.	Routes development	Ongoing
<b>DRAFT DECISION 1/3:</b>	<b>REQUIREMENT FOR PBN IMPLEMENTATION SYSTEM SAFETY MONITORING AT REGIONAL LEVEL</b>	That, APIRG assess the requirement for PBN implementation system safety monitoring at Regional level, as well as the nature of an appropriate body/entity to undertake such task, should the need be identified.	Assess monitoring need and monitoring body.	APIRG	<ul style="list-style-type: none"> <li>- Identification of need for PBN implementation system monitoring.</li> <li>- Identification of monitoring body</li> </ul>	APIRG/17







CONCL DEC No. --- STRATEGIC OBJECTIVE A & D	TITLE OF CONCLUSION/DECISION	TEXT OF CONCLUSION/DECISION	FOLLOW-UP ACTION	TO BE INITIATED BY	DELIVERABLE	TARGET DATE
		b) provide feedback to the ESAF and WACAF Regional Offices by 30 October regarding progress in the development of their national plans, indicating any challenges, if any, that are delaying the development of the plan, as well as measures taken or to be taken to overcome such challenges; and  c) complete their National PBN Plans as soon as possible, but not later than 31 December 2009,	State letter.	ROs		
<b>CONCLUSION 1/7:</b>	<b>PBN IMPLEMENTATION TOOLS</b>	That States,  a) are encouraged to use project management plans and implementation action plans such as provided in <b>Appendices 5</b> to the report on agenda item 5, to support PBN implementation activities; and  b) carry out a gap analysis using the project plan template attached to the report, or similar approach, in order to more accurately develop their PBN implementation plans.	State letters/ Report.  Implement Conclusion.	ROs  States.	Awareness on planning tools.  National plans accuracy & effectiveness.	Nov. 09  On-going.

CONCL DEC No. --- STRATEGIC OBJECTIVE A & D	TITLE OF CONCLUSION/DECISION	TEXT OF CONCLUSION/DECISION	FOLLOW-UP ACTION	TO BE INITIATED BY	DELIVERABLE	TARGET DATE
<b>DRAFT DECISION 1/8:</b>	<b>ESTABLISHMENT OF THE PBN IMPLEMENTATION PLANNING ADVISORY GROUP (PAG)</b>	That, the PBN implementation Planning Advisory Group (PAG) is established with the terms of reference as at <b>Appendix 5C</b> to the report on Agenda Item 5.	Judication of need for assistance.	PAG, States	Assistance to States on PBN plans.	In accordance with TOR.
<b>CONCLUSION 1/9:</b>	<b>IMPLEMENTATION OF REDUCED LATERAL EN-ROUTE SEPARATION</b>	That, recognizing that States should adequately comply with safety management provisions, the Regional Offices advise AFI States that further Regional implementation of reduced separation minima should only proceed in circumstances where implementing States can demonstrate an ability to comply with Annex 11, Chapter 2, safety management provisions for the continuous monitoring and regular assessment of the safety level achieved.	State letter  Implement Conclusion.	ROs  States	Awareness  Compliance with Annex 11.	Dec. 09  Ongoing
<b>DECISION 1/10:</b>	<b>ASSIGNMENT OF TASKS</b>	That, in order to facilitate PBN implementation in the AFI Region:  a) the Joint PBN and GNSS Implementation Task Forces (proposed PBN/GNSS/I/TF) are to deliver on the tasks in <b>Appendix 6B</b> to the Report of Agenda Item 6; and	State letter.	ROs	In accordance with the task list.	Ongoing

CONCL DEC No. --- STRATEGIC OBJECTIVE A & D	TITLE OF CONCLUSION/DECISION	TEXT OF CONCLUSION/DECISION	FOLLOW-UP ACTION	TO BE INITIATED BY	DELIVERABLE	TARGET DATE
		<p>b) the Working Groups of the Task Force are to utilize, to the extent practical, electronic means of communication and exchange of working material (documents), and use available ICAO website as necessary.</p> <p>(This Draft Decision supersedes the PBN TF/2 Decisions 2/2, 2/3, 2/4; ATS/AIS/SAR/SG/10 Decision 10/07)</p>				
<b>DRAFT CONCLUSION 1/11:</b>	<b>PERFORMANCE BASED APPROACH AND MEASUREMENT</b>	<p>That, in accordance with Special AFI RAN (2008) Recommendation 3/3, the following PBN performance indicators are to form part of the regional performance framework forms (PFFs):</p> <p>i) Efficiency: Number of PBN routes/Number of APV approaches to runway ends, reduction in track miles.</p> <p>ii) Environment: CO2 burn, Noise reduction.</p> <p>ii) Safety: reduction of CFIT (Ref. SP AFI RAN).</p>	<p>State letter</p> <p>Implement Conclusion.</p>	<p>ROs</p> <p>PBN TF, States</p>	<p>Implementation of metrics in PFFs.</p>	<p>Dec. 09</p>

CONCL DEC No. --- STRATEGIC OBJECTIVE A & D	TITLE OF CONCLUSION/DECISION	TEXT OF CONCLUSION/DECISION	FOLLOW-UP ACTION	TO BE INITIATED BY	DELIVERABLE	TARGET DATE
DRAFT CONCLUSION 1/12 :	GNSS STRATEGY	That,	Implement Conclusion.	PBN & GNSS Task Forces.	Co-ordinated Implementation in accordance with ICAO provisions.	Ongoing
		<p>a) the GNSS implementation strategy is aligned with the Regional PBN implementation plan to provide supplementary PBN implementation support, as at <b>Appendix 8A</b> to the report on agenda item 8, except for precision approach operations, which are currently not part of PBN; and</p> <p>b) the GNSS implementation strategy be integrated into the AFI Doc 003.</p>	Updated Doc.003	ROs.	Updated Doc.003	APIRG/17

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\*Note: ICAO has established the following Strategic objectives for the period 10005-10010

*A: Safety: Enhance global civil aviation safety;*

*B: Security: Enhance Global civil aviation security;*

*C: Environmental Protection: Minimize the adverse effect of global civil aviation on the environment;*

*D: Efficiency: Enhance the efficiency of aviation operation;*

*E: Continuity: Maintain the continuity of aviation operations; and*

*F: Rule of Law: Strengthen law governing international civil aviation*

FOLLOW-UP ACTION ON ATM APIRG/16 CONCLUSIONS/DECISIONS

Conclusions/Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/Intended Outcome	Target Dates
<b>DECISION 16/2:</b>  A	<b>ESTABLISHMENT OF AN APIRG PERFORMANCE-BASED NAVIGATION TASK FORCE (APIRG/PBN/TF):</b>	That an APIRG PBN Task Force, with terms of reference as outlined in Appendix D to this report, be established to develop a PBN implementation plan for the AFI Region and address related regional PBN implementation issues.	Nomination of Members of the Task Force	ESAF Office	State Letter to nominate Members.	Completed.
<b>CONCLUSION 16/3:</b>  A	<b>DEVELOPMENT OF STATES PBN IMPLEMENTATION PLANS:</b>	That the Regional Offices encourage States to begin development of their State PBN implementation plans in harmony with the development of the AFI Regional PBN implementation plan being coordinated by the AFI PBN Task Force for submission to APIRG.	Encourage States to develop State PBN implementation Plan 2008.	ESAF Office	State Letter.	Dec. 09
<b>CONCLUSION 16/4:</b>  A	<b>DESIGNATION OF CONTACT PERSON FOR PBN IMPLEMENTATION:</b>	That, by 28 February 2008, States designate a focal contact person responsible for Performance-Based Navigation implementation and provide details of the contact person to ICAO Regional Offices for the AFI Region.	Follow-up with States for POC.	ESAF Office  WACAF Office	State Letter  State Letter	Dec. 09  Completed.

Conclusions/Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/Intended Outcome	Target Dates
<b>CONCLUSION 16/21:</b>  <b>A &amp; F</b>	<b>IMPLEMENTATION OF GNSS EN-ROUTE AND NON-PRECISION APPROACH OPERATIONS:</b>	That AFI States continue their efforts to implement GNSS applications for en-route and non-precision approach operations as part of Phase 1 of AFI GNSS Strategy. In so doing, particular attention should be accorded to meeting all GNSS implementation requirements, including establishment of GNSS legislation, regulatory framework, and approval and monitoring procedures.	Notify AFI States	WACAF	State Letter	Nov. 09*
<b>CONCLUSION 16/22:</b>  <b>A &amp; E</b>	<b>RECORDING OF GNSS PARAMETERS:</b>	That AFI States that approve GNSS-based operations ensure that GNSS data relevant to those operations are recorded as recommended in ICAO Annex 10, Volume I, Chapter 2, para. 2.4.3.  Particularly, for GNSS core systems, the following monitored items should be recorded for all satellites in view:	Notify AFI States	WACAF	State Letter	Nov. 09*

Conclusions/Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/Intended Outcome	Target Dates
		<ul style="list-style-type: none"> <li>a) observed satellite carrier-to-noise density;</li> <li>b) observed satellite raw pseudo-range code and carrier phase measurements;</li> <li>c) broadcast satellite navigation messages, for all satellites in view; and</li> <li>d) relevant recording receiver status information.</li> </ul>				
<b>CONCLUSION 16/23:</b>	<b>AERONAUTICAL INFORMATION RELATED TO GNSS</b>	That when implementing GNSS-based operations, AFI States ensure that the relevant aeronautical information is provided to the users as appropriate.	Notify AFI States	WACAF	State Letter	Nov. 09*
<b>DECISION 16/24: A &amp; F</b>	<b>AFI GNSS IMPLEMENTATION STRATEGY</b>	That the action taken by the Commission on APIRG/15, Conclusions 15/18, 15/19 and 15/20 be referred to the AFI GNSS Implementation Task Force for updating the AFI GNSS Strategy and progressing its work accordingly.	Hold AFI/GNSS/1/T F Meeting	WACAF	Organize an AFI GNSS/I/TF meeting and update AFI/GNSS Implementation Strategy	Completed.



Conclusions/Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/Intended Outcome	Target Dates
<b>CONCLUSION 16/67:  A &amp; D</b>	<b>ELIMINATION OF AIR NAVIGATION DEFICIENCIES</b>	That States be reminded to adopt a step-by-step approach when implementing air navigation system elements, by giving priority to solving the deficiencies affecting all elements of the system.	Notify States	WACAF	State Letter	Nov. 09*

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- B: Security: Enhance Global civil aviation security;*
- C: Environmental Protection: Minimize the adverse effect of global civil aviation on the environment;*
- D: Efficiency: Enhance the efficiency of aviation operation;*
- E: Continuity: Maintain the continuity of aviation operations; and*
- F: Rule of Law: Strengthen law governing international civil aviation*

**FOLLOW-UP ACTION ON ATS/AIS/SAR/SG/10 CONCLUSIONS/DECISIONS**

Conclusions/ Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates
<b>Conclusion 10/15:</b>	<b>Members of PBN Task Force</b>	That the following States and International Organizations shall nominate experts to serve as members of the PBN Task Force: Algeria, Benin, Burundi, Botswana, Cameroon, Cape Verde, Chad, Democratic Republic of Congo (DRC), Egypt, Ethiopia, Ghana, Kenya, Lesotho, Liberia, Mauritius, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Tanzania, Tunisia, Uganda, IFALPA, IFATCA, IATA, ASECNA and Roberts FIR.	No action in light of ATS/AIS/SAR /SG/10 Concl.10/13			Superseded by Joint meeting of PBN & GNSS TF <b>Draft Decision 1/1.</b>
<b>Conclusion 10/16:</b>	<b>Conduct of Surveys on aircraft equipage</b>	That:  a) ICAO Regional Offices conduct regular surveys on aircraft equipage within the AFI Region, as part of PBN implementation related activities; and	-State letter  -Follow-up for updated data.	ROs  ROs States	States requested for data.  Significant up to-date data available.	Completed.  On-going.

Conclusions/ Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates
		b) ICAO regional surveys on aircraft equipage should be carried out in close coordination with States, IATA and AFRAA.	-Coordination with IATA	ICAO	Coordinated data acquisition.	On-going.
<b>Conclusion 10/18:</b>	<b>Nomination of National PBN Program Managers (NPPMs)</b>	<p>That:</p> <p>States/service providers which have not done so, designate/nominate as soon as possible, but not later than 31 July 2009 a National PBN Program Manager PBN (NPPM), who will be responsible for ensuring that the proper mechanism be put in place for the effective implementation of PBN.</p> <p>Note: The terms of reference of PBN program managers are provided at Appendix I to this report.</p>	<p>-State letter</p> <p>-Follow-up on responses.</p>	<p>ROs</p> <p>ROs States</p>	<p>-State letter</p> <p>-NPPMs nominated.</p>	<p>Nov. 09</p> <p>On-going.</p>

Conclusions/ Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates
<b>Conclusion 10/19:</b>	<b>Implementation of PBN in the AFI Region</b>	<p>That:</p> <p>a) States in the AFI Region ensure that all requirements be met with a view to safely implementing PBN; and</p> <p>b) Implementation of PBN in the AFI Region be harmonized and coordinated with other adjacent Regions.</p>	<p>-State letter</p> <p>-Implement conclusion.</p>	<p>ROs State</p> <p>PBN TF</p>	<p>-Safe Implementation of PBN.</p> <p>-Inter-regional coordinated in PBN implementation.</p>	<p>On-going.</p> <p>On-going.</p>
<b>Conclusion 10/20:</b>	<b>Training of all personnel involved with the implementation of PBN in the AFI Region</b>	<p>That:</p> <p>a) APIRG PBN Task Force identify training needs in order to assist States with RNAV/RNP implementation in the en-route, terminal, and approach flight phases, taking account the performance-based navigation (PBN) concept.</p>	<p>-Implement conclusion.</p>	<p>PBN TF</p>	<p>-Training needs document.</p>	<p>APIRG/17</p>

Conclusions/ Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates
		<p>b) Seminars/Workshops be organized in the Region for training of relevant personnel directly involved in the implementation of PBN namely pilots, controllers, procedures designers, dispatchers, OPS/Air, operators etc;</p> <p>c) ICAO develop training modules on PBN by 31 December 2009 that may be used by States for training; and</p> <p>d) States having difficulties in implementing PBN implementation programme, may either individually or in group explore the possibility of seeking outside expertise.</p>	<p>-Implement Conclusion part (b)</p> <p>-Training modules.</p> <p>-Implement Conclusion part (d)</p> <p>-State letter</p>	<p>ICAO</p> <p>ICAO</p> <p>States</p> <p>ROs</p>	<p>-Seminars /workshops concerned.</p> <p>-Training modules.</p> <p>-Expertise sourced as necessary.</p> <p>-States awareness.</p>	<p>On-going till Dec. 09</p> <p>Dec.2010</p> <p>On-going</p> <p>Dec.2009</p>
<b>Conclusion 10/21:</b>	<b>PBN Legislation</b>	That the States that have not done so, include in their legislation and regulations the provisions relating to PBN.	<p>-State letter</p> <p>-Implement conclusion.</p>	<p>ROs</p> <p>States</p>	<p>States urged.</p> <p>PBN related legislation.</p>	APIRG/17

Conclusions/ Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates
<b>Conclusion 10/22:</b>	<b>Participation of representatives of States involved in PBN approval process</b>	That representatives of States involved in the PBN approval process of aircraft operators, be invited to attend the future meetings of the PBN Task Force.	-State letter	ROs	-States urged.	Dec.2009
<b>Conclusion 10/23:</b>	<b>Funding of the PBN Implementation Program</b>	That regulatory bodies, operators, service providers and other stakeholders be granted budgetary allocations for acquisitions and other activities necessary for ensuring that all the requirements be met in a timely manner in order to safely implement PBN in the AFI Region.	-State letter  -Funding	ROs  -States	-States awareness.  Funding of PBN programmes.	Dec. 2009  On-going.
<b>Conclusion 10/24:</b>	<b>AFI Regional PBN Implementation Plan and National PBN Plan Template</b>	That:  a)The Regional PBN Implementation Plan at Appendix J is applicable in the AFI Region.	Implement conclusion.	PBN TF States.	National PBN Implementation Plans.	On-going

Conclusions/ Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates
		<p>b) States use the National PBN Plan Template at Appendix K in developing their National PBN Plans; and</p> <p>c) States complete their National PBN Plans as soon as possible, but not later than 31 December 2009.</p>	<p>Implement conclusion.</p> <p>Implement conclusion.</p>	<p>States.</p> <p>States.</p>	<p>National PBN Implementation Plans</p>	<p>Dec. 09</p> <p>Dec. 09</p>
<b>Conclusion 10/25:</b>	<b>Amendment to the AFI CNS/ATM Plan (Doc.003)</b>	That ICAO Regional Offices carry out necessary actions in coordination with States to amend the relevant parts of the AFI/CNS/ATM Plan (Doc.003) to incorporate PBN issues.	Implement conclusion.	ROs	Updated Doc.003	APIRG/17
<b>Decision 10/6:</b>	<b>Proposals of amendment to the AFI/CNS/ATM Plan (Doc.003)</b>	That the PBN Task Force develop amendment proposals to assist APIRG in the incorporation of PBN elements in the AFI/CNS/ATM Plan (Doc.003).	Implement conclusion.	PBN/TF	Amendment material	APIRG/17

Conclusions/ Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates
<b>Conclusion 10/26:</b>	<b>Renaming of the APIRG PBN Task Force</b>	Taking into account the assigned objectives of both the PBN and GNSS Task Forces, the ATS/AIS/SAR proposes that APIRG endorses the merger of the two task forces into the AFI PBN/GNSS task force in order to prevent duplication of work, as per combined Terms of Reference at Appendix L.				Superseded by Joint meeting of PBN& GNSS TF <b>Draft Decision 1/1</b>
<b>Decision 10/7:</b>	<b>AFI Regional PBN Performance Objectives and Action Plans</b>	That, in accordance with Special AFI RAN 08 Recommendation 6/9, the APIRG PBN Task Force finalize the development of the AFI PBN performance objectives and Action Plans based on the performance framework forms (PFFs), and report to APIRG.				Superseded by Joint meeting of PBN & GNSS TF <b>Draft Decision 1/10.</b>
<b>Conclusion 10/27:</b>	<b>Need for early implementation of PBN</b>	That AFI States and other stakeholders anticipate PBN implementation activities, in accordance with APIRG Conclusion 16/3 - Development of States PBN implementation Plans, using	Implement conclusion.	-States -International Organizations. -Other stakeholders.	Coordinated implementation	On-going



Conclusions/ Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates
		available guidance material, including the navigation specifications shown in Appendix M . In so doing, partnership with relevant Organizations should be considered as required				
<b>Conclusion 10/28:</b>	<b>Implementation of AFI Flight Procedures Office (FPO)</b>	<p>That ICAO:</p> <ul style="list-style-type: none"> <li>a) Expedite the establishment of an AFI Flight Procedures Office; and</li> <li>b) Expedite its work on additional guidance material on PBN in a timeframe compatible with the milestones established under Assembly Resolution A36-23, and ensure that is made available in other ICAO working languages.</li> </ul>	Ref. follow-up action on AFI SP RAN Rec.6/10.			

