



GNSS IMPLEMENTATION STRATEGY FOR THE AFI REGION

**Regional workshop on AFI GNSS/SBAS
Virtual Meeting, 04–05 March 2021**

Agenda Item 3: Global and Regional Updates on SBAS developments

Presented by:

Mr. François-Xavier Salambanga
Regional Officer, CNS WACAF Regional Office





Outline

- I. Background
- II. Objectives
- III. General considerations & key principles
- IV. Strategy deployment Phases
- V. Linkage with the PBN Implementation roadmap
- VI. SBAS implementation criteria
- VII. The way Forward



Background APIRG provision for GNSS

- APIRG 11 (Nairobi, 30 March - 3 April 1998)
 - Decision 11/16: Establishment of a GNSS/TF
- APIRG13 (Sal, Cape Verde, 25 – 29 June 2001)
 - Conclusion 13/84: Adoption of the AFI GNSS Strategy
- APIRG 14 (Yaounde, Cameroon, 23 – 27 June 2003)
 - Conclusion 14/44: Use of GNSS from En-Route to NPA (Regulation & procedures)
 - Conclusion 14/45: States' support for the funding of GNSS implementation



Background APIRG provision for GNSS

- APIRG 14 (Yaoundé, Cameroon, 23 – 27 June 2003)
 - Conclusion 14/46: Implementation of a GNSS SBAS operational system
 - Conclusion 14/47: Establishment of a GNSS /TF
 - Conclusion 14/49: GNSS Legislation (States regulation)



Background APIRG provision for GNSS

- APIRG 15 (Nairobi, Kenya, 26 – 30 September 2005)
 - Conclusion 15/18: Proposed institutional structure for interregional SBAS over the AFI Region (Inter-regional SBAS for Africa-ISA)
 - Conclusion 15/19: Meeting of investor in the ISA
 - Decision 15/20: Revised AFI GNSS strategy
- APIRG 16 (Rubavu, Rwanda, 19-23 November 2007)
 - Conclusion 16/21: Implementation of GNSS En-Route and Non Precision Approach operations
 - Conclusion 16/22: Recording of GNSS Parameters (*ICAO Annex 10, Volume I, Chapter 2, para. 2.4.3.*)



Background APIRG provision for GNSS

- APIRG 16 (Rubavu, Rwanda, 19-23 November 2007)
 - Conclusion 16/23: Aeronautical Information related to GNSS
 - Decision 16/24: AFI GNSS Implementation strategy (*The AFI GNSS Implementation T/F to update the GNSS strategy in consideration with the outcome of APIRG Conclusions 15/18, 15/19 and 15/20*)
- APIRG 17 (Ouagadougou, Burkina Faso, 2-6 August 2010)
 - Conclusion 17/28: **Need for a High Level Meeting on AFI GNSS strategy** (*AFCAC in coordination with ICAO, ASECNA, IATA, AFRAA and other relevant stakeholders to organize as a matter of urgency*)
 - Conclusion 17/29: **Need for an independent CBA**



Background APIRG provision for GNSS

- APIRG 18 (Kampala, Uganda, 27-30 March 2012)
 - Conclusion 18/31: **Updated GNSS Strategy**
 - Conclusion 18/32: Monitoring of SBAS development in ICAO Regions in Equatorial areas
 - Conclusion 18/33: **Funding of AFI CBA** (*In coordination with AFCAC, ICAO facilitates the search for funding to support the conduct of an independent CBA*)
- APIRG19 (Dakar, Senegal, 28-31 October 2013)
 - Conclusion 19/28: Assessment and mitigation and mitigation of GNSS vulnerabilities
 - Conclusion 19/29: Impact analysis of the implementation of GNSS/SBAS in the AFI Region



Background APIRG provision for GNSS

- APIRG 20 (Yamoussoukro, Cote d'Ivoire, 30 November – 2 December 2015)
 - Conclusion 20/25: Sharing of study on GNSS
- APIRG 22 (Accra, Ghana, 29 July – 2 August 2019)
 - Conclusion 22/39: SBAS for Africa - Indian Ocean initiative
 - a) AFCAC should fast-track the conduct of a continental cost-benefit analysis (CBA) on SBAS implementation in the region by June 2020, to support the decision making process by States and stakeholders, and to enable update of the AFI GNSS strategy accordingly; and**
 - b) ICAO and AFCAC organize a regional workshop with all stakeholders involved in SBAS implementation thereafter**



Objectives of the Strategy

- 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
- Does not analyze GNSS systems configuration per se nor the advantages and disadvantages of various deployment strategies



General considerations & key principles

- Satellite-based and ground-based navigation systems will co-exist for a period of time in accordance with the ASBUs technology Roadmap
- 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



General considerations & key 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



General considerations & key principles

- Operational advantage shall be taken in to consideration the available technology 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



GNSS deployment phase I (Short term) up to 2012

- GNSS as a primary-means of navigation for En-route, and for NPA;
- GNSS as a supplemental-means navigation system for TMA;
- Existing ground infrastructure remains intact.



GNSS deployment phase II (Medium term) 2013 - 2016

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 aid
- 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.



GNSS deployment phase II (Medium term) 2013 - 2016

Terminal areas:

- Sufficient capability to meet TMA navigation requirements everywhere in the AFI region;
- GNSS as sole-means for TMAs, taking into account technical, legal developments, and institutional aspects;
- VOR/DME/NDB, and Locators not associated with ILS, not replaced.
- **Approach and landing phase:** Sufficient capability for APV1 in the whole AFI Region. ILS will continue to be provided at aerodromes



GNSS deployment phase III (Medium term) beyond 2016

Assumption 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) ;



GNSS deployment phase III (Medium term) beyond 2016

- 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 (ASBUs technology roadmap refers).



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



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 2



SBAS implementation criteria

1. Availability of conclusive cost-benefit analysis (APIRG Conclusion 17/29 refers)
2. Full compliance with ICAO technical requirements (Standards and Recommended Practices);
3. Agreement between stakeholders on pre-implementation cost benefit analyses on case by case basis;
4. Application of the user pays principle across all sectors (SBAS users). National authorities shall prevent cross-subsidization of non-civil aviation users of SBAS.



The way Forward

- To consider the ASBUs technologies Roadmap related to PBN requirements on NAV;
- To consider the regional framework within the APIRG Project approach (NAV Project);
- To consider the outcome of the CBA and update the AFI GNSS Strategy;
- To build a strong inclusive regional CDM network for the implementation of SBAS



ICAO

North American
Central American
and Caribbean
(NACC) Office
Mexico City

South American
(SAM) Office
Lima

ICAO
Headquarters
Montréal

Western and
Central African
(WACAF) Office
Dakar

European and
North Atlantic
(EUR/NAT) Office
Paris

Middle East
(MID) Office
Cairo

Eastern and
Southern African
(ESAF) Office
Nairobi

Asia and Pacific
(APAC) Sub-office
Beijing

Asia and Pacific
(APAC) Office
Bangkok



THANK YOU