Regional Focus



Future of Air Navigation in Africa Part 2

Friday 12 February 2021 14:00 – 16:30 CAT



Ms. Boni Dibate

Director Africa Affairs

CANSO



Mr. Tefera Mekonnen Secretary General

AFCAC



Mr. Stephen Creamer Director, Air Navigation Bureau ICAO



Global ATM Strategies for Africa

Grasping the Future Today

male



Vision: Achieve the sustainable growth of the global civil aviation system



17 February 2021



Summarizing the Chicago Convention A'LICENSED' PERSON (Annex 1) FOLLOWING 'THE RULES OF THE AIR' (Annex 2) UTILIZING 'THE METEOROLOGICAL SERVICES' (Annex 3) AND 'AERONAUTICAL CHARTS' (Annex 4) AND THE PROPER 'UNITS OF MEASUREMENT' (Annex 5) **'OPERATING'** ACCORDING TO ANNEX 6 WITH A'REGISTERED' (Annex 7) AND **'AIRWORTHY' (Annex 8)** AIRCRAFT; CROSSING BORDERS AND AVAILING HIMSELF OF THE 'FACILITATION' OF ANNEX 9



Summarizing the Chicago Convention

HE USES THE 'AERONAUTICAL TELECOMMUNICATIONS' (Annex 10)

TO CONTACT THE 'AIR TRAFFIC SERVICES' (Annex 11)

FOR SEPARATION OF HIS AIRCRAFT FROM ANOTHER AND

WILL HOPEFULLY NOT NEED 'SEARCH AND RESCUE' (Annex 12).

HE WILL DRAW WISDOM FROM THE WORK

OF THE 'ACCIDENT AND INCIDENT INVESTIGATION' (Annex 13) TEAM.

BEFORE TAKE-OFF FROM AN 'AERODROME' (Annex 14)

HE WILL HAVE USED THE 'AERONAUTICAL INFORMATION SERVICES' (Annex 15)

17 February 2021



Summarizing the Chicago Convention

HE WILL DEPART IN AN **'ENVIRONMENTALLY' (Annex 16)** ACCEPTABLE AIRCRAFT

BEEN 'SECURITY' CHECKED (Annex 17) AND

ANY **'DANGEROUS GOODS' (Annex 18)** HAVE BEEN PROPERLY DOCUMENTED.

AND FINALLY, WILL MITIGATE THE SAFETY RISK THROUGH PRACTICING

'SAFETY MANAGEMENT' (Annex 19)

ALLOWING THE INTERNATIONAL AVIATION SYSTEM

TO SUSTAIN ITS ENVIABLE SAFETY RECORD.



Aviation Development

ICAO is also actively engaged in fostering aviation development, which refers to a wide range of infrastructure, human resources, training, and related assistance and capacity-building activities.





Leaving 'No Country Left Behind'

The ultimate goal of these efforts is to realize a safe and efficient air transport foundation in a given State, consistent with ICAO's Standards and Strategic Objectives. This helps to ensure that <u>all</u> States and Regions have the opportunity to realize the significant socio-economic benefits of safe and reliable air transport services.



UNITING AVIATION

Relationship with industry

In addition to fostering cooperation between world governments, ICAO also provides a forum where airline, airport and air navigation services operators, aircraft and avionics manufacturers, pilot and controller associations, and other industry groups, can contribute to the development of new air transport guidance and procedures.



25 February 2019

New Entrants, Diverse Needs, Global Challenges







Delivering in rural vs urban environments







Safe, secure co-existence







A NEW ERA IN AVIATION

- Technology and information
 - Full connectivity

"ANYTHING THAT CAN BE CONNECTED, WILL BE CONNECTED"





The Global Air Navigation Plan (GANP)



- Strategy to achieve a global interoperable air navigation system offering safe, secure and efficient air transport for people and goods worldwide, while limiting the impact of aviation on the environment.
- The GANP serves as a worldwide reference to transform the air navigation system in an evolutionary and inclusive manner so that no State or Stakeholder is left behind.



Evolving Standardization

- Innovation starts on the flight deck, at the control position and on the tarmac
 - People using the tools are the first to know how they can be improved





Going back to the roots...