Conclusions/ Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates
<b>Conclusion 10/29:</b>	<b>IATA Guidelines for Operational Approvals</b>	That IATA facilitates stakeholders' access to its Guidelines developed to assist operators in obtaining Airworthiness and Operational Approvals for PBN, for guidance and reference as required.	Implement conclusion.	IATA	Stakeholders access to PBN approved guidelines.	Dec. 09
<b>Conclusion 10/39:</b>	<b>Need for a comprehensive list of deficiencies and coordination of initiatives</b>	That: a) APIRG establish a comprehensive list of deficiencies consistent with ICAO definition; and b) ICAO establish mechanisms to ensure that AFI initiatives aimed at ensuring that air navigation safety and efficiency issues are properly coordinated to avoid duplication of efforts and develop effective synergy, thus enabling the timely resolution of identified deficiencies in the Region.	Implement conclusion	APIRG	Reviewed deficiency identification and resolution follow-up system.	APIRG/17

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*C: Environmental Protection: Minimize the adverse effect of global civil aviation on the environment;*

*D: Efficiency: Enhance the efficiency of aviation operation;*

*E: Continuity: Maintain the continuity of aviation operations; and*

*F: Rule of Law: Strengthen law governing international civil aviation*

**LIST OF CONCLUSIONS/DECISIONS From GNSS Task Force/4 Meeting (8 -9 December 2008, Nairobi, Kenya)**

Conclusions/Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/Intended Outcome	Target Dates
<b>Conclusion 4/2:</b>	<b>Need for ICAO assistance to States</b>	That the Regional Office carry out a survey on States' needs for assistance in implementing APIRG conclusions concerning Phase I of the AFI GNSS Strategy as defined by APIRG/15, including GNSS operational requirements (such as legislation/regulations, design and/or publication of procedures, etc.)	State Letter by January 2009	ICAO	Assistance to States.	On going
<b>Conclusion 4/3:</b>	<b>Deletion of Footnotes in ITU Radio Regulations</b>	That CAAs which have not yet done so should liaise with telecommunication regulatory authorities to delete the existing footnotes in the ITU RR.	To be addressed at Frequency meeting 1-3 Oct.  State Letter by January 2009.	ICAO States	Deletion of existing footnotes.	
<b>Conclusion 4/1:</b>	<b>Aeronautical Information on GNSS –Daily Advisory.</b>	That a) States should register at : <a href="http://www.navcen.uscg.gov">http://www.navcen.uscg.gov</a> for the daily GPS advisory. b) The need for AIS Seminar/Workshop.	GPS Advisory workshop 1-3 September 2009.  State letter by January 2009.	States ICAO	- Seminar/workshops - GPS Advisories ongoing.	Completed

Conclusions/Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/Intended Outcome	Target Dates
		c) That ICAO conducts Seminar/Workshop on GPS advisory for AFI States.				
<b>Conclusion 4/4:</b>	<b>Report on AFI Test Bed</b>	That, ESA, in cooperation with ASECNA, ATNS South Africa and Kenya provide the ICAO Secretariat with a consolidated final report on AFI GNSS Test Bed, covering Zone A, Zone B and Zone C.	3 reports have been received from ESA but not technical report	ESA ASECNA ATNS Kenya ICAO		March 2009
<b>Decision 4/1:</b>	<b>ISA Cost Benefit Analysis:-</b>	That:-  a) ICAO Secretariat ensure that the input to the Cost Benefit analysis related to ISA , include Statistical data, fleet data and equipage, industry trends etc.,  b) When finalized, the ISA Cost Benefit Analysis presented to GNSS/I/ TF/4 be circulated to all AFI GNSS TASK FORCE members for comments and feed- back to the Secretariat.		To be submitted to this meeting by ESA.  ICAO	CBA Feedback.	Draft CBA reviewed by Joint meeting of PBN TF & GNSS/1 TF.

Conclusions/Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/Intended Outcome	Target Dates
<b>Conclusion 4/4:</b>	<b>Navigation Specifications to be supported by AFI GNSS</b>	That the AFI GNSS operational requirements should be based on the navigation specifications provided in draft GNSS strategy, in accordance with the AFI PBN Regional Plan.	Review GNSS Strategy.	APIRG States	<ul style="list-style-type: none"> <li>- GNSS alignment with PBN Regional Plan.</li> <li>- Implementation.</li> </ul>	Oct. 2009  Ongoing
<b>Conclusion 4/5:</b>	<b>Implementation of Approach with Vertical Guidance (APV)</b>	<p>That APIRG should coordinate and specify the applicable approach with vertical guidance (APV) type (Baro-VNAV versus SBAS) in view of Assembly Resolution A36-23 to achieve 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.</p> <p>Note: An APIRG decision is required no later than 2010 in order to meet the above date.</p>		APIRG	To be submitted to APIRG/17	Obsolete Ref. joint meeting of PBN & GNSS TFs Report on Agenda 8.

Conclusions/Decisions No. Strategic Objectives*	Title of conclusion/Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/Intended Outcome	Target Dates
<b>Conclusion 4/6:</b>	<b>Proposed amendments to AFI GNSS Strategy</b>	That the AFI GNSS Strategy be updated as proposed in Appendix (draft AFI GNSS)to this report.	On going	APIRG	Revised GNSS Implementation strategy.	Completed in September 2009.
<b>Decision 4/2:</b>	<b>Finalization of draft amendments to AFI GNSS Strategy as part of AFI CNS/ATM Implementation Plan (Doc 003)</b>	That a joint meeting of APIRG PBN and GNSS Implementation Task Force be held in order to finalize draft amendments to AFI GNSS Strategy as part of AFI CNS/ATM Implementation Plan (Doc 003), based on the AFI Regional PBN Plan (Roadmap) and related performance objectives and action plan for en – route, terminal and approach flight phases.	On going for submission to this meeting	ICAO	Joint Meeting.	Completed.
<b>Conclusion 4/7:</b>	<b>Establishment of a combined APIRG PBN/GNSS Task Force</b>	That APIRG establish a combined PBN/GNSS Task Force to ensure consistency in the planning and implementation of AFI requirements for Performance Based Navigation concept and the Navigation element of CNS/ATM, with the Terms of reference shown in Appendix 8A to this report.	Submit proposal to APIRG/17.	Joint meeting of PBN & GNSS TFs.	PBN/GNSS/TF	APIRG/17

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*D: Efficiency: Enhance the efficiency of aviation operation;*

*E: Continuity: Maintain the continuity of aviation operations; and*

*F: Rule of Law: Strengthen law governing international civil aviation*



**FOLLOW-UP ON ATM RECOMMENDATIONS OF SP AFI RAN 2008**

Conc/Dec No. Strategic Objectives*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates
<b>Recommendation 6/9:</b>	<b>Performance-based navigation (PBN) performance objectives</b>	<p>That APIRG adopt the Performance Objectives as contained in the performance framework forms in Appendix D to the Report on Agenda Item 6:</p> <p>a) optimization of the air traffic services (ATS) route structure in en-route airspace;</p> <p>b) optimization of the ATS route structure in terminal airspace; and</p> <p>c) implementation of vertically guided required navigation performance (RNP) approaches.</p> <p>That States develop their national action plans to meet the requirements of the regional performance framework forms, as a matter of priority to meet the PBN implementation goals established by Assembly Resolution A36-23.</p>	<ul style="list-style-type: none"> <li>➤ Implement recommendation. <ul style="list-style-type: none"> <li>• Identify action parties and specific target dates.</li> <li>• Update PFFs.</li> <li>• Follow-up</li> <li>• Provide guidance for States.</li> </ul> </li> <li>➤ Implement the States recommendations. <ul style="list-style-type: none"> <li>• Identify action parties and specific target dates.</li> <li>• Update PFFs.</li> <li>• Follow-up</li> </ul> </li> </ul>	APIRG (PBN/TF)	Updated PFFs	PBN TF/4

Conc/Dec No. Strategic Objectives*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates
<b>Recommendation 6/10:</b>	<b>Support for establishment of an Africa ICAO flight procedure office</b>	That:  a) States and international organizations support the implementation of an AFI flight procedures office; and  b) ICAO disseminate a letter, with supporting documentation, inviting interested States and international organizations to submit proposals for establishment and hosting of the FPO.	Provide support to FPO.  State letters.	States and International Organizations.  ICAO HQ.	Invitation to establish FPO.	Based on APAC FPO experience to be reviewed by APIRG/17.
<b>Recommendation 6/13:</b>	<b>Publication of GNSS-based RNP approach procedures</b>	That:  a) States having taken part in the IATA area navigation (RNAV) global navigation satellite systems (GNSS) procedures development and implementation programme and which had not yet done so, publish GNSS-based required navigation performance (RNP) approaches, and at the same time, remove any operational restrictions that may be in place; and	- Publish GNSS-based instrument Flight Procedures (IFPs).  - Remove restrictions.	States.	GNSS-based IAPs published and operational.	APIRG/17

Conc/Dec No. Strategic Objectives*	Title of Conclusion/ Decision	Text of Conclusion/Decision	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates
		b) States that had not taken part in the IATA RNAV GNSS procedures development and implementation programme, seek assistance from appropriate organizations with the objective of designing and implementing GNSS-based RNP approach procedures.	Implement conclusion.	States.		APIRG/17
<b>Recommendation 6/14:</b>	<b>ICAO assistance with legal and regulatory issues associated with implementation of GNSS approach procedures</b>	That ICAO provide assistance to States in overcoming legal and regulatory difficulties associated with implementation of global navigation satellite systems (GNSS) based approach procedures.	Implement Conclusion.	ICAO HQs.	Guidance material to overcome legal regulators challenged in use of GNSS.	APRIG/17

\*Note: ICAO has established the following Strategic objectives for the period 2005-2010

*A: Safety: Enhance global civil aviation safety;*

*B: Security: Enhance Global civil aviation security;*

*C: Environmental Protection: Minimize the adverse effect of global civil aviation on the environment;*

*D: Efficiency: Enhance the efficiency of aviation operation;*

*E: Continuity: Maintain the continuity of aviation operations; and*

*F: Rule of Law: Strengthen law governing international civil aviation*

**PROPOSED TERMS OF REFERENCE FOR COMBINED APIRG  
PBN/GNSS TASK FORCE**

**1. Terms of Reference**

- a) Carry out specific studies in support of the implementation of Performance Based Navigation (PBN) in the AFI Region, according to the ICAO Strategic Objectives and Global Plan Initiative (GPI) 5 and related GPIs (GPIs 7, 10, 11, 12, 20, 21).
- b) Identify other issues/action items arising from the work of ICAO or for consideration by ICAO in order to facilitate regional and global harmonization of existing applications as well as future implementation of Performance Based Navigation operations.
- c) Determine and recommend, on the basis of the studies, the PBN strategy and Implementation Plan for the AFI Region, based on the ICAO PBN Implementation goals as reflected in assembly resolution 36-23.
- d) Assist States that may require support in the implementation of PBN.

**2. Work Programme**

- a) Study and assess the Regional RNAV and RNP requirements.
- b) Initially focus assistance to States that may require support on development of the State PBN implementation plans.
- c) Identify priority routes and terminal areas where RNAV and RNP should be implemented.
- d) Identify priority runways for Approach Procedures with Vertical Guidance (APV) to be implemented based on the ICAO RNP APCH navigation specification (APV).
- e) Develop an amendment proposal to the AFI Regional Supplementary Procedures concerning the implementation of PBN in the Region.
- f) Identify guidance material and training needs.
- g) Follow up on the developments in ICAO affecting the Global Plan and PBN in particular, in order to update the Regional plans accordingly.
- h) Coordinate with other ICAO Regions as necessary to address implementation interface issues.

- i) Undertake other functions relevant to implementation of PBN as assigned by APIRG.
- j) Develop and update (as necessary) the Regional PBN Implementation Strategy and Plan.
- k) Develop the PBN performance objectives and related action plans for en-route, terminal and approach phases of flight; and;
- l) Report to APIRG through its ATM and CNS Sub-groups.

**3. The Task Force shall in its work be guided by the following principles:**

- a) Implementation of PBN shall follow the ICAO PBN goals and milestones.
- b) Avoid undue equipage of multiple on board equipment and/or ground-based systems.
- c) Avoid the need for multiple airworthiness and operational approvals for intra- and interregional operations.
- d) Continue application of conventional air navigation procedures during the transition period, to guarantee the operations by users that are not RNAV- and/or RNP-equipped
- e) The first regional PBN Implementation Strategy and Plan should address the short term (2008-2012), medium term (2013-2016) and take into account long term global planning issues.
- f) Cognizance that the primary objective of ICAO is that of ensuring the safe and efficient performance of the global Air Navigation System, ensure that pre- and post-implementation safety assessments will be conducted to ensure the application and maintenance of the established target levels of safety g) Take into account the introduction of new technologies, encourage implementation and development in GNSS.
- h) Coordinated implementation with other relevant Regional Plans.
- i) Apply ICAO guidance material and information as may be applicable to the Region to facilitate the implementation of PBN.

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~~Region Performance Based  
Navigation Roadmap~~

AFI

Regional Performance Based Navigation

Implementation Plan

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## 1. Introduction

- 1.1 The AFI Region Performance Based Navigation (PBN) Roadmap details the framework within which the ICAO PBN concept will be implemented in the AFI Region for the foreseeable future. The AFI Region Roadmap for PBN is guided by ICAO Doc. 9613 and relevant SARPS. The primary driver for this plan is to maintain and increase safety, air traffic demand and capacity, and services and technology in consultation with relevant stakeholders. The AFI Region Roadmap also supports national and international interoperability and global harmonization.

## 2. BACKGROUND

- 2.1 The continuing growth of aviation places increasing demands on airspace capacity and emphasizes the need for the optimum utilization of the available airspace.
- 2.2 Growth in scheduled and GA aircraft is expected to increase point-to-point and direct routings. The increasing cost of fuel also presents a significant challenge to all segments of the aviation community. This anticipated growth and higher complexity of the air transportation system could result in increased flight delays, schedule disruptions, choke points, inefficient flight operations, and passenger inconvenience, particularly when unpredictable weather and other factors constrain airport capacity. Without improvements in system efficiency and workforce productivity, the aviation community and cost of operations will continue to increase. Upgrades to the air transportation system must leverage current and evolving capabilities in the near term, while building the foundation to address the future needs of the aviation community stakeholders. These circumstances can be partially alleviated by efficiencies in airspace and procedures through the implementation of PBN concepts.
- 2.3 In setting out requirements for navigation applications on specific routes or within a specific airspace, it is necessary to define requirements in a clear and concise manner. This is to ensure that both flight crew and ATC are aware of the on-board area navigation (RNAV) system capabilities and to ensure that the performance of the RNAV system is appropriate for the specific airspace requirements.
- 2.4 The early use of RNAV systems arose in a manner similar to conventional ground-based routes and procedures. A specific RNAV system was identified and its performance was evaluated through a combination of analysis and flight testing. For domestic operations the initial systems used VOR and DME for their position estimation. For oceanic operations, inertial navigation systems (INS) were employed.



