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AFI Air Navigation Report (AANR)

First Edition, November 2022

PREPARED BY THE SECRETARIAT OF APIRG WITH THE ASSISTANCE OF APIRG MEMBERS

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Contents

EXECUTIVE SUMMARY **5**
1. INTRODUCTION **5**
1.1. Objective **5**
1.2. Background **5**
1.3. Scope **6**
1.4. Organizational Structure of the APIRG **8**
1.5. Traffic Overview **9**
1.6. Structure of the Report **12**
2. REGIONAL AIR NAVIGATION PRIORITIES, TARGETS AND ACHIEVEMENTS **13**
2.1. Abuja Safety and Air Navigation Targets **13**
2.1.1. Implementation status of the Abuja Targets 13
2.1.2. The Revised Abuja Safety and Air Navigation Services Targets 14
2.2. ASBU Modules Categorization and Prioritization **15**
2.3. Airports Operations Planning (AOP) **16**
2.3.1. Aerodrome Certification 16
2.3.2. Aerodrome Infrastructure and Operations 17
2.3.3. Global Reporting Format for Runway Surface Conditions (GRF) 19
2.4. Air Traffic Management (ATM) **20**
2.4.1. AFI ATM Basic building blocks (BBB) 20
2.4.2. Performance – Based Navigation (PBN) 20
2.4.3. RVSM Airspace 22
2.4.4. PBCS 26
2.4.5. Free Routing Airspace (FRA) 27
2.5. Communications, Navigation and Surveillance (CNS) **32**
2.5.1. Aeronautical Fixed Service -ATS/DS 32
2.5.2. Aeronautical Fixed Service -AFTN/AMHS/ AIDC 32
2.5.3. Aeronautical Mobile Service HF & VHF coverage 33
2.5.4. Aeronautical Mobile Service CPDLC 34
2.5.5. Aeronautical Radio navigation Service 34
2.5.6. Aeronautical Surveillance Service SSR Mode S 34
2.5.7. Aeronautical Surveillance Service ADS-C &ADS-B 35
2.5.8. PBCS 35
2.5.9. Spectrum 35
2.6. Aeronautical Information Management (AIM) **37**

2.6.1. AIS Basic Building Blocs 37
2.6.2. Transition from AIS to AIM 38
2.6.3. Regional implementation initiatives 39
2.7. Aeronautical Meteorology (MET) 40
2.7.1. MET Basic Building Blocks 40
2.7.2. Key achievements in MET 40
2.7.3. Regional implementation initiatives are captured in Appendix 4 to this report. 41
2.8. Search and Rescue (SAR) 42
2.8.1. Search and Rescue System, the AFI regional development. 42
2.8.2. Regional SAR promotions and regional Survey 42
2.9. Aviation System Block Upgrades (ASBU) Implementation Status 45
2.9.1. AOP ASBU 45
2.9.2. ATM ASBU 45
2.9.3. CNS ASBU 47
2.9.4. AIM ASBU 47
2.9.4.1 AIM Applicable ASBU elements 47
2.9.5. MET ASBU 49
2.9.6. SAR ASBU 49
3. ENVIRONMENTAL PROTECTION 50
3.1. Air Navigation developments related to Environmental Protection 50
4. COORDINATION AND COOPERATION 51
4.1. Interregional Coordination 51
4.2. Coordination between APIRG and RASG-AFI 51
4.3. Air Navigation Services Providers Peer Review Initiatives 52
CANSO Africa ATM Safety Peer Review Initiative 54
5. INDUSTRY ACHIVIEMENTS AND INITIATIVES 55
5.1. Air Navigation Services Providers 55
***6.* CHALLENGES AND OPPORTUNITIES 64**
7. RECOMMENDATIONS 65

EXECUTIVE SUMMARY

The first Edition of the Africa Indian Ocean Planning and Implementation Regional Group Air Navigation Report (AANR) provides an overview of the traffic and forecast as well as the status of implementation of the regional air navigation plan and priorities. Planning on the status of implementation of the prioritized ASBU elements adopted by APIRG, in line with the 6th edition of the Global Air Navigation Planning, are provided. Furthermore, the report highlights some significant achievements at regional and national levels in the AFI region as well as key regional and interregional initiatives aimed at harmonizing efforts and sharing best practices on development and implementation of air navigation plans and projects. The report also underlines some environmental benefits of PBN implementation in the region and provides information on the challenges and opportunities as well as recommendations for the strengthening of the air navigation system in the AFI region.

1. INTRODUCTION

1.1. Objective

The first edition of the AANR presents an overview of the status of implementation of AFI regional air navigation plan with emphasis on the level of implementation of prioritized ASBU elements as adopted by APIRG. The implementation status data covers the forty-eight (48) AFI States despite challenges experienced in the collection of feedback from States.

