

PBN/GNSS TF/1-REPORT

INTERNATIONAL CIVIL AVIATION ORGANIZATION



THE AFI PLANNING AND IMPLEMENTATION REGIONAL GROUP (APIRG)

**REPORT OF THE FIRST MEETING OF THE PERFORMANCE BASED
NAVIGATION/GLOBAL NAVIGATION SATELLITE SYSTEM TASK FORCE**

PBN/GNSS TF/1

(Nairobi, Kenya, 12 – 14 October 2010)

Approved by the Meeting
and published by authority of the Secretary General

The views expressed in this Report should be taken as those of the APIRG ATS/AIS/SAR Sub-Group and not of the Organization. This Report will, however, be submitted to the APIRG and any formal action taken will be published in due course as a Supplement to the Report.

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PBN/GNSS TF1
History of the Meeting

PART I – HISTORY OF THE MEETING

1. PLACE AND DURATION

1.1 The first meeting of the Performance Based Navigation/Global Navigation Satellite System Task Force (PBN/GNSS TF/1) was held at the Silver Springs Hotel, Nairobi, Kenya from 12-14 October 2010.

2. OPENING

2.1 The Meeting was opened by Mr. Geoffrey P. Moshabesha, ICAO Regional Director Eastern and Southern African (ESAF) Office. In his opening remarks, Mr. Moshabesha welcomed all delegates to Nairobi and to the eleventh meeting. He expressed appreciation on the level of attendance and thanked States and Organizations that had made it possible for the officials to attend the meeting.

2.2 Mr. Moshabesha highlighted the challenges faced by States in the implementation of PBN. He also recalled that the outcomes of the APIRG 17 Meeting and the 37th Session of the Assembly have an impact on the business of the Task Force, and challenged the Task Force to give effect to implementation provisions from the two events.

2.3 Finally, Mr. Moshabesha reminded the participants that their primary role in the Sub-Groups was the interest of the AFI Region, and as such urged them to work as experts of the Sub-Groups in order to achieve Regional goals.

3. ATTENDANCE

3.1 The meeting was attended by a total of 53 participants from nineteen (19) States and four (4) organisations. The list of participants is at the **Attachment A** to the Report.

4. OFFICERS AND SECRETARIAT

4.1 The meeting was chaired by Mr. Popoola Adebisi, General Manager Air Navigation Services, Nigerian Civil Aviation Authority (NCAA). Mr. Seboeso Machobane, Regional Officer ATM/SAR ESAF Regional Office was the Secretary of the meeting, supported by Messrs. Prosper Zo'o-Minto'o Regional Officer CNS, ESAF Regional Office, Sadou Marafa Regional Officer ATM/SAR WACAF Regional Office, François-Xavier Salambanga Regional Officer CNS WACAF Regional Office, and David Labrosse ATM Consultant ESAF Regional Office.

5. LANGUAGE

5.1 Discussions were conducted in the English language and documentation was issued in the English language.

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6. AGENDA

6.1 The following Agenda was adopted:

STRATEGIC OBJECTIVES	AGENDA ITEM NO.	SUBJECT
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
A & D	3	PBN and GNSS Regional Performance Objectives, Update on Actions
A & D	4	Status of implementation of PBN in the AFI Region
D	5	AFI GNSS Implementation Strategy
D	6	Review of Terms of Reference (TOR) of the PBN/GNSS Task Force and Work Programme
D	7	Date and Venue of the next meeting
	8	Any other business

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7. CONCLUSIONS AND DECISIONS

DEFINITION

7.1 All APIRG Sub-Groups and Task Forces record their actions in the form of Conclusions and Decisions with the following significance:

- a) **Conclusions** deal with the matters which, in accordance with the Group's terms of reference, merit directly the attention of States on which further action will be initiated by ICAO in accordance with established procedures; and
- b) **Decisions** deal with matters of concern only to the APIRG and its contributory bodies.

LIST

7.2 The list of PBN/GNSS TF1 Conclusions and Decisions is at **Attachment B** to the Report.

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Report on Agenda Item 1

PART II: REPORT ON AGENDA ITEMS

Report on Agenda Item 1: Adoption of the Provisional Agenda and Election of the Chairperson

1.1 The meeting reviewed the proposed agenda for the First Meeting of the Performance Based Navigation/Global Navigation Satellite System Task Force (PBN/GNSS TF/1) 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 6 of the History of the Meeting.

1.2 On the process of electing the chairman for the Task Force, the Task Force noted that at its 11th meeting in Nairobi, 26 – 30 April 2010, the ATS/AIS/SAR Sub-Group was of the view that the Chairmanship of the Sub-Group should rotate among the AFI sub-regions as part of enabling the use of expertise from all parts of the AFI Region as officials of the Sub-Group.

1.3 The Task Force agreed that the Chairperson should be active in following up with States and Regional Offices, on the work of the Task Force. Accordingly, while embracing a similar approach as the ATS/AIS/SAR Sub-Group, the Task Force agreed that the Chairperson should nevertheless chair two meetings in order to enable him/her to actively support the work of the Task Force in between meetings, and to provide a detailed progress report to the next meeting.

1.4 In light of the above, and in accordance with established procedure within APIRG, the representative from Zambia proposed Mr. Popoola Adebisi, General Manager Air Navigation Services, Nigerian Civil Aviation Authority (NCAA), as Chairman. The proposal was seconded by the representative from Senegal. The meeting acknowledged the nomination by acclamation. Accordingly Mr. Popoola Adebisi was elected Chairman of the APIRG PBN/GNSS Task Force.

1.5 In accepting the election, Mr. Popoola thanked the participants for their confidence in him, and assured them that, with their able support he will do his best to serve the proceedings of the Sub-Group.

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Report on Agenda Item 2

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/08 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/GNSS Task Force.

2.2 It was noted that the Special AFI/08 RAN Meeting formulated eight (8) Recommendations that are applicable to PBN and GNSS implementation. It was also noted that the APIRG 17 meeting, Ouagadougou, Burkina Faso 2-6 August 2010, had adopted 106 Conclusions and Decisions, of which 21 are directly applicable to the work of the PBN/GNSS Task Force.

2.3 The meeting reviewed progress on follow up action items relating to each of the Recommendations, Conclusions and Decisions in the context of discussions under various agenda items, and updated the information on follow up action.

2.4 The meeting acknowledged that the 106 Conclusions and Decisions adopted by APIRG 17 were exceptionally high in number, and that this presents a challenge with regard to implementation prioritization and follow-up by parties concerned, including States, international organizations and the Secretariat. The Task Force acknowledged also, that the number of Conclusions/Decisions adopted by APIRG is related to inputs from the APIRG subsidiary bodies and that in this regard each subsidiary body has a role in reducing the number of Conclusions and Decisions.

2.5 In this context, the Task Force took a decision to limit its number of Conclusions and Decisions from its deliberations. Furthermore, the Task Force reviewed existing Conclusions and Decisions with the objective of identifying those that might be merged with others that are considered similar or closely related; identify those that are adequately addressed by other Conclusions, Decisions, procedures, or activities; identify those that may be included in the terms of reference and work programmes of relevant APIRG subsidiary bodies or be included in the APIRG handbook to serve general purposes.

2.6 The meeting reviewed the issue of operational benefits that were intended in APIRG 17 Conclusion 17/51. It was agreed that rather than the coordination process which could take long, the Regional Offices send a State Letter to concerned States (along ATS routes UM214 and UM 215) urging them to establish the lowest usable flight level on the RNAV routes UM214 and UM215 as flight level 250 for operational reasons. It was recognized that such a lower limit would serve not only intercontinental flights between the Southern part of AFI and the Northern AFI/EUR Region, but would also make the routes more accessible to intra-Continental traffic.

2.7 Based on the above, the meeting updated the follow-up action and target dates as necessary, relating to the RAN Recommendations and the APIRG Conclusions and Decisions at **Appendix 2A** and **Appendix 2B** respectively. Furthermore, the Task Force agreed on the consolidation actions of the APIRG Conclusions and Decisions as reflected in **Appendix B** to the report on agenda item 2, and the following reformulation:

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Report on Agenda Item 2

DRAFT CONCLUSION 1/01 NATIONAL PBN IMPLEMENTATION PLAN

That States,

- (a) that have not already done so, complete their national PBN implementation plans as a matter of urgency, using the template at **Appendix 4A** to the report on agenda item 4;
- (b) consider the use of planning tools provided by the PBN/GNSS Task Force, as well as project management software; and
- (c) provide updates to Regional Offices.

(This Draft Conclusion is to supersede APIRG Conclusions 17/47 and 17/48)

DRAFT CONCLUSION 1/02 LOWERING OF RNAV/RNP ROUTES UM214 AND UM215

That, concerned States be urged to establish the lowest usable flight level on the RNAV routes UM214 and UM215 as flight level 250 for operational reasons.

(This Draft Conclusion is to supersede APIRG Conclusions 17/51)

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Report on Agenda Item 3

REPORT ON AGENDA ITEM 3: PBN AND GNSS REGIONAL PERFORMANCE OBJECTIVES

3.1 The meeting recalled the introduction of a performance-based approach to the planning of air navigation services in the AFI region by the SP AFI/08 RAN Meeting, Durban, South Africa 24 to 29 November 2008. It was recalled also that the SP AFI/08 RAN Meeting considered a series of performance framework Forms (PFF) relating to air navigation fields and referred them to APIRG as a mechanism to identify the performance objectives as well as to establish timeframes for the regional planning and implementation process.