- 2.5 These 'new' systems were developed, evaluated and certified. Airspace and obstacle clearance criteria were developed on the basis of available equipment performance. Requirements specifications were based upon available capabilities and, in some implementations, it was necessary to identify the individual models of equipment that could be operated within the airspace concerned.
- 2.6 Such prescriptive requirements result in delays to the introduction of new RNAV system capabilities and higher costs for maintaining appropriate certification. To avoid such prescriptive specifications of requirements, the PBN concept introduces an alternative method for defining equipage requirements by specification of the performance requirements. This is termed Performance Based Navigation (PBN).

### **3. PERFORMANCE BASED NAVIGATION**

- 3.1 Performance based navigation (PBN) is a concept that encompasses both area navigation (RNAV) and required navigation performance (RNP) and revises the current RNP concept. Performance based navigation is increasingly seen as the most practical solution for regulating the expanding domain of navigation systems.
- 3.2 Under the traditional approach, each new technology is associated with a range of system-specific requirements for obstacle clearance, aircraft separation, operational aspects (e.g. arrival and approach procedures), aircrew operational training and training of air traffic controllers. However, this system-specific approach imposes an unnecessary effort and expense on States, airlines and air navigation services (ANS) providers.
- 3.3 Performance based navigation eliminates the need for redundant investment in developing criteria and in operational modifications and training. Rather than build an operation around a particular system, under performance based navigation the operation is defined according to the operational goals, and the available systems are then evaluated to determine whether they are supportive.
- 3.4 The advantage of this approach is that it provides clear, standardized operational approvals which enable harmonized and predictable flight paths which result in more efficient use of existing aircraft capabilities, as well as improved safety, greater airspace capacity, better fuel efficiency, and resolution of environmental issues.

- 3.5 The PBN concept specifies aircraft RNAV system performance requirements in terms of accuracy, integrity, availability, continuity and functionality needed for the proposed operations in the context of a particular Airspace Concept. 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 are defined at a sufficient level of detail to facilitate global harmonization by providing specific implementation guidance for States and operators.
- 3.6 Under PBN, generic navigation requirements are defined based on the operational requirements. Operators are then able to evaluate options in respect of available technologies and navigation services that could allow these requirements to be met. The chosen solution would be the most cost effective for the operator, rather than a solution being imposed as part of the operational requirements. Technologies can evolve over time without requiring the operation itself to be revisited, as long as the requisite performance is provided by the RNAV system. As part of the future work of the ICAO it is anticipated that other means for meeting the requirements of the Navigation Specifications will be evaluated and may be included in the applicable Navigation Specifications, as appropriate.
- 3.7 ICAO's Performance Based Navigation (PBN) concept aims to ensure global standardisation of RNAV and RNP specifications and to limit the proliferation of navigation specifications in use world-wide. It is a new concept based on the use of Area Navigation (RNAV) systems. Significantly, it is a move from a limited statement of required performance accuracy to more extensive statements for required performance in terms of accuracy, integrity, continuity and availability, together with descriptions of how this performance is to be achieved in terms of aircraft and flight crew requirements.

#### **4. PBN BENEFITS**

- 4.1 PBN offers a number of advantages over the sensor-specific method of developing airspace and obstacle clearance criteria. These include:
- a) Reduces need to maintain sensor-specific routes and procedures, and their associated costs. For example, moving a single VOR ground facility can impact dozens of procedures, as that VOR can be used on routes, VOR approaches, as part of missed approaches, etc. Adding new sensor specific procedures will compound this cost, and the rapid growth in available navigation systems would soon make system-specific routes and procedures unaffordable.

- b) Avoids need for development of sensor-specific operations with each new evolution of navigation systems, which would be cost-prohibitive. The expansion of satellite navigation services is expected to contribute to the continued diversity of RNAV systems in different aircraft. The original Basic GNSS equipment is evolving due to the augmentations of SBAS, GBAS and GRAS, while the introduction of Galileo and modernization of GPS and GLONASS will further improve performance. The use of GNSS/inertial integration is expanding.
  - c) Allows more efficient use of airspace (route placement, fuel efficiency, noise abatement).
  - d) Clarifies the way in which RNAV systems are used.
  - e) Facilitates the operational approval process for operators by providing a limited set of navigation specifications intended for global use.
- 4.2 RNAV and RNP specifications facilitate more efficient design of airspace and procedures, which collectively result in improved safety, access, capacity, predictability, operational efficiency and environmental effects. Specifically, RNAV and RNP may:
- a) Increase safety by using three-dimensional (3D) approach operations with course guidance to the runway, which reduce the risk of controlled flight into terrain.
  - b) Improve airport and airspace access in all weather conditions, and the ability to meet environmental and obstacle clearance constraints.
  - c) Enhance reliability and reduce delays by defining more precise terminal area procedures that feature parallel routes and environmentally optimized airspace corridors. Flight management systems (FMS) will then be poised to save operators time and money by managing climb, descent, and engine performance profiles more efficiently.
  - d) Improve efficiency and flexibility by increasing use of operator-preferred trajectories airspace-wide, at all altitudes. This will be particularly useful in maintaining schedule integrity when convective weather arises.
  - e) Reduce workload and improve productivity of air traffic controllers.

- 4.3 Performance-based navigation will enable the needed operational improvements by leveraging current and evolving aircraft capabilities in the near term that can be expanded to address the future needs of aviation stakeholders and service providers.

## 5. STAKEHOLDERS

- 5.1 Coordination is critical with the aviation community through collaborative forums. This will assist aviation stakeholders in understanding operational goals, determining requirements, and considering future investment strategies. This, in turn, enables the aviation stakeholders to focus on addressing future efficiency and capacity needs while maintaining or improving the safety of flight operations by leveraging advances in navigation capabilities on the flight deck. RNAV and RNP have reached a sufficient level of maturity and definition to be included in key plans and strategies, such as this AFI Region PBN Roadmap.
- 5.2 The stakeholders who will benefit from the concepts in the AFI Region PBN Roadmap include airspace operators, air traffic service providers, regulators and standards organizations. As driven by business needs, airlines and operators can use the AFI Region PBN Roadmap to plan future equipage and capability investments. Similarly, air traffic service providers can determine requirements for future automation systems, and more smoothly modernize ground infrastructure. Finally, regulators and standards organizations can anticipate and develop the key enabling criteria needed for implementation.
- 5.3 The AFI Region PBN Roadmap also supports other CAA and government-wide planning processes, working on several fronts to address the needs of the aviation community. This Roadmap is a work in progress and will be amended through collaborative AFI Region States, industry efforts and consultations that establish a joint aviation community/government/industry strategy for implementing performance-based navigation. Critical initiative strategies are required to accommodate the expected growth and complexity over the next two decades. These strategies have five key features:
- a) Expediting the development of performance-based navigation criteria and standards.
  - b) Introducing airspace and procedure improvements in the near term.
  - c) Providing benefits to operators who have invested in existing and upcoming capabilities.
  - d) Establishing target dates for the introduction of navigation mandates for selected procedures and airspace, with an understanding that any mandate must be rationalized on the basis of benefits and costs.
  - e) Defining new concepts and applications of performance-based navigation for the mid term and Long term and building synergy and integration among other capabilities toward the realization of the AFI Region PBN goals.

## 6. STRATEGY

- 6.1 This Roadmap provides a high-level strategy for the evolution of navigation capabilities to be implemented in three timeframes: near term (2008-2012), mid term (2013-2016), and Long term (2017 and Beyond). The strategy rests upon two key navigation concepts; Area Navigation (RNAV) and Required Navigation Performance (RNP). It also encompasses instrument approaches, Standard Instrument Departure (SID) and Standard Terminal Arrival (STAR) operations, as well as en-route continental, oceanic and remote operations. The section on Long-term initiatives discusses integrated navigation, communication, surveillance and automation strategies.
- 6.2 To avoid proliferation of new navigation standards, States and other aviation stakeholders in the AFI region should communicate any new operational requirements with ICAO HQ, so that it can be taken into account by the PBN SG.

## 7. NEAR TERM (2008-2012) MID TERM (2013-2016) AND LONG TERM (2016 AND BEYOND) KEY TASKS

- 7.1 The key tasks involved in the transition to performance-based navigation are:
- a) Establish navigation service needs through the Long term that will guide infrastructure decisions and specify needs for navigation system infrastructure, and ensure funding for managing and transitioning these systems.
  - b) Define and adopt a national policy enabling additional benefits based on RNP and RNAV.
  - c) Identify operational and integration issues between navigation and surveillance, air-ground communications, and automation tools that maximize the benefits of RNP.
  - d) Support mixed operations throughout the term of this Roadmap, in particular considering navigation system variations during the near term until appropriate standards are developed and implemented.
  - e) To support Civil/Military coordination and develop the policies needed to accommodate the unique missions and capabilities of military aircraft operating in civil airspace.
  - f) Harmonize the evolution of capabilities for interoperability across airspace operations.
  - g) Increase emphasis on human factors, especially on training and procedures as operations increase reliance on appropriate use of flight deck systems.
  - h) Facilitate and advance environmental analysis efforts required to support the development of RNAV and RNP procedures.
  - i) Maintain consistent and harmonized global standards for RNAV and RNP operations.

**8. NEAR-TERM (2008-2012)**

- 8.1 Initiatives in the near-term focus on investments by operators in current and new aircraft acquisitions; in satellite-based navigation and conventional navigation infrastructure as well as AFI Region States investments. Key components include wide-scale RNAV implementation and the introduction of RNP for en route, terminal, and approach procedures.
- 8.2 The near-term strategy will also focus on expediting the implementation and proliferation of RNAV and RNP procedures. As demand for air travel continues at healthy levels, choke points will develop and delays at the major airports will continue to climb. RNAV and RNP procedures will help alleviate those problems. Continued introduction of RNAV and RNP procedures will not only provide benefits and savings to the operators but also encourage further equipage.
- 8.3 ANSPs as a matter of urgency must adapt new flight plan procedures to accommodate PBN operations. This particularly addresses fields 10 and 18.
- 8.4 Operators will need to plan to obtain operational approvals for the planned Navigation Specifications for this period. Operators shall also review Regional PBN Implementation Plans from other Regions to assess if there is a necessity for additional Operational approvals.

**9. OCEANIC AND REMOTE OPERATIONS**

- 9.1 To promote global harmonization, the AFI Region States continues to work closely with its international partners in implementing RNAV 10 and where operationally required RNP 4 by 2010. Safety assessment shall be undertaken to evaluate reduced oceanic and remote longitudinal/lateral separation minima between aircraft approved for RNAV 10 and RNP 4 operations. (NB. Deleted (-) in between route and number).
- 9.2 For Oceanic Remote Areas where high density traffic operations occur, a review of the airspace concept must be undertaken to convert to Continental En-Route Operation where sufficient, surveillance is available so as to allow RNAV 5 operations.

## 10. CONTINENTAL EN-ROUTE OPERATIONS

- 10.1 For airspace and corridors requiring structured routes for flow management, AFI Region States will review existing conventional and RNAV routes to transition to PBN RNAV 5 or where operationally required RNAV 2/1.

## 11. TERMINAL OPERATIONS

- 11.1 RNAV reduces conflict between traffic flows by consolidating flight tracks. RNAV 1/Basic RNP 1 SIDs and STARs improve safety, capacity, and flight efficiency and also lower communication errors.
- 11.2 AFI Region States will continue to plan, develop and implement RNAV 1 SIDs and STARs, at major airports and make associated changes in airspace design. In addition, AFI Region States will implement Basic RNP 1 SIDs and STARs. RNAV 1 will be implemented in airspace where there is sufficient surveillance coverage and Basic RNP-1 where there is no such coverage.
- 11.3 Where operationally feasible, States should develop operational concepts and requirements for continuous descent arrivals (CDAs) based on FMS Vertical Guidance and for applying time of arrival control based on RNAV and RNP procedures. This would reduce workload for pilots and controllers as well as increase fuel efficiency.
- 11.4 PBN SIDs and STARs would allow the following:
- a) Reduction in controller-pilot communications;
  - b) Reduction of route lengths to meet environmental and fuel efficiency requirements;
  - c) Seamless transition from and to en-route entry/exit points;
  - d) Sequence departures to maximize benefits of RNAV and identify automation requirements for traffic flow management, sequencing tools, flight plan processing, and tower data entry activities.

## 12. APPROACH OPERATIONS

- 12.1 The application of RNP APCH is expected to be implemented in the maximum possible number of aerodromes. To facilitate a transitional period, conventional approach procedures and conventional navigation aids should be maintained for non PBN equipped aircraft during this term.

12.2 States should promote the use of ~~(with Baro VNAV)~~ APV Operations to enhance safety of RNP Approaches and accessibility of runways.

12.3 The application of RNP AR Approach should be limited to selected runways where obvious operational benefits can be obtained due to the existence of significant obstacles.

12.4 RNP approaches include:

- a) APV implemented at all instrument runways at major regional airports and all non-instrument runways serving aircraft weighing greater than 5,700kg.

**13. SUMMARY TABLE NEAR-TERM (2008-2012)**

Airspace	Nav. Specifications	Nav. Specifications where Operationally Required
En-Route Oceanic	RNAV 10	RNP 4
En-Route Remote Continental	RNAV 10	RNP 4
En-Route Continental	RNAV 5	RNAV 1
TMA Arrival/Departure	RNAV 1 in a surveillance environment	
	Basic RNP 1 in non-surveillance environment	
Approach	RNP APCH <del>(with Baro VNAV)</del> (APV) OR RNP AR APCH if required	

**14. NEAR TERM IMPLEMENTATION TARGETS**

- a) RNP APCH ~~(with Baro VNAV)~~ (APV) 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.



## 15 MID TERM (2013-2016) PRIORITIES

- 15.1 In the mid term, increasing demand for air travel will continue to challenge the efficiencies of the air traffic management system.
- 15.2 While the hub-and-spoke system will remain largely the same as today for major airline operations, the demand for more point-to-point service will create new markets and spur increases in low-cost carriers, air taxi operations, and on-demand services. Additionally, the emergence of VLJs is expected to create new markets in the general and business aviation sectors for personal, air taxi, and point-to-point passenger operations. Many airports will thus experience significant increases in unscheduled traffic. In addition, many destination airports that support scheduled air carrier traffic are forecast to grow and to experience congestion or delays if efforts to increase their capacity fall short. As a result, additional airspace flexibility will be necessary to accommodate not only the increasing growth, but also the increasing air traffic complexity.
- 15.3 The mid term will leverage these increasing flight capabilities based on RNAV and RNP, with a commensurate increase in benefits such as fuel-efficient flight profiles, better access to airspace and airports, greater capacity, and reduced delay. These incentives, which should provide an advantage over non-RNP operations, will expedite propagation of equipage and the use of RNP procedures.
- 15.4 To achieve efficiency and capacity gains partially enabled by RNAV and RNP, the AFI Region States and aviation industry will pursue use of data communications (e.g., for controller-pilot communications) and enhanced surveillance functionality, e.g. ADS-Broadcast (ADS-B). Data communications will make it possible to issue complex clearances easily and with minimal errors. ADS-B will expand or augment surveillance coverage so that track spacing and longitudinal separation can be optimized where needed (e.g., in non-radar airspace). Initial capabilities for flights to receive and confirm 3D clearances and time of arrival control based on RNP will be demonstrated in the mid term. With data link implemented, flights will begin to transmit 4D trajectories (a set of points defined by latitude, longitude, altitude, and time.) Stakeholders must therefore develop concepts that leverage this capability.

## 16. OCEANIC EVOLUTION

- 16.1 In the mid term, AFI Region States will endeavour to work with international air traffic service providers to promote the application of **RNP 10** and **RNP 4** in additional sub-regions of the oceanic environment.

**17. EN ROUTE EVOLUTION**

17.1 The review of en-route airspace will be completed by 2016.

**18. IMPLEMENTATION**

18.1 By the end of the mid term other benefits of PBN will have been enabled, such as flexible procedures to manage the mix of faster and slower aircraft in congested airspace and use of less conservative PBN requirements.

**19. Automation for RNAV and RNP Operations**

19.1 By the end of the mid term enhanced en route automation will allow the assignment of RNAV and RNP routes based upon specific knowledge of an aircraft's RNP capabilities. En route automation will use collaborative routing tools to assign aircraft priority, since the automation system can rely upon the aircraft's ability to change a flight path and fly safely around problem areas. This functionality will enable the controller to recognize aircraft capability and to match the aircraft to dynamic routes or procedures, thereby helping appropriately equipped operators to maximize the predictability of their schedules.