- An Aviation System Block Upgrade (ASBU) contains
 - Intended **Operational Improvement** / Metric to determine success
 - Necessary Procedures / Air and Ground
 - Necessary Technology / Air and Ground
 - Regulatory Approval Plan / Air and Ground
 - Positive *Business Case* per Upgrade
 - Well *understood* by a Global Demonstration Trial
 - All synchronized to allow initial implementation
 - Won't matter when or where implemented



ICNSS project - Challenges and Way Forward



Benefits for States, SMOs, and the aviation industry





Mr. Louis Bakienon Director of Air Navigation Operations ASECNA



Mr. Adikiny H Olwenge Manager Air Traffic Services and PBN Expert KCAA



Mr. Carl Bollweg President, ALPA-SA IFALPA Regional Vice President AFI South Region



Ms Joyce Asante Director, Air Traffic Safety Engineering Ghana CAA



Mr. Louis Bakienon Director of Air Navigation Operations

ASECNA





ASECNA perspectives on Future of Air Navigation services in Africa

Contents

- A-SBAS programme
- Perspectives on GBAS
- Wrap-up

Louis BAKIENON ASECNA - Director operations

A-SBAS programme Need for CAT-I operations

2011-2015 [IATA annual review 2016] CFITs = 20% of fatalities, most of them occurring in the approach/landing phase and being often associated with imprecise approach

< 20 % of runways ends ILS equipped

Operational and safety limitations of LNAV and Baro-VNAV operations



SBAS as the cost-effective solution in complement to ILS



A-SBAS programme Feasibility of SBAS services

- Perturbations of GPS and GAL signals propagation due to specific dynamic of the equatorial ionosphere
- SAGAIE project (from 2013):





- Dedicated network of GNSS stations to collect data from core constellations
- Ionosphere characterisation: analysis of scintillations and plasma's bubbles
- Development of dedicated SBAS correction algorithms and processing set
- SBAS emulation using representative SBAS test platform

Feasibility of SBAS services provision in compliance with ICAO SARPs demonstrated, including during high ionosphere activity



A-SBAS programme Services provision plan

SBAS for Africa & Indian Ocean (A-SBAS) = ICAO SP identifier n°7

- Step 0:Pre-operational / open service (L1, L5) (effective
since 2020)
- Step 1:(L1) services from 2024 for en-route/NPA, APV-1(DH/250 ft) and CAT-I (DH/200 ft) operations
- Step 2:(DFMC) services beyond 2028/2030 for CAT-I auto-
land operations and potentially further

Compliance with ICAO SARPs

Complementing existing navigation services (ILS, NPA...)

A-SBAS programme Coverage & performances



APV-1 availability (L1) - 2024

En-route/NPA availability (L1) - 2024

A-SBAS programme Pre-operational service (since Sept. 2020)



« SBAS can revolutionise navigation for the approach phase »

Capt. Patrice Moevi

« SBAS means flight safety through approaches with minima equivalent to ILS CAT-I everywhere at all times »

Capt. Zouel Bayli





PRN 147

A-SBAS programme Users

- Flow of events is directing towards SBAS introduction over the world as baseline operations
 - SBAS benefits today widely acknowledged by airspace users
 - Exponential development of SBAS services in the world
 - Impact of regulations (e.g. EU PBN regulation)
 - · Forward-fit and retrofit solutions more and more available at lower cost
 - Growing number of airlines operating having integrated or, planning to integrate SBAS in their navigation strategy, based on their own assessment of the positive benefit/cost ratio
- Aircraft operators not yet interested in SBAS will not be penalized:
 - Existing navigation (conventional/GNSS) services will continue to be delivered
 - No mandatory equipage will be applied
 - No additional air navigation charges due to A-SBAS services
 - Airlines are strongly invited to attend the flights demonstrations based on SBAS/LPV

Perspectives on GBAS R&D activities in ASECNA



R&D (since 2012)

- Capacity building on GBAS for ASECNA area
- Proof Of Concept based on technical and operational assessment
- Development of GBAS approach procedures at Dakar airport
- Early studies on iono impact
- Participation in global standardization meetings: ICAO/SG, LATO, IGWG



Perspectives on GBAS An enabler for CAT-I, and for CAT-III in the future

- GBAS enables CAT-I operations (GAST-C service)
- First SARPs (L1) since 2001, 20 years later status:
 - deployed in Russia, through specific stations
 - In most other countries, limited deployment observed at this stage, operational in few airports
- . GBAS will enable CAT II-III operations (GAST-D service)
- SARPs (L1) effective since 2018
- First aircraft certified for GAST-D operations planned to fly in 2022
- GAST-C and GAST-D (L1) services to be demonstrated as feasible in Iowlatitude (equatorial) regions due to ionospheric conditions
- GBAS will enable **CAT-III operations**, including in low-latitude conditions (**GAST-F service**)
- SARPs (DFMC) in progress, expected 2030
- GAST-F (DFMC) service expected... 2035



Wrap-up





Mr. Adikiny H Olwenge Manager Air Traffic Services

KCAA

Contents.