3.2 The meeting noted that the Regional Performance Objectives relevant to PBN implementation and their related Performance Framework Forms have, since then, been considered and updated progressively by AFI competent bodies, and formally adopted by the APIRG 17 meeting as follows:

- The PBN TF/2 meeting (Nairobi, December 2008) established two Working Groups: Working Group on En-Route Operations (WG-EO) and of the Working Group on Terminal and Approach Operations (WG-TAO) to develop the Regional Performance Objectives related to PBN implementation and the PBN Implementation Action Plan.
- The ATS/AIS/SAR SG/10 meeting (Dakar, May 2009) 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) proposed by the AFI/08 RAN, and report to APIRG.
- The Joint PBN/GNSS/I TFs/1 meeting (Nairobi, 8 to 10 September 2009) recognizing that due to very limited participation of members, the above Working Groups as originally composed had not been effective, agreed to re-establish them and re-assigned the unfinished work.
- The ATS/AIS/SAR SG/11 meeting, recognizing the importance of the PFFs in the management of the implementation projects, formed small working groups (SWG) and assigned them the task of updating and completing the PFFs provided by the SP AFI/8 RAN meeting.
- The APIRG 17 (Ouagadougou, 02-06 August 2010) meeting endorsed the PFFs as updated by the ATS/AIS/SAR SG/11 meeting.

3.3 In reviewing the details of the Performance Framework Forms (PFFs), the meeting recalled that in accordance with Assembly Resolution A36-23, States were to complete State PBN implementation plans by 2009. In this regard, the meeting noted with concern that many AFI States had still not completed development of their State PBN implementation plans.

3.4 In view of the status of PBN implementation as noted during the review of the PFFs and, more particularly during discussion under agenda item 4, taking into consideration the outcome of the 37th Session of the Assembly on the matter of PBN implementation including amendment of Assembly Resolution A36-23, the meeting updated the PBN related AFI PFFs. Furthermore, the meeting agreed that AFI States that had not already done so, be urged to complete their national PBN implementation plans in accordance with Assembly Resolution A36-23 as amended by the 37th Session of the Assembly.

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Report on Agenda Item 3

3.5 Based on the above, the meeting formulated the following Draft Conclusion

DRAFT CONCLUSION 1/ 03: AFI PBN REGIONAL PERFORMANCE FRAMEWORK FORMS

That;

- a) the AFI PBN Regional Performance Framework Forms are updated as at **Appendix 3A-1 to 3A-3**, to the report on agenda item 3;
- b) noting that the 2009 deadline established in Assembly Resolution A36-23 for the completion of State PBN implementation Plans has passed, States that have not done so, complete their national PBN implementation plans as a matter of urgency.

3.6 Concern was raised regarding hierarchy of planning documents applicable in the Region, more particularly the AFI Doc 003 and newly adopted system of performance objectives. It was noted that the AFI RAN Meeting agreed that the PFFs should be included the CNS/ATM Implementation Plan for the AFI Region (Doc 003), moreover much of the material in the Doc 003 is reflected in the ANP. The meeting requested ICAO to review and align these documents.

3.7 It was noted that a performance framework workshop will be held in Nairobi 6-10 December 2010 and that States were expected to participate in significant numbers in order to improve familiarity and usage of the system. Issues regarding the relationship of the PFFs and other planning document will also be discussed.

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Report on Agenda Item 4

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

Scope of PBN

4.1 The meeting recalled that Performance-based navigation (PBN) provides the global framework of harmonized modern navigation requirements, which (framework) did not exist previously or existed on a regional basis only, and provides the platform to implement and benefit from existing and future area navigation technologies. It includes two key “building blocks”: area navigation (RNAV) and required navigation performance (RNP), the application of which encompasses all phases of flight from en-route to approach. PBN provides improved navigational guidance from departure to en-route, arrival and approach. It enables operational improvements including shortened routes, continuous climb and descent operations and enhanced approach procedures, all of which reduce fuel consumption thereby reducing aviation’s environmental impact and improving safety. Other benefits include the ability to access airspaces and airports not otherwise accessible, and increasing airspace capacity.

Development of National PBN Plans

4.2 It was also recalled in this context, that Assembly Resolution A36-23 calls for, *inter alia*, the PIRGs and States to develop PBN Implementation plans by 31 December 2009, to achieve specific goals in the implementation of PBN.

4.3 The Special AFI/08 RAN Meeting, Durban, South Africa 24-29 November 2008, formulated eight (8) Recommendations that are applicable to PBN and GNSS implementation, including a set of performance objectives outlining specific actions, responsible parties and action target dates. The performance objectives, which are formulated on performance framework forms (PFFs), have since been reviewed within the framework of APIRG and adopted as discussed under agenda item 3 of the report.

4.4 The meeting noted that, in order to facilitate the States’ development of national plans by the 31 December 2009 goal provided in Assembly Resolution A36-23, and to facilitate the desired harmonization between the Regional and national plans, the AFI Regional Offices recognize the necessity to coordinate with States on the applicability of the Regional PBN Implementation Plan. In this regard, in July 2009 the concurrence of States was sought through a State Letter, 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 implementation plans, in the same capacity as material adopted by APIRG.

Status of implementation of PBN in the AFI Region

4.5 Based on the PBN Implementation Regional Plan, it was noted that some States had developed their national plans. All member States, including AFI States were expected to have completed these plans by the end of 2009. However, due to resource and expertise shortages, the target date could not be met. A list of the AFI States that have provided their national PBN plans for their aerodromes and their terminal airspace (SIDs and STARs) is shown at **Appendix 4A** to the report on agenda item 4.

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Report on Agenda Item 4

4.6 The meeting reviewed the report containing an action plan that reflects the current status of implementation the SP AFI/08 RAN Meeting Recommendations. The meeting noted the action taken or to be taken by States, the Secretariat and APIRG as well the specific target dates for implementation in relation to each recommendation; categorization of the recommendations in terms of short- (2010), medium- (2011-2015) and long-term (ongoing) projects as defined by ICAO SP AFI RAN 2008; challenges being encountered in the implementation of the Recommendations; and identified accountable parties with regard to each Recommendation.

4.7 Based on the above, the meeting agreed to the following conclusion:

DRAFT CONCLUSION 1/04: DEVELOPMENT AND IMPLEMENTATION OF PBN NATIONAL PLANS

That:

- (a) ICAO Regional Offices assess the PBN plans submitted by the States against the available global and regional guidance pertaining to PBN; and
- (b) ICAO should pursue its efforts towards establishing an effective PBN programme with a view to assisting States in overcoming PBN implementation challenges.

PBN implementation for terminal airspace and aerodrome operations

4.8 The meeting noted that a very limited number of States had reported PBN implementation for terminal and/or aerodrome operations. However, RNAV/GNSS procedures continued to be developed for SIDs and STARs and non-precision approaches (NPA), based on non-PBN criteria.

PBN implementation for en-route operations

4.9 The meeting was informed that the performance-based navigation route network development working group (PRND/WG) was instrumental for the implementation of thirty (30) user-required RNAV10 routes scheduled for 21 October 2010 (AIRAC), through a meeting which was hosted by IATA in Johannesburg, South Africa. A follow-up meeting was planned for 26-28 October 2010, Johannesburg, in order to address implementation issues between some States.

Training requirements

4.10 The meeting acknowledged that awareness and training were critical in facilitating progress in the implementation of PBN. In this regard the meeting discussed at length on ways and means of addressing training requirements in the PBN and GNSS areas. It was recalled that ICAO had made significant effort in supporting States implementation efforts by, inter alia, arranging PBN seminars, workshops and courses. However, the level of States' participation in these training opportunities was limited. It was also recalled that the Joint Meeting of the PBN and GNSS/I Task Forces in September 2009, formed the PBN Implementation Advisory Group (PAG) with the objective of supporting States that may require assistance, to complete their national PBN implementation plans by 2009. However, the availability of the PAG was not taken advantage of.

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4.11 It was noted that Regional bodies have been established in the past to study training requirements in various fields of civil aviation. However, one of the perennial challenges faced by such bodies has been lack of data from States. Similarly, the challenge in determining PBN training needs is that States have already carried out training and awareness to various levels; from very little or nothing to advanced training that only requires minimal improvements and upgrading as new criteria is published by ICAO. Another aspect to note was the pending establishment of the AFI FPP. The meeting nevertheless agreed that further steps were needed towards a suitable training strategy for the Region.

4.12 In light of the above discussion, the meeting proposed reformulation of APIRG 17 Conclusion 17/53 as follows:

DRAFT CONCLUSION 1/05: TRAINING IN SUPPORT OF PBN IMPLEMENTATION

That, in order to support the implementation of PBN in the AFI Region, AFI Regional Offices organize seminars/workshops for training of relevant personnel directly involved in the implementation of PBN

(This draft Conclusion is to supersede APIRG Conclusion 17/53)

4.13 The meeting was informed that ICAO has planned, pending availability of funds, to arrange a PBN seminar/workshop in 2011, and participants were requested to complement the information provided by ICAO regarding the seminar/workshop, by informing and where applicable sensitizing responsible parties on the importance of the event.

Review of Regional PBN Implementation Plan

4.14 The meeting noted that the APIRG 17 meeting, during discussion on the AFI Regional PBN Implementation Plan, while noting the successful development of the Plan to guide the Region in meeting the goals outline in Assembly Resolution A36-23, deliberated at length on the role of augmented GNSS to support PBN implementation. APIRG 17 adopted the Plan under Conclusion 17/46: *AFI PBN Implementation Regional Plan*. Furthermore, APIRG 17 referred the matter of GNSS augmentation and APV to the Task Force, noting that there were ongoing discussions under the partnership between the AU and EC on the role that might be played by EGNOS in the augmentation of GNSS signal to support APV in the AFI Region.

