Twenty-Fourth Meeting of the AFI Planning and Implementation Regional Group (APIRG/24)

(Virtual – 2 to 4 November 2021)

Agenda item 4: Other Air Navigation Initiatives

4.1. Initiatives by States & Industry and other air navigation matters

Carbon footprint assessment as part of the implementation of CNS / ATM projects

(Presented by ASECNA)

SUMMARY	
This working paper presents the environmental impact studies that ASECNA is now carrying out within the framework of the implementation of CNS / ATM projects. It explains the methodologies used as well as the results obtained by ASECNA as part of: • its A-SBAS programme, for which a net reduction of at least 140,000 tons of CO_2 emissions per year on average is expected over the period 2025-2045. • the implementation of the concept of "Direct Routing" in the Brazzaville FIR thanks to the space-based ADS-B surveillance capability which enables airlines to achieve significant flight time savings and subsequent CO_2 emission reduction. The Meeting is invited to: a) take note of the information contained herein; b) encourage ANSPs, airport operators as well as all the other actors concerned in the implementation of CNS / ATM projects, to consider the assessment of a carbon footprint in the planning of these projects	
REFERENCE (S)	- ICAO Global Air Navigation Plan (Doc 9750) - ICAO Annex 16, Volumes III and IV
Strategic Objectives	B- Air Navigation Capacity and Efficiency and E- Environmental Protection

1. INTRODUCTION

1.1 The improvements that need to be made in the aviation system to meet the ever-changing needs of the sector require in most cases the deployment of CNS / ATM infrastructure, technologies and services in accordance with the Aviation System Block Upgrades (ASBU) framework defined in the Global Air Navigation Plan, and with regional and national plans.

1.2 However, in relation to the global strategic objectives, the protection of the environment, and especially the reduction of CO_2 emissions, is one of the major challenges induced by these improvements.

1.3 In addition, the financing and implementation of development projects in all sectors of activity, including aviation, are increasingly conditioned by the presentation of a positive carbon footprint.

1.4 It is therefore necessary to systematically plan for carrying out the Co2 balance during the planification and implementation of CNS / ATM projects.

1.5 ASECNA henceforth includes in any new investment project the achievement of a carbon footprint assessment.

1.6 Thus, as part of the implementation of its Satellite-Based Augmentation System programme (A-SBAS), an assessment of the CO_2 emission gain was performed. It is the same for the implementation of the concept of "Direct Routing" in a full ADS-B environment.

2. CARBON BALANCE RELATING TO THE IMPLEMENTATION OF THE A-SBAS SYSTEM

2.1. To establish a carbon footprint, it is necessary to assess both the negative and the positive contributions of the project to the reduction of Co2 emissions.

2.2. An evaluation of the contribution of A-SBAS services to Co2 emissions is presented here in a synthetic manner, taking into account:

- on the one hand, the reduction in Co2 emissions induced by the use of SBAS services (positive contribution);
- and on the other hand, the increase in Co2 emissions induced by the production and provision of SBAS services (negative contribution).

2.3. Also, this assessment was carried considering a period of the system operation ranging from 2025 to 2045 and over the geographical service area covering the Western and Central Africa, and the Indian Ocean.

2.2 <u>Reduction of CO_2 emissions (positive contribution)</u>

2.2.1 The assessment of the reduction of Co2 emissions is limited to the aviation sector.

2.2.2 The reduction of Co2 emissions induced using SBAS services in other sectors of activity could not be achieved, making the approach more than conservative, given the immense potential offered by SBAS services in these other sectors.

2.2.3 The reduction of Co2 emissions in the aviation sector is induced by the benefits provided to users (airspace users, mainly airlines) in terms of improving flight efficiency and therefore of fuel savings, thus reducing the environmental impact beyond the reduction of operational costs.

2.2.4 A CBA study has shown that, for a first set of benefits (reduction of flight times thanks to the optimization of approach and en-route trajectories, and the elimination of the operational practice of landing on opposite QFU), the use of SBAS services by airlines will result in a reduction in CO2 emissions, in cumulative volume over the period 2025-2045, estimated at 3 million tons, induced by around 950 million kg of fuel saved.