This report provides detailed information on the performances achieved in Aerodrome Operations Planning (AOP), Communication navigation Surveillance (CNS), Air Traffic Management (ATM), Meteorology (MET), Aeronautical Information Management (AIM) and Search and Rescue (SAR). An emphasis is put on the main projects and activities carried out in each area and related outputs to show the progress made in the region towards the attainment of the Abuja safety and air navigation targets.

Some regional and interregional initiatives are highlighted in this report to showcase the benefits of collaboration and cooperation which should be perpetuated and extended to other aviation domains.

The report raises areas of challenges that required the attention of relevant stakeholders as well as opportunities that can be converted to effective solutions.

1.2. Background

The Assembly Resolution 38-02 agreed, amongst others, to call upon States, Planning and Implementation Regional Groups (PIRGs), and the aviation industry to provide timely information to ICAO (and to each other) regarding the implementation status of the GANP, including the lessons learned from the implementation of its provisions; and to invite PIRGs to use ICAO standardized tools or adequate regional tools to monitor and analyze in collaboration with ICAO the implementation status of air navigation systems.

APIRG/23 recalled the need to develop and publish the APIRG Annual Air Navigation Report by the Annual Air Navigation Reporting Team (AANRT) based on available information, and invited States and Organizations wishing to provide their contributions to submit them to the Secretariat by 31 December 2020. AANRT is comprised of core members from States, ANSPs and International Organizations, supported by the Chairperson and Vice-chairperson of APIRG and the ICAO Secretariat. The Team was encouraged to develop and release the first Report by 31 March 2021.

APIRG/24 Meeting tasked the Team to develop an annual report on the status of the air navigation system in the AFI Region based on available information, including the air navigation deficiency database, global/regional reports, survey results, studies, gap analyses, traffic forecast data and other relevant data and information.

APIRG/25 called on AANRT to complete the drafting of the report and circulate to States for review by 31 December 2022 so as to release the first edition by 31 March 2023.

1.3. Scope

The first edition of AANR provides detailed information on the status of implementation of AFI regional air navigation plan up to December 2022. It covers 48 AFI states.

- ✓ 24 Eastern and Southern African accredited States:
  Angola, Botswana, Burundi, Comoros, Djibouti, Eritrea, Eswatini, Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Rwanda, Seychelles, Somalia, South Africa, South Sudan, Uganda, United Republic of Tanzania, Zambia, and Zimbabwe.

- ✓ 24 Western and Central African accredited States:
  Benin, Burkina Faso, Cameroon, Cabo Verde, Central African Republic, Chad, Congo, Cote d'Ivoire, Democratic Republic of Congo, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea Bissau, Guinea, Liberia, Mali, Mauritania, Niger, Nigeria, Sao Tome & Principe, Senegal, Sierra Leone, and Togo.


AFI Air Navigation Region
Mauritania
Mali
Niger
Chad
Eritrea
Djibouti
Cape Verde
Senegal
Gambia
Guinea Bissau
Guinea
Burkina Faso
Nigeria
Ethiopia
South Sudan
CAR
Somalia
Sierra Leone
Liberia
Côte D'Ivoire
Ghana
Togo
Benin
Cameroun
Uganda
Kenya
Congo
DRC
Gabon
Rwanda
Burundi
Tanzania
Seychelles
São Tomé et Principe
Guinée Equatorial
Comoros
Angola
Zambia
Malawi
Reunion
Mauritius
Zimbabwe
Mozambique
Namibia
Botswana
Madagascar
Swaziland
South Africa
Lesotho