4.15 The Task Force noted that the terminology “approach with vertical guidance (APV) procedures,” is used in the AFI Regional PBN Implementation Plan in the context of its definition in the PBN Manual (Doc 9613), that is to indicate an instrument procedure which utilizes lateral and vertical guidance but which does not meet the requirements established for precision approach and landing operations. It was noted also, that the first edition of the Plan developed in December 2008 (which was titled “*AFI Region Performance Based Navigation Roadmap*”), had in some parts indicated that APV would be achieved through Baro-VNAV and SBAS, while in some parts only Baro-VNAV was identified to support APV.

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4.16 The meeting acknowledged that the object of A36-23 is getting the infrastructure (instrument flight procedures) in place so that, inter alia, aircraft that are equipped with APV (Baro-VNAV or augmented GNSS) would have the ability to realize safety, efficiency, access and other benefits. While the Resolution calls for “... *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...*,” the Resolution does not require any specific equipage by 2016.

4.17 Recognizing the intent of A36-23 to increase the number of vertically guided approach operations by requiring vertically guided approach procedures designed to all instrument runway ends, it was noted that (within the A36-23 time frames) Baro-VNAV can only partially meet this intent. For some time, some aircraft will not be Baro-VNAV equipped, as some will not be SBAS equipped. The meeting noted also that, while current aircraft equipage information provides a useful indication of equipage on airline fleets, the status of equipage of non-airline aircraft, particularly in the weight categories closed to 5700kg is not adequately known. It is recognized however, that many AFI States’ economies, development and other nationally essential programmes still depend significantly on activities supported by aircraft around (below and slightly over) this weight category.

4.18 In reviewing the AFI PBN Implementation Plan, the meeting considered the impact of outcome of the 37th Session of the Assembly, ICAO Headquarters, Montréal, Canada, 28 September to 8 October 2010. It was noted the Council submitted A37-WP/13 calling for amendment of Assembly Resolution A36-23, inter alia, to provide for development of procedures with LNAV only minima. The meeting acknowledged the significant contribution that would be made by the amendment, in particular noting the vast areas of the AFI Region that would benefit.

4.19 The meeting was of the view that the text of the A36-23 as amended by the 37th Session of the Assembly, read with the text of the PBN Manual (Doc 9613), might necessitate guidance to States in order to accurately interpret the Resolution. In this regard, the Task Force requested the Secretariat to work further on finding a language that would be inserted in the AFI Regional PBN Implementation Plan to accurately reflect the goals in the Resolution.

4.20 In view of the above, and taking into consideration discussion under agenda item 5, the meeting reviewed the AFI PBN Regional Plan as at **Appendix 4B** to the report on agenda item 4, and accordingly formulated the following Draft Conclusion:

DRAFT CONCLUSION 1/06: AFI PBN IMPLEMENTATION REGIONAL PLAN

That;

- (a) the AFI Regional PBN Implementation Plan is updated as at **Appendix 4B** to the report on agenda item 4; and
- (b) the Plan be included in the AFI Doc 003.

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Report on Agenda Item 5

REPORT ON AGENDA ITEM 5: AFI GNSS IMPLEMENTATION STRATEGY

LATEST DEVELOPMENTS RELATED TO GNSS AUGMENTATION

Development of SARPs

5.1 The meeting was briefed on two amendments to ICAO Annex 10 – Aeronautical Telecommunications, Volume I – Radio Navigation Aids, which are the subject of the following State letters:

5.2 *State Letter Ref.: AN 7/1.3.94-09/46 of 18 June 2009:* Amendment to Annex 10 concerning (*inter alia*) global navigation satellite system (GNSS) signal-in-space performance requirements and Global Navigation Satellite System (GLONASS) system requirements. The purpose of the proposed amendment which is envisaged for applicability on 18 November 2010 is to enable Category I approach operations supported by satellite-based augmentation system (SBAS); and reflect the evolution of the GLONASS system.

5.3 *State Letter Ref.: AN 7/1.3.97-10/43 22 of June 2010:* Amendment to Annex 10 concerning the global navigation satellite system (GNSS) ground-based augmentation system (GBAS). The purpose of the proposed amendment which is envisaged for applicability on 17 November 2011 is to reflect the initial experience gained with the ongoing technical implementations of GBAS for Category I operations.

Status of the implementation of the satellite-based augmentation system (SBAS)

5.4 The meeting noted the commencement of the operational implementation phase of European Geostationary Navigation Overlay Service (EGNOS) on 2 August 2010, the satellite-based augmentation system (SBAS) for augmenting the global positioning system (GPS) service in accordance with Standards contained in ICAO Annex 10 — Aeronautical Telecommunications, Volume I — Radio Navigation Aids. The procedure to transition towards the EGNOS Safety-of-Life (SoL) service started on 2 August 2010, was expected to trigger the broadcast of the first EGNOS SoL signal, by removing from the EGNOS Signal-in-Space the specific message (called Message Type 0) which limits EGNOS utilization to Open Service (OS) users.

5.5 However, the meeting was informed that, soon after first step of this procedure, the EGNOS Signal-In-Space broadcasted "NOT MONITORED" messages for all GPS satellites and for the ionosphere correction data, therefore causing the service to be unusable. On 6 August 2010, ESSP reverted to the OS signal, i.e. broadcasting the EGNOS signal with Message Type 0. A consolidated safety analysis will be presented to the civil aviation authorities for review. On this basis, and subject to due coordination of the deployment of the change with the civil aviation authorities, EC and ESSP expect the SoL transition procedure to be initiated again in early November 2010.

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5.6 EGNOS is the latest addition to a set of regional SBAS projects that have been successfully implemented, namely the wide area augmentation system (WAAS) and the multifunctional transport satellite (MTSAT) satellite-based augmentation system (MSAS). Some other systems such as GPS and geostationary orbit augmented navigation (GAGAN) and system for differential correction and monitoring (SDCM) are currently under development.

AFI GNSS Strategy – Outcome of APIRG/17 Meeting

5.7 The meeting was briefed on the deliberations of the Seventeenth Meeting of APIRG (APIRG/17, Ouagadougou, Burkina Faso, 2-6 August 2010) concerning the draft amendments to AFI GNSS Strategy as developed by CNS/SG/3 Meeting (Nairobi, Kenya, 26-30 April 2010) as a follow-up to APIRG Decision 16/24. APIRG/17 particularly called for a High-Level Meeting of AFI GNSS Strategy to be organized by AFCAC in coordination with ICAO (Conclusion 17/28) and an independent cost-benefit analysis (CBA) (Conclusion 17/29).

5.8 The meeting reviewed the updated AFI Strategy drafted by the CNS Sub-group as shown in **Appendix 5A** to this report, together with the GNSS infrastructure in support of PBN requirements shown in **Appendix 5B**.

5.9 The meeting noted that the three-phases of the AFI GNSS Strategy were aligned with the three-phases of the AFI Regional PBN Plan, and that the latest developments concerning GNSS (Paras 5.1 through 5.13 above) were duly reflected.

REVIEW OF AFI GNSS IMPLEMENTATION

5.10 The meeting recalled that the Seventh Africa-Indian Ocean Regional Air Navigation Meeting (AFI/7) (Abuja, Nigeria, 12-23 May 1997) agreed that the future navigation plan for the region would be based on the global navigation satellite system (GNSS) which was expected to evolve from the two existing systems, i.e. the global positioning system (GPS) and the global orbiting navigation satellite system (GLONASS). AFI/7 adopted Recommendation 10/5 on GNSS implementation in the AFI Region addressed to States, and Conclusion 10/6 on GNSS implementation - AFI Strategy, addressed to APIRG.

5.11 As a follow up to AFI/7 Conclusion 10/6, the Twelfth Meeting of APIRG (APIRG/12, Tunis, Tunisia, 25-29 June 1999) adopted a three-phased strategy for the introduction of GNSS in the Africa-Indian Ocean, which defines an evolution path for replacement of conventional ground-based navigation aids, ensuring that operational and other concerns such as positive cost-benefit are fully taken into account. It assumes availability of a GNSS meeting of the specified parameters at every phase of deployment. It does not analyze GNSS systems configuration per se nor the advantages and disadvantages of various deployment strategies. The AFI GNSS strategy is being updated from time to time by APIRG to reflect developments related to GNSS.

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Implementation of WGS-84

5.12 Although AFI/7 Meeting had identified the implementation of WGS-84 as a sine qua non condition for the safe and efficient use of GNSS, particularly in support of approach and landing operations, surveys conducted within the region show that the implementation of WGS-84 has not yet been completed properly in many States. In this connection, APIRG has developed a performance framework form (PFF) for WGS-84 and electronic terrain data as part of AIM performance objectives.

Implementation of Phase I of the AFI GNSS Strategy (up to 2012)

5.13 Phase I of the strategy allows the use of basic GNSS (GNSS augmented with ABAS) from en-route down to non-precision approaches (NPA); and as a supplemental-means navigation system for TMA. Existing ground infrastructure remains intact. APIRG/16 Meeting (Rubavu, Rwanda, 25-29 November 2007), after noting that it had not been completed properly and uniformly throughout the Region recommended a prolongation of this phase which has now been expanded up to 2012, in consistency with Phase I (Short-term) of the Regional Performance-based navigation (PBN) Plan.

5.14 The meeting recalled that APIRG/16 Meeting recognized that en-route use of basic GNSS was not yet approved in a majority of AFI States, and NPA procedures and/or related regulatory texts had not yet been published. It also noted that the requirement for the recording of GNSS parameters was not met by the States that have approved GNSS-based procedures.