19.2 Conflict prediction and resolution in most en route airspace must improve as airspace usage increases. Path repeatability achieved by RNAV and RNP operations will assist in achieving this goal. Mid-term automation tools will facilitate the introduction of RNP offsets and other forms of dynamic tracks for maximizing the capacity of airspace. By the end of the mid term, en route automation will have evolved to incorporate more accurate and frequent surveillance reports through ADS-B, and to execute problem prediction and conformance checks that enable offset manoeuvres and closer route spacing (e.g., for passing other aircraft and manoeuvring around weather).

**20. TERMINAL EVOLUTION**

20.1 During this period, either Basic **RNP 1** or **RNAV 1** will become a required capability for flights arriving and departing major airports based upon the needs of the airspace, such as the volume of traffic and complexity of operations. This will ensure the necessary throughput and access, as well as reduced controller workload, while maintaining safety standards.

20.2 With RNAV-1 operations as the predominant form of navigation in terminal areas by the end of the mid term, AFI Region States will have the option of removing conventional terminal procedures that are no longer expected to be used.

**21. TERMINAL AUTOMATION**

- 21.1 Terminal automation will be enhanced with tactical controller tools to manage complex merges in busy terminal areas. As data communications become available, the controller tools will apply knowledge of flights' estimates of time of arrival at upcoming waypoints, and altitude and speed constraints, to create efficient manoeuvres for optimal throughput.
- 21.2 Terminal automation will also sequence flights departing busy airports more efficiently than today. This capability will be enabled as a result of PBN and flow management tools. Flights arriving and departing busy terminal areas will follow automation-assigned PBN routes.

**22. APPROACH EVOLUTION**

- 22.1 In the mid term, implementation priorities for instrument approaches will still be based on RNP APCH and RNP AR APCH and full implementation is expected at the end of this term.
- 22.2 The introduction of the application of landing capability using GBAS (currently non PBN) is expected to guarantee a smooth transition towards high performance approach and landing capability.

**23. Summary Table Mid-Term (2013-2016)**

Airspace	Nav. Specifications	Nav. Specifications where Operationally Required
En-Route Oceanic	RNAV 10,	RNP 4
En-Route Remote Continental	RNAV 10,	RNP 4
En-Route Continental	RNAV 2, RNAV 5	RNAV 1
TMA Arrival/Departure	Expand RNAV 1, or RNP-1 application  Mandate RNAV 1, or RNP-1 in high density TMAs	
Approach	Expand RNP APCH with <del>(with Baro-VNAV)</del> (APV)  Expand RNP AR APCH where there are operational benefits	

(NB. Deleted (-) in between route and number).

**24. MID TERM IMPLEMENTATION TARGETS**

- a) RNP APCH (~~with Baro-VNAV~~) (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 .

**25. LONG TERM (2016 AND BEYOND): ACHIEVING A PERFORMANCE-BASED NAVIGATION SYSTEM**

- 25.1 The Long-term environment will be characterized by continued growth in air travel and increased air traffic complexity.
- 25.2 No one solution or simple combination of solutions will address the inefficiencies, delays, and congestion anticipated to result from the growing demand for air transportation. Therefore, AFI Region States and key Stakeholders need an operational concept that exploits the full capability of the aircraft in this time frame.

**26. LONG TERM KEY STRATEGIES (2017 AND BEYOND)**

- 26.1 Airspace operations in the Long term will make maximum use of advanced flight deck automation that integrates CNS capabilities. RNP, RCP, and RSP standards will define these operations. Separation assurance will remain the principal task of air traffic management in this time frame. This task is expected to leverage a combination of aircraft and ground-based tools. Tools for conflict detection and resolution, and for flow management, will be enhanced significantly to handle increasing traffic levels and complexity in an efficient and strategic manner.
- 26.2 Strategic problem detection and resolution will result from better knowledge of aircraft position and intent, coupled with automated, ground-based problem resolution. In addition, pilot and air traffic controller workload will be lowered by substantially reducing voice communication of clearances, and furthermore using data communications for clearances to the flight deck. Workload will also decrease as the result of automated confirmation (via data communications) of flight intent from the flight deck to the ground automation.
- 26.3 With the necessary aircraft capabilities, procedures, and training in place, it will become possible in certain situations to delegate separation tasks to pilots and to flight deck systems that depict traffic and conflict resolutions. Procedures for airborne separation assurance will reduce reliance on ground

infrastructure and minimize controller workload. As an example, in IMC an aircraft could be instructed to follow a leading aircraft, keeping a certain distance. Once the pilot agreed, ATC would transfer responsibility for maintaining spacing (as is now done with visual approaches).

- 26.4 Performance-based operations will exploit aircraft capabilities for “electronic” visual acquisition of the external environment in low-visibility conditions, which may potentially increase runway capacity and decrease runway occupancy times.
- 26.5 Improved wake prediction and notification technologies may also assist in achieving increased runway capacity by reducing reliance on wake separation buffers.
- 26.6 System-wide information exchange will enable real-time data sharing of NAS constraints, airport and airspace capacity, and aircraft performance. Electronic data communications between the ATC automation and aircraft, achieved through data link, will become widespread—possibly even mandated in the busiest airspace and airports. The direct exchange of data between the ATC automation and the aircraft FMS will permit better strategic and tactical management of flight operations.
- 26.7 Aircraft will downlink to the ground-based system their position and intent data, as well as speed, weight, climb and descent rates, and wind or turbulence reports. The ATC automation will uplink clearances and other types of information, for example, weather, metering, choke points, and airspace use restrictions.
- 26.8 To ensure predictability and integrity of aircraft flight path, RNP will be mandated in busy en route and terminal airspace. RNAV operations will be required in all other airspace (except oceanic). Achieving standardized FMS functionalities and consistent levels of crew operation of the FMS is integral to the success of this Long-term strategy.
- 26.9 The most capable aircraft will meet requirements for low values of RNP (RNP 0.3 or lower en route). Flights by such aircraft are expected to benefit in terms of airport access, shortest routes during IMC or convective weather, and the ability to transit or avoid constrained airspace, resulting in greater efficiencies and fewer delays operating into and out of the busiest airports.

- 26.10 Enhanced ground-based automation and use of real-time flight intent will make time-based metering to terminal airspace a key feature of future flow management initiatives. This will improve the sequencing and spacing of flights and the efficiency of terminal operations.
- 26.11 Uniform use of RNP for arrivals and departures at busy airports will optimize management of traffic and merging streams. ATC will continue to maintain control over sequencing and separation; however, aircraft arriving and departing the busiest airports will require little controller intervention. Controllers will spend more time monitoring flows and will intervene only as needed, primarily when conflict prediction algorithms indicate a potential problem.
- 26.12 More detailed knowledge of meteorological conditions will enable better flight path conformance, including time of arrival control at key merge points. RNP will also improve management of terminal arrival and departure with seamless routing from the en route and transition segments to the runway threshold. Enhanced tools for surface movement will provide management capabilities that synchronize aircraft movement on the ground; for example, to coordinate taxiing aircraft across active runways and to improve the delivery of aircraft from the parking areas to the main taxiways.

## **27. SUMMARY OF LONG TERM KEY STRATEGIES (2017 AND BEYOND)**

- 27.1 The key strategies for instituting performance-based operations employ an integrated set of solutions.
- a) Airspace operations will take advantage of aircraft capabilities, i.e. aircraft equipped with data communications, integrated displays, and FMS.
  - b) Aircraft position and intent information directed to automated, ground-based ATM systems, strategic and tactical flight deck-based separation assurance in selected situations (problem detection and resolution).
  - c) Strategic and tactical flow management will improve through use of integrated airborne and ground information exchange.
  - d) Ground-based system knowledge of real-time aircraft intent with accurate aircraft position and trajectory information available through data link to ground automation.
  - e) Real-time sharing of National Air Space (NAS) flight demand and other information achieved via ground-based and air-ground communication between air traffic management and operations planning and dispatch.

- f) Overall system responsiveness achieved through flexible routing and well-informed, distributed decision-making.
- g) Systems ability to adapt rapidly to changing meteorological and airspace conditions.
- h) System leverages through advanced navigation capabilities such as fixed radius transitions, RF legs, and RNP offsets.
- i) Increased use of operator-preferred routing and dynamic airspace.
- j) Increased collaboration between service providers and operators.
- k) Operations at the busiest airports will be optimized through an integrated set of capabilities for managing pre-departure planning information, ground-based automation, and surface movement.
- l) RNP-based arrival and departure structure for greater predictability.
- m) Ground-based tactical merging capabilities in terminal airspace.
- n) Integrated capabilities for surface movement optimization to synchronize aircraft movement on the ground. Improved meteorological and aircraft intent information shared via data link.

## **28. KEY RESEARCH AREAS**

28.1 The aviation community must address several key research issues to apply these strategies effectively. These issues fall into several categories:

## **29. NAVIGATION**

- a) To what extent can lower RNP values be achieved and how can these be leveraged for increased flight efficiency and access benefits?
- b) Under what circumstances RNAV should be mandated for arriving/departing satellite airports to enable conflict-free flows and optimal throughput in busy terminal areas?

**30. FLIGHT DECK AUTOMATION**

- a) What FMS capabilities are required to enable the future concepts and applications?
- b) How can performance-based communication and surveillance be leveraged in the flight deck to enable Long-term strategies such as real-time exchange of flight deck data?

**31. AUTOMATION**

- a) To what extent can lateral or longitudinal separation assurance be fully automated, in particular on final approach during parallel operations?
- b) To what extent can surface movement be automated, and what are the cost-benefit trade-offs associated with different levels of automation?
- c) To what extent can conflict detection and resolution be automated for terminal ATC operations?

**32. PROCEDURES**

- a) How can time of arrival control be applied effectively to maximize capacity of arrival or departure operations, in particular during challenging wind conditions?
- b) In what situations is delegation of separation to the flight crews appropriate?
- c) What level of onboard functionality is required for flight crews to accept separation responsibility within a manageable workload level?

**33. AIRSPACE**

- a) What separation standards and procedures are needed to enable smoother transition between en route and terminal operations?
- b) How can fuel-efficient procedures such as CDAs be accomplished in busy airspace?

**34. POLICY**

- a) How is information security ensured as information exchange increases?
- b) What are the policy and procedure implications for increased use of collaborative decision-making processes between the service provider and the operator?



- 34.1 The answers to these and other research questions are critical to achieving a performance-based airspace system. Lessons learned from the near-term and mid-term implementation of the Roadmap will help answer some of these questions. The aviation community will address others through further concept development, analysis, modelling, simulation, and field trials. As concepts mature and key solutions emerge, the community will develop more detailed implementation strategies and commitments.

### **35. PERIODIC REVIEW OF IMPLEMENTATION ACTIVITIES**

- 35.1 Procedures to Modify the Regional Plan
- 35.2 Whenever a need is identified for a change to this document, the Request for Change (RFC) Form (to be developed) should be completed and submitted to the ICAO Regional Offices. The Regional Offices will collate RFCs for consideration by the PBN Task Force (ATM/SAR/AIS Sub-group of APIRG).
- 35.3 When an amendment has been agreed by a meeting of the PBN Task Force, a new version of the PBN Regional Plan will be prepared, with the changes marked by an “|” in the margin, and an endnote indicating the relevant RFC, to enable a reader to note the origin of the change. If the change is in a table cell, the outside edges of the table will be highlighted. Final approval for publication of an amendment to the PBN Regional Plan will be the responsibility of APIRG.

**Glossary**

ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-C	Automatic Dependent Surveillance-Contract
ATC	Air Traffic Control
CDA	Continuous Descent Arrival
CNS	Communications, Navigation, Surveillance
EFVS	Enhanced Flight Visibility System
GA	General Aviation
GBAS	Ground-Based Augmentation System
GLS	GNSS Landing System
GPS	Global Positioning System
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
LNAV	Lateral Navigation
LPV	Localizer Performance with Vertical Guidance
NAS	National Airspace System
NAVAID	Navigation Aid
NM	Nautical Miles
PBN	Performance Based Navigation
RCP	Required Communications Performance
RF	Radius-to-Fix
RNAV	Area Navigation
RNP	Required Navigation Performance

**Glossary**

RNPSORSG	Required Navigation Performance and Special Operational Requirements Study Group
RSP	Required Surveillance Performance
SID	Standard Instrument Departure
STAR	Standard Terminal Arrival Route
VLJ	Very Light Jet
VNAV	Vertical Navigation
WAAS	Wide Area Augmentation System

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**Joint Meeting of the PBN and GNSS/I Task Forces  
Nairobi, 8-10 September 2009**

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**PBN ROUTE NETWORK DEVELOPMENT WORKING GROUP (PRND WG)**

**A) TERMS OF REFERENCE**

1. Review the AFI ATS route network in order to assess its capacity and constraints.
2. Based on the airspace user needs and in coordination with stakeholders (States, International Organizations, user representative organizations and other ICAO Regions), AFI Regional Performance Objectives, the Regional PBN Implementation Plan, as well as related ICAO provisions and guidance material, identify requirements and improvements for achieving and maintaining an efficient route network in the AFI Region.
3. Propose a strategy and prioritized plan for development of improvements to the route network, highlighting:
  - areas that require immediate attention
  - interface issues with adjacent ICAO Regions
  - the implementation of PBN
4. Develop a working depository for route proposals that will be used as a dynamic reference document for ongoing discussions on routes under development/modification. In this respect, the TF should explore the utility that can be realized from the route catalogue concept/ATS route database.
5. Engage the necessary parties regarding routes under consideration.
6. In coordination with the ARMA, carry out safety assessment of the proposed changes to the ATS route network.
7. After adoption by the ATS/AIS/SAR SG, or as delegated by the same, submit completed route proposals for amendment of the Basic ANP Table ATS-1, to the AFI Regional Offices for processing

**B) COMPOSITION**

The PRND WG will comprise:

- a) experts nominated by AFI Provider States from both civil aviation entities and military authorities;
- b) ARMA, IATA, IFALPA and IFATCA
- c) representatives from adjacent States and concerned international organizations (on ad-hoc basis).

**C) WORKING ARRANGEMENTS**

The Working Group shall:

- a) report to the ATS/AIS/SAR SG Sub Group through the PBN TF (or its successor); and
- b) meet as required and at least once a year
- c) use electronic communication between members as much as feasible

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AFI State PBN Plan Template

Performance Based Navigation (PBN) Implementation Plan

**State X**

Version 1

December 2008

**AFI State PBN Plan Template****About the Plan****Requirement for PBN**

- 1.1 ICAO Assembly Resolution A36-23 calls for each State to develop a national PBN implementation plan by December 2009. This is a template developed by the ICAO PBN Programme as an example for use by the ICAO Contracting States as they each develop their own plans. This is only one example of what subjects a “National PBN Implementation Plan” that meets the intent of the resolution might include. States are encouraged to tailor their plans to meet their needs. This may mean that the “PBN Implementation Plan” is not stand-alone, but part of a broader plan for development of aviation in the State. This is a determination that only the State can make. It should be pointed out that if the State has not yet met its obligations with regard to conversion to the WGS-84 coordinate system, this should be included in the plan, as all RNAV and RNP operations are conducted solely with reference to WGS-84 coordinates.

**Why is a PBN implementation plan or roadmap needed?**

- 1.2 With RVSM implemented or soon to be implemented in most of the world, the main tool for optimising the airspace structure is the implementation of performance-based navigation (PBN), which will foster the necessary conditions for the utilization of RNAV and RNP capabilities by a significant portion of airspace users in the Regions and State s.
- 1.3 Current planning by the Regional Planning and Implementation Groups is based on the Air Navigation Plans and the Regional CNS/ATM Plans. Currently, these plans are mostly made up of tables that do not contain the necessary details for the implementation of each of the CNS and ATM elements. For this reason, the Regions will be developing Regional PBN implementation plans. The necessary concurrent and follow-on step is to develop national plans that implement the regional plans at the State level and address PBN implementation strategy at the national level.
- 1.4 In view of the need for detailed navigation planning, it was deemed advisable to call for preparation of a national PBN Implementation Plan by each State, to provide proper guidance and direction to the domestic air navigation service provider(s), airspace operators and users, regulating agency, as well as foreign operators who operate or plan to operate in the State. This guidance should address the planned evolution of navigation, as one of the key systems supporting air traffic management, and describe the RNAV and RNP navigation applications that should be implemented in at least the short and medium term, in the State.

**AFI State PBN Plan Template****What are the objectives of the PBN Implementation Plan or Roadmap?**

1.5 The PBN implementation plan should meet the following strategic objectives:

- a) provide a high-level strategy for the evolution of the navigation applications to be implemented in the State in the short term (2008-2012) and medium term (2013-2016). This strategy is based on the concepts of PBN, Area Navigation (RNAV) and Required Navigation Performance (RNP), which will be applied to aircraft operations involving instrument approaches, standard departure (SID) routes, standard arrival (STAR) routes, and ATS routes in oceanic and continental areas in accordance with the implementation goals in the Assembly resolution;
- b) ensure that the implementation of the navigation portion of the CNS/ATM system is based on clearly established operational requirements;
- c) avoid unnecessarily imposing the mandate for multiple equipment on board or multiple systems on the ground;
- d) avoid the need for multiple airworthiness and operational approvals for intra- and inter-regional operations;
- e) prevent commercial interests from outdoing ATM operational requirements, generating unnecessary costs for the State as well as for airspace users.

