



INTERNATIONAL CIVIL AVIATION ORGANIZATION
AFI PLANNING AND IMPLEMENTATION REGIONAL GROUP
SEVENTEENTH MEETING (APIRG/17)
(Burkina Faso, 2 to 6 August 2010)

Agenda Item 3: AFI Regional Air Navigation Planning and Implementation Issues

3.3 Communications, Navigation and Surveillance (CNS)

Review of the Report of the Third Meeting of APIRG Communications, Navigation and Surveillance Sub-group (CNS/SG/3)

AFI GNSS STRATEGY

(Presented by the Secretariat)

SUMMARY
The report of the Third Meeting of the CNS Sub-group (CNS/SG/3) on AFI GNSS Strategy and other GNSS related issues is presented for review by APIRG.
Action by the meeting is at paragraph 3.
References : [1] – Report of the CNS/SG/3 Meeting (Principal reference) [2] – Report of the CNS/SG/2 Meeting [3] – Report of the APIRG/16 Meeting [4] – Report of the ICAO Special AFI RAN Meeting (2008) (Doc 9930) [5] – Annex 10 to the Convention on International Civil Aviation, Volume I <i>Note: References [1], [2], [3] and [4] can be downloaded from: http://www.icao.int.</i>
Related ICAO Strategic Objectives: A, D.

1. INTRODUCTION

1.1. Under its Agenda Item 6, the Third Meeting of the AFI Communications, Navigation and Surveillance Sub-group (CNS/SG/3) (Nairobi, 26 to 30 April 2010) discussed the strategy for the introduction of global navigation satellite system (GNSS) applications in the AFI Region, and other GNSS related issues. This working paper reports on CNS/SG/3 discussions.

2. DISCUSSION

2.1 AFI GNSS Strategy Update

2.1.1 The meeting recalled that, mindful of the action taken by the Air Navigation Commission (ANC) on APIRG/15 Report on issues pertaining to GNSS implementation, and of IATA's position on SBAS, APIRG/16 had opted to delay consideration of the ISA until further cost-benefit analysis in coordination with users demonstrates a conclusive need.

2.1.2 APIRG/16 recommended that the action taken by the ANC on APIRG/15 Report should be referred to the AFI GNSS Implementation Task Force for subsequent

amendment to the AFI GNSS Strategy (Decision 16/24). A as a follow-up to APIRG Decision 16/24, the 4th Meeting of AFI GNSS Implementation Task Force (GNSS/I/TF/4) (Nairobi, Kenya, 8-9 December 2008) developed an initial updated GNSS Strategy.

2.1.3 The meeting noted that GNSS/I/TF/4 had called for a joint meeting of APIRG PBN and GNSS Implementation Task Forces in order to finalize the amended GNSS Strategy taking due account of performance based navigation (PBN) considerations as well as non-PBN requirements. The Joint Meeting of APIRG PBN and GNSS Task Forces was held in Nairobi, Kenya from 8 to 10 September 2009.

2.1.4 The meeting endorsed the updated AFI GNSS Strategy as drafted by the Joint Meeting of APIRG PBN and GNSS Task Forces. The draft updated AFI GNSS Strategy is shown at **Appendix A** to this working paper. **Appendix B** shows the relationship between GNSS infrastructure and performance based navigation specifications requirements.

2.2 SBAS developments

2.2.1 The meeting was briefed by the European Commission on developments on EGNOS project. It noted that EGNOS service was expected to be certified for safety-of-life applications by mid 2010 and support aircraft operations by end of 2010.

2.2.2 The meeting was also informed that the provision of SBAS over AFI has been considered in the frame work of Africa-European Union strategic partnership. The plan for the implementation will be discussed at a planned Africa – European Union Summit in November 2010.

SBAS Cost Benefit Analysis

2.2.3 European Commission presented to the meeting information paper on draft Cost-Benefit Analysis (CBA) on implementation of Extension of EGNOS in the AFI Region for information and comments. The final Cost-Benefit Analysis (CBA) will be submitted to APIRG/17.

2.2.4 The meeting expressed concerns at the lack of credible traffic data for Cost-Benefit Analysis and formulated the following draft Decision:

DRAFT CONCLUSION 03/14: COORDINATION OF TRAFFIC DATA FOR AERONAUTICAL STUDIES

That APIRG bodies should closely coordinate their work with the AFI Traffic Forecast Group (TFG) to ensure that accurate and reliable traffic data are made available for aeronautical studies conducted in the AFI Region, including CNS/ATM related Cost Benefit Analysis (CBA).

2.3 Merger between the AFI GNSS Implementation Task Force and PBN Task Force

2.3.1 The meeting was briefed on a proposal to merge the AFI GNSS Implementation Task force and the PBN task Force established under APIRG Decision 16/2. The terms of reference and work programme of the proposed joint task force are shown at **Appendix C** to this working paper.

3. ACTION BY APIRG

3.1 The meeting is invited to:

- a) Note the report of the CNS/SG/3 Meeting on GNSS related issues as presented in this working paper;
- b) Review and endorse the revised Concept of GNSS Strategy for the AFI Region as proposed in Appendix B; and
- c) Discuss the merger between the AFI GNSS Implementation Task Force and Performance-Based Navigation Task Force as proposed under Paragraph 2.3 above, together with the terms of reference shown at Appendix C.

— E N D —

APPENDIX A

AMENDMENT PROPOSALS TO AFI CNS/ATM IMPLEMENTATION PLAN (DOC. 003)

Concept of the GNSS Strategy for the AFI Region

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 be progressively withdrawn in 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 be progressively withdrawn in consultation with users 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, the withdrawal of ILS CAT I should be considered.

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

3.3 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 be withdrawn in 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.*

APPENDIX B

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.*

APPENDIX C

**DRAFT TERMS OF REFERENCE AND WORK PROGRAMME
FOR THE PROPOSED JOINT 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).
- b) Identify other issues/action items arising from the work of ICAO or for consideration by ICAO in order to facilitate regional and global harmonization of existing applications as well as future implementation of Performance Based Navigation operations.
- c) Determine and recommend, on the basis of the studies, the PBN strategy and Implementation Plan for the AFI Region, based on the ICAO PBN Implementation goals as reflected in assembly resolution 36-23.
- d) Assist States that may require support in the implementation of PBN.

2. Work Programme

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 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)

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 representative from International/Regional Organizations may be invited when required.