5.15 The meeting adopted the following conclusion:

CONCLUSION 1/07: IMPLEMENTATION OF PHASE I OF AFI GNSS STRATEGY

That AFI States which have not yet done so:

- a) complete the implementation of WGS-84 coordinates; and
- b) ensure that all the prerequisites are met when implementing GNSS applications for en-route and non-precision approach (NPA) operations in accordance with the current Phase 1 of AFI GNSS Strategy, and in support of PBN operations.

PBN/GNSS TF/1
Report on Agenda Item 6

Report on Agenda Item 6: Review of the Terms of Reference of the PBN/GNSS Task Force

6.1 The meeting noted that its tenth meeting in 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 Task Force. The Conclusion was reviewed and update by the ATS/AIS/SAR SG/11 meeting for consideration by APIRG 17. Furthermore, the CNS SG/3 Meeting Nairobi, Kenya, 26 – 30 April 2010 was briefed on the proposed merger of the PNB Task Force and the GNSS Implementation Task Force, and noted the proposed terms of reference.

6.2 The meeting noted also that, the APIRG 17 meeting, Ouagadougou, Burkina Faso 2-6 August 2010 agreed on the establishment of the PBN/GNSS Task Force, and accordingly formulated the following Conclusion.

Decision 17/49: 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 3.4F to this report.

6.3 The meeting recognized that since this is the first meeting of the Task Force since establishment by the APIRG 17 meeting; the first time that relevant experts (ATM, CNS, operational approval, etc) meet as one Task Force, it is appropriate to take the opportunity to review the terms of reference (TOR), taking into consideration latest developments in PBN implementation, and discussions under other various agenda items.

6.4 The meeting deliberated at length on the matter of appropriately reflecting main tasks of the Task Force, alignment of documentation with the fact that GNSS is a PBN enabler, and in this context the issue of the name “PBN/GNSS Task Force,” as opposed to PBN Task Force.

6.5 The history of the GNSS/Implementation Task Force (GNSS/I/TF) was recalled and it was noted that, while GNSS is part of the PBN enabling infrastructure, and while the Task Force has, during deliberation under agenda item 5, agreed that GNSS should be indicated as the primary enabling infrastructure, there are functionalities such as precision approach Cat. I and Cat. II for which the role of GNSS is already being considered. On the other hand, as of the time of the meeting, the PBN concept does not include precision approach procedures. It was also acknowledged that at this time when several GNSS augmentation options are available, technical guidance would be required to avoid uncoordinated implementation which might include duplication of efforts, lack of interoperability, etc.

6.6 The meeting recalled also, that as the ATS/AIS/SAR SG/11 recognized, what is reflected in a name tends to have significance on the States’ decisions regarding what expertise should be made available in a delegation. In view of this discussion the meeting agreed not to propose change of the name of the PBN/GNSS Task Force.

PBN/GNSS TF/1
Report on Agenda Item 6

6.7 The meeting nevertheless revised the TOR and work programme of the PBN/GNSS Task Force as at **Appendix 6A** to the report on agenda item 6, to better reflect, the work assigned to the Task Force. Amongst others, the meeting agreed that the fields of expertise expected to be made available by States, to participate in the business of the Task Force should be highlighted in the TOR. It was recognized in particular, that as was reflected in APIRG 17/55, inclusion of officials involved in PBN approvals should be highlighted.

6.8 Based on the above, the Task Force formulated the following Draft Decision:

DRAFT DECISION 1/08: REVISED TERMS OF REFERENCE OF THE PBN/GNSS TASK FORCE

That, the terms of reference of the APIRG PBN/GNSS Task Force are revised as at **Appendix 6A** to the report on agenda item 6.

PBN/GNSS TF/1
Report on Agenda Item 7

REPORT ON AGENDA ITEM 7: DATE AND VENUE OF THE NEXT MEETING

7.1 The meeting recalled that, in accordance with the APIRG Procedural Handbook, the Task Force is expected to decide on the dates and venue of its next meeting.

7.2 In discussing this subject, the meeting recalled that the Task Force should report to the ATM/AIS/SAR Sub-Group and the latter will report to APIRG 18. Considering that APIRG 18 and ATM/AIS/SAR SG 12 meetings are tentatively scheduled for November 2011 and July 2011 respectively, the meeting recognized the need to convene the PBN/GNSS TF/2 meeting in the May- June time frame in 2011.

7.3 With regards to the venue, the meeting recalled the established practice which implies that the meetings of a given AFI body are held alternatively in ESAF and WACAF regions. In this regard, the meeting agreed that the next meeting should be held at the WACAF ICAO Regional Office in Dakar.

7.4 However the meeting recognized that the final dates and venue of the meeting would have to be coordinated with other activities of the Regional Offices, and accordingly agreed that the ESAF and WACAF Offices would do the necessary in this regard

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

REPORT ON AGENDA ITEM 8: ANY OTHER BUSINESS

8.1 The meeting was reminded about forthcoming events organized by ICAO. In particular information was provided about the Performance Framework Workshop, Special Implementation Project (SIP) that is scheduled to be held at Fairview Hotel in Nairobi, Kenya 6-10 December 2010. Importance of the workshop including its relevance to the planning approach that was introduced by the SP AFI/08 RAN Meeting in 2008, were highlighted; attendance was highly encouraged.

8.2 In his closing remarks, the Task Force Chairman once again thanked all participants for their cooperation and their active participation, which has made the meeting as success.

-----END-----

RECOMMENDATIONS OF SP AFI RAN 2008 RELATED TO PBN

Recs No. Strategic Objectives*	Title of Recommendations	Text of Recommendations	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates	Status of Implementation
<p>Rec 3/3: A & D</p>	<p>Performance-based approach and measurement</p>	<p>That APIRG and regional safety groups develop indicators that are specific, measurable, achievable, realistic and time bound and attach them to the performance framework forms (PFFs) in the appropriate box, using the following metrics and/or others determined to be appropriate indicators for the African continent</p>	<p>Include tasks in the APIRG & Subsidiary bodies programme</p>	<p>APIRG & Subsidiary bodies</p>	<p>Performance indicators for AFI Region</p>	<p>APIRG 17</p>	<p>Adopted. To be continuously reviewed</p>
<p>Rec 6/9: A & D</p>	<p>Performance-based navigation (PBN) performance objectives</p>	<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>	<p>➤ Implement recommendation.</p> <ul style="list-style-type: none"> • Identify action parties and specific target dates. • Update PFFs. • Follow-up • Provide guidance for States. <p>➤ Implement States recommendations.</p> <ul style="list-style-type: none"> • Identify action parties and specific target dates. • Update PFFs. • Follow-up 	<p>APIRG (PBN/TF)</p>	<p>Updated PFFs</p>	<p>PBN TF/4</p>	

Recs No. Strategic Objectives*	Title of Recommendations	Text of Recommendations	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates	Status of Implementation
<p>Rec 6/10: D</p>	<p>Support for establishment of an Africa ICAO flight procedure office</p>	<p>That:</p> <p>a) States and international organizations support the implementation of an AFI flight procedures office; and</p> <p>b) ICAO disseminate a letter, with supporting documentation, inviting interested States and international organizations to submit proposals for establishment and hosting of the FPO.</p>	<p>Provide support to FPO.</p> <p>State letters to invite States to make proposal</p>	<p>States and International Organisations</p> <p>ICAO HQ.</p>	<p>Support for FPO</p> <p>Invitation to establish FPO.</p>	<p>Based on APAC FPO experience to be reviewed by APIRG/17.</p>	
<p>Rec 6/11: A & D</p>	<p>Implementation of WGS-84 and eTOD</p>	<p>That APIRG adopt the AIM Performance Objective: Implementation of world geodetic system-1984 (WGS-84) and electronic terrain and obstacle data (eTOD) as contained in the performance framework form in Appendix E to the Report on Agenda Item 6.</p>	<p>Implement Recommendation</p>	<p>APIRG</p>	<p>Full implementation of WGS-84 & eTOD</p>		<p>Implementation on a continuous basis</p>

Recs No. Strategic Objectives*	Title of Recommendations	Text of Recommendations	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates	Status of Implementation
Rec 6/12: A & D	Full implementation of Atlantic Ocean random RNAV routing area (AORRA)	That ICAO: a) take immediate action to inform all concerned States that implementation of AORRA Phase II will be delayed until further notice; and b) as a matter of urgency, facilitate and coordinate implementation of all phases of AORRA and assist in determining a suitable date for AORRA Phase II implementation.	State Letter Implement Recommendation	WACAF Office Concerned FIRs, SAT	Information to States Revised implementation date of AORRA Phase II		Completed (AORRA phase 2 implemented on 9 th April 2009)

Recs No. Strategic Objectives*	Title of Recommendations	Text of Recommendations	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates	Status of Implementation
Rec 6/28 A & D	Implementation of a Global ATM System ICAO technical cooperation project Long-term project	States were encouraged to join ICAO TC project for implementation of performance-based air navigation plan. A project for assistance to States in the implementation of PBN has been developed and the draft presented at APIRG/17 meeting.		ICAO States	Regional project for assistance to States in the implementation of performance-based air navigation systems	Implementation on continuous basis Update at APIRG/17 meeting	Adopted. To be continuously reviewed

