



ICAO



## INTERNATIONAL CIVIL AVIATION ORGANIZATION

**Twenty-Fifth Meeting of the AFI Planning and Implementation Regional Group (APIRG/25)  
7 - 11 November 2022**

**Agenda Item 3: Implementation of air navigation goals, targets and indicators, including the priorities set in the regional air navigation plan**

**3.6 Autres initiatives de navigation aérienne**

**Progress on the implementation of GNSS/SBAS in Africa**

(Presented by AFCAC Secretariat)

**EXECUTIVE SUMMARY**

This paper provides an update on the status of GNSS/SBAS implementation in the African continent, including outcomes of the stakeholder consultative workshop held in Kigali, Rwanda in May 2022 on the cost benefit analysis (CBA) study on SBAS implementation in Africa.

Action: The Meeting is invited to:

- a) Take note of outcomes of the multi-stakeholder consultative workshop on the CBA study report on SBAS implementation in Africa;
- b) Take note of the SBAS demonstration service in Western and Central Africa, in compliance with ICAO Standards and Recommended Practices, since 2020;
- c) Urge member States to continue exploring the continental implementation of SBAS to increase air navigation safety and efficiency, and reduce environmental impact due to air navigation;
- d) Urge member States to report on GNSS deficiencies and support the development of GNSS monitoring systems including enlisting support from SatNav Africa JPO.

<i>Strategic Objectives:</i>	This working paper relates to Strategic Objectives: (1) Safety, (2) Capacity and efficiency, and (4) economic development
<i>Financial implications:</i>	Under AUC authority

<i>References:</i>	<p>[1] Africa Union Space Strategy and Policy</p> <p>[2] First ordinary session of the African Union Specialized Technical Committee on Transport, Infrastructure, Intercontinental and Interregional Infrastructure, Energy and Tourism, 13-17 March 2017, Declaration of Lomé</p> <p>[3] APIRG/22 Meeting report of the Africa-Indian Ocean Planning and Implementation Regional Group (APIRG/22), Accra, Ghana, 29 July - 02 August 2019</p> <p>[4] Final report on CBA for SBAS implementation in Africa</p> <p>[5] ICAO Annex 10, Volume I, up to amendment 92</p>
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## 1. INTRODUCTION

1.1 Navigation & positioning is a key component of the Africa's space programme as per the Space Policy and Strategy adopted by the African Union (AU) Member States to support the implementation of the Agenda 2063. It includes GNSS (Global Satellite Navigation Systems) which supports gate-to-gate navigation and all-weather operations and are key enablers to Performance-Based Navigation.

1.2 The continental GNSS strategies developed under the aegis of ICAO provide a roadmap for the development of GNSS in the region and the evolution of the conventional navigation aids towards a Minimum Operating Network (MON) to ensure full resilient capabilities, including in case of GNSS outages. SBAS is a key element of these strategies to support all phases of flight from en-route down to precision approaches, which can be deployed at all runways ends, including in remote areas, without the need for local infrastructure. SBAS operations enhance flight safety and efficiency, while reducing its environmental impact, and improves airports accessibility. They contribute to the objectives of the Single African Air Transport Market (SAATM) and to the implementation of the highest priority of the Aviation Community which is PBN.

1.3 As per the decision adopted by the AU Member States in 2017 [2] and in line with the APIRG/22 conclusion 22/39 [3], the African Union Commission (AUC) was tasked to conduct a continental cost-benefit analysis (CBA) on SBAS introduction in the region, taking consideration of existing initiatives, with the overall objectives to assess the SBAS economic attractiveness for the continent, in order to support the decision-making process by States and Stakeholders on the best implementation options, and enable update of the AFI GNSS strategy accordingly.

1.4 The implementation of SBAS is on-going on the continent, with more than half of AU members involved in deployment programmes, such as the Agency for Air Navigation Safety in Africa and Madagascar (ASECNA) and Arab Civil Aviation Organisation (ACAO), while in others, technical and economical feasibility studies are being conducted.

## 2. CBA STAKEHOLDER CONSULTATIVE WORKSHOP OUTCOMES

2.1 The key objective of the continental CBA study by the AUC was to investigate the impact in terms of benefits and costs of SBAS implementation in Africa as a whole, with a specific focus made on the aviation sector, evaluating the operational, safety, environmental, social benefits as well as the costs of SBAS implementation for all aviation stakeholders. The decision to conduct a CBA was made at APIRG/16 which was convened here in Rwanda from 19-23 November 2007,

which noted the lack of consensus between Stakeholders on available AFI SBAS cost-benefit analyses, and accordingly decided to delay consideration of an Inter-Regional SBAS for Africa (ISA) until further cost-benefit analysis in coordination with users demonstrated a conclusive need. Despite delays, the study was finally conducted during year 2021.

2.2 This study was finalised and successfully reviewed through a multi-stakeholder consultative workshop which included AU Member States, Regional Economic Communities (RECs) and industry partners (IATA, AFRAA, airlines). The workshop, which was attended by 70 on-site participants and 90 participants connected via zoom, was conducted in Kigali, Rwanda in May 2022

2.3 The workshop presentations were conducted by SatNav Africa JPO in collaboration with DT Global consultants who carried out the CBA study. The meeting was co-chaired by both AUC and AFCAC. The following key points were highlighted

- For airlines, the SBAS business case is highly profitable and attractive, with positive values in all the evaluated financial indicators.
- For ground-side users (ANSPs, airport operators and SBAS service provider), the business case is also profitable. The socioeconomic impact of SBAS has also been monetised and included in the economic results of the CBA, with emphasis on the environmental impact of the SBAS implementation for which a very positive carbon footprint has been demonstrated.