**What is the intent of the PBN Implementation Plan or Roadmap?**

1.6 The PBN Implementation Plan should be developed by the State together with the stakeholders concerned and is intended to assist the main stakeholders of the aviation community plan a gradual transition to the RNAV and RNP concepts. The main stakeholders of the aviation community that benefit from this roadmap and should therefore be included in the development process are:

- Airspace operators and users
- Air navigation service providers
- Regulating agencies
- National and international organizations

1.7 The PBN Implementation Plan is intended to assist the main stakeholders of the aviation community plan the future transition and their investment strategies. For example, airlines and operators can use this roadmap to plan future equipage and additional navigation capability investments; air navigation service providers can plan a gradual transition for the evolving ground infrastructure. Regulating agencies will be able to anticipate and plan for the criteria that will be needed in the future as well as the future regulatory workload and associated training requirements for their work force.



**AFI State PBN Plan Template****What principles should be applied in development of the PBN Implementation Plan or Roadmap?**

1.8 The implementation of PBN in the State should be based on the following principles:

- a) Continued application of conventional air navigation procedures during the transition period, to guarantee availability by users that are not RNAV- and/or RNP-equipped;
- b) Development of airspace concepts, applying airspace modelling tools as well as real-time and accelerated simulations, which identify the navigation applications that are compatible with the aforementioned concept;
- c) Conduct of cost-benefit analyses to justify the implementation of the RNAV and/or RNP concepts in each particular airspace;
- d) Conduct of pre- and post-implementation safety assessments to ensure the application and maintenance of the established target levels of safety.
- e) Must not conflict with the regional PBN implementation plan.

## AFI State PBN Plan Template

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## AFI State PBN Plan Template

### 1. Introduction

The AFI Region Performance Based Navigation (PBN) Roadmap details the framework within which the ICAO PBN concept will be implemented in the AFI Region for the foreseeable future. The AFI Region Roadmap for PBN is guided by ICAO Doc. 9613 and relevant SARPs. The primary driver for this plan is to maintain and increase safety, air traffic demand and capacity, and services and technology in consultation with relevant stakeholders. The AFI Region Roadmap also supports national and international interoperability and global harmonization.

### 2. Background

The continuing growth of aviation places increasing demands on airspace capacity and emphasizes the need for the optimum utilization of the available airspace.

Growth in scheduled and General Aviation aircraft is expected to increase point-to-point and direct routings. The increasing cost of fuel also presents a significant challenge to all segments of the aviation community. This anticipated growth and higher complexity of the air transportation system could result in increased flight delays, schedule disruptions, choke points, inefficient flight operations, and passenger inconvenience, particularly when unpredictable weather and other factors constrain airport capacity. Without improvements in system efficiency and workforce productivity, the aviation community and cost of operations will continue to increase. Upgrades to the air transportation system must leverage current and evolving capabilities in the near term, while building the foundation to address the future needs of the aviation community stakeholders. These circumstances can be partially alleviated by efficiencies in airspace and procedures through the implementation of PBN concepts.

In setting out requirements for navigation applications on specific routes or within a specific airspace, it is necessary to define requirements in a clear and concise manner. This is to ensure that both flight crew and ATC are aware of the on-board area navigation (RNAV) system capabilities and to ensure that the performance of the RNAV system is appropriate for the specific airspace requirements.

The early use of RNAV systems arose in a manner similar to conventional ground-based routes and procedures. A specific RNAV system was identified and its performance was evaluated through a combination of analysis and flight testing. For domestic operations the initial systems used VOR and DME for their position estimation. For oceanic operations, inertial navigation systems (INS) were employed.

These 'new' systems were developed, evaluated and certified. Airspace and obstacle clearance criteria were developed on the basis of available equipment performance. Requirements specifications were based upon available capabilities and, in some implementations, it was necessary to identify the individual models of equipment that could be operated within the airspace concerned.

Such prescriptive requirements result in delays to the introduction of new RNAV system capabilities and higher costs for maintaining appropriate certification. To avoid such prescriptive specifications of requirements, the PBN concept introduces an alternative method for defining equipment requirements by specification of the performance requirements. This is termed Performance Based Navigation (PBN).

## AFI State PBN Plan Template

### 3. Performance Based Navigation (PBN)

Performance based navigation (PBN) is a concept that encompasses both area navigation (RNAV) and required navigation performance (RNP) and revises the current RNP concept. Performance based navigation is increasingly seen as the most practical solution for regulating the expanding domain of navigation systems.

Under the traditional approach, each new technology is associated with a range of system-specific requirements for obstacle clearance, aircraft separation, operational aspects (e.g. arrival and approach procedures), aircrew operational training and training of air traffic controllers. However, this system-specific approach imposes an unnecessary effort and expense on States, airlines and air navigation services (ANS) providers.

Performance based navigation eliminates the need for redundant investment in developing criteria and in operational modifications and training. Rather than build an operation around a particular system, under performance based navigation the operation is defined according to the operational goals, and the available systems are then evaluated to determine whether they are supportive.

The advantage of this approach is that it provides clear, standardized operational approvals which enables harmonized and predictable flight paths which result in more efficient use of existing aircraft capabilities, as well as improved safety, greater airspace capacity, better fuel efficiency, and resolution of environmental issues.

The PBN concept specifies aircraft RNAV system performance requirements in terms of accuracy, integrity, availability, continuity and functionality needed for the proposed operations in the context of a particular Airspace Concept. 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 are defined at a sufficient level of detail to facilitate global harmonization by providing specific implementation guidance for States and operators.

Under PBN, generic navigation requirements are defined based on the operational requirements. Operators are then able to evaluate options in respect of available technologies and navigation services that could allow these requirements to be met. The chosen solution would be the most cost effective for the operator, rather than a solution being imposed as part of the operational requirements. Technologies can evolve over time without requiring the operation itself to be revisited, as long as the requisite performance is provided by the RNAV system. As part of the future work of the ICAO, it is anticipated that other means for meeting the requirements of the Navigation Specifications will be evaluated and may be included in the applicable Navigation Specifications, as appropriate.

ICAO's Performance Based Navigation (PBN) concept aims to ensure global standardization of RNAV and RNP specifications and to limit the proliferation of navigation specifications in use worldwide. It is a new concept based on the use of Area Navigation (RNAV) systems. Significantly, it is a move from a limited State ment of required performance accuracy to more extensive State ments for required performance in terms of accuracy, integrity, continuity and availability, together with descriptions of how this performance is to be achieved in terms of aircraft and flight crew requirements.

## AFI State PBN Plan Template

### 3.1. RNAV Current status in [State X]

#### 3.1.1 RNAV, ATS routes, SIDs, STARs and approaches

#### 3.1.2 Fleet equipage

(To be developed by State )

### 3.2 Benefits of PBN and global harmonization

PBN offers a number of advantages over the sensor-specific method of developing airspace and obstacle clearance criteria. These include:

- Reduces need to maintain sensor-specific routes and procedures, and their associated costs. For example, moving a single VOR ground facility can impact dozens of procedures, as that VOR can be used on routes, VOR approaches, as part of missed approaches, etc. Adding new sensor specific procedures will compound this cost, and the rapid growth in available navigation systems would soon make system-specific routes and procedures unaffordable.
- Avoids need for development of sensor-specific operations with each new evolution of navigation systems, which would be cost-prohibitive.
- Allows more efficient use of airspace (route placement, fuel efficiency, noise abatement).
- Clarifies the way in which RNAV systems are used.
- Facilitates the operational approval process for operators by providing a limited set of navigation specifications intended for global use.

RNAV and RNP specifications facilitate more efficient design of airspace and procedures, which collectively result in improved safety, access, capacity, predictability, operational efficiency and environmental effects. Specifically, RNAV and RNP may:

- Increase safety by using three-dimensional (3D) approach operations with course guidance to the runway, which reduce the risk of controlled flight into terrain.
- Improve airport and airspace access in all weather conditions, and the ability to meet environmental and obstacle clearance constraints.
- Enhance reliability and reduce delays by defining more precise terminal area procedures that feature parallel routes and environmentally optimized airspace corridors. Flight management systems (FMS) will then be poised to save operators time and money by managing climb, descent, and engine performance profiles more efficiently.
- Improve efficiency and flexibility by increasing use of operator-preferred trajectories airspace-wide, at all altitudes. This will be particularly useful in maintaining schedule integrity when convective weather arises.

## AFI State PBN Plan Template

- Reduce workload and improve productivity of air traffic controllers.

Performance-based navigation will enable the needed operational improvements by leveraging current and evolving aircraft capabilities in the near term that can be expanded to address the future needs of aviation stakeholders and service providers.

### 3.3 Stakeholders

Coordination is critical with the aviation community through collaborative forums. This will assist aviation stakeholders in understanding operational goals, determining requirements, and considering future investment strategies. This, in turn, enables the aviation stakeholders to focus on addressing future efficiency and capacity needs while maintaining or improving the safety of flight operations by leveraging advances in navigation capabilities on the flight deck. RNAV and RNP have reached a sufficient level of maturity and definition to be included in key plans and strategies, such as this State PBN plan.

The stakeholders who will benefit from the concepts in this State PBN plan include airspace operators, air traffic service providers, regulators, and standards organizations. As driven by business needs, airlines and operators can use the State PBN roadmap to plan future equipage and capability investments. Similarly, air traffic service providers can determine requirements for future automation systems, and more smoothly modernize ground infrastructure. Finally, regulators and standards organizations can anticipate and develop the key enabling criteria needed for implementation.

This plan is a work in progress and will be amended through collaborative AFI Region States, industry efforts and consultations that establish a joint aviation community/government/industry strategy for implementing performance-based navigation. Critical initiative strategies are required to accommodate the expected growth and complexity over the next two decades. These strategies have five key features:

- Expediting the development of performance-based navigation criteria and standards.
- Introducing airspace and procedure improvements in the near term.
- Providing benefits to operators who have invested in existing and upcoming capabilities.
- Establishing target dates for the introduction of navigation mandates for selected procedures and airspace, with an understanding that any mandate must be rationalized on the basis of benefits and costs.
- Defining new concepts and applications of performance-based navigation for the mid term and Long term and building synergy and integration among other capabilities toward the realization of the AFI Region PBN goals.

**AFI State PBN Plan Template****4. Challenges****4.1 Increasing Demands**

(To be developed by State )

**4.1.1 En route****4.1.1.1 Oceanic and Remote Continental**

(To be developed by State )

**4.1.1.2 Continental**

(To be developed by State )

**4.1.2 Terminal Areas (Departures and Arrivals)**

(To be developed by State )

**4.1.3 Approach**

(To be developed by State )

**4.2 Efficient Operations****4.2.1 En route****4.2.1.1 Oceanic and remote continental**

(To be developed by State )

**4.2.1.2 Continental**

(To be developed by State )

**4.2.2 Terminal Areas**

(To be developed by State )

**4.2.3 Approach**

(To be developed by State )

**4.3 Environment**

(To be developed by State )



## AFI State PBN Plan Template

### 5. Implementation strategy

This plan provides a high-level strategy for the evolution of navigation capabilities to be implemented in three timeframes: near term (2008-2012), mid term (2013-2016), and Long term (2017 and Beyond). The strategy rests upon two key navigation concepts: Area Navigation (RNAV) and Required Navigation Performance (RNP). It also encompasses instrument approaches, Standard Instrument Departure (SID) and Standard Terminal Arrival (STAR) operations, as well as en-route continental, oceanic and remote operations. The section on Long-term initiatives discusses integrated navigation, communication, surveillance and automation strategies.

To avoid proliferation of new navigation standards, [State X] and other aviation stakeholders in the AFI region should communicate any new operational requirements with ICAO HQ, so that it can be taken into account by the ICAO Study Group in charge of PBN.

#### Near Term (2008-2012) Mid Term (2013-2016) and Long Term (2017 and Beyond) Key Tasks

The key tasks involved in the transition to performance-based navigation are:

- Establish navigation service needs through the Long term that will guide infrastructure decisions and specify needs for navigation system infrastructure, and ensure funding for managing and transitioning these systems.
- Define and adopt a national policy enabling additional benefits based on RNP and RNAV.
- Identify operational and integration issues between navigation and surveillance, air-ground communications, and automation tools that maximize the benefits of RNP.
- Support mixed operations throughout the term of this Roadmap, in particular considering navigation system variations during the near term until appropriate standards are developed and implemented.
- To support Civil/Military coordination and develop the policies needed to accommodate the unique missions and capabilities of military aircraft operating in civil airspace.
- Harmonize the evolution of capabilities for interoperability across airspace operations.
- Increase emphasis on human factors, especially on training and procedures as operations increase reliance on appropriate use of flight deck systems.
- Facilitate and advance environmental analysis efforts required to support the development of RNAV and RNP procedures.
- Maintain consistent and harmonized global standards for RNAV and RNP operations.

## AFI State PBN Plan Template

### 5.2 Near term strategy (2008-2012)

In the near-term, initiatives focus on investments by operators in current and new aircraft acquisitions, in satellite-based navigation and conventional navigation infrastructure as well as [States X] investments. Key components include wide-scale RNAV implementation and the introduction of RNP for en route, terminal, and approach procedures.

The near-term strategy will also focus on expediting the implementation and proliferation of RNAV and RNP procedures. As demand for air travel continues at healthy levels, choke points will develop and delays at the major airports will continue to climb. RNAV and RNP procedures will help alleviate those problems. Continued introduction of RNAV and RNP procedures will not only provide benefits and savings to the operators but also encourage further equipage.

ANSPs as a matter of urgency must adapt new flight plan procedures to accommodate PBN operations. This particularly addresses fields 10 and 18.

Operators will need to plan to obtain operational approvals for the planned Navigation Specifications for this period. Operators shall also review Regional PBN Implementation Plans from other Regions to assess if there is a necessity for additional Operational approvals.

#### 5.2.1 En route

##### 5.2.1.1 Oceanic and Remote Continental

To promote global harmonization, [State X] continues to work closely with its international partners in implementing RNAV-10 and where operationally required RNP-4 by 2010. Safety assessment shall be undertaken to evaluate reduced oceanic and remote longitudinal/lateral separation minima between aircraft approved for RNAV-10 and RNP-4 operations.

For Oceanic and Remote Areas where high density traffic operations occur, a review of the airspace concept must be undertaken to convert to Continental En-Route Operation where sufficient, surveillance is available so as to allow RNAV-5 operations.

##### 5.2.1.2 Continental

For airspace and corridors requiring structured routes for flow management, [State X] will review existing conventional and RNAV routes to transition to PBN RNAV-5 or where operationally required RNAV-2/1.

#### 5.2.2 Terminal Areas (Departures and Arrivals)

RNAV reduces conflict between traffic flows by consolidating flight tracks. RNAV-1/Basic RNP-1 SIDs and STARs improve safety, capacity, and flight efficiency and also lower communication errors.

[State X] will continue to plan, develop and implement RNAV-1 SIDs and STARs, at major airports and make associated changes in airspace design. In addition, [State X] will implement Basic RNP-1 SIDs and STARs. RNAV-1 will be implemented in airspace where there is sufficient surveillance coverage and Basic RNP-1 where there is no such coverage. Where operationally feasible, [State X] should develop operational concepts and requirements for continuous descent arrivals (CDAs) based on FMS Vertical Guidance and for applying time of arrival control based on RNAV and RNP procedures. This would reduce workload for pilots and controllers as well as increase fuel efficiency.

## AFI State PBN Plan Template

PBN SIDs and STARS would allow the following:

- Reduction in controller-pilot communications;
- Reduction of route lengths to meet environmental and fuel efficiency requirements;
- Seamless transition from and to en-route entry/exit points;
- Sequence departures to maximize benefits of RNAV and identify automation requirements for traffic flow management, sequencing tools, flight plan processing, and tower data entry activities.

### 5.2.3 Approach

The application of RNP APCH is expected to be implemented in the maximum possible number of aerodromes. To facilitate a transitional period, conventional approach procedures and conventional navigation aids should be maintained for non PBN equipped aircraft during this term.

[State X] should promote the use of APV Operations (Baro-VNAV or SBAS) to enhance safety of RNP Approaches and accessibility of runways.

The application of RNP AR Approach should be limited to selected runways where obvious operational benefits can be obtained due to the existence of significant obstacles.

RNP approaches include:

- APV implemented at all instrument runways at major regional airports and all non-instrument runways serving aircraft weighing greater than 5,700kg.