*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

APIRG17 CONCLUSIONS & DECISIONS RELATED TO PBN

Cons/Decs No. Strategic Objectives*	Title of Cons/Decs	Text of Cons/Decs	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates	Status of Implementation
Conclusion 17/28	NEED FOR A HIGH LEVEL MEETING ON AFI GNSS STRATEGY	That, in order to assist AFI States in making an informed decision on the regional strategy for the introduction of GNSS applications, AFCAC organize as a matter of urgency a high level meeting in coordination with ICAO, ASECNA, IATA, AFRAA and other relevant stakeholders.	Convene High level meeting	AFCAC	Informed strategy on GNSS application	31 March 2011	
Conclusion 17/29	NEED FOR AN INDEPENDENT COST-BENEFIT ANALYSIS	That, considering the lack of consensus between stakeholders on available cost-benefit analyses related to SBAS implementation in the AFI Region, a cost benefit analysis based on objective assumptions should be performed by independent experts, and submitted to the high level meeting to be organized by AFCAC on AFI GNSS strategy, for consideration.	Identify and appoint Experts Perform cost benefit analysis	ICAO AFCAC	Cost benefit analysis based on objective assumptions	30 June 2011	
Conclusion 17/40	CNS PERFORMANCE OBJECTIVES	That, the CNS performance objectives and performance framework form developed by ICAO SP AFI RAN (2008) be amended as shown at Appendix 3.3G to this report.	Amend CNS performance objective and PFFs	ICAO ROs States	Amended CNS Objectives and PFFs	31 Mar 2011	
Conclusion 17/41	ATM PERFORMANCE FRAMEWORK	That, the AFI performance framework forms formulated by the Special AFI/08 RAN Meeting regarding performance objectives in the fields of ATM and SAR are updated as at Appendix 3.4A to this report.	Update ATM/SAR performance objectives and PFFs.	ICAO ROs	Updated ATM/SAR performance objectives and PFFs.	31 Mar 2011	

Cons/Decs No. Strategic Objectives*	Title of Cons/Decs	Text of Cons/Decs	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates	Status of Implementation
		<p>Appendix 3.4A (1) <i>Implementation of the new ICAO Flight Plan Provisions;</i></p> <p>Appendix 3.4A (2) <i>Optimization of the ATS route Structure in en-route airspace;</i></p> <p>Appendix 3.4A (3) <i>Optimization of the ATS route Structure in terminal airspace;</i></p> <p>Appendix 3.4A (4) <i>Optimization of vertically guided RNP approaches;</i></p> <p>Appendix 3.4A (5) <i>Search and Rescue.</i></p>	Align National PFF	States	Harmonized planning	31 Mar 2011	
Conclusion 17/46	AFI PBN IMPLEMENTATION REGIONAL PLAN	<p>That:</p> <p>a) The AFI Regional PBN implementation plan is updated and endorsed as at Appendix g 3.4D to this report, to more accurately reflect PBN implementation goals in Assembly Resolution A36-23, guidance in the PBN Manual (9613), and Regional planning guidance provided by APIRG; and</p> <p>b) The Regional PBN Implementation Plan be included in the AFI Doc 003.</p>	<p>Implementation PBN Regional plan</p> <p>Update Doc003</p>	<p>States</p> <p>ICAO ROs</p>	<p>Updated AFI Regional PBN implementation plan</p> <p>Updated Doc003</p>	<p>According to plan</p> <p>31Mar 2011</p>	

Cons/Decs No. Strategic Objectives*	Title of Cons/Decs	Text of Cons/Decs	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates	Status of Implementation
Conclusion 17/47	NATIONAL PBN IMPLEMENTATION PLAN	That States:					
		(a) Use the Regional PBN implementation plan template at Appendix 3.4E to this report , for the development of a national PBN implementation plan and consider the action planning provided by the Joint PBN/GNSS/I Task Forces Meeting to support planning;	Develop National PBN implementation Plan	States	National PBN implementation Plan	ASAP, latest 30 June 2011	On-going process
		(b) Provide feedback to the ESAF and WACAF Regional Offices by 30 October 2010 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	Provide feedback on progress of national plans	States	Updated progress on national plan implementation	30-Oct 2010	Continuous process
		(c) Complete their National PBN plans as soon as possible.					Refer to Draft Conclusion 1/01 below, merging Con17/47 and 17/48

Cons/Decs No. Strategic Objectives*	Title of Cons/Decs	Text of Cons/Decs	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates	Status of Implementation
<p>Proposed merger of 17/47 & 17/48</p> <p>DRAFT Concl. 1/01</p>	<p>NATIONAL PBN IMPLEMENTATION PLAN</p>	<p>That States,</p> <p>(a) that have not already done so, complete their national PBN implementation plans as soon as possible, using the template at Appendix C to the report on agenda item 2;</p> <p>(b) consider the use of planning tools provided by the PBN/GNSS Task Force, as well as project management software.</p> <p>(c) provide updates to Regional Offices</p> <p>(This Draft Conclusion is to supersede APIRG Conclusions 17/47 and 17/48)</p>	<p>Develop and complete National PBN implementation Plans</p> <p>Use planning tools provided by PBN/GNSS TF</p> <p>Update Regional Offices</p>	<p>States</p> <p>States</p> <p>States</p>	<p>Completed National PBN implementation plans</p> <p>Use of planning tools</p> <p>Regional Offices are updated</p>	<p>30 June 2011</p> <p>30 Oct 2010</p>	<p>Continuous process</p> <p>Continuous process</p> <p>Continuous process</p>
<p>Conclusion 17/48</p>	<p>PBN IMPLEMENTATION TOOLS</p>	<p>That States:</p> <p>(a) Use project management plans and implementation action plans provided by the PBN Task Force, as well as project management softwares (such as Microsoft project or freely available applications), to support PBN implementation activities; and</p> <p>(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.</p>					<p>Refer to draft Conclusion 1/01 above</p>

Cons/Decs No. Strategic Objectives*	Title of Cons/Decs	Text of Cons/Decs	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates	Status of Implementation
Decision 17/49	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 3.4F to this report.	Convene PBN/GNSS TF meetings	PBN/GNSS TF	As per TOR	Continuous	Continuous process
Decision 17/50	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 3.4G to this report.	Convene PRND WG meetings	PRND EG TF	As per TOR	Continuous	Continuous process
Conclusion 17/51	LOWERING OF RNAV/RNP ROUTES UM214 AND UM215	That, the ICAO Regional Offices carry out further consultations with the States concerned about the lowering of RNAV / RNP routes UM214 and UM215 from FL330 down to FL320, taking into account operational considerations.					Refer to Draft Conclusion 1/02 below
Proposed reformulation on DRAFT Concl. 1/XX	LOWERING OF RNAV/RNP ROUTES UM214 AND UM215	That, concerned States be urged to establish the lower limit of RNAV routes UM214 and UM215 to FL250 for operational reasons.	State Letter to concerned States.	ICAO ROs	Lower limit of FL250 implemented	AIRAC date of 13 Jan 2011	

Cons/Decs No. Strategic Objectives*	Title of Cons/Decs	Text of Cons/Decs	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates	Status of Implementation
Conclusion 17/52	DISSEMINATION OF A LETTER INVITING PROPOSALS FOR ESTABLISHMENT OF THE AFI FLIGHT PROCEDURES PROGRAMME (FPP)	That, pursuant to special AFI/08 RAN meeting Recommendation 6/10, ICAO disseminate, as a matter of urgency, the letter inviting interested States and international organizations to submit proposals for establishment and hosting of the AFI FPP.	Establish pre-requisites State Letter	ICAO ROs	Establishment of AFI FPP	30 Nov 2010	As of 14 Oct 2010, status of procedures data received from 28 States.
Conclusion 17/53 Redrafted below as follow	TRAINING IN SUPPORT OF PBN IMPLEMENTATION	That, in order to support the implementation of PBN in the AFI Region: a) PBN Task Force identify priority training needs for implementation for PBN; c) AFI Regional Offices organize seminars/workshops for training of relevant personnel directly involved in the implementation of PBN.					
Conclusion 17/53 Proposed reformulation on DRAFT Concl. 1/XX	TRAINING IN SUPPORT OF PBN IMPLEMENTATION	That, in order to support the implementation of PBN in the AFI Region, AFI Regional Offices organize seminars/workshops for training of relevant personnel directly involved in the implementation of PBN.	Organize Seminars and workshops	ICAO ROs	Seminars and Workshops	2010-2012	Continuous process
Conclusion 17/54	PBN ENABLING LEGISLATION	That, AFI States that have not already done so, include in their legislation and/or regulations provisions to enable the implementation of PBN.	Develop PBN Legislation	States	Legislation for PBN implementation	31 Jul 2011	

Cons/Decs No. Strategic Objectives*	Title of Cons/Decs	Text of Cons/Decs	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates	Status of Implementation
Conclusion 17/55	PARTICIPATION OF REPRESENTATIVES OF STATES INVOLVED IN PBN APPROVAL PROCESS	That, in order to support the PBN planning and implementation processes, AFI States are urged to include in their delegations to meetings of the PBN Task Force, experts and officials involved in the PBN approval process of aircraft operators.	Propose to be deleted, requirements to be moved to TOR				Propose to be deleted, requirements to be moved to TOR
Conclusion 17/56	FUNDING OF THE PBN IMPLEMENTATION PROGRAMME	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.	Make budgetary allocation for safe implementation of PBN	States, Regulatory bodies, Operators, Stakeholders	Sufficient funds	2010-2016	
Conclusion 17/57	IATA GUIDELINES FOR OPERATIONAL APPROVALS	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.	Facilitate access to guidelines	IATA	Access to guidelines	2010-2012	Completed

