International Civil Aviation Organization

Fourth Meeting of the APIRG Communications, Navigation and Surveillance Sub-group (CNS/SG/4) (Dakar, Senegal, 25 – 29 July 2011)

Agenda Item 6: Aeronautical Radio Navigation Service (ARNS)

Review of the Conclusions and Decisions of the Second Meeting of the AFI Performance Based Navigation/Global Navigation Satellite System AFI Task Force (PBN/GNSS TF/2) pertaining to GNSS implementation

SUMMARY
This paper presents the summary of the conclusions and decisions of the 2nd meeting of the AFI Performance Based Navigation/Global Navigation Satellite System AFI Task Force (PBN/GNSS TF/2) pertaining to GNSS implementation
Action by the meeting is at paragraph 3.
References : Terms of Reference of AFI PBN/GNSS Task Force Report on APIRG/16 & 17 meetings Report on AFI PBN/GNSS Task Force 1st Meeting Report on AFI PBN/GNSS Task Force 2nd Meeting ICAO Doc 9750: Global Air Navigation Plan ICAO Doc 9613:Performance Based Navigation Manual ICAO Doc 9849 GNSS Manual *Note: References can be downloaded from* ***www.icao.int/wacaf.***
Related ICAO Strategic Objective **A**: ***Safety*** and **C**: ***Environmental Protection and Sustainable Development of Air Transport.***

1. Introduction

1.1 The second meeting of AFI PBN/GNSS Task Force was held in the Conference room of The Agence pour la Securité de la Navigation Aérienne en Afrique et à Madagascar (**ASECNA**), Dakar, Senegal from 13 to 15 June 2011.

1.2 The meeting was attended by 72 participants from 24 contracting States, 02 Airnavigation Service Providers (ASECNA and Roberts managing 20 western and central Africa States airspace), 02 international organizations representing the users IATA and IFALPA.

2. Discussion

2.1 The second meeting of PBN/GNSS Task Force addressed the issue related to the implementation of GNSS in the AFI Region under its agenda item 5 (***Review of GNSS implementation strategy***).

2.2 The meeting reviewed a list of perceived hurdles to the implementation of GNSS worldwide. Theses hurdles were collected by ICAO Regional Offices as a response to the request of the Secretariat of the Navigation System Panel (NSP) to conduct a survey in order to address as many of these hurdles as possible in the revised GNSS Manual (ICAO Doc 9849).

Based on the results of the survey and the categorization of the type of hurdles (**Open* (16 hurdles) or Close** (33 Hurdles)),** the Navigation System Panel noted that although in many cases it was possible to address specific hurdles by adding guidance material to the draft GNSS Manual, some hurdles, however, require action by other ICAO bodies, by States or by equipment manufacturers.

2.3 The PBN/GNSS Task Force was also provided with additional barriers experienced in the other ICAO Regions. It was agreed that in order to ensure a successful implementation of GNSS in AFI region, AFI States/Organizations should clearly identify among the hurdles provided, those who should be critical to the implementation of GNSS and develop an adequate Action Plan aiming to overcoming them.

2.4 The Task Force meeting captured information pertaining to the development of GNSS implementation process within the other ICAO regions (APAC, EUR/NAT, SAM, MID). It was agreed that the technical and environmental conditions were similar to those experienced in AFI region.

Based on this, the Task Force reviewed the status of implementation of GNSS in AFI Region and concluded to take into consideration the experience gained in the other ICAO regions to develop or update the adequate documents that must govern the GNSS strategy, GNSS implementation Plan, GNSS capacity building, GNSS safety assessment in AFI region.

2.5 The secretariat provided the meeting with the outcome actions undertaken in order to implement APIRG/Conclusion 17/28 ***(Need for a High Level Meeting on AFI GNSS Strategy***).The meeting was informed that a high level meeting was held in Dakar on November 2010 with the participation of ICAO.

2.6 The Task Force was also briefed on the ongoing actions conducted by ICAO for the implementation of APIRG/17 Conclusion 17/29 (**Need *for an Independent Cost-Benefit Analysis***)
It was noted that the Terms of Reference for the Cost Benefit Study were developed and provided to AFCAC for consideration and action.

2.7 The meeting discussed in length on the suitable GNSS technology to be implemented within AFI Region in support to PBN operations.
The meeting was informed that the African Union has accepted the principle of a Memorandum of Understanding for the usage of extended EGNOS (**SBAS**) within AFI region for various satellite localization and navigation purposes.
Moreover some AFI States/ Administrations are inclined to use SBAS for their domestic Air Navigation Operations in order to take advantages of the opportunity that can be derived from this technology for national airports.

2.8 IATA confirmed that the users do not support the implementation of SBAS within AFI and confirm his request of an independent cost benefit analysis.

2.8 A Working Group composed by Air navigation Services Providers and IATA under ICAO coordination was established by the Task Force to review the Strategy of Implementation of GNSS by clearly defining the condition of implementation of SBAS within AFI region:

Four conditions were identified by the Working Group and added to the draft Strategy:

1. *Subjected to APIRG Conclusion 17/29*: *Need of an independent Cost Benefit Analysis*

2. *Full compliance with ICAO technical requirements*;

3. *Case to case Cost Benefit agreement before implementation*;

4. *The Civil Aviation stakeholders in particular governments should guarantee that there will be no cross-subsidization of non civil aviation users of SBAS. The users pays principle is to be applied across all sectors*;

The Task Force adopted two draft conclusions as presented in **Appendix A** and revised the draft strategy as presented in **Appendix B.**

3. Action by the meeting

The meeting is invited to:

a) Take note of the information given above
b) Comments the summary report on GNSS Implementation;
c) Adopt the draft conclusions and the revised draft Implementation Strategy.

N.B: *Hurdles are considered **CLOSED*** when: they were directly addressed by text in the GNSS Manual; other action has been taken to close them; or, when no action is possible, otherwise they are **OPEN*****

APPENDIX A

Draft Conclusions of AFI PBN/GNSS/ Implementation Task Force pertaining to GNSS

Conclusion 2/XXX: **Identification of hurdles to the implementation of GNSS in AFI Region**

That;
Based on ICAO provision in GNSS Manual (ICAO Doc 9849), AFI States/Administrations should identify from the list of hurdles provided, those who should be critical and develop an adequate Action Plan aiming to overcoming them.

Conclusion 2/XXX: Updating AFI PBN/GNSS Action Plan

That taking into consideration the status of implementation of PBN in ICAO Regions, AFI States /Administrations identify from the area of PBN/GNSS planning, strategy, capacity building and safety assessment, the guidance materials from which, can be driven additional provision to update the current AFI PBN/GNSS Implementation Plan and strategy.

APPENDIX B

Draft GNSS Implementation 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) <u>En-route phase</u>: 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) <u>Terminal areas</u>: 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 aerodromes[1].

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.*

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.*

6. Conditions of Implementation of SBAS

a) **Subjected to APIRG Conclusion 17/29: *Need of an independent Cost Benefit Analysis***

b) Full compliance with ICAO technical requirements;

c) Case to case Cost Benefit agreement before implementation;

d) The Civil Aviation stakeholders in particular governments should guarantee that there will be no cross-subsidization of non civil aviation users of SBAS. The users pays principle is to be applied across all sectors;