1.4.Organizational Structure of the APIRG

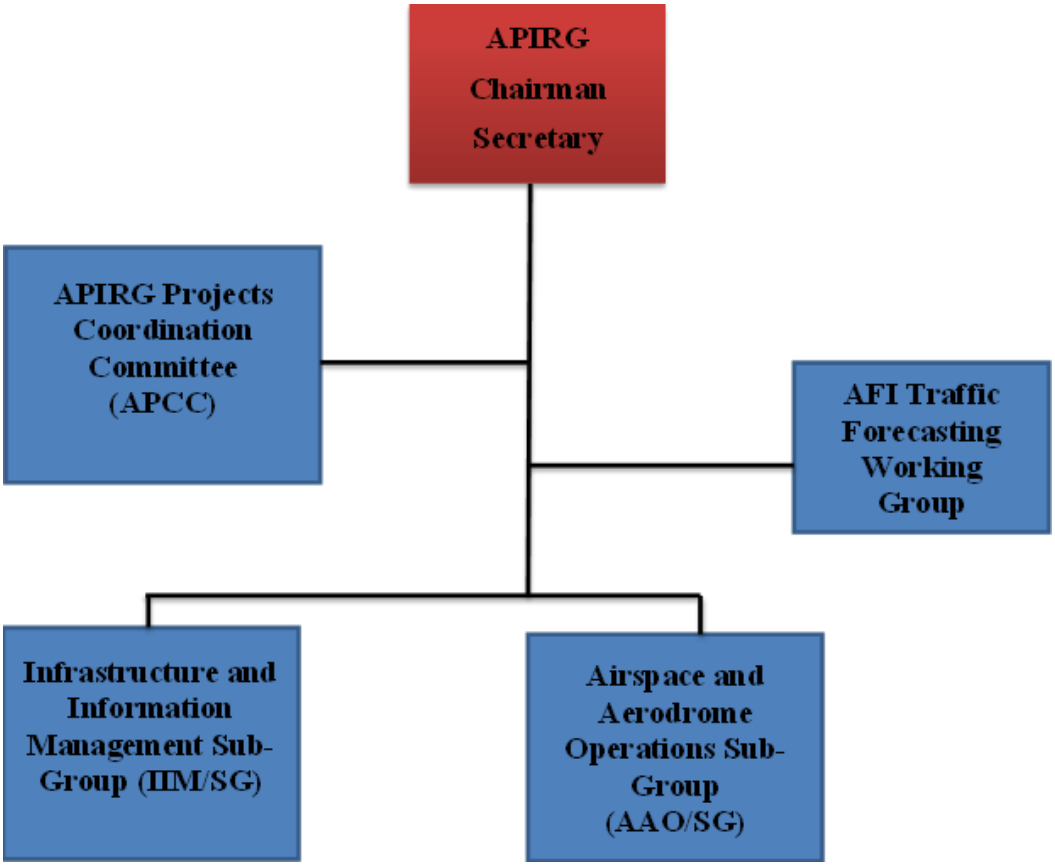


Figure 1 -APIRG Organizational Structure

1.5. Traffic Overview

1.5.1. Africa Air Passenger Traffic Outlook

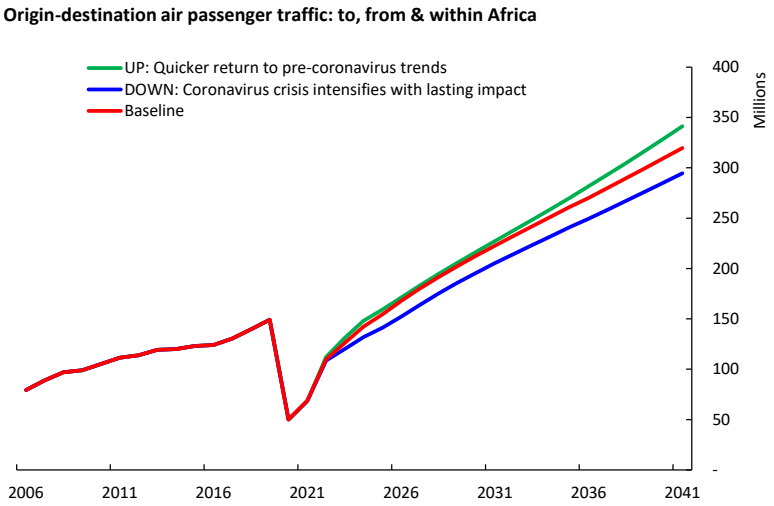
- Over the next 20 years the number of airline passengers travelling to, from and within Africa is expected to more than double, and possibly triple from 2022.

- Current trends in the economy and aviation policy look set to deliver a passenger market back to its 2019 level by 2025 and will reach 2.9x as large as 2022 in 20 years forecast horizon (the red line in Chart 1).

- Even on the downside scenario, where coronavirus crisis intensifies with lasting impact (the blue line in Chart 1), the underlying drivers of air travel in Africa are projected to bring the number of passengers back to pre-pandemic level by 2026, and to more than double passenger traffic in 2022 by the end of 2041.

- On the upper side, if a quicker return to pre-coronavirus trend is to be realized, then air passenger markets could more than triple in size (the green line in Chart 1).

Chart 1. Air passenger traffic to, from & within Africa forecast to more than double