Cons/Decs No. Strategic Objectives*	Title of Cons/Decs	Text of Cons/Decs	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates	Status of Implementation
Conclusion 17/58	NATIONAL PBN PROGRAMME MANAGER (NPPM)	<p>That, in order to facilitate the implementation of PBN and Regional coordination:</p> <p>a) AFI States that have not already done so nominate/designate NPPMs as soon as possible and assign them the terms of reference as at Appendix 3.4H to this report .and provide ICAO with contact details of the NPPMs; and</p> <p>b) States update the NPPMs contact information provided to ICAO whenever changes have been made.</p>	<p>Nominate/Designate NPPMs</p> <p>Update NPPMs contacts</p>	<p>States</p> <p>States</p>	<p>Nominated / Designated NPPMs</p> <p>Updated NPPM contacts</p>	<p>30 Nov 2010</p> <p>30 Nov 2010</p>	
Conclusion 17/59	AIRSPACE PLANNING AND AIRCRAFT EQUIPMENT SURVEY	<p>That, in order to facilitate airspace planning and decisions related to air navigation infrastructure:</p> <p>a) ICAO in coordination with IATA and AFRAA conduct regular surveys on aircraft equipage within the AFI Region;</p> <p>b) 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;</p>	<p>Conduct regular surveys on aircraft equipage</p> <p>Support the ICAO/IATA global survey on aircraft equipment</p>	<p>ICAO ROs IATA AFRAA</p> <p>States ANSPs</p>	<p>Updated surveys on aircraft equipage</p> <p>Updated surveys on aircraft equipage</p>	<p>31 Mar 2011</p> <p>31 Mar 2011</p>	<p>Annual updates</p> <p>Annual updates</p>

Cons/Decs No. Strategic Objectives*	Title of Cons/Decs	Text of Cons/Decs	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates	Status of Implementation
		<p>c) AFI States make efforts to bring awareness to the aircraft operators regarding the ICAO efforts on aircraft equipage data, and that joint efforts between civil aviation authorities and ANSPs be embarked upon to bring quicker results; and</p> <p>d) AFI States ensure that initiatives for air navigation system enhancements are matched with fleets capabilities and readiness.</p>	<p>State Letter to concerned States</p> <p>Bring awareness to the aircraft operators regarding the ICAO efforts on aircraft equipage.</p> <p>Ensure that initiatives for air navigation system enhancements are matched with fleets capabilities and readiness.</p>	<p>ICAO ROs</p> <p>States</p> <p>States</p>	<p>Awareness to Operators on acft equipage</p> <p>Awareness</p> <p>Matching of air nav systems with fleet capabilities and readiness</p>	<p>31 Mar 2010</p> <p>Continuous</p> <p>Continuous</p>	<p>Continuous process</p> <p>Continuous process</p>
Conclusion 17/60	DIRECT TRANSITIONS TO/FROM AORRA AIRSPACE	That, the ICAO Regional Offices facilitate coordination, publication and implementation by Angola, Ghana, Sao Tome and Principe, ASECNA and Roberts FIR, with regard to the AORRA airspace to/from transition points in Appendix 3.4I (as amended) to this report.	Facilitate coordination and implementation of AORRA	ICAO ROs	Implementation of AORRA	31 Mar 2011	
Conclusion 17/90	IMPLEMENTATION OF WGS-84 AND ELECTRONIC TERRAIN AND OBSTACLE DATA	That: a) States adopt the revised AIM performance objective “Implementation of WGS-84 and Electronic Terrain and Obstacle Data” as contained in the Performance Framework Form in the Appendix 3.6F to this report, as a strategy for implementation;	State Letter to States to establish necessity	ICAO ROs States	Adoption of AIM performance objectives Report progress	31 Dec 2010 30 Jun 2011	

Cons/Decs No. Strategic Objectives*	Title of Cons/Decs	Text of Cons/Decs	Follow-up Action	To be initiated by	Deliverable/ Intended Outcome	Target Dates	Status of Implementation
		<p>b) The proposed FASID table at Appendix F be adopted for inclusion as a requirement in the AFI FASID (Document 7474, Vol. II);</p> <p>c) The AFI Region e-TOD implementation strategy under Appendix 3.6G to this report be adopted for implementation; and</p> <p>d) The revised Terms of Reference of the AFI Region e-TOD working group are at Appendix 3.6H to this report be adopted.</p>	<p>Adopt FASID Table</p> <p>Adopt e-TOD implementation strategy</p> <p>Adopt TOR of e-TOD WG</p>	<p>ICAO ROs States</p> <p>ICAO ROs States</p> <p>ICAO ROs</p>	<p>Adoption of FASID Table</p> <p>Adoption of e-TOD implementation strategy</p> <p>Adopted TOR for e-TOD WG</p>	<p>31 Mar 2011</p> <p>31 Mar 2011</p> <p>31 Mar 2011</p>	
Conclusion 17/96	PROJECT TO COMPLETE WGS-84 IMPLEMENTATION IN THE AFI REGION	That, ICAO takes necessary action to initiate a project for the completion of implementation of WGS-84 within AFI States having difficulties to complete WGS-84 implementation.					

*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

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

AFI REGIONAL PERFORMANCE OBJECTIVES/NATIONAL PERFORMANCE OBJECTIVES OPTIMIZATION OF THE ATS ROUTE STRUCTURE IN EN-ROUTE AIRSPACE				
Benefits				
Environment	<ul style="list-style-type: none"> reduction in gas emissions 			
Efficiency	<ul style="list-style-type: none"> ability of aircraft to conduct flight more closely to preferred trajectories 			
Safety	<ul style="list-style-type: none"> increase in airspace capacity 			
	<ul style="list-style-type: none"> facilitate utilization of advanced technologies (e.g., FMS-based arrivals) and ATC decision support tools (e.g., metering and sequencing), thereby increasing efficiency 			
<i>Strategy</i>				
<i>Short term (2010)</i>				
<i>Medium term (2011-2015)</i>				
ATM OC COMPONENTS	TASKS	TIMEFRAME START-END	RESPONSIBILITY	STATUS
AOM	<i>En-route airspace</i>	2008		
	<ul style="list-style-type: none"> develop regional implementation plan 	2008-2009	AFI PBN TF	Completed
	<ul style="list-style-type: none"> develop regional action plan 	2009-2010	AFI PBN TF	Completed
	<ul style="list-style-type: none"> establish collaborative decision making (CDM) process 	2010	States	Continuous
	<ul style="list-style-type: none"> develop airspace concept based on AFI PBN regional implementation plan, in order to design and implement a trunk route network, connecting major city pairs in the upper airspace and for transit to/from aerodromes, on the basis of PBN, e.g. RNAV 10 and RNAV 5, and taking into account interregional harmonization 	2009-2012	AFI PBN TF/States	In progress
	<ul style="list-style-type: none"> harmonize national and regional PBN implementation plans 	2010-2016	AFI PBN TF/States	On-going
	<ul style="list-style-type: none"> develop performance measurement plan 	2010-2012	States	In progress
	<ul style="list-style-type: none"> formulate safety plan 	2010-2012	States	To be developed
	<ul style="list-style-type: none"> publish national regulations for aircraft and operators approval using PBN manual as guidance material 	2010-2011	States	To be developed
	<ul style="list-style-type: none"> identify training needs and develop corresponding guidelines 	2010-2011	States	In progress
	<ul style="list-style-type: none"> identify training programmes and develop corresponding guidelines 	2010-2011	AFI PBN TF/States	in progress

PBN/GNSS TF/1 REPORT

APPENDIX 3A-1

	<ul style="list-style-type: none">• formulate system performance monitoring plan	2010-2011	AFI PBN TF/States	To be developed
	<ul style="list-style-type: none">• implementation of en-route ATS routes	2010-2012	AFI PBN TF/States	In progress
	<ul style="list-style-type: none">• monitor implementation progress in accordance with AFI PBN implementation plan and State implementation plan	2010 and beyond	AFI PBN TF/States	On-going

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AFI REGIONAL PERFORMANCE OBJECTIVES/NATIONAL PERFORMANCE OBJECTIVES OPTIMIZATION OF THE ATS ROUTE STRUCTURE IN TERMINAL AIRSPACE				
Benefits				
Environment Efficiency Safety	<ul style="list-style-type: none"> reduction in gas emissions ability of aircraft to conduct flight more closely to preferred trajectories increase in airspace capacity improved availability of procedures facilitate utilization of advanced technologies (e.g., FMS based arrivals) and ATC decision support tools (e.g., metering and sequencing), thereby increasing efficiency 			
<i>Strategy</i> <i>Short term (2010)</i> <i>Medium term (2011-2015)</i>				
ATM OC COMPONENTS	TASKS	TIMEFRAME START-END	RESPONSIBILITY	STATUS
AOM	<i>Terminal airspace</i>	2008		
	<ul style="list-style-type: none"> develop regional implementation plan 	2009	AFI PBN TF	Completed
	<ul style="list-style-type: none"> develop regional action plan 	2009-2010	AFI PBN TF	Completed
	<ul style="list-style-type: none"> develop State PBN implementation plan 	2009-2010	States	In progress
	<ul style="list-style-type: none"> establish collaborative decision making (CDM) process 	2010	States	In progress
	<ul style="list-style-type: none"> develop airspace concept based on AFI PBN roadmap, in order to design and implement an optimized standard instrument departures (SIDs), standard instrument arrivals (STARs), holding and associated instrument flight procedures, on the basis of PBN and, in particular RNAV 1 and Basic-RNP 1 	2009-2012	PBN TF/States	In progress
	<ul style="list-style-type: none"> develop performance measurement plan 	2010-2012	States	In progress
	<ul style="list-style-type: none"> formulate safety plan 	2010-2012	States	To be developed
	<ul style="list-style-type: none"> publish national regulations for aircraft and operators approval using PBN manual as guidance material 	2010-2011	States	To be developed
	<ul style="list-style-type: none"> identify training needs and develop corresponding guidelines 	2010-2011	States	In progress
	<ul style="list-style-type: none"> identify training programmes and develop corresponding guidelines 	2010-2011	AFI PBN TF	To be developed
	<ul style="list-style-type: none"> formulate system performance monitoring plan 	2010-2012	AFI PBN TF/States	In progress
	<ul style="list-style-type: none"> develop a regional strategy and work programme implementation of SIDs and STARs 	2009-2012	AFI PBN TF/States	In progress
<ul style="list-style-type: none"> monitor implementation progress in accordance with AFI PBN implementation roadmap and State implementation plan 	2010 and beyond	AFI PBN TF/States	On going	
Linkage to GPIs	GPI/5: performance-based navigation; GPI/7: dynamic and flexible ATS route management; GPI/8: collaborative airspace design and management; GPI/10: terminal area design and management; GPI/11: RNP and RNAV SIDs and STARs; GPI/12: FMS-based arrival procedures.			