- Current use of GNSS
- Benefits so far
- Future use of GNSS
- Challenges



• Current use of GNSS:

- AFI GNSS strategy and relationship to PBN,
- General Considerations (Safety, accuracy, evolution, advantages)
- Functionalities,

 $_{\odot}$ Short Term 2008-2013: (GNSS as primary means for en-route Navigation and NPA, preparation for SBAS),

 Medium Term 2013-2017: (GNSS approved as a sole-means of Navigation for enroute, TMA and APV SBAS in

North Africa)

o Long Term 2017 and beyond:where are we?

MAGAD XAKRI VAKRI VAKRI VAREMA AREMA VITATA VITATA VITATA

Proliferation of user preferred direct routings across EAC



Improved trajectories between cities (Safety, Efficiency, Environment)



Facilitate operation in the UPR (RNP4 NAVSPECS)



Optimize climb profile by allowing continuous climb operations



Minimize engine thrust, optimize on airspace utilization and stabilize approach



Reduce flight time and CO₂ emission, optimize flight profile, improve safety and lower ANSP implementation costs

Offering APV procedures and enabling CDO leading to a decrease in the number of CFIT occurrences. Thus increasing Safety.



Reduce decision height at airport hence reducing number of delays, Diversions and cancellations



SBAS expected to improve ADS-B enabling accurate aircraft positioning and better route optimization.



Withdrawal of some conventional NAVAIDS (VOR and NDB), harmonized PD



Reduced maintenance of ground-based navigation aids



Access to remote aerodromes/ airstrips for GA (tourism, security, administration)

• Future use of GNSS:

- Long Term Strategies (2017 and beyond):
- where GNSS is an enabler to GANP/ASBU-PIA of:
- Airport Operations (optimization of approach procedures including vertical guidance)
- Optimum Capacity and Flexible Flights (Improve operations through enhanced en-route trajectories)
- Efficient Flight Path (Improve flexibility and efficiency in departure and descent profile)

• Future use of GNSS:

- Enroute Navigation especially at regional level.
- SBAS/GBAS augment GNSS in terms of accuracy and integrity.
- $_{\odot}$ Use of SBAS for CAT I/II approaches
- Use of GBAS to support CAT I/II/ III landing operations.
- Optimize use of already available technology (Data-link, ADS-B) to facilitate use of PBN NAVSPECS.
- $\circ~$ Will support TBO.

Challenges:

oInterference (microwave links with L1 band)

Aircrafts need to be equipped with SBAS receivers

 Re-defining airport procedures to support SBAS-based approaches.





Mr. Carl Bollweg President ALPA - SA

IFALPA Regional Vice President AFI South Region

Future of Air Navigation in Africa An IFALPA / ALPA-SA Perspective

SCOPE

1. Definition Recap

2. IFALPA Vision for Future Air Navigation







DEFINITIONS RECAP

- 1. GNSS. Global Navigation Satellite System
- 2. PBN. Performance Based Navigation
- 3. RNAV. Area Navigation
- 4. RNP. Required Navigation Performance
- 5. RNP-AR. Authorisation Required
- 6. GLS. GBAS Landing System





Global Voice of Pilots



IFALPA'S VISION FOR FUTURE NAVIGATION

- 1. ICAO's Role.
- 2. Government's Role.
- 3. Regional / National ANSP's Role.
- 4. The Aviation Industry's Role.
- 5. IFALPA'S Role.







IFALPA VISION STATEMENT

- **1. Global Consideration**
- 2. Safety Performance Indicator
- 3. ATM Considerations
- 4. Role of Human vs Automation
- 5. Training









Ms Joyce Asante Director, Air Traffic Safety Engineering

Ghana CAA

PRESENTATION OUTLINE

- Introduction
- Conventional Navigational Aids
- Future Navigational Technologies -Global Navigation Satellite System (GNSS)
- Limitation of GNSS
- Augmentation Systems
- GBAS and its Benefits
- SBAS and its Benefits
- What Ghana is Doing
- Conclusion
- Questions and Answers



INTRODUCTION

There is rapid growth in Air Transportation globally - said to double every fifteen years.

✤Need to match demand in growth with capacity.