Source: IATA/Tourism Economics 'Air Passenger Forecasts' September 2022

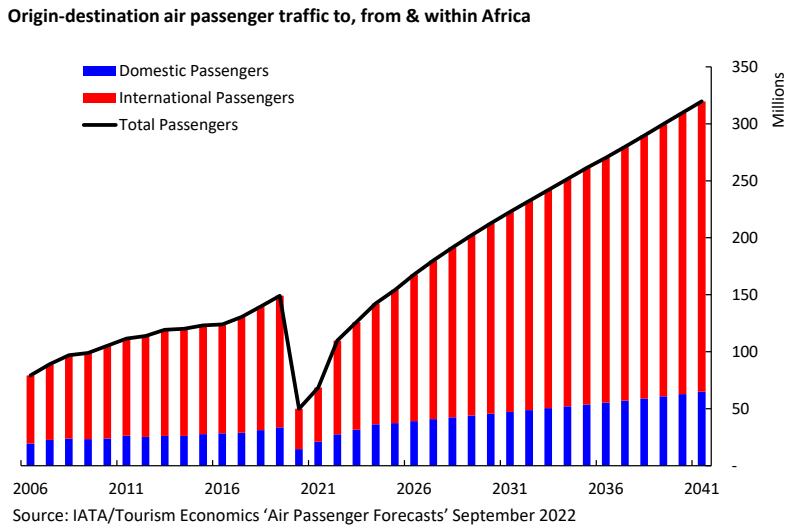
- In line with the post-pandemic recovery, the air passenger traffic is expected to rebound. Among them, domestic passenger traffic is expected to increase by 31% from last year, while international passenger traffic is expected to increase by 73%, buoyed by the recovery of global economy. Indeed, in the 20-year forecast horizon, international air passenger traffic is expected to lead the growth, whose share in total air passenger traffic is expected to reach 80% (Chart 2).

- On the country level, South Africa is expected to recover to pre-pandemic level in 2024 and is expected to reach 2.9x as large as 2022 in the next 20 years. Other large markets

including Egypt and Morocco in North Africa will also more than double from 2022, while Algeria will rise to four-folds as large in the forecast horizon (Chart 3). The four countries cover more than half of the total Africa air passenger traffic. Most of the Sub-Sahara Africa countries are forecasted to recover to pre-pandemic levels between 2024 and 2026, except that Congo Republic expected to recover earlier than its peers by 2023 (Chart 4 and Table 1).

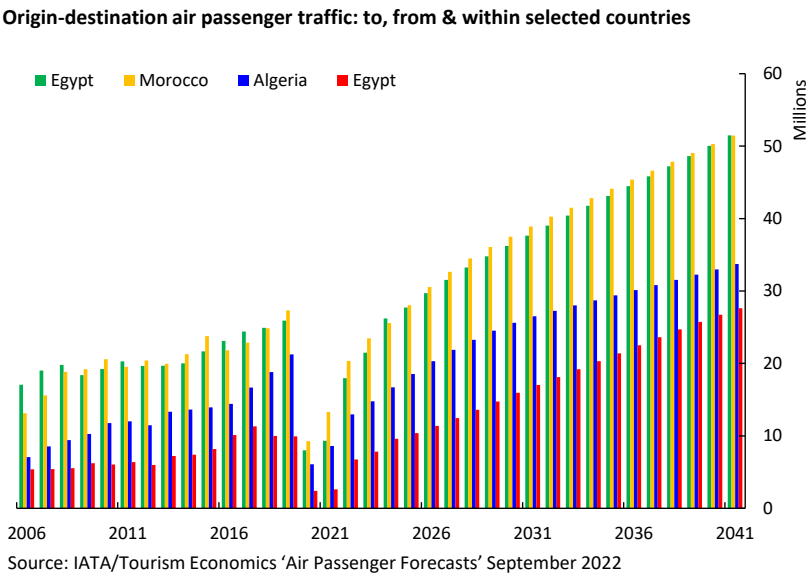
- The increase in air service connections between cities in Africa and to major cities outside the continent will bring both value to consumers and economic development, through the resulting flows of trade, investment and tourism.

Chart 2. International passengers leading the growth in total air passenger traffic



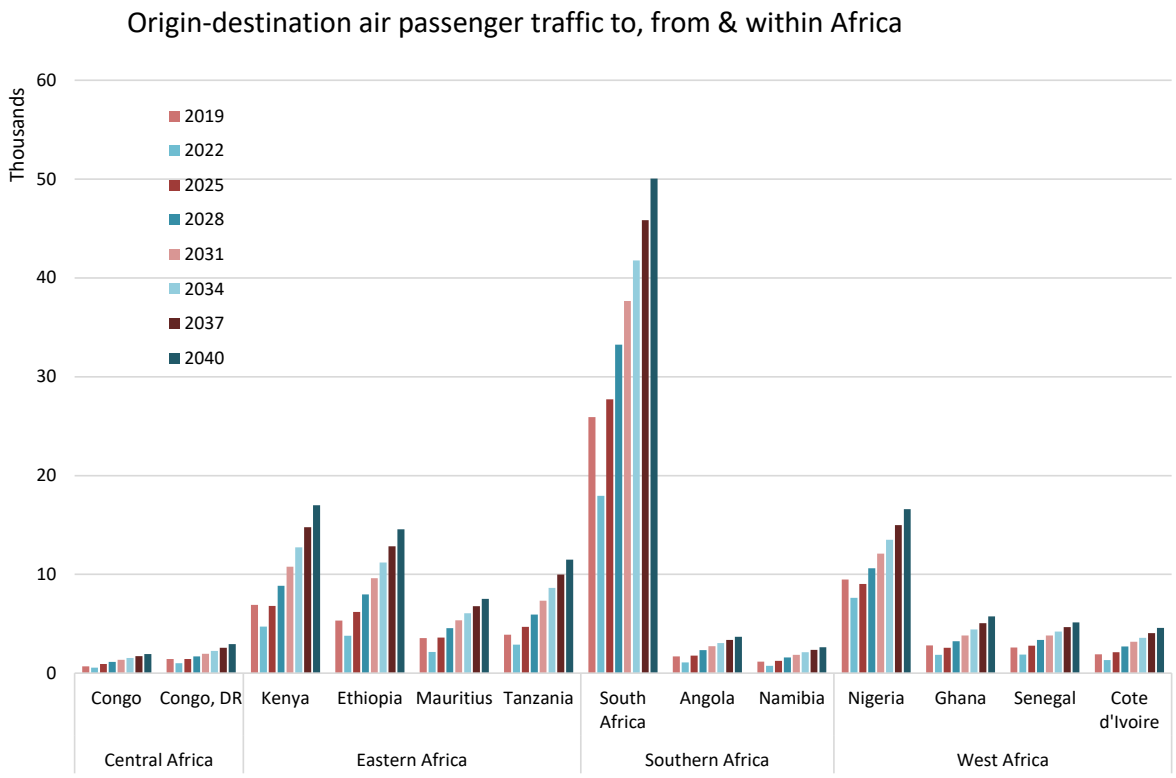
Source: IATA/Tourism Economics 'Air Passenger Forecasts' September 2022