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AFI REGIONAL PERFORMANCE OBJECTIVES/NATIONAL
PERFORMANCE OBJECTIVES FOR PBN

OPTIMIZATION OF VERTICALLY GUIDED RNP APPROACHES				
Benefits				
Environment Efficiency Safety	<ul style="list-style-type: none"> reduction in gas emissions increased accessibility to aerodromes, including continuity of access increased runway capacity reduced pilot workload availability of reliable lateral and vertical navigation capability 			
<i>Strategy</i>				
<i>Short term (2010)</i>				
<i>Medium term (2011-2015)</i>				
ATM OC COMPONENTS	TASKS	TIMEFRAME START-END	RESPONSIBILITY	STATUS
AOM	<i>Terminal airspace</i>	2008		
	• develop regional implementation plan	2008 – 2009	AFI PBN TF	Completed
	• develop regional action plan	2009-2010	AFI PBN TF	Completed
	• develop State PBN implementation plan	2009	States	In progress,
	• establish collaborative decision making (CDM) process	2010	States	in progress
	• develop airspace concept based on AFI PBN implementation plan, in order to design and implement RNP APCH with Baro-VNAV or LNAV only (<i>see note 1</i>) in accordance with relevant Assembly resolutions , and RNP AR APCH where beneficial	2009 – 2012	AFI PBN TF/States	In progress
	• develop performance measurement plan	2010-2012	States	in progress
	• formulate safety plan	2010-2012	States	To be developed
	• publish national regulations for aircraft and operators approval using PBN manual as guidance material	2010-2011	States	To be developed
	• identify training needs and develop corresponding guidelines	2010-2011	States	In progress
	• identify training programmes and develop corresponding guidelines	2010-2011	AFI PBN TF/States	To be developed
	• implementation of APV procedures	2010 - 2016	AFI PBN TF/States	In progress
	• Formulate system performance monitoring plan	2010-2012	AFI PBN TF/States	in progress
linkage to GPIs	GPI/8: collaborative airspace design and management; GPI/10: terminal area design and management; GPI/11: RNP and RNAV SIDs and STARs; GPI/12: FMS-based arrival procedures			

Note 1: where altimeter setting does not exist or aircraft are not suitably equipped for APV.

INTERNATIONAL CIVIL AVIATION ORGANISATION

ESAF AND WACAF REGIONAL OFFICES

STATES RESPONSES TO PBN ACTIVITIES

STATES		RESPONSE TO NATIONAL PBN PLAN	RESPONSE TO FPP QUESTIONNAIRE	STATES		RESPONSE TO NATIONAL PBN PLAN	RESPONSE TO FPP QUESTIONNAIRE
01	Algeria			28	Lybia		
02	Angola			29	Madagascar		YES
03	Benin		YES	30	Malawi		YES
04	Botswana	YES	YES	31	Mali		YES
05	Burkina Faso		YES	32	Mauritania		YES
06	Burundi			33	Mauritius	YES	YES
07	Cameroon		YES	34	Morocco		
08	Cape Verde			35	Mozambique		
09	Central African Republic		YES	36	Namibia		YES
10	Chad		YES	37	Niger		
11	Comoros		YES	38	Nigeria		
12	Congo		YES	39	Rwanda		YES
13	Cote D'Ivoire		YES	40	Sao Tome and Principe		YES
14	Dem. Republic of Congo	YES		41	Senegal		
15	Djibouti			42	Seychelles	YES	YES
16	Egypt			43	Sierra Leone		
17	Equatorial Guinea			44	Somalia		
18	Eritrea			45	South Africa	YES	YES
19	Ethiopia	YES	YES	46	Sudan		
20	Gabon		YES	47	Swaziland		
21	Gambia			48	Tanzania		YES
22	Ghana			49	Togo		
23	Guinea		YES	50	Tunisia		
24	Guinea- Bissau		YES	51	Uganda	YES	YES
25	Kenya	YES	YES	52	Zambia		
26	Lesotho			53	Zimbabwe		YES
27	Liberia						

AFI
Regional Performance Based Navigation
Implementation Plan

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1. Introduction

- 1.1 The AFI Region Performance Based Navigation (PBN) Implementation Plans details the framework within which the ICAO PBN concept will be implemented in the AFI Region for the foreseeable future. The Plan 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 Plan also supports national and international interoperability and global harmonization.
- 1.2 It is the intent of the Regional PBN Implementation Plan to give effect to Assembly Resolution A36-23 as amended by the 37 Session of the Assembly.

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

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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 equipment 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.

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- 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:

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- 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.

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- 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 Plan.
- 5.2 The stakeholders who will benefit from the concepts in the Plan 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 Plan 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 Implementation Plan also supports other CAA and government-wide planning processes, working on several fronts to address the needs of the aviation community. 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:
- 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.

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6. STRATEGY

6.1 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.

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.

6.3 The Strategy for implementation of GNSS in the AFI Region for the purpose of supporting PBN implementation will be developed as Appendix to this Plan. It is to be noted that the AFI GNSS strategy, while supporting implementation of the AFI Regional PBN Implementation Plan, may include other aspects related to the Global Air Navigation Plan beyond the current PBN requirements. The GNSS strategy may however, not defeat the purpose and intent of the Plan and shall be guided by the provisions of APIRG.

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 Plan, 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.

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- 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.

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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.

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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 APV Operations (Baro-VNAV or ~~SBAS~~ Augmented GNSS) to enhance safety of RNP Approaches and accessibility of runways. Furthermore, at aerodromes where there is no local altimeter setting available and where aircraft of maximum certificated take-off mass of 5700kg or more, using an aerodrome are not suitably equipped for APV operations, RNP APCH (LNAV only) procedures should be promoted. This interim measure however, while having significant safety benefits, should not be taken as justification to defer the final implementation of APV. Where APV approaches have been developed, “LNAV only” procedures should also be developed for aircraft that may not be suitably equipped for APV.
- 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 1/2
TMA Arrival/Departure	RNAV 1 in a surveillance environment	
	Basic RNP 1 in non-surveillance environment	
Approach	RNP APCH (with Baro-VNAV) OR RNP APCH (LNAV only) <u>See Note below.</u> RNP AR APCH if required	
Note: Where altimeter setting does not exist or aircraft of maximum certificated take-off mass of 5700kg or more, using an aerodrome are not suitably equipped for APV.		

14. NEAR TERM IMPLEMENTATION TARGETS

- a) RNP APCH (with Baroa-VNAV) in 30% of instrument runways by 2010 and 50% by 2012 and priority given to airports with operational benefits. [Each instrument runway will have an associated RNP APCH \(LNAV only\)](#)
- 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 equipment and the use of RNP procedures.
- 15.4 [In order to optimize the](#) ~~To achieve~~ efficiency and capacity gains partially enabled by RNAV and RNP, the AFI Region States and aviation industry will ~~pursue~~ [expand/intensify the](#) use of data communications (e.g., for controller-pilot communications) and enhanced surveillance functionality, e.g. [ADS-C](#), [ADS-Broadcast \(ADS-B\)](#), [etc.](#) Data communications will make it possible to issue complex clearances easily and with minimal errors. [Enhanced](#)

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[surveillance](#)~~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 endeavor 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.

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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 ([APV](#)) and RNP AR APCH and full implementation is expected at the end of this term. **Leading up to meeting this requirement, RNP APCH (LNAV only) procedures should still be promoted for aerodromes where there is no local altimeter setting available and where aircraft of maximum certificated take-off mass of 5700 kg or more, using an aerodrome are not suitably equipped for APV operations.**

22.2 The introduction of the application of landing capability using GBAS (currently non PBN) is expected to guarantee a smooth transition towards high

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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 (Baro-VNAV or Augmented GNSS), and APV <u>Supplemented with LNAV only procedures</u> (See note below) Expand <u>Implement</u> RNP AR APCH where there are operational benefits	
Note: Where altimeter setting does not exist or aircraft of maximum certificated take-off mass of 5700kg or more, using an aerodrome are not suitably equipped for APV.		

24. MID TERM IMPLEMENTATION TARGETS

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

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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).

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- 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.

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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.

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- 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?

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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 Plan will help answer some of these questions. The aviation community will address others through further concept development, analysis, modeling, simulation, and field trials. As concepts mature and key solutions emerge, the community will develop more detailed implementation strategies and commitments.

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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.