### 5.2.5 Summary near term strategy

Airspace	Nav. Specifications	Nav. where required	Specifications operationally
En-Route Oceanic	RNAV-10	RNP-4	
En-Route Remote Continental	RNAV-10	RNP-4	
En-Route Continental	RNAV-5	RNAV-1	
TMA Arrival/Departure	RNAV-1 in a surveillance environment Basic RNP-1 in non-surveillance environment		
Approach	RNP APCH with Baro-VNAV or RNP AR APCH if required		

## AFI State PBN Plan Template

### 1.9 Implementation Targets

- RNP APCH (with Baro-VNAV) in 30% of instrument runways by 2010 and 50% by 2012 and priority given to airports with operational benefits
- RNAV-1 SID/STAR for 30% of international airports by 2010 and 50% by 2012 and priority given to airports with RNP Approach
- Review existing conventional and RNAV routes to transition to PBN RNAV-5 or where operationally required RNAV-2/1 by 2012.

### 5.3 Medium term strategy (2013-2016)

In the mid term, increasing demand for air travel will continue to challenge the efficiencies of the air traffic management system.

While the hub-and-spoke system will remain largely the same as today for major airline operations, the demand for more point-to-point service will create new markets and spur increases in low-cost carriers, air taxi operations, and on-demand services. Additionally, the emergence of VLJs is expected to create new markets in the general and business aviation sectors for personal, air taxi, and point-to-point passenger operations. Many airports will thus experience significant increases in unscheduled traffic. In addition, many destination airports that support scheduled air carrier traffic are forecast to grow and to experience congestion or delays if efforts to increase their capacity fall short. As a result, additional airspace flexibility will be necessary to accommodate not only the increasing growth, but also the increasing air traffic complexity.

The mid term will leverage these increasing flight capabilities based on RNAV and RNP, with a commensurate increase in benefits such as fuel-efficient flight profiles, better access to airspace and airports, greater capacity, and reduced delay. These incentives, which should provide an advantage over non-RNP operations, will expedite propagation of equipage and the use of RNP procedures.

To achieve efficiency and capacity gains partially enabled by RNAV and RNP, [State X] and aviation industry will pursue use of data communications (e.g., for controller-pilot communications) and enhanced surveillance functionality, e.g. ADS-Broadcast (ADS-B). Data communications will make it possible to issue complex clearances easily and with minimal errors. ADS-B will expand or augment surveillance coverage so that track spacing and longitudinal separation can be optimized where needed (e.g., in non-radar airspace). Initial capabilities for flights to receive and confirm 3D clearances and time of arrival control based on RNP will be demonstrated in the mid term. With data link implemented, flights will begin to transmit 4D trajectories (a set of points defined by latitude, longitude, altitude, and time.) Stakeholders must therefore develop concepts that leverage this capability.

## AFI State PBN Plan Template

### 5.3.1 En route

#### 5.3.1.1 Oceanic and Remote Continental

In the mid term, [State X] will endeavour to work with international air traffic service providers to promote the application of RNP 10 and RNP 4 in additional sub-regions of the oceanic environment.

#### 5.3.1.2 Continental

The review of en-route airspace will be completed by 2016.

#### Implementation

By the end of the mid term other benefits of PBN will have been enabled, such as flexible procedures to manage the mix of faster and slower aircraft in congested airspace and use of less conservative PBN requirements.

#### Automation for RNAV and RNP Operations

By the end of the mid term enhanced en route automation will allow the assignment of RNAV and RNP routes based upon specific knowledge of an aircraft's RNP capabilities. En route automation will use collaborative routing tools to assign aircraft priority, since the automation system can rely upon the aircraft's ability to change a flight path and fly safely around problem areas. This functionality will enable the controller to recognize aircraft capability and to match the aircraft to dynamic routes or procedures, thereby helping appropriately equipped operators to maximize the predictability of their schedules.

Conflict prediction and resolution in most en route airspace must improve as airspace usage increases. Path repeatability achieved by RNAV and RNP operations will assist in achieving this goal. Mid-term automation tools will facilitate the introduction of RNP offsets and other forms of dynamic tracks for maximizing the capacity of airspace. By the end of the mid term, en route automation will have evolved to incorporate more accurate and frequent surveillance reports through ADS-B, and to execute problem prediction and conformance checks that enable offset manoeuvres and closer route spacing (e.g., for passing other aircraft and manoeuvring around weather).

### 5.3.2 Terminal Areas (Departures and Arrivals)

During this period, either Basic RNP-1 or RNAV-1 will become a required capability for flights arriving and departing major airports based upon the needs of the airspace, such as the volume of traffic and complexity of operations. This will ensure the necessary throughput and access, as well as reduced controller workload, while maintaining safety standards.

With RNAV-1 operations as the predominant form of navigation in terminal areas by the end of the mid term, AFI [State X] will have the option of removing conventional terminal procedures that are no longer expected to be used.

## AFI State PBN Plan Template

### Terminal Automation

Terminal automation will be enhanced with tactical controller tools to manage complex merges in busy terminal areas. As data communications become available, the controller tools will apply knowledge of flights' estimates of time of arrival at upcoming waypoints, and altitude and speed constraints, to create efficient maneuvers for optimal throughput.

Terminal automation will also sequence flights departing busy airports more efficiently than today. This capability will be enabled as a result of PBN and flow management tools. Flights arriving and departing busy terminal areas will follow automation-assigned PBN routes.

### 5.3.3 Approach

In the mid term, implementation priorities for instrument approaches will still be based on RNP APCH and RNP AR APCH and full implementation is expected at the end of this term.

The introduction of the application of landing capability, using GBAS (currently non PBN) is expected to guarantee a smooth transition towards high performance approach and landing capability.

### 5.3.4 Helicopter operations (To be developed by State)

### 5.3.5 Medium term strategy summary

Airspace	Nav. Specifications	Nav. where required	Specifications operationally
En-Route Oceanic	RNAV-10,	RNP-4	
En-Route Remote Continental	RNAV-10,	RNP-4	
En-Route Continental	RNAV-2, RNAV-5	RNAV-1	
TMA Arrival/Departure	Expand RNAV-1, or basic RNP-1 application Mandate RNAV-1, or basic RNP-1		
Approach	Expand RNP APCH with (Baro-VNAV) and APV Expand RNP AR APCH where there are operational benefits		

## AFI State PBN Plan Template

### Implementation Targets

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

### 5.4 Long term strategy (2017 and beyond)

The Long-term environment will be characterized by continued growth in air travel and increased air traffic complexity.

No one solution or simple combination of solutions will address the inefficiencies, delays, and congestion anticipated to result from the growing demand for air transportation. Therefore, [State X] and key Stakeholders need an operational concept that exploits the full capability of the aircraft in this time frame.

#### 5.4.1 Long Term Key Strategies (2017 and Beyond)

Airspace operations in the Long term will make maximum use of advanced flight deck automation that integrates CNS capabilities. RNP, RCP, and RSP standards will define these operations. Separation assurance will remain the principal task of air traffic management in this time frame. This task is expected to leverage a combination of aircraft and ground-based tools. Tools for conflict detection and resolution, and for flow management, will be enhanced significantly to handle increasing traffic levels and complexity in an efficient and strategic manner.

Strategic problem detection and resolution will result from better knowledge of aircraft position and intent, coupled with automated, ground-based problem resolution. In addition, pilot and air traffic controller workload will be lowered by substantially reducing voice communication of clearances, and furthermore using data communications for clearances to the flight deck. Workload will also decrease as the result of automated confirmation (via data communications) of flight intent from the flight deck to the ground automation.

With the necessary aircraft capabilities, procedures, and training in place, it will become possible in certain situations to delegate separation tasks to pilots and to flight deck systems that depict traffic and conflict resolutions. Procedures for airborne separation assurance will reduce reliance on ground infrastructure and minimize controller workload. As an example, in IMC an aircraft could be instructed to follow a leading aircraft, keeping a certain distance. Once the pilot agreed, ATC would transfer responsibility for maintaining spacing (as is now done with visual approaches).

Performance-based operations will exploit aircraft capabilities for “electronic” visual acquisition of the external environment in low-visibility conditions, which may potentially increase runway capacity and decrease runway occupancy times.

## AFI State PBN Plan Template

Improved wake prediction and notification technologies may also assist in achieving increased runway capacity by reducing reliance on wake separation buffers.

System-wide information exchange will enable real-time data sharing of NAS constraints, airport and airspace capacity, and aircraft performance. Electronic data communications between the ATC automation and aircraft, achieved through data link, will become widespread—possibly even mandated in the busiest airspace and airports. The direct exchange of data between the ATC automation and the aircraft FMS will permit better strategic and tactical management of flight operations.

Aircraft will downlink to the ground-based system their position and intent data, as well as speed, weight, climb and descent rates, and wind or turbulence reports. The ATC automation will uplink clearances and other types of information, for example, weather, metering, choke points, and airspace use restrictions.

To ensure predictability and integrity of aircraft flight path, RNP will be mandated in busy en route and terminal airspace. RNAV operations will be required in all other airspace (except oceanic). Achieving standardized FMS functionalities and consistent levels of crew operation of the FMS is integral to the success of this Long-term strategy.

The most capable aircraft will meet requirements for low values of RNP (RNP 0.3 or lower en route). Flights by such aircraft are expected to benefit in terms of airport access, shortest routes during IMC or convective weather, and the ability to transit or avoid constrained airspace, resulting in greater efficiencies and fewer delays operating into and out of the busiest airports.

Enhanced ground-based automation and use of real-time flight intent will make time-based metering to terminal airspace a key feature of future flow management initiatives. This will improve the sequencing and spacing of flights and the efficiency of terminal operations.

Uniform use of RNP for arrivals and departures at busy airports will optimize management of traffic and merging streams. ATC will continue to maintain control over sequencing and separation; however, aircraft arriving and departing the busiest airports will require little controller intervention. Controllers will spend more time monitoring flows and will intervene only as needed, primarily when conflict prediction algorithms indicate a potential problem.

More detailed knowledge of meteorological conditions will enable better flight path conformance, including time of arrival control at key merge points. RNP will also improve management of terminal arrival and departure with seamless routing from the en route and transition segments to the runway threshold. Enhanced tools for surface movement will provide management capabilities that synchronize aircraft movement on the ground; for example, to coordinate taxiing aircraft across active runways and to improve the delivery of aircraft from the parking areas to the main taxiways.

### 5.4.2 Summary of Long Term Key Strategies (2017 and Beyond)

The key strategies for instituting performance-based operations employ an integrated set of solutions.

- Airspace operations will take advantage of aircraft capabilities, i.e. aircraft equipped with data communications, integrated displays, and FMS.
- Aircraft position and intent information directed to automated, ground-based ATM systems, strategic and tactical flight deck-based separation assurance in selected situations (problem detection and resolution).



### AFI State PBN Plan Template

- Strategic and tactical flow management will improve through use of integrated airborne and ground information exchange.
- Ground-based system knowledge of real-time aircraft intent with accurate aircraft position and trajectory information available through data link to ground automation.
- Real-time sharing of National Air Space (NAS) flight demand and other information achieved via ground-based and air-ground communication between air traffic management and operations planning and dispatch.
- Overall system responsiveness achieved through flexible routing and well-informed, distributed decision-making.
- Systems ability to adapt rapidly to changing meteorological and airspace conditions.
- System leverages through advanced navigation capabilities such as fixed radius transitions, RF legs, and RNP offsets.
- Increased use of operator-preferred routing and dynamic airspace.
- Increased collaboration between service providers and operators.

Operations at the busiest airports will be optimized through an integrated set of capabilities for managing pre-departure planning information, ground-based automation, and surface movement.

- RNP-based arrival and departure structure for greater predictability.
- Ground-based tactical merging capabilities in terminal airspace.
- Integrated capabilities for surface movement optimization to synchronize aircraft movement on the ground. Improved meteorological and aircraft intent information shared via data link.

#### 5.4.3 Key Research Areas

The aviation community must address several key research issues to apply these strategies effectively. These issues fall into several categories:

##### Navigation

- To what extent can lower RNP values be achieved and how can these be leveraged for increased flight efficiency and access benefits?
- Under what circumstances RNAV should be mandated for arriving/departing satellite airports to enable conflict-free flows and optimal throughput in busy terminal areas?

**AFI State PBN Plan Template****Flight Deck Automation**

- What FMS capabilities are required to enable the future concepts and applications?
- How can performance-based communication and surveillance be leveraged in the flight deck to enable Long-term strategies such as real-time exchange of flight deck data?

**Automation**

- To what extent can lateral or longitudinal separation assurance be fully automated, in particular on final approach during parallel operations?
- To what extent can surface movement be automated, and what are the cost-benefit trade-offs associated with different levels of automation?
- To what extent can conflict detection and resolution be automated for terminal ATC operations?

**Procedures**

- How can time of arrival control be applied effectively to maximize capacity of arrival or departure operations, in particular during challenging wind conditions?
- In what situations is delegation of separation to the flight crews appropriate?
- What level of onboard functionality is required for flight crews to accept separation responsibility within a manageable workload level?

**Airspace**

- To what extent can airspace be configured dynamically on the basis of predicted traffic demand and other factors?
- What separation standards and procedures are needed to enable smoother transition between en route and terminal operations?
- How can fuel-efficient procedures such as CDAs be accomplished in busy airspace?

## AFI State PBN Plan Template

**Glossary**

3D	Three-Dimensional
4D	Four-Dimensional
ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-C	Automatic Dependent Surveillance-Contract
ATC	Air Traffic Control
CDA	Continuous Descent Arrival
CNS	Communications, Navigation, Surveillance
EFVS	Enhanced Flight Visibility System
GA	General Aviation
GBAS	Ground-Based Augmentation System
GLS	GNSS (Global Navigation Satellite System) Landing System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
ICAO	International Civil Aviation Organization

## AFI State PBN Plan Template

IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
LNAV	Lateral Navigation
LPV	Localizer Performance with Vertical Guidance
NAS	National Airspace System
NAVAID	Navigation Aid
NM	Nautical Miles
PBN	Performance Based Navigation
RCP	Required Communications Performance
RF	Radius-to-Fix
RNAV	Area Navigation
RNP	Required Navigation Performance
RNPSORSG	Required Navigation Performance and Special Operational Requirements Study Group

**AFI State PBN Plan Template**

RSP	Required Surveillance Performance
SAAAR	Special Aircraft and Aircrew Authorization Required
SID	Standard Instrument Departure
STAR	Standard Instrument Arrival
VLJ	Very Light Jet
VNAV	Vertical Navigation
WAAS	Wide Area Augmentation System

**AFI State PBN Plan Template**

**Appendix A – Oceanic and Remote Continental implementation schedule by area or city pair (to be developed by State )**

**AFI State PBN Plan Template**

**Appendix B – En route continental implementation schedule by area or city pair (to be developed by State )**

**AFI State PBN Plan Template**

**Appendix C – Terminal area and approach implementation schedule by aerodrome (to be developed by State)**

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**JOINT PBN/GNSS TFs ACTION PLAN**

No.	ICAO Strategic Objective	Associated GPI	Tasks	Objective	Deliverables	Target Date	To be delivered by	Supporting Parties	Status
1	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Develop the AFI PBN Performance Objectives and Action Plan for en – route phase of flight operations.	To facilitate PBN Regional implementation	Draft document		Working Group on En-Route Operations (WG-EO)	States, ROs	Ongoing
2	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Develop the AFI PBN Performance Objectives and Action Plan for terminal and approach phases of flight operations	To facilitate PBN Regional implementation	Draft document		Working Group on Terminal and Approach Operations (WG-TAO)	States, ROs	Ongoing
3	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Carry out necessary actions in coordination with States to amend the relevant parts of the AFI/CNS/ATM Plan (Doc.003) to incorporate PBN issues.	Update of planning documentation	Update Doc 003		ICAO ROs	States	Ongoing
4	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Develop amendment proposals to assist APIRG in the incorporation of PBN elements in the AFI/CNS/ATM Plan (Doc.003)	Update of planning documentation	Amendment proposals		PBN Task Force		Ongoing
5	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Assist States with advise and guidance in developing national PBN Plans.	Development of National PBN Implementation Plan.	National PBN Implementation Plans.	As per Draft Decision	PBN TF PAG		Ongoing

6A-2

No.	ICAO Strategic Objective	Associated GPI	Tasks	Objective	Deliverables	Target Date	To be delivered by	Supporting Parties	Status
6	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21						–	
7	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21						–	

**Members of Working Group for En-route**

<i>Algeria</i>	<i>South Africa</i>
<i>Benin</i>	<i>Sudan</i>
<i>Burundi</i>	<i>Tanzania</i>
<i>Cape Verde</i>	<i>Uganda</i>
<i>DRC</i>	<i>ASECNA (Rapporteur)</i>
<i>Egypt</i>	<i>IATA</i>
<i>Lesotho</i>	<i>IFALPA</i>
<i>Liberia</i>	<i>IFATCA</i>
<i>Mauritius</i>	<i>Roberts FIR</i>

**Members of the Working Group for Terminal and Approach**

<i>Botswana</i>	<i>Senegal</i>
<i>Cameroon</i>	<i>Seychelles (Rapporteur)</i>
<i>Chad</i>	<i>Sierra Leone</i>
<i>Ethiopia</i>	<i>Tunisia</i>
<i>Ghana</i>	<i>ASECNA</i>
<i>Kenya</i>	<i>IATA</i>
<i>Liberia</i>	<i>IFALPA</i>
<i>Nigeria</i>	<i>IFATCA</i>
<i>Rwanda</i>	<i>Roberts FIR</i>

Notes:

1. Focal points for delivery by the Member States and Organization of the WG-EO are:
2. Focal points for delivery by the Member States and Organization of the WG-TAO are:

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JOINT PBN & GNSS/I TFs  
Appendix 5X to the Report on Agenda Item X

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**PBN IMPLEMENTATION PLANNING ADVISORY GROUP (PAG) OF THE  
TERMS OF REFERENCE AND COMPOSITION**

The AFI PBN Task Force PBN Implementation PAG is established as an ad-hoc group to address queries within its ability and scope in order to promote the development of national PBN implementation plans in AFI Region, pursuant to Assembly Resolution A36-23. Specifically, the PAG will:

- a. Assist States with advice and guidance on the use of the national PBN implementation plan templates in order to facilitate completion of their national plans by 31 December 2009; and
- b. Develop such other guidance as may be appropriate and feasible to assist States in completing their national plans.

