IIM/SG/3 **IPXX**

INTERNATIONAL CIVIL AVIATION ORGANISATION

Third Meeting of APIRG Infrastructure and Information Management Sub-Group (IIM/SG/3)
Virtual meeting, 12-14 October 2020

Agenda item n°4: Status of implementation of APIRG projects

Benefits of SBAS services in Africa

(Prepared by ASECNA)

SUMMARY	
The flow of history heads towards SBAS introduction over the world as baseline operations, as GPS is today. The SBAS benefits are indeed today widely acknowledged by airspace users, thanks to the global expansion of SBAS services over the world. These benefits will be much higher in Africa than in the rest of the world. A recent cost-benefit analysis (CBA) undertaken by ASECNA showed that the use by airlines of SBAS services in the AFI airspace, over the 2025-2045-time period, will generate net profits higher than 800 million USD. In this frame, several users of the AFI airspace are not only interested in SBAS services, but are also calling for expediting their deployment. The meeting is invited to: • consider the safety, environmental and efficiency benefits of SBAS services in Africa, and the need to expedite the deployment of SBAS to enable airspace users to take advantage of these benefits • position SBAS services as a high priority of the AFI GNSS strategy • assimilate and facilitate the SBAS services programmes in Africa, as the « SBAS for Africa & Indian Ocean »	
Strategic Objectives	A – Safety, B – Air Navigation Capacity and Efficiency, D – Economic Development
ASBU KPIs and B0 modules	PIA 1 (B0 – APTA), PIA 3 (B0 - FRTO), PIA 4 (B0-CDO)

1. INTRODUCTION

1.1 The SBAS benefits are today widely acknowledged by airspace users, thanks to the global expansion of SBAS services over the world. An important number of airlines have integrated or plan to integrate SBAS in their navigation strategy, based on their own assessment of the positive benefits/costs ratio.

1.2 Use of SBAS services brings indeed many benefits for airspace users for all phases of flight from en-route down to approaches, through the enhancement of performance-based navigation (PBN) and automatic dependent surveillance - broadcast (ADS-B) operations, increasing significantly flight safety and efficiency.

1.3 These benefits are widely considered to be much more important in Africa than in any other part of the world.

2. SBAS BENEFITS FOR AFRICA

2.1 SBAS does not require the installation or maintenance of local ground-based navigation aids or landing systems and the provision of related staff, and is particularly adapted to the African operational environment, where remote and isolated regions are vast and numerous.

2.2 In the navigation domain, the SBAS services will improve availability for all area navigation (RNAV) routes and flexibility for new and more efficient routes. They will provide an effective solution for CAT-I equivalent operations “everywhere every time”, especially in the very large number of runways ends of the continent, in international, regional and domestic airports, not served by precision approaches today. They will thereby enable to ensure service continuity during instrument landing system (ILS) maintenance and renewal periods, and overcome the known safety and operational performance limitations of lateral navigation (LNAV) / vertical navigation (VNAV) operations, through lower minima, geometric guidance, and no linkage with QFE setting.

2.3 The main expected safety benefits include the reduction of Controlled Flight Into Terrain (CFIT), which represented 20% of the fatalities in the world over the 2011-2015 period, most of them occurring in the approach/landing phase and being often associated with imprecise approaches, according to the IATA Annual Review 2016. The main expected efficiency benefits include shorter flight time, reduction of delays, deviations and cancellations, reduction of fuel consumption and Co2 emissions, lower fuel load requirements due to closest alternates availability, and elimination of the requirement for RAIM check before departure.

2.4 In the surveillance domain, SBAS provides, as primary navigation system, positioning source to meet the most stringent ADS-B requirements in support of advanced ATM operations, as enhancing the quality of the position information reported, compared to GPS/RAIM only. In particular, it improves the availability of ADS-B operations.

3. NET PROFITS FOR AIRSPACE USERS IN AFRICA

3.1 A recent cost-benefit analysis (CBA) undertaken by ASECNA in conjunction with the EGIS-AVIA company, and with the support of the EGNOS-Africa Joint Programme Office (JPO) has assessed the profitability of the use by airlines of SBAS services in the AFI airspace, over the 2025-2045-time period.

3.2 This study focused on the profits for airlines, and did not cover the air navigation services providers, airport operators, and States and citizen perspectives.

3.3 It assessed the overall net profits as the difference between the present value of the benefits (of use of SBAS services) and the present value of costs (of acquisition of SBAS capability), the ratio between the net profits and the costs to emphasise the return on investment, and the payback period as the length of time the users recover their initial investment.