Chart 3. Major North Africa markets expected to more than double in the next 20 years



Source: IATA/Tourism Economics 'Air Passenger Forecasts' September 2022

Chart 4. Major Sub-Sahara Africa markets expected to more than double in the next 20 years



Source: IATA/Tourism Economics Air Passenger Forecasts' September 2022.

Table 1. *Table 1. Year to recover to pre-pandemic levels for Sub-Sahara Africa countries.*

		Year to recover to pre-pandemic levels
Central Africa	Congo	2023
	Congo, DR	2025
Eastern Africa	Kenya	2026
	Ethiopia	2024
	Mauritius	2025
	Tanzania	2024
Southern Africa	South Africa	2024
	Angola	2025
	Namibia	2024
West Africa	Nigeria	2026
	Ghana	2026
	Senegal	2024
	Cote d'Ivoire	2024

1.6. Structure of the Report

This Report highlights air navigation activities that have been deployed in the AFI region for the recent past years. It is structured in six parts, each providing insightful information and data in all air navigation components.

Section 1 provides information on regional air navigation achievements with a recall of the Abuja safety and air navigation targets and priorities.

Section 2 exposes the environmental impact of air navigation development in the region, with focus on the implementation of PBN and free route airspace.

Section 3 gives an inside on interregional and regional cooperation and coordination such as APIRG and RASG-AFI coordination and the ANSP peer review initiatives.

Section 4 sets light on some AFI states initiatives in the domain of air navigation.

Section 5 provides a summary of challenges and opportunities in AFI region with regards to air navigation.

Section 6 contains some recommendations for improvement of air navigation system in the AFI region.