2.2.5 As this CBA study has the primary objective of monetizing the profit of airlines for the use of A-SBAS services, the methodology used to assess the quantities of Co2 avoided consists of using the model for calculating each of the monetary benefits concerned in order to deduce the quantities of fuel saved and then the gain in CO2 emissions.

2.2.6 This result is conservative, as only scheduled flights were considered in the study, in association with a cautious scenario of traffic resumption after the COVID-19 crisis. Also, some benefits, such as the lower fuel load resulting from the greater number of alternative airport options, have not been evaluated.

2.2.7 An additional internal study, evaluated the reduction in Co2 emissions thanks to the benefit of reducing flight delays and diversions, at around 360,000 tons over the same period 2025-2045.

2.2.8 In total, the reduction in CO2 emissions is estimated at 3.38 million tons. The contribution of each type of benefit considered in this assessment is presented in the table below:

TYPE OF BENEFIT	**MINUTES OF FLIGHT SAVED**	**FUEL SAVED** (in Kg)	**CO2 EMISSIONS AVOIDED (in kg)**
Optimization of flight trajectories during en-route phase	18 863 899	660 236 477	2 079 744 902
Elimination of the practice of landing on opposite QFU	5 353 274	187 364 590	590 198 459
Optimization of trajectories during the arrival and approach phases of flight	3 191 964	111 718 753	351 914 073

Reduction of the number of flight delays and diversions	3 291 180	115 191 309	362 852 623
TOTAL	30 700 317	959 319 820	**3 384 710 057**

Table 1: Distribution by type of benefit of the amount of CO2 emissions avoided

2.3 Increase in CO2 emissions (negative contribution)

2.3.1 The increase in Co2 emissions is linked to indirect emissions induced by the production and provision of SBAS services, and mainly:

- Co2 emissions during the development, deployment and commissioning phases of the A-SBAS system (phases C/D/E1);
- Energy consumption for the maintenance and operations of the A-SBAS system;
- Travel of personnel in charge of operations.

2.3.2 The first item has not been evaluated, since phases C / D / E1 is not yet the subject of a contract. However, this is not considered to impact the results.

2.3.3 For the second item, the average annual energy consumption is estimated at 2,000 MWH, resulting in an average annual CO2 emission estimated at around 500 tons. This assessment conservatively considered the energy sources to date in the concerned States (the share of non-fossil fuels expected to increase in the next 20 years).

2.3.4 Regarding the movement of personnel in charge of operations, the emission of Co2 is estimated at around 100 tons of Co2 per year.

2.4 Summary of the carbon footprint assessment

2.4.1 The contribution of the use (positive effect) and the production and provision (negative effect) of A-SBAS services is assessed, using a conservative approach, as leading to a reduction in Co2 emissions of at least 140,000 tons per year on average, over the period 2025-2045.

3. REDUCTION OF CO2 EMISSIONS THANKS TO THE IMPLEMENTATION OF SPACE-BASED ADS-B

a) The implementation of space-based ADS-B has been effective in ASECNA airspace since January 2020 and constitutes a vector for improving the quality of services provided to users in terms of both safety and efficiency.
b) The improvement in flight efficiency, through optimised flight profiles and fuel savings, certainly benefits to airlines, but it has also impact on the environment, particularly in terms of reducing CO2 emissions.
c) With the implementation of space-based ADS-B, the Agency had planned to carry out trials on the concept of Free Route Airspace (FRA) in the Brazzaville FIR in 2020. But with the advent of the COVID-19 pandemic, these trials have been

postponed.

d) However, the concept of “Direct Routing” was implemented during the pandemic thanks to the operationality of space-based ADS-B in all the FIRs managed by the Agency above the Flight Level 290, with the publication of Aeronautical Information Circulars (AIC) NR 44 / A / 20GO, NR 30 / A / 21FC and NR 11 / A / 21FM.