- There is the urgent need to deploy Systems to support the growth.
- A fully harmonized global air navigation system built on modern performance-based procedures and technologies is a solution to the concerns of <u>limited air traffic capacity</u> and <u>unnecessary gas</u> <u>emissions.</u>

CONVENTIONAL NAVIGATIONAL AIDS

- All navigation and approach aids (NAVAIDs) must meet the requirements of accuracy, continuity, availability and integrity specified to each phase of flight.
- The conventional NAVAIDs may not be able to provide the required capacity to meet the increasing growth in Air Traffic in our Airspaces as well as adverse weather.
- Can not guarantee preferred flight levels and resulting fuel and time savings

FUTURE AIR NAVIGATION TECHNLOGIES

Global Navigation Satellite System (GNSS):Term used to describe any constellation of satellites :

with global coverage;

*transmitting time signals to receivers (GNSS receivers);

Receivers use these signals to determine their <u>position</u>, <u>velocity</u> and the <u>local time</u> at their specific location.

LIMITATION OF THE GNSS - LOCATION ACCURACY

One major limitation of a GNSS core constellation is that, in its raw state, it cannot be trusted for use in applications with stringent requirements in terms of the performance criteria discussed earlier.

- Ionosphere: inconsistency of ionospheric activity. Ionospheric error varies from day to day. Can cause errors of more than 20 meters.
- 2. Troposphere: Differences in humidity causes variable delay
- 3. Orbital errors: Satellites orbits are deviated due to gravitational forces.
- 4. Satellite clock errors.

AUGMENTATION SYSTEMS

- Augmentation of a GNSS is a method of improving the system's performance criteria such as accuracy, integrity, continuity and availability through the integration of external information into the calculation process.
- The Augmentation systems are generally named based on how the external information is generated and sent to the GNSS receiver of the end user.

AUGMENTATION SYSTEMS

- GNSS Augmentations are classified in three broad categories:
- 1. Aircraft-based (ABAS)
- 2. Ground-based (GBAS)
- 3. Satellite-based (SBAS)

AUGMENTATION SYSTEMS



GROUND BASE AUGMENTATION SYSTEM (GBAS)

- The current core constellation is unable to provide accuracy, availability, continuity and integrity to achieve precision approach. GBAS uses the concept of <u>differential corrections</u> to augment satellites signal in order to meet these requirements.
- GBAS provides augmentation to the core constellations to enable precision approach up to Category III.
- GBAS operation is based on 3 main segments:
- 1 Satellite constellation
- 2. Ground station
- 3. Aircraft receivers.

BENEFITS OF GBAS

- GBAS-optimised low visibility operations are primarily aimed at busy airports with capacity limitations as they facilitate runway throughput.
- Can support airports seeking to address noise issues.
- Reduce runway occupancy times;
- It is cost-efficiency: only one ground station is needed to service multiple approaches at different runway ends at one airport;

SATELLITE BASE AUGMENTATION SYSTEM (SBAS)



BENEFITS OF SATELLITE BASED AUGMENTATION (SBAS)

- Provides augmentation of coverage over large areas by using satellites to transmit augmentation information.
- reduce the risks associated with Controlled Flight Into Terrain (CFIT)
- improve the ability to land in a greater range of conditions such as low cloud cover and compromised visibility
- contribute to the reduction of delays, diversions and cancellations through improved Position, Navigation and Timing (PNT).

WHAT GHANA IS DOING

- Ghana currently has ground based Navigational Aids such as: VORs /DMEs and Instrument Landing Systems (ILS).
- As part of plans to migrate from purely ground based systems, we have fully implemented Performance Based Navigation (PBN).
- We appreciate the benefits of deploying the Future Air Navigation Technologies such as GBAS and SBAS, however work is ongoing to clearly identify the operational requirement in our Airspace and Aerodromes (Our National Air Navigation Plan)which would inform the decisions on which of the technologies to deploy.

SOME GROUND-BASED



CONCLUSION

- ANSPs must determine their operational requirement looking at their current and projected traffic growth.
- Engage stakeholders i.e., Airlines to access the readiness of their fleet for new technologies.
- ANSPs must prioritise the needs of their unique Airspaces, making safety a key consideration



Mr. Jeoffrey Matshoba Executive ATM/CNS Planning and Standards

ATNS



Mr. Jeoffrey Matshoba ATM/CNS Planning and Standards ATNS



Mr. Gawie Bestbier Executive Aviation Infrastructure SACAA



Mr. Louis Bakienon Director of Air Navigation Operations ASECNA



Mr. Adikiny H Olwenge Manager Air Traffic Services and PBN Expert KCAA



Mr. Carl Bollweg President, ALPA-SA IFALPA Regional Vice President AFI South Region



Ms Joyce Asante Director, Air Traffic Safety Engineering Ghana CAA



Mr. Jeoffrey Matshoba Executive ATM/Cns Planning and Standards

ATNS



Ms. Boni Dibate

Director Africa Affairs

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Thank you

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