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PROGRESS ON THE IMPLEMENTATION OF GNSS/SBAS IN AFRICA

(Presented by the African Civil Aviation Commission (AFCAC) on behalf of
54 African States²)

EXECUTIVE SUMMARY

This paper provides an update on the status of GNSS/SBAS implementation in the African continent, including on the implementation of the Decision of AU Member States on the continental cost benefit analysis (CBA) study on SBAS, and the provision of an SBAS demonstration service.

<i>Strategic Objectives:</i>	This working paper relates to the Safety, Air Navigation Capacity and Efficiency, and Economic Development Strategic Objectives.
<i>Financial implications:</i>	Under AUC authority
<i>References:</i>	[1] Africa Union Space Strategy and Policy ³ [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 ⁴ [3] APIRG/22 Meeting report of the Africa-Indian Ocean Planning and Implementation Regional Group (APIRG/22), Accra, Ghana, 29 July - 02 August 2019 ⁵ [4] Final report on CBA for SBAS implementation in Africa ⁶ [5] ICAO Annex 10, Volume I, up to amendment 92

¹ English and French versions provided by AFCAC.

² Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cabo Verde, Central African Republic, Chad, Comoros, Cote d'Ivoire, Democratic Republic of the Congo, Republic of the Congo, Djibouti, Egypt, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, São Tomé and Príncipe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Togo, Tunisia, United Republic of Tanzania, Uganda, Zambia, Zimbabwe

³ [37434-doc-au space strategy isbn-electronic.pdf](#)

⁴ [Microsoft Word - Declaration-Diakhate-English-Rev 1.docx \(icao.int\)](#)

⁵ [ATMGE/2 Draft Summary of Discussions \(icao.int\)](#)

⁶ [Report Regional Workshop Implement. GNSS-SBAS Final.pdf \(icao.int\)](#)

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 [1] to support the implementation of the Agenda 2063. It includes GNSS (Global Navigation Satellite 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. Satellite Based Augmentation System (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).

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 to 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, 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), or in technical and economic feasibility studies.

2. ECONOMIC ATTRACTIVENESS OF SBAS IN AFRICA

2.1 The specific 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.

2.2 This study was finalised and successfully reviewed by AU Member States, regional stakeholders (Regional Economic Communities) and industry (IATA, AFRAA, airlines) in May 2022. It demonstrates the high economic attractiveness of SBAS implementation for the overall aviation sector [4].

2.3 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 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.

2.5 These outcomes are under submission for consideration by the AU Policy Organs and APIRG 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^o7) [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 demos 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 implementation in Southern Africa. These future demonstrations will benefit from the lessons learnt aiming to improve the maintenance in operational conditions.

3.7 The successful CBA study, various tests and demonstration services in Western, Central Africa (by ASECNA), COMESA, EAC, IGAD and South Africa were positive developments in support of SBAS implementation in Africa. The next steps include development of a framework on governance and institutional support for implementation of SBAS and further planning at APIRG level.

4. CONCLUSION

4.1 The Assembly is invited to take note:

- a) of the finalisation of the continental CBA study on SBAS in May 2022, successfully reviewed by AU Member States, regional stakeholders, and industry, and demonstrating the high economic attractiveness of SBAS implementation for the overall African aviation sector
- b) of the provision of an SBAS demonstration service in Western and Central Africa, in compliance with ICAO Standards and Recommended Practices, since 2020, the first SBAS service ever to be deployed in equatorial region typically impacted by adverse ionosphere conditions
- c) that African States are encouraged to continue exploring the continental implementation of SBAS to increase air navigation safety and efficiency, and reduce environmental impact.

— END —