3.4 Conservatively, the quantified benefits only include:

- Reduction of the risk of Controlled Flight Into Terrain (CFIT)
- Reduction of delays and diversions
- Reduction of flight time through:
    - Elimination of the operational practice of landing at the opposite QFU
    - Optimisation of approach trajectories
    - Optimisation of en-route trajectories in ADS-B airspace

3.5 All the other benefits, such as increased options for alternate runways, lower fuel load requirements, increased dispatch reliability, elimination of the pre-flight requirement to ensure GPS availability using RAIM prediction tools and increased runway throughput were not considered for the quantification.

3.6 The quantified costs covered:

- SBAS airborne equipment acquisition, integration and installation
- Flight crew training, and operational/technical documentation
- Certification

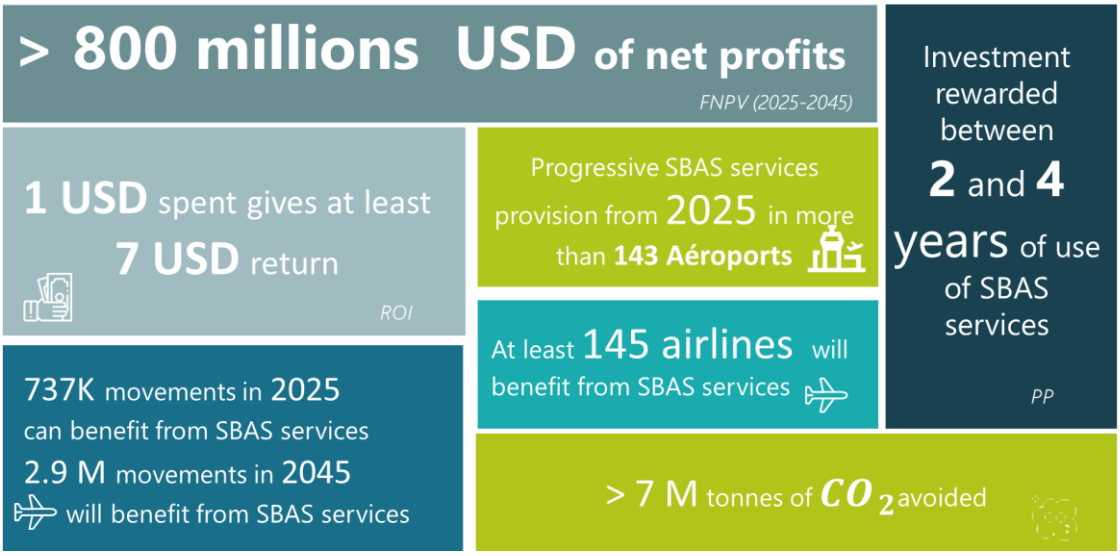

Figure 1: Outcomes of the SBAS CBA study for airlines

3.7 The study shows conservatively that the net profits for airlines generated by SBAS operations in the AFI region will be higher than 800 million USD. During the same period, more than 7 million tonnes of CO2 emissions will be avoided.

3.8 In terms of global return on investment, use of SBAS services will produce a net profit for airlines higher than 7 USD for each USD spent.

3.9 As regard to the payback period, the initial investment of airlines to acquire the SBAS capability will be recovered between 2 and 4 years after starting the use of the services.

3.10 These outcomes were reviewed with partner airlines such as ASKY, Air Côte d'Ivoire, Air Senegal and Air France.

4. ADOPTION OF SBAS

4.1 SBAS benefits are nowadays widely acknowledged by airlines, which integrate increasingly SBAS in their navigation strategy. SBAS services are in exponential development in the world, and avionics solutions are more and more available at lower cost. It is largely recognised that, in 2030, SBAS will be the baseline navigation system, as GPS is today.

4.2 Several airlines operating in the AFI airspace, such as ASKY, Air France and Qatar Airways, are not only interested in SBAS services, but are also calling for expediting their deployment to improve the safety and efficiency of air navigation over the continent.

4.3 Other airlines are also assessing the possibility to adopt SBAS, considering the growing number of airborne SBAS solutions offered by aircraft at very acceptable costs. In this frame, some African airlines, such as Ethiopian Airlines for their A350, has already acquired the SBAS capability.

4.4 The trend of aircraft SBAS solutions is indeed very positive, and it is expected that the number of forward-fit or retrofit SBAS avionics will significantly increase in the next years. SBAS capabilities

are today available in standard-fit or as customer option in the Airbus A220 and A350, ATR 42- and 72-600, Embraer ERJ-135-140-145 and Bombardier Q-Series families, to name just a few of them. From 2025-27, it is expected that all new aircraft will offer SBAS capabilities, while the retrofit solutions for legacy aircraft are more and more available.