2. REGIONAL AIR NAVIGATION PRIORITIES, TARGETS AND ACHIEVEMENTS

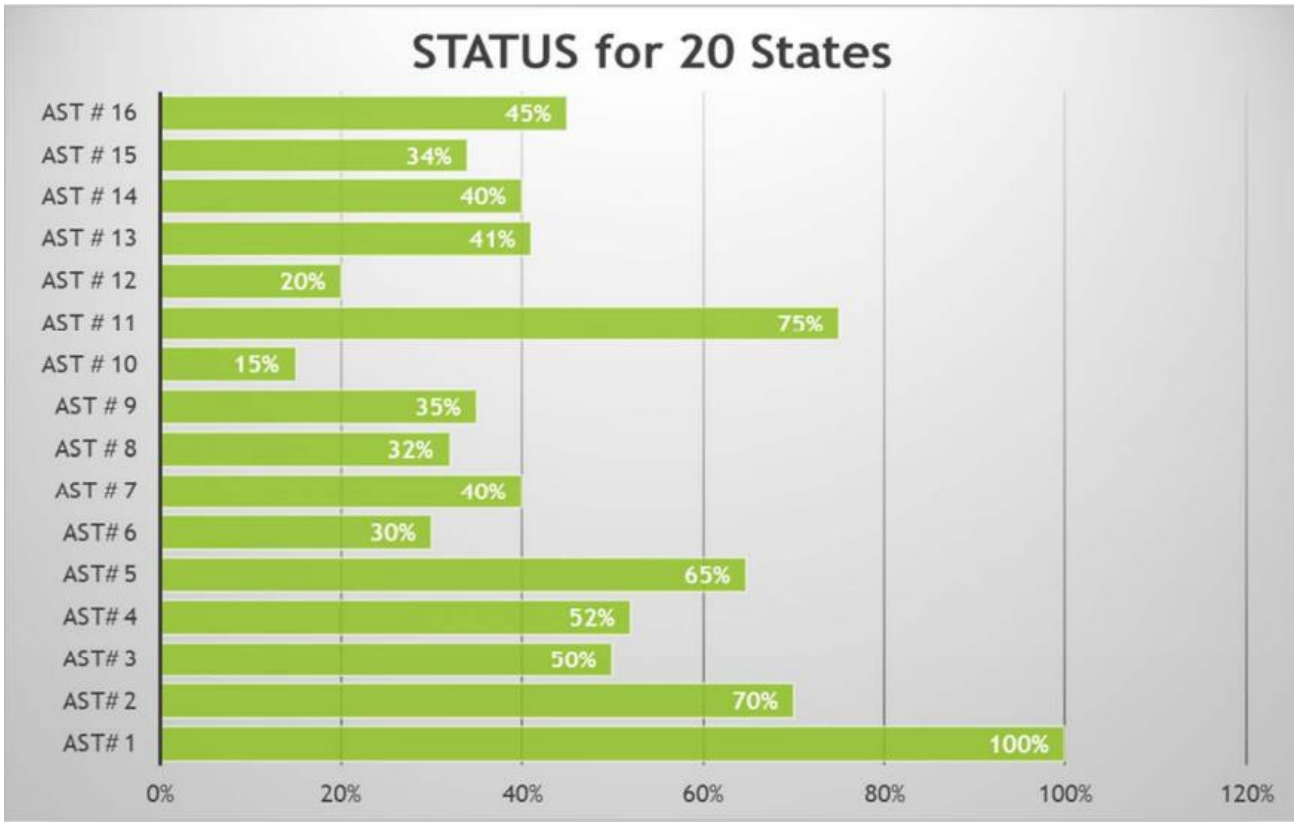
2.1.Abuja Safety and Air Navigation Targets

2.1.1. Implementation status of the Abuja Targets

2.1.1.1. Highlights on Status of Implementation

The qualitative analysis of available data was based on submissions by AFCAC Member States and supplementary data from IATA and ICAO iSTARS. This resulted in the observations summarized in below. The report on status of implementation of the Abuja Safety Targets for 2021 was summed up using baseline information provided by member States in for 2020 and additional information for year 2021 (*see* ***Figure 2*** *below*).

Figure 2: Status of implementation of the Abuja Safety Targets for December 2021.



Based on summed up points for each target, the average level of implementation for member States was **47%,** and this was below the target of 60%. This percentage point (47%) was the same compared to 2020 performance, since member States could not do much in terms of systems upgrade due to low level of flights conducted as a result of COVID-19 pandemic.

Further analysis of the 2021 performance resulted in the following observations:

- African States average EI as at 31 December 2021 was **57.82%** compared to **56.64% in 2021 indicating** a positive marginal increase of **1.18%.**

- Comparatively low level of implementation of air navigation related targets (ASTs) : –

  AST # 14 – Implementation of ASBU B0 Modules – average **40%** (compared to the desired 60%)
  AST # 13 – Establishment of seamless Air Navigation Services in the AFI Region – average **41%**;