The PAG will, unless extended by advice from the Regional Offices based on continued demand, automatically dissolve after 31 December 2009, and in any circumstances before the next APIRG meeting

The PAG shall communicate primarily by means of email and where deemed expedient, teleconferencing and telephone.

**Composition:**

The PAG shall comprise the following:

Seychelles (Messrs Marlon Orr and David Labrosse)

South Africa (Messrs Gary Newman and Wayne Lessard)

ASECNA (Name to be given)

IATA (Mr. Prosper ZO'O MINTO'O)

ICAO:

Mrs. Mary Obeng (ESAF)

Mr. Seboeso Machobane (ESAF) Group Focal Point  
[seboeso.machobane@icao.unon.org](mailto:seboeso.machobane@icao.unon.org)

Mr. Sadou Marafa (WACAF) [marafa@dakar.icao.int](mailto:marafa@dakar.icao.int))

Mr. Erwin Lassooij (HQ)

Mr. Doug Marek (HQ)

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<p>_____ (State)</p> <p><b>NATIONAL PERFORMANCE OBJECTIVES AND ACTION PLAN  OPTIMIZATION OF THE ATS ROUTE STRUCTURE IN TERMINAL AIRSPACE</b></p> <p><b>PERIOD: Near Term (2008-2012)</b>  <b>APPLICATION: Terminal Phase</b></p>						
<i>Benefits</i>						
<p><b>Environment:</b></p> <p><b>Efficiency :</b></p>						
<i>Strategy</i>						
PROCESS	TASKS	INPUT SOURCE	OUTPUT	TARGET DATE	ACTION PERSON/GROUP	STATUS
<i>Preliminary</i>						
	<ul style="list-style-type: none"> <li>Review AFI PBN Implementation Plan Key Targets (Terminal)</li> </ul>	<i>AFI PBN Implementation Plan</i> Near Term: 2008-2012 [Ch. 10-14]				
	<ul style="list-style-type: none"> <li>Review State PBN Implementation Plan Key Targets (Terminal)</li> </ul>	<i>State PBN Implementation Plan</i> Near Term: 2008-2012 [Ch. 5.1.2-5.1.3]				

JOINT PBN & GNSS/I TFs REPORT  
APPENDIX 6A (a)

PROCESS	TASKS	INPUT SOURCE	OUTPUT	TARGET DATE	ACTION PERSON/GROUP	STATUS
<i>Terminal Applications Implementation</i>						
<b>Process 1</b> <b>Determine Requirements</b>	<b>Step 1-</b> Formulate airspace concept	PBN Manual, Vol. 1B Ch. B 2.3.1 ➤ ATM needs (civil/military)				
	<b>Step 2-</b> Assessment of existing fleet capability and available navaid infrastructure	PBN Manual, Vol. 1B Ch. B 2.3.2 ➤ IATA Survey ➤ State Survey				
	<b>Step 3-</b> Assessment of existing ATS surveillance system and communications infrastructure and ATM system	PBN Manual, Vol. 1B Ch. B 2.3.3				
	<b>Step 4-</b> Identify necessary navigation performance and functional requirements	PBN Manual, Vol. 1B Ch. B 2.3.4				
			<ul style="list-style-type: none"> <li>➤ <b>Navigation functional requirements</b></li> <li>➤ <b>Fleet capability</b></li> <li>➤ <b>CNS/ATM capabilities</b></li> </ul>			

<b>Process 2</b>  <b>Identifying ICAO navigation specification for implementation</b>	<b>Step 1-</b> Review ICAO navigation specifications	PBN Manual, Vol. 1B Ch. B 3.3.1 ➤ Navigation functional requirements ➤ Fleet capability ➤ CNS/ATM capabilities				
	<b>Step 2-</b> Identify appropriate ICAO navigation specification to apply in the specific CNS/ATM environment ➤ RNAV 5 ➤ RNAV 2 ➤ RNAV 1 ➤ New specification?	PBN Manual, Vol. 1B Ch. B 3.3.2				
	<b>Step 3-</b> Identify trade-offs with airspace concept and navigation functional requirements (if necessary)	PBN Manual, Vol. 1B Ch. B 3.3.3				

➤ **Navigation specifications**

JOINT PBN & GNSS/I TFs REPORT  
**APPENDIX 6A (a)**

<b>Process 3</b> <b>Planning and implementation</b>	<b>Step 1-</b> Formulate safety plan	PBN Manual, Vol. 1B Ch. B 4.3.1 ➤ Navigation specifications				
	<b>Step 2-</b> Validate airspace concept for safety	PBN Manual, Vol. 1B Ch. B 4.3.2				
	<b>Step 3-</b> Procedure design	PBN Manual, Vol. 1B Ch. B 4.3.3				
	<b>Step 4-</b> Procedure ground validation	PBN Manual, Vol. 1B Ch. B 4.3.4				
	<b>Step 5-</b> Implementation decision	PBN Manual, Vol. 1B Ch. B 4.3.5				
	<b>Step 6-</b> Flight inspection and flight validation	PBN Manual, Vol. 1B Ch. B 4.3.6				
	<b>Step 7-</b> ATC system integration considerations	PBN Manual, Vol. 1B Ch. B 4.3.7				
	<b>Step 8-</b> Awareness and training material	PBN Manual, Vol. 1B Ch. B 4.3.8				
	<b>Step 9-</b> Establishing operational implementation date	PBN Manual, Vol. 1B Ch. B 4.3.9				
	<b>Step 10-</b> Post-implementation review	PBN Manual, Vol. 1B Ch. B 4.3.10			<b>DEC 2012</b>	

➤ **Training**

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<p>programmes ➤ RNAV STARs and SIDs</p>
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<p>_____ (State)</p> <p><b>NATIONAL PERFORMANCE OBJECTIVES AND ACTION PLAN          OPTIMIZATION OF THE ATS ROUTE STRUCTURE IN TERMINAL AIRSPACE</b></p> <p><b>PERIOD: Mid Term (2013-2016)</b>  <b>APPLICATION: Terminal Phase</b></p>						
<i>Benefits</i>						
<p><b>Environment:</b></p> <p><b>Efficiency :</b></p>						
<i>Strategy</i>						
PROCESS	TASKS	INPUT SOURCE	OUTPUT	TARGET DATE	ACTION PERSON/GROUP	STATUS
<i>Preliminary</i>						
	<ul style="list-style-type: none"> <li>Review AFI PBN Implementation Plan Key Targets (Terminal- Approach)</li> </ul>	<i>AFI PBN Implementation Plan</i> Mid Term: 2013-2016 [Ch. 20-24]				
	<ul style="list-style-type: none"> <li>Review State PBN Implementation Plan Key Targets (Terminal Approach)</li> </ul>	<i>State PBN Implementation Plan</i> Mid Term: 2013-2016 [Ch. 5.2.2-5.2.3]				

JOINT PBN & GNSS/I TFs REPORT  
APPENDIX 6A (b)

PROCESS	TASKS	INPUT SOURCE	OUTPUT	TARGET DATE	ACTION PERSON/GROUP	STATUS
<i>Terminal Applications Implementation</i>						
<b>Process 1</b> <b>Determine Requirements</b>	<b>Step 1-</b> Formulate airspace concept	PBN Manual, Vol. 1B Ch. B 2.3.1 ➤ ATM needs (civil/military)				
	<b>Step 2-</b> Assessment of existing fleet capability and available navaid infrastructure	PBN Manual, Vol. 1B Ch. B 2.3.2 ➤ IATA Survey ➤ State Survey				
	<b>Step 3-</b> Assessment of existing ATS surveillance system and communications infrastructure and ATM system	PBN Manual, Vol. 1B Ch. B 2.3.3				
	<b>Step 4-</b> Identify necessary navigation performance and functional requirements	PBN Manual, Vol. 1B Ch. B 2.3.4				
			<ul style="list-style-type: none"> <li>➤ <b>Navigation functional requirements</b></li> <li>➤ <b>Fleet capability</b></li> <li>➤ <b>CNS/ATM capabilities</b></li> </ul>			

<b>Process 2</b>  <b>Identifying ICAO navigation specification for implementation</b>	<b>Step 1-</b> Review ICAO navigation specifications	PBN Manual, Vol. 1B Ch. B 3.3.1 ➤ Navigation functional requirements ➤ Fleet capability ➤ CNS/ATM capabilities				
	<b>Step 2-</b> Identify appropriate ICAO navigation specification to apply in the specific CNS/ATM environment ➤ RNP APCH ➤ RNP AR APCH ➤ New specification?	PBN Manual, Vol. 1B Ch. B 3.3.2				
	<b>Step 3-</b> Identify trade-offs with airspace concept and navigation functional requirements (if necessary)	PBN Manual, Vol. 1B Ch. B 3.3.3				

➤ **Navigation specifications**

JOINT PBN & GNSS/I TFs REPORT  
APPENDIX 6A (b)

<b>Process 3</b> <b>Planning and implementation</b>	<b>Step 1-</b> Formulate safety plan	PBN Manual, Vol. 1B Ch. B 4.3.1 ➤ Navigation specifications				
	<b>Step 2-</b> Validate airspace concept for safety	PBN Manual, Vol. 1B Ch. B 4.3.2				
	<b>Step 3-</b> Procedure design	PBN Manual, Vol. 1B Ch. B 4.3.3				
	<b>Step 4-</b> Procedure ground validation	PBN Manual, Vol. 1B Ch. B 4.3.4				
	<b>Step 5-</b> Implementation decision	PBN Manual, Vol. 1B Ch. B 4.3.5				
	<b>Step 6-</b> Flight inspection and flight validation	PBN Manual, Vol. 1B Ch. B 4.3.6				
	<b>Step 7-</b> ATC system integration considerations	PBN Manual, Vol. 1B Ch. B 4.3.7				
	<b>Step 8-</b> Awareness and training material	PBN Manual, Vol. 1B Ch. B 4.3.8				
	<b>Step 9-</b> Establishing operational implementation date	PBN Manual, Vol. 1B Ch. B 4.3.9				
	<b>Step 10-</b> Post-implementation review	PBN Manual, Vol. 1B Ch. B 4.3.10			<b>DEC 2012</b>	

➤ **Training**

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<p>programmes ➤ RNAV STARs and SIDs</p>
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<p>_____ (State)</p> <p><b>NATIONAL PERFORMANCE OBJECTIVES AND ACTION PLAN</b>  <b>OPTIMIZATION OF THE ATS ROUTE STRUCTURE IN TERMINAL AIRSPACE</b></p> <p><b>PERIOD: Long Term (2016 +)</b>  <b>APPLICATION: Terminal Phase</b></p>						
<i>Benefits</i>						
<p><b>Environment:</b></p> <p><b>Efficiency :</b></p>						
<i>Strategy</i>						
PROCESS	TASKS	INPUT SOURCE	OUTPUT	TARGET DATE	ACTION PERSON/GROUP	STATUS
<i>Preliminary</i>						
	<ul style="list-style-type: none"> <li>Review AFI PBN Implementation Plan Key Targets (Terminal)</li> </ul>	<i>AFI PBN Implementation Plan</i> Long Term: 2016 + [Ch. 25-26]				
	<ul style="list-style-type: none"> <li>Review State PBN Implementation Plan Key Targets (Terminal)</li> </ul>	<i>State PBN Implementation Plan</i> Long Term: 2016 + [Ch. 5.3]				

JOINT PBN & GNSS/I TFs REPORT  
APPENDIX 6A (c)

PROCESS	TASKS	INPUT SOURCE	OUTPUT	TARGET DATE	ACTION PERSON/GROUP	STATUS
<i>Terminal Applications Implementation</i>						
<b>Process 1</b> <b>Determine Requirements</b>	<b>Step 1-</b> Formulate airspace concept	PBN Manual, Vol. 1B Ch. B 2.3.1 ➤ ATM needs (civil/military)				
	<b>Step 2-</b> Assessment of existing fleet capability and available navaid infrastructure	PBN Manual, Vol. 1B Ch. B 2.3.2 ➤ IATA Survey ➤ State Survey				
	<b>Step 3-</b> Assessment of existing ATS surveillance system and communications infrastructure and ATM system	PBN Manual, Vol. 1B Ch. B 2.3.3				
	<b>Step 4-</b> Identify necessary navigation performance and functional requirements	PBN Manual, Vol. 1B Ch. B 2.3.4				
			<ul style="list-style-type: none"> <li>➤ <b>Navigation functional requirements</b></li> <li>➤ <b>Fleet capability</b></li> <li>➤ <b>CNS/ATM capabilities</b></li> </ul>			

<b>Process 2</b>  <b>Identifying ICAO navigation specification for implementation</b>	<b>Step 1-</b> Review ICAO navigation specifications	PBN Manual, Vol. 1B Ch. B 3.3.1 ➤ Navigation functional requirements ➤ Fleet capability ➤ CNS/ATM capabilities				
	<b>Step 2-</b> Identify appropriate ICAO navigation specification to apply in the specific CNS/ATM environment ➤ RNAV 5 ➤ RNAV 2 ➤ RNAV 1 ➤ New specification?	PBN Manual, Vol. 1B Ch. B 3.3.2				
	<b>Step 3-</b> Identify trade-offs with airspace concept and navigation functional requirements (if necessary)	PBN Manual, Vol. 1B Ch. B 3.3.3				

➤ <b>Navigation specifications</b>
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JOINT PBN & GNSS/I TFs REPORT  
APPENDIX 6A (c)

<b>Process 3</b> <b>Planning and implementation</b>	<b>Step 1-</b> Formulate safety plan	PBN Manual, Vol. 1B Ch. B 4.3.1 ➤ Navigation specifications				
	<b>Step 2-</b> Validate airspace concept for safety	PBN Manual, Vol. 1B Ch. B 4.3.2				
	<b>Step 3-</b> Procedure design	PBN Manual, Vol. 1B Ch. B 4.3.3				
	<b>Step 4-</b> Procedure ground validation	PBN Manual, Vol. 1B Ch. B 4.3.4				
	<b>Step 5-</b> Implementation decision	PBN Manual, Vol. 1B Ch. B 4.3.5				
	<b>Step 6-</b> Flight inspection and flight validation	PBN Manual, Vol. 1B Ch. B 4.3.6				
	<b>Step 7-</b> ATC system integration considerations	PBN Manual, Vol. 1B Ch. B 4.3.7				
	<b>Step 8-</b> Awareness and training material	PBN Manual, Vol. 1B Ch. B 4.3.8				
	<b>Step 9-</b> Establishing operational implementation date	PBN Manual, Vol. 1B Ch. B 4.3.9				
	<b>Step 10-</b> Post-implementation review	PBN Manual, Vol. 1B Ch. B 4.3.10			<b>DEC 2012</b>	

➤ **Training**

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<p>programmes ➤ RNAV STARs and SIDs</p>
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<p>_____ (State)</p> <p><b>NATIONAL PERFORMANCE OBJECTIVES AND ACTION PLAN          OPTIMIZATION OF THE ATS ROUTE STRUCTURE IN TERMINAL AIRSPACE</b></p> <p><b>PERIOD: Near Term (2008-2012)</b>  <b>APPLICATION: Approach Phase</b></p>						
<i>Benefits</i>						
<p><b>Environment:</b></p> <p><b>Efficiency :</b></p>						
<i>Strategy</i>						
PROCESS	TASKS	INPUT SOURCE	OUTPUT	TARGET DATE	ACTION PERSON/GROUP	STATUS
<i>Preliminary</i>						
	<ul style="list-style-type: none"> <li>Review AFI PBN Implementation Plan Key Targets (Terminal- Approach)</li> </ul>	<i>AFI PBN Implementation Plan</i> Near Term: 2008-2012 [Ch. 10-14]				
	<ul style="list-style-type: none"> <li>Review State PBN Implementation Plan Key Targets (Terminal-Approach)</li> </ul>	<i>State PBN Implementation Plan</i> Near Term: 2008-2012 [Ch. 5.1.2-5.1.3]				