4.5 In that respect, the SBAS Interoperability Working Group (IWG), which is the platform of the SBAS providers from over the world (USA, Europe, Indian, Japan, Russia, China, South Korea, Australia and ASECNA), has launched a dialogue with airlines and aircraft manufacturers, to develop enhanced cooperation and combined efforts to accelerate user adoption and penetration of SBAS services.

4.6 In the margins of the 36th SBAS IWG held in India in last February, the first outreach event on the SBAS adoption in aviation was organised. It gathered airlines (Air France, Japan Airlines, Qatar Airways, Go Airlines, Indi'Go …), aircraft manufacturers (Airbus, Boeing, ATR…) and avionics manufacturers (Collins Aerospace …), and gave impetus for enhanced consultations between the different stakeholders, with the shared objective to expedite the integration of SBAS in the navigation strategy of each.

5. SBAS STATUS IN THE WORLD

5.1 SBAS services provision is expanding over the world. At this date, nine (09) operational and under-development SBAS have been recognised by ICAO through the assignment of service provider identifiers as follows:

Identifier	SBAS
0	WAAS (US)
1	EGNOS (Europe)
2	MSAS (Japan)
3	GAGAN (India)
4	SDCM (Russia)
5	BDSBAS (China)
6	KASS (Korea)
7	**SBAS for Africa & Indian Ocean (Africa)**
8	SPAN (Australia/NZ)

Figure 2: SBAS service providers' identifiers (Annex 10)

5.2 The current status and plans for SBAS approach procedures deployment are the following:

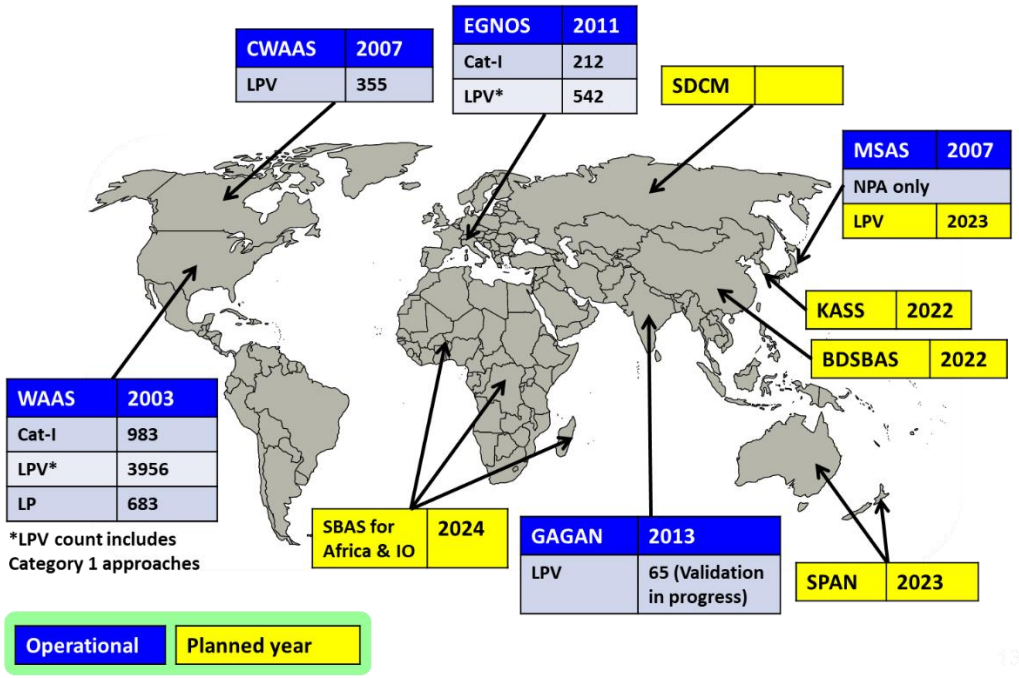

Figure 3: Status and plans for SBAS procedures deployment in the world

6. WAY FORWARD

6.1 The flow of history heads towards SBAS introduction over the world as baseline operations, as GPS is today.

6.2 Users of the AFI airspace shall not be left behind thereof. SBAS deployment shall be expedited to enable these users to take fully advantage of the huge benefits which will be offered.

7. ACTION BY THE MEETING

7.1 The meeting is invited to:

- consider the safety, environmental and efficiency benefits of SBAS services in Africa, and the need to expedite the deployment of SBAS to enable airspace users to take advantage of these benefits
- position SBAS services as a high priority of the AFI GNSS strategy
- assimilate and facilitate the SBAS services programmes in Africa, as the « SBAS for Africa & Indian Ocean »