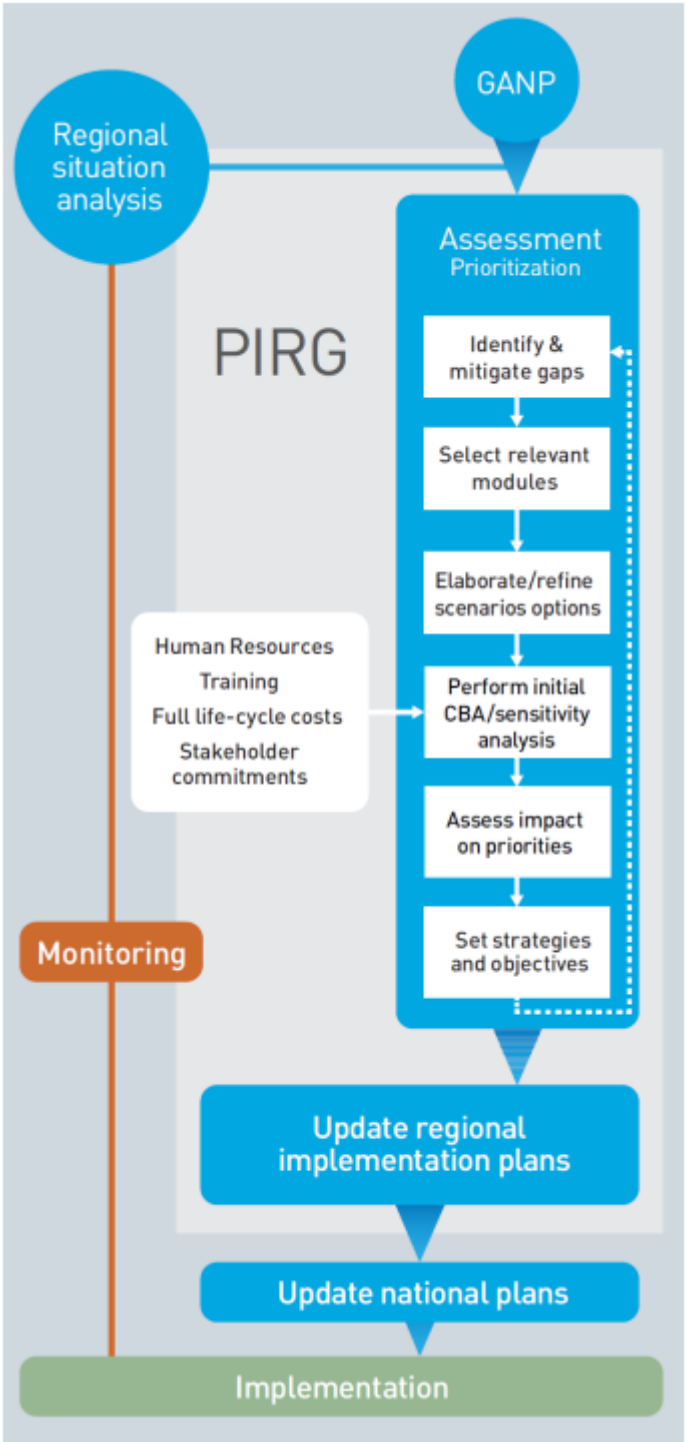
  AST # 10 – Implementation of the transition from AIS to AIM – average **15%**;
  AST # 11 – Implementation of the PBN procedures for all instrument runways – average **75%**.

2.1.2. The Revised Abuja Safety and Air Navigation Services Targets

The revised Abuja Safety and ANS Targets are captured in Appendix 1 to this report.

2.2. ASBU Modules Categorization and Prioritization

This taxonomy describes the process of selection and prioritization of ASBU elements applicable to the region as well as consequential amendments expected on the regional and national air navigation plans and implementation. The process was used to select ASBU elements applicable to the AFI region which are appended to this report.



2.3. Airports Operations Planning (AOP)





The AOP as a Subgroup is mandated by Airspace and the Aerodrome Operations Subgroup (AAO SG) of APIRG to carry out implementation projects in support of States areas of AOP in accordance with the ASBUs methodology and as guided by the regional performance objectives, to support States in the implementation of SARPs and regional requirement.

Various projects are currently being implemented under the ASBU framework such as Aerodrome Certification, Runway Safety while two more namely, ACDM and Training and Qualification of Regulators and Aerodrome personnel are under development.

The priorities of the AOP are to ensure implementation of the Project as well as specific related conclusions and decisions as guided in the APIRG Procedural handbook which require that:

AOP ensures environmental initiatives related to Airport Operations and Planning are consistently identified and progressed, and report outcomes on the initiatives appropriately; as well as identify and collect, State by State, information on deficiencies in the areas of AOP in accordance with the Uniform Methodology approved by Council and the APIRG guidance; analyze and propose solution; report on progress and obstacles beyond the capacity of the sub-group.

The AOP Subgroup aims to ensure that deficiencies at aerodromes are identified and addressed in a systematic manner and the identified modules on ACDM in accordance with the 6th edition of the GANP are implemented in all the AFI States Aerodromes.

2.3.1. Aerodrome Certification

Various initiatives have been undertaken under the No Country Left behind initiative to increase the Aerodrome Certification Status in the AFI Region. By June 2022, 44.4% (28 airports over 63) for ESAF and 28% (15 airports over 54) for WACAF. Some of the identified key challenges slowing down the progress of Aerodrome Certification in AFI are inadequate training and qualification of aerodrome experts, the cost of the certification activities, and organizational issues.

However, amid all these Zambia has made progress. After being assisted under the AFI Plan project to certify one international airport in Lusaka, the State has certified four more and built internal capacity to do so.

The ICAO ESAF Office has also conducted workshops to sensitize States on the need and Process for Aerodrome Certification. In May 2022, a workshop jointly organized by ICAO ESAF and CASSOA, hosted by Kenya saw ninety five (95) participants from the five East African States namely; Kenya, Uganda, Tanzania, Burundi, Rwanda and South Sudan participate in sharing experiences and best practices on aerodrome Certification. A similar State specific workshop was conducted by the ESAF Office for Uganda in August 2022.





Aerodrome Certification workshop participants at training venue and at the taxiway at Jomo Kenyatta International Airport- Nairobi KENYA during the workshop held in May 2022

The SADC States have organized an Aerodrome Certification workshop to be facilitated by the ICAO ESAF Office in January 2023 to be hosted by South Africa. Similarly, the ICAO ESAF Office and WACAF office held a Hybrid workshop in October 2022 for Cameroon and Djibouti under the AFI plan with experts from Senegal and Burkina Faso as Donor States.