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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

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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

REPORT ON AGENDA ITEM 5

**Concept of the GNSS Strategy for the AFI Region
Amendment proposals to AFI CNS/ATM
Implementation Plan (Doc 003)**

1. INTRODUCTION

1.1 The purpose of the AFI GNSS strategy is to define an evolution path for replacement of ground-based navigation aids, i.e. VOR/DME/ILS/NDB, ensuring that operational and other concerns such as positive cost-benefit are fully taken into account.

1.2 The AFI GNSS strategy assumes availability of a GNSS meeting of the specified parameters at every phase of deployment. It does not analyze GNSS systems configuration per se, nor the advantages and disadvantages of various deployment strategies.

2. GENERAL CONSIDERATIONS

2.1 By necessity, satellite-based and ground-based navigation systems will co-exist for a period of time. Considering that the operation of a dual system is detrimental to a positive cost-benefit, users and providers will co-operate with the view of reducing the duration of the transition period as much as possible, having due regard for the following principles:

- The level of safety will not be downgraded during the transition;
- GNSS-based service must, before the end of the transition period, fully meet the required parameters of accuracy, availability, integrity and continuity for all phases of flight;
- During the transition, gradually evolving levels of functionality will be available;
- Operational advantage shall be taken in to consideration the available and capabilities at every step of deployment;
- Methods of application will take into account full consideration of safety considerations of any functional limitations;
- Users must be given sufficient advance notice to re-equip before ground-based systems are decommissioned.

3. EVOLVING FUNCTIONALITY

3.1 Phase I (Short term), up to 2012:

- This phase will allow the use of GNSS as a primary-means of navigation for en-route, and for NPA; and as a supplemental-means navigation system for TMA. Existing ground infrastructure remains intact.

3.2 Phase II (Medium term) -2013 - 2016:

- **This phase will allow for:**

- a) En-route phase: sufficient capability to meet en-route navigation requirements everywhere in the AFI Region. GNSS will continue to be used as principal en-route navigation. The same principle will be characterized by a clearly planned transition for the use of GNSS as the sole means for en-route navigation. Navigational aids will accordingly not be replaced, subject to consultation with the Users.
- b) Terminal areas: sufficient capability to meet TMA navigation requirements everywhere in the AFI region. GNSS is approved as sole-means for TMAs, taking into account technical and legal developments, and institutional aspects.

- c) Terminal area VOR/DME/NDB, and Locators not associated with ILS, will not be replaced during Phase II.
- d) Approach and landing phase: sufficient capability for APV1 in the whole AFI Region. ILS will continue to be provided at aerodromes¹.

Note 1: Where the requirements for approach and landing can be met by APV 1, ILS CAT I should not be replaced.

During Phase II, the implementation of Long- term GNSS will be developed.

Phase III (Long term) 2017 onwards: It is assumed that more constellations of navigation satellites will be available to support GNSS as the sole-means of navigation from en-route to CAT I operations. CAT I by SBAS or GBAS will be available in those locations where analysis of historical MET data or traffic characteristics justifies the requirement. Other requirements will be met by ground-based augmentation system (GBAS). During Phase III, ILS CAT I will not be replaced, subject to consultation with users. Where CAT II/III ILS requirements have been confirmed, these facilities will remain unless technical evolution then demonstrates that the requirement can be supported by GBAS or SBAS.

4. The strategy will be reviewed periodically. In particular, it will be reviewed and updated at the beginning of each planning phase to ensure continuous relevance in support of the global ATM operational concept, taking into account technological evolution and developments in the field of GNSS.

5. Summary of AFI GNSS Strategy

AFI GNSS Strategy – Synopsis

	Short term	Medium term	Long term
Time scale	2008 – 2012	2013 – 2016	2017 and beyond
Certification	Primary for en-route Supplemental for TMA Non-precision approach (NPA)	Primary means from en route to APV	Primary means from en route to CAT-I
Oceanic and Remote Continental En route	Basic GNSS	Basic GNSS	Multi-constellation GNSS
Continental En route	Basic GNSS	Basic GNSS	Multi-constellation GNSS
Terminal	Basic GNSS	Basic GNSS	Multi-constellation GNSS
Approach and Landing	Basic GNSS with Barometric Altimetry	Basic GNSS with ABAS, SBAS*	Multi-constellation GNSS with ABAS, SBAS, GBAS
			CAT I (GLS) CAT II/III/ (GLS) as required

**Note: As from 18 November 2010, it is expected that ICAO Annex 10, Volume I will enable Category I approach operations supported by satellite-based augmentation system (SBAS). The upper vertical alert limit (VAL) for CAT I operations has drastically been increased from 15.0 m to 35.0 m. However, a vertical alert limit greater than 10 m for a specific system design may only be used if a system-specific safety analysis has been completed.*

REPORT ON AGENDA ITEM 5

GNSS INFRASTRUCTURE IN SUPPORT OF PBN REQUIREMENTS

Time scale		Short term	Medium term	Long term
		2008 – 2012	2013 – 2016	2017 and beyond
Certification		Primary for en-route Supplemental for TMA Non-precision approach (NPA)	Primary means from en route to APV	Primary means from en route to CAT-I
Oceanic and Remote Continental/En route	GNSS Configuration	Basic GNSS	Basic GNSS	Multi-constellation GNSS
	PBN Nav Spec	RNAV-10, RNP-4	RNAV-10, RNP-4	RNAV-10, RNP-4
Continental En route	GNSS Configuration	Basic GNSS	Basic GNSS	Multi-constellation GNSS
	PBN Nav Spec	RNAV-5, RNAV-1	RNAV-5, RNAV-2, RNAV-1	RNAV-5, RNAV-2, RNAV-1
Terminal	GNSS Configuration	Basic GNSS	Basic GNSS	Multi-constellation GNSS
	PBN Nav Spec	RNAV-1 in a surveillance environment Basic RNP-1 in non-surveillance environment	Expand RNAV-1, or RNP-1 application Mandate RNAV-1, or RNP-1 in high density TMAs	RNAV-1 in a surveillance environment Basic RNP-1 in non-surveillance environment
Approach	GNSS Configuration	Basic GNSS	Basic GNSS with ABAS, SBAS*	Multi-constellation GNSS with ABAS, SBAS*
	PBN Nav Spec	RNP APCH: NPA RNP APCH: APV with Baro-VNAV or RNP AR APCH: APV with Baro-VNAV	RNP APCH: NPA RNP APCH: Expand APV (with Baro-VNAV and/or augmented GNSS) Expand RNP AR APCH: APV with Baro-VNAV	RNP APCH: NPA RNP APCH: APV (with Baro-VNAV and/or augmented GNSS) RNP AR APCH: APV with Baro-VNAV

**Note: Although SBAS operations not yet included in the PBN concept contained in ICAO Doc 9613, they have been introduced in the spirit of Assembly Resolution A36-23.*

PBN/GNSS TF/1 REPORT

**REVISED (DRAFT) TERMS OF REFERENCE AND WORK PROGRAMME
FOR THE AFI 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 including CNS related GPIs).
- 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 A36-23 as amended, and other relevant resolutions.
- d) Assist States that may require support in the implementation of PBN.

2. WORK PROGRAMME

Activity/Task	Assigned person/organ	Target date
<ul style="list-style-type: none"> 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. l) Report to APIRG through its ATM and CNS Sub-groups. 		

3. THE TASK FORCE SHALL BE GUIDED BY THE FOLLOWING PRINCIPLES

1. 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.

4. COMPOSITION OF THE TASK FORCE:

States: AFI States and States having territories in the AFI Region
(Meeting to decide on a concise list, preferably not exceeding 15).

*The Task Force comprises of the following expertise:
Regulatory authorities and ANSP professionals who are charged with the responsibilities relating to PBN implementation. These may be from various fields of air navigation services or flight operations;*

Professionals from Regulatory authorities who are charged with the responsibilities for operational approvals. These will include such officials as from air navigation service, flight operations and airworthiness fields.

Note: States are requested to include in their delegations: PBN experts, GNSS (CNS) experts, as well as official experts involved in the PBN approval process of aircraft operators.

Organizations: ASECNA, IATA, IFALPA, IFATCA and ESA. Additional representatives from International/Regional Organizations may be invited when required.

**FIRST MEETING OF THE APIRG PERFORMANCE BASED NAVIGATION AND GLOBAL
NAVIGATION SATELLITE SYSTEM IMPLEMENTATION TASK FORCE (PBN/GNSS TF/1)
(NAIROBI, 12 - 14 OCTOBER 2010)
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LIST OF PBN/GNSS TF/1 CONCLUSIONS AND DECISIONS

CONCLUSIONS/DECISIONS NO. STRATEGIC OBJECTIVES		TITLE OF CONCLUSION / DECISION
DRAFT CONCLUSION	1/01	NATIONAL PBN IMPLEMENTATION PLAN
DRAFT CONCLUSION	1/02	LOWERING OF RNAV/RNP ROUTES UM214 AND UM215
DRAFT CONCLUSION	1/03	AFI PBN REGIONAL PERFORMANCE FRAMEWORK FORMS
DRAFT CONCLUSION	1/04	DEVELOPMENT AND IMPLEMENTATION OF PBN NATIONAL PLANS
DRAFT CONCLUSION	1/05	TRAINING IN SUPPORT OF PBN IMPLEMENTATION
DRAFT CONCLUSION	1/06	AFI PBN IMPLEMENTATION REGIONAL PLAN
DRAFT CONCLUSION	1/07	IMPLEMENTATION OF PHASE I OF AFI GNSS STRATEGY
DRAFT DECISION	1/08	REVISED TERMS OF REFERENCE OF THE PBN/GNSS TASK FORCE