JOINT PBN & GNSS/I TFs REPORT  
APPENDIX 6A (d)

PROCESS	TASKS	INPUT SOURCE	OUTPUT	TARGET DATE	ACTION PERSON/GROUP	STATUS
<i>Terminal Applications Implementation</i>						
<b>Process 1</b> <b>Determine Requirements</b>	<b>Step 1-</b> Formulate airspace concept	PBN Manual, Vol. 1B Ch. B 2.3.1 ➤ ATM needs (civil/military)				
	<b>Step 2-</b> Assessment of existing fleet capability and available navaid infrastructure	PBN Manual, Vol. 1B Ch. B 2.3.2 ➤ IATA Survey ➤ State Survey				
	<b>Step 3-</b> Assessment of existing ATS surveillance system and communications infrastructure and ATM system	PBN Manual, Vol. 1B Ch. B 2.3.3				
	<b>Step 4-</b> Identify necessary navigation performance and functional requirements	PBN Manual, Vol. 1B Ch. B 2.3.4				
			<ul style="list-style-type: none"> <li>➤ <b>Navigation functional requirements</b></li> <li>➤ <b>Fleet capability</b></li> <li>➤ <b>CNS/ATM capabilities</b></li> </ul>			

<b>Process 2</b>  <b>Identifying ICAO navigation specification for implementation</b>	<b>Step 1-</b> Review ICAO navigation specifications	PBN Manual, Vol. 1B Ch. B 3.3.1 ➤ Navigation functional requirements ➤ Fleet capability ➤ CNS/ATM capabilities				
	<b>Step 2-</b> Identify appropriate ICAO navigation specification to apply in the specific CNS/ATM environment ➤ RNP APCH ➤ RNP AR APCH ➤ New specification?	PBN Manual, Vol. 1B Ch. B 3.3.2				
	<b>Step 3-</b> Identify trade-offs with airspace concept and navigation functional requirements (if necessary)	PBN Manual, Vol. 1B Ch. B 3.3.3				

➤ **Navigation specifications**

<b>Process 3</b> <b>Planning and implementation</b>	<b>Step 1-</b> Formulate safety plan	PBN Manual, Vol. 1B Ch. B 4.3.1 ➤ Navigation specifications				
	<b>Step 2-</b> Validate airspace concept for safety	PBN Manual, Vol. 1B Ch. B 4.3.2				
	<b>Step 3-</b> Procedure design	PBN Manual, Vol. 1B Ch. B 4.3.3				
	<b>Step 4-</b> Procedure ground validation	PBN Manual, Vol. 1B Ch. B 4.3.4				
	<b>Step 5-</b> Implementation decision	PBN Manual, Vol. 1B Ch. B 4.3.5				
	<b>Step 6-</b> Flight inspection and flight validation	PBN Manual, Vol. 1B Ch. B 4.3.6				
	<b>Step 7-</b> ATC system integration considerations	PBN Manual, Vol. 1B Ch. B 4.3.7				
	<b>Step 8-</b> Awareness and training material	PBN Manual, Vol. 1B Ch. B 4.3.8				
	<b>Step 9-</b> Establishing operational implementation date	PBN Manual, Vol. 1B Ch. B 4.3.9				
	<b>Step 10-</b> Post-implementation review	PBN Manual, Vol. 1B Ch. B 4.3.10			<b>DEC 2012</b>	

➤ **Training**

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<p>programmes ➤ RNP approaches with Baro VNAV</p>
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<p>_____ (State)</p> <p><b>NATIONAL PERFORMANCE OBJECTIVES AND ACTION PLAN          OPTIMIZATION OF THE ATS ROUTE STRUCTURE IN TERMINAL AIRSPACE</b></p> <p><b>PERIOD: Mid Term (2013-2016)</b>  <b>APPLICATION: Approach Phase</b></p>						
<i>Benefits</i>						
<p><b>Environment:</b></p> <p><b>Efficiency :</b></p>						
<i>Strategy</i>						
PROCESS	TASKS	INPUT SOURCE	OUTPUT	TARGET DATE	ACTION PERSON/GROUP	STATUS
<i>Preliminary</i>						
	<ul style="list-style-type: none"> <li>Review AFI PBN Implementation Plan Key Targets (Terminal- Approach)</li> </ul>	<i>AFI PBN Implementation Plan</i> Mid Term: 2013-2016 [Ch. 20-24]				
	<ul style="list-style-type: none"> <li>Review State PBN Implementation Plan Key Targets (Terminal Approach)</li> </ul>	<i>State PBN Implementation Plan</i> Mid Term: 2013-2016 [Ch. 5.2.2-5.2.3]				



JOINT PBN & GNSS/I TFs REPORT  
APPENDIX 6A (e)

PROCESS	TASKS	INPUT SOURCE	OUTPUT	TARGET DATE	ACTION PERSON/GROUP	STATUS
<i>Terminal Applications Implementation</i>						
<b>Process 1</b> <b>Determine Requirements</b>	<b>Step 1-</b> Formulate airspace concept	PBN Manual, Vol. 1B Ch. B 2.3.1 ➤ ATM needs (civil/military)				
	<b>Step 2-</b> Assessment of existing fleet capability and available navaid infrastructure	PBN Manual, Vol. 1B Ch. B 2.3.2 ➤ IATA Survey ➤ State Survey				
	<b>Step 3-</b> Assessment of existing ATS surveillance system and communications infrastructure and ATM system	PBN Manual, Vol. 1B Ch. B 2.3.3				
	<b>Step 4-</b> Identify necessary navigation performance and functional requirements	PBN Manual, Vol. 1B Ch. B 2.3.4				
			<ul style="list-style-type: none"> <li>➤ <b>Navigation functional requirements</b></li> <li>➤ <b>Fleet capability</b></li> <li>➤ <b>CNS/ATM capabilities</b></li> </ul>			

<b>Process 2</b>  <b>Identifying ICAO navigation specification for implementation</b>	<b>Step 1-</b> Review ICAO navigation specifications	PBN Manual, Vol. 1B Ch. B 3.3.1 ➤ Navigation functional requirements ➤ Fleet capability ➤ CNS/ATM capabilities				
	<b>Step 2-</b> Identify appropriate ICAO navigation specification to apply in the specific CNS/ATM environment ➤ RNP APCH ➤ RNP AR APCH ➤ New specification?	PBN Manual, Vol. 1B Ch. B 3.3.2				
	<b>Step 3-</b> Identify trade-offs with airspace concept and navigation functional requirements (if necessary)	PBN Manual, Vol. 1B Ch. B 3.3.3				

➤ **Navigation specifications**

JOINT PBN & GNSS/I TFs REPORT  
APPENDIX 6A (e)

<b>Process 3</b> <b>Planning and implementation</b>	<b>Step 1-</b> Formulate safety plan	PBN Manual, Vol. 1B Ch. B 4.3.1 ➤ Navigation specifications				
	<b>Step 2-</b> Validate airspace concept for safety	PBN Manual, Vol. 1B Ch. B 4.3.2				
	<b>Step 3-</b> Procedure design	PBN Manual, Vol. 1B Ch. B 4.3.3				
	<b>Step 4-</b> Procedure ground validation	PBN Manual, Vol. 1B Ch. B 4.3.4				
	<b>Step 5-</b> Implementation decision	PBN Manual, Vol. 1B Ch. B 4.3.5				
	<b>Step 6-</b> Flight inspection and flight validation	PBN Manual, Vol. 1B Ch. B 4.3.6				
	<b>Step 7-</b> ATC system integration considerations	PBN Manual, Vol. 1B Ch. B 4.3.7				
	<b>Step 8-</b> Awareness and training material	PBN Manual, Vol. 1B Ch. B 4.3.8				
	<b>Step 9-</b> Establishing operational implementation date	PBN Manual, Vol. 1B Ch. B 4.3.9				
	<b>Step 10-</b> Post-implementation review	PBN Manual, Vol. 1B Ch. B 4.3.10			<b>DEC 2012</b>	

➤ **Training**

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<p>programmes ➤ RNP approaches with Baro VNAV</p>
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<p>_____ (State)</p> <p><b>NATIONAL PERFORMANCE OBJECTIVES AND ACTION PLAN          OPTIMIZATION OF THE ATS ROUTE STRUCTURE IN TERMINAL AIRSPACE</b></p> <p><b>PERIOD: Long Term (2016 +)          APPLICATION: Approach Phase</b></p>						
<i>Benefits</i>						
<p><b>Environment:</b></p> <p><b>Efficiency :</b></p>						
<i>Strategy</i>						
PROCESS	TASKS	INPUT SOURCE	OUTPUT	TARGET DATE	ACTION PERSON/GROUP	STATUS
<i>Preliminary</i>						
	<ul style="list-style-type: none"> <li>Review AFI PBN Implementation Plan Key Targets (Terminal-Approach)</li> </ul>	<i>AFI PBN Implementation Plan</i> Long Term: 2016 + [Ch. 25-26]				
	<ul style="list-style-type: none"> <li>Review State PBN Implementation Plan Key Targets (Terminal Approach)</li> </ul>	<i>State PBN Implementation Plan</i> Long Term: 2016 + [Ch. 5.3]				

JOINT PBN & GNSS/I TFs REPORT  
APPENDIX 6A (f)

PROCESS	TASKS	INPUT SOURCE	OUTPUT	TARGET DATE	ACTION PERSON/GROUP	STATUS
<i>Terminal Applications Implementation</i>						
<b>Process 1</b> <b>Determine Requirements</b>	<b>Step 1-</b> Formulate airspace concept	PBN Manual, Vol. 1B Ch. B 2.3.1 ➤ ATM needs (civil/military)				
	<b>Step 2-</b> Assessment of existing fleet capability and available navaid infrastructure	PBN Manual, Vol. 1B Ch. B 2.3.2 ➤ IATA Survey ➤ State Survey				
	<b>Step 3-</b> Assessment of existing ATS surveillance system and communications infrastructure and ATM system	PBN Manual, Vol. 1B Ch. B 2.3.3				
	<b>Step 4-</b> Identify necessary navigation performance and functional requirements	PBN Manual, Vol. 1B Ch. B 2.3.4				
			<ul style="list-style-type: none"> <li>➤ <b>Navigation functional requirements</b></li> <li>➤ <b>Fleet capability</b></li> <li>➤ <b>CNS/ATM capabilities</b></li> </ul>			

<b>Process 2</b>  <b>Identifying ICAO navigation specification for implementation</b>	<b>Step 1-</b> Review ICAO navigation specifications	PBN Manual, Vol. 1B Ch. B 3.3.1 ➤ Navigation functional requirements ➤ Fleet capability ➤ CNS/ATM capabilities				
	<b>Step 2-</b> Identify appropriate ICAO navigation specification to apply in the specific CNS/ATM environment ➤ RNP APCH ➤ RRNP AR APCH ➤ New specification?	PBN Manual, Vol. 1B Ch. B 3.3.2				
	<b>Step 3-</b> Identify trade-offs with airspace concept and navigation functional requirements (if necessary)	PBN Manual, Vol. 1B Ch. B 3.3.3				

➤ **Navigation specifications**

<b>Process 3</b> <b>Planning and implementation</b>	<b>Step 1-</b> Formulate safety plan	PBN Manual, Vol. 1B Ch. B 4.3.1 ➤ Navigation specifications				
	<b>Step 2-</b> Validate airspace concept for safety	PBN Manual, Vol. 1B Ch. B 4.3.2				
	<b>Step 3-</b> Procedure design	PBN Manual, Vol. 1B Ch. B 4.3.3				
	<b>Step 4-</b> Procedure ground validation	PBN Manual, Vol. 1B Ch. B 4.3.4				
	<b>Step 5-</b> Implementation decision	PBN Manual, Vol. 1B Ch. B 4.3.5				
	<b>Step 6-</b> Flight inspection and flight validation	PBN Manual, Vol. 1B Ch. B 4.3.6				
	<b>Step 7-</b> ATC system integration considerations	PBN Manual, Vol. 1B Ch. B 4.3.7				
	<b>Step 8-</b> Awareness and training material	PBN Manual, Vol. 1B Ch. B 4.3.8				
	<b>Step 9-</b> Establishing operational implementation date	PBN Manual, Vol. 1B Ch. B 4.3.9				
	<b>Step 10-</b> Post-implementation review	PBN Manual, Vol. 1B Ch. B 4.3.10		<b>DEC 2012</b>		

➤ **Training**



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<p>programmes ➤ RNP approaches with Baro VNAV</p>
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**Joint PBN & GNSS/I TFs Task List**

No.	ICAO Strategic Objective	Associated GPI	Tasks	Objective	Deliverables	Target Date	To be delivered by	Supporting Parties	Status
1	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Develop the AFI PBN Performance Objectives and Action Plan for en – route phase of flight operations.	To facilitate PBN Regional implementation	Draft document	Feb. 2010	Working Group on En-Route Operations (WG-EO)	States, ROs	Ongoing
2	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Develop the AFI PBN Performance Objectives and Action Plan for terminal and approach phases of flight operations	To facilitate PBN Regional implementation	Draft document	Feb. 2010	Working Group on Terminal and Approach Operations (WG-TAO)	States, ROs	Ongoing
3	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Carry out necessary actions in coordination with States to amend the relevant parts of the AFI/CNS/ATM Plan (Doc.003) to incorporate PBN issues.	Update of planning documentation	Update Doc 003	Feb. 2010	ICAO ROs	States	Ongoing
4	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Develop amendment proposals to assist APIRG in the incorporation of PBN elements in the AFI/CNS/ATM Plan (Doc.003)	Update of planning documentation	Amendment prosals	Feb. 2010	PBN Task Force		Ongoing
5	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21							Ongoing
6	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21							Ongoing

6A-2

No.	ICAO Strategic Objective	Associated GPI	Tasks	Objective	Deliverables	Target Date	To be delivered by	Supporting Parties	Status
7	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Follow up development of the national PBN implementation plans	Assist States in developing plans	Completed plans by Dec 09	ongoing	Regional Offices (CNS and ATM)	HQ (PBN Programme)	Ongoing
8	A: Safety D: Efficiency C: Environment	GPI-5, GPI- 7, GPI-10, GPI-11, GPI-12, GPI-20, GPI-21	Assist States with advice and guidance in developing national PBN Implementation Plans.	To facilitate implementation.	Advice and guidance.	As per PAG TOR	PAG		Ongoing

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APPENDIX 8A

**AFI GNSS STRATEGY**

<b>Table 1: Summary of AFI GNSS Strategy for 2008-2012</b>		
<b>Airspace</b>	<b>Navigation Specifications</b>	<b>Navigation Specifications where operationally required</b>
En-Route Oceanic	IN ACCORDANCE WITH THE PBN IMPLEMENTATION PLAN	
En-Route Remote Continental		
En-Route Continental		
TMA Arrival/Departure		
Approach		

<b>Table 2: Summary of AFI GNSS Strategy for 2013-2016</b>		
<b>Airspace</b>	<b>Navigation Specifications</b>	<b>Navigation Specifications where operationally required</b>
En-Route Oceanic	IN ACCORDANCE WITH THE PBN IMPLEMENTATION PLAN	
En-Route Remote Continental		
En-Route Continental		
TMA Arrival/Departure		
Approach		
Approach (Precision)	CAT I (SBAS, GBAS) and CAT II/III (GBAS)	

<b>Table 3: Summary of AFI GNSS Strategy for 2017 and beyond</b>		
<b>Airspace</b>	<b>Navigation Specifications</b>	<b>Navigation Specifications where operationally required</b>
En-Route Oceanic	IN ACCORDANCE WITH THE PBN IMPLEMENTATION PLAN	
En-Route Remote Continental		
En-Route Continental		
TMA Arrival/Departure		
Approach		
Approach (Precision)	CAT I (ABAS, SBAS, GBAS) and CAT II/III (GBAS)	

JOINT PBN & GNSS/I TFs  
Appendix 9A to the Report on Agenda Item 9

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**Proposed Agenda of the First Meeting of the  
Proposed PBN/GNSS Task Forces (PBN/GNSS TF/1 TFs)**

<b>STRATEGIC OBJECTIVES</b>	<b>AGENDA ITEM NO.</b>	<b>SUBJECT</b>
D	1	Adoption of the Agenda and Election of Chairperson.
A & D	2	Review and follow up of Recommendations, Conclusions and Decisions applicable to the Task Forces.
D	3	Terms of Reference of the proposed PBN/GNSS Task Force.
A & D	4	Status of implementation of PBN in the AFI Region.
D	5	PBN Implementation Action Plan.
D	6	PBN and GNSS Regional Performance Objectives.
A & D	7	GNSS Strategy.
D	8	Date and Venue of the next meeting.
	9	Any other business.

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