2.4 Among other key recommendations, the workshop noted that airspace users support implementation of SBAS in Africa provided that;

- no mandatory requirements by regulatory authorities to fit SBAS equipment to aircraft,
- no unjustified restrictions to operations due to a lack of SBAS equipment; and
- no costs or charges related to SBAS being imposed directly or indirectly to airspace users who do not use such technology.

2.5 Beyond the validation of the study, the African stakeholders noted that airlines operating in Africa acknowledge the value of SBAS services in enhancing safety and improving efficiency, especially at both international and secondary airports, and support the implementation of SBAS in Africa, provided that no mandatory equipage is applied, and no extra air navigation charges are introduced, and that airlines not using SBAS are not penalised, all these conditions being considered in the study.

2.6 These outcomes are under submission for consideration by the AU Policy Organs, APIRG and RASG-AFI groups.

### **3. ON-GOING SBAS PROGRAMMES AND FEASIBILITY STUDIES**

3.1 The “SBAS for Africa & Indian Ocean” (A-SBAS) initiative developed by ASECNA, aims to autonomously provide airspace users with operational SBAS services from 2025, to enhance PBN and ADS-B operations for all phases of flight, with a potential for a progressive

coverage of the continent. This initiative is recognised by ICAO under the Annex 10, Volume 1 through the assignment of an SBAS service provider identifier (n°7) [5]. The definition and design of the A-SBAS system, based on an indigenous African infrastructure, are completed. The system development and deployment are on-going in view of initial operation services declaration in 2025.

3.2 In parallel, as the first essential step of the A-SBAS services provision plan, an SBAS demonstration service compliant to ICAO SARPs is provided in Western and Central Africa since September 2020. It is the first ever SBAS service to be provided in an equatorial region and constitutes an important technical achievement for Africa and even beyond for the global satellite navigation infrastructure, as it takes up the major technical challenge of SBAS operations in a region affected by important ionospheric disturbances.

3.3 The SBAS demonstration signal-in-space is generated and broadcasted from a fully-fledged test-bed infrastructure composed of a network of GNSS reference stations, a representative system prototype in Dakar (Senegal), an uplink station deployed in Abuja (Nigeria) and the navigation payload of NigComSat-1R GEO satellite. It includes a specific message type to prevent any use by aircraft equipped with certified SBAS receivers. Beyond technical tests, this service has been used to perform with partner airlines a series of demonstrations with aircraft and rotorcraft equipped with test receivers, to showcase the benefits of SBAS operations. It has the potential to be extended in other regions of the continent, through additional reference stations.

3.4 In Northern Africa, the ACAO Member States have adopted a technical scenario for SBAS implementation and impact assessment studies have also revealed positive impact of SBAS for the aviation sector. The phased approach taken for SBAS provision plan includes operational services from 2024 based on EGNOS extension. An independent SBAS infrastructure is expected to be deployed in the long-Term (2035+).

3.5 In Eastern Africa, COMESA, EAC and IGAD are beneficiaries of the Satellite Navigation in Africa Support Programme and have undertaken within this framework technical and economic feasibility studies for SBAS development in the region, with the support of the SatNav in Africa JPO. Results showed positive impacts both on aviation and other sectors. In addition, a project concept on the implementation of a GNSS monitoring system is currently being developed by the SatNav in Africa JPO for the East African States (EAC Member states).

3.6 In Southern Africa, a GNSS monitoring network has been deployed and is operated in South Africa to assess GNSS performances, including potential SBAS performances. South Africa recently developed the navigation strategy that includes the implementation of augmented GNSS, primarily SBAS in the medium to short-term. As part of the initial phases of supporting the strategy, SBAS performances were obtained by the deployment of a testbed. The observed performances were very encouraging. They are in line with expected level of service (accuracy and integrity) or very close (availability) to the APV-I requirements. These good SBAS performances foster an evolution from present conventional navigation and landing system to a GNSS-based system. They pave the way to further demonstrations to prepare future SBAS system in Southern Africa. These future demonstrations will benefit from the lessons learnt aiming to improve the maintenance in operational conditions.

#### **4. CONCLUSION**

- a) The report on continental CBA study on SBAS was discussed in May 2022 in Kigali, Rwanda and consequently was endorsed by member States, regional stakeholders, and industry. The report demonstrated the high economic attractiveness of SBAS implementation for the overall African aviation sector
- b) SBAS demonstration service in Western and Central Africa was conducted, in compliance with ICAO Standards and Recommended Practices, since 2020 by ASECNA. The demonstration was the first SBAS service ever to be deployed in equatorial region typically impacted by adverse ionosphere conditions
- c) African States are encouraged to continue exploring the continental implementation of SBAS to increase air navigation safety and efficiency, and reduce environmental impact. States are also encouraged to collaborate with ICAO, AFCAC and key international organisations to establish the institutional and legal framework and funding to support the adoption scheme required to fully implement SBAS in Africa.
- d) African States are encouraged to report on GNSS deficiencies and support the development of GNSS monitoring systems including with support from SatNav Africa JPO