e) A survey carried out during the month of September 2021 in the Brazzaville FIR revealed a time saving ranging from 2 to 10 minutes for flights operating "Direct Routes" in this airspace, with an average of 6 minutes of time saved by each flight.

f) The Direct Routes concerned by this survey and the time savings recorded are shown in the figures below:

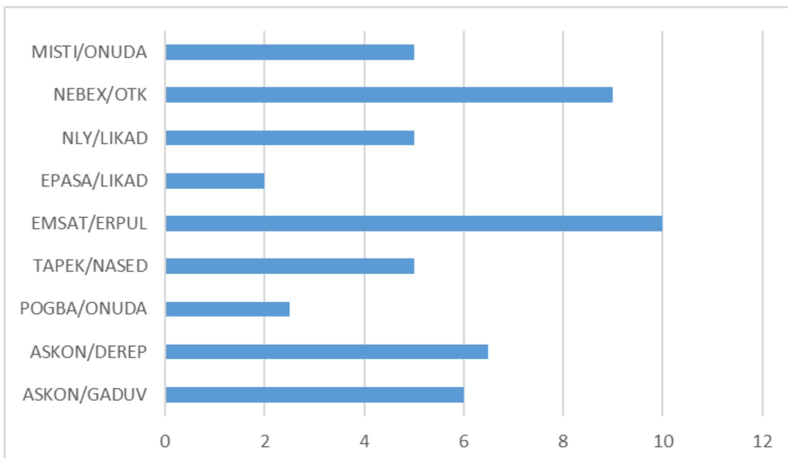

Figure 1: Time savings recorded per segment of Direct Route

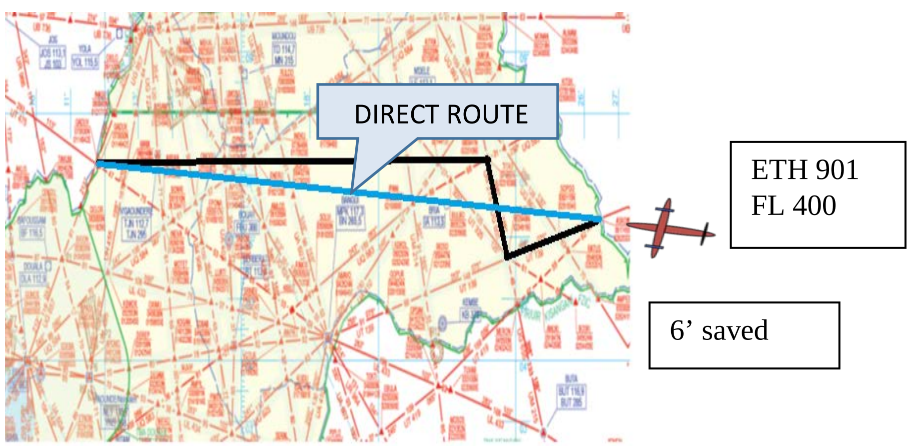

Figure 2: Direct Route between the points ASKON and GADUV, flown by ETH 901 with a time saving of 6 minutes

Figure 3: Direct Route between the points ONUDA et POGBA, flown by RWD 700 with a time saving of 2,5 minutes

g) On the basis of assumptions from Eurocontrol data relating to fuel consumption on the one hand, and the quantity of Co2 emitted per kg of fuel consumed by an aircraft on the other hand, each flight will save on average 200 kg (B737) to 900 kg (B777) during its operation in the Brazzaville FIR, thanks to Direct Routing supported by space-based ADS-B. This corresponds to a reduction in the quantity of Co2 emitted by each flight ranging on average from 630 kg (B737) to 2800 kg (B777) in the Brazzaville FIR.

4. ACTION BY THE MEETING

The Meeting is invited to:

a) take note of the information in this document;
b) encourage ANSPs, airport operators as well as all the other actors concerned in the implementation of CNS / ATM projects, to consider the assessment of a carbon footprint in the planning of these projects