2.3.2. Aerodrome Infrastructure and Operations

Zambia Constructed a new Green field international Airport in Ndola to replace the existing Ndola Airport. The New Simon Kapwepwe International Airport has gone through the five phases of certification and a PFA has been initiated to include the airport in the Air Navigation Plan.

Angola has recently upgraded the Runways, Taxiways and Apron at Luanda Airport and recruited more than one hundred and fifty Rescue Fire Fighting Service (RFFS) personnel who are getting trained on site by experts from Brazil. Angola is also in the process of acquiring new RFFS equipment with all the personnel recruited having been issued with Personal Protective Equipment (PPE) for RFFS purposes.





New Simon Kapwepwe International Airport in Ndola Zambia (Control tower and terminal building)

In 2020/2021 Uganda resurfaced the primary runway and extended the Apron at the Entebbe Airport and is in the process of installation of new signage.

The ICAO ESAF conducted from 16 to 19 August 2022 a workshop on Airport Master planning for Green Airports in Kigali (Rwanda), with the participation of the Civil Aviation Authority, Rwanda Airlines, Ministries of Environment, Ministry of Water and the State Military. This workshop aimed to provide knowledge and skills to the participants to effectively plan for the proposed new international Airport in Rwanda.



Expert from Zambia carrying out Aerodrome Certification assistance mission in Botswana

2.3.3. Global Reporting Format for Runway Surface Conditions (GRF)

The applicability date for GRF was 4th November 2021 after being extended by 1 year from 5th November 2020 due to COVID 19. States have rushed to ensure implementation of the GRF. By August 2022, the Status of implementation of GRF was at 29% for WACAF States and 55% for ESAF States. States have been urged to ensure full implementation of GRF and address any challenges that are hindering the progress.

2.4. Air Traffic Management (ATM)





2.4.1. AFI ATM Basic building blocks (BBB)

The AFI states have implemented the following BBB, which represent the essential services to be provided by them in accordance with article 28 of the convention on international civil aviation (Doc7300), in their airspaces and aerodrome on a case-by-case basis:

- **Air Traffic Services (ATS),** that includes Aerodrome control service, aerodrome flight information service, approach control service, area control service, and flight information service.
- **Airspace management,** which encompasses flight procedure design, ATS route structure, and airspace organization.

The ATFM is yet to be fully implemented in the AFI Region but, it is under consideration in the framework of the seamless airspace concept.

2.4.2. Performance – Based Navigation (PBN)

Performance Based Navigation (PBN) is one of the key enablers of some of the Aviation System Block Upgrade (ASBU) modules, namely APTA-B0/4 CDO, APTA-B0/5 CCO and APTA-B0/5 PINS.

The AFI states, under the APIRG /17 Conclusion 17/47, were required to develop the National PBN Implementation Plans (NPIP) in line with ICAO Assembly Resolution A36-23. The NPIP was to include implementation of PBN approaches, departure (SIDs) and arrival (STARs) flight procedures, as well as PBN routes. The SIDs and STARs were to incorporate Continuous Climb Operations and Continuous Descent Operations techniques commonly known as CCO/CDO.

2.4.2.1. The Abuja Safety Target Number 11

The Abuja Safety and ANS Target number 11 is on Performance Based Navigation (PBN). The Target required that all States implement PBN procedures for all instrument runways. It required:

- ✓ 75% of Instrument Runways to have PBN procedures by end of 2020;
- ✓ 100% of Instrument Runways to have PBN Procedures by end of 2025.

Available information indicated that 33 out of 48 RASG-AFI States attained target of 100 percent PBN implementation, representing 68.75 per cent. *(Source – ICAO iSTARS)*

As indicated by the results, although group average is high, a number of States have not initiated PBN procedures for their instrument runways. There is need for effective coordination

amongst key stakeholders and appropriate regional interventions are required to ensure effective implementation of this target.

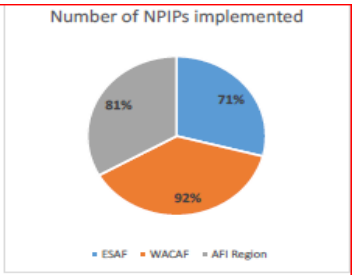
2.4.2.2. The African Flight Procedure Programme

The development of PBN in the AFI region has mainly been under the African Flight Procedure Programme (AFPP). A survey carried out under this programme indicated that a number of the AFI states had implemented PBN flight procedures without first developing the National PBN plan, raise concern as to the status of harmonized procedures in the region.

The tables and charts below provide the PBN implementation status in the AFI Region as of 23 August 2022. The figures are based on the list of international airports provided in the AFI eANPs. However, with regards to the PBN flight procedures, for some States, the figures can be improved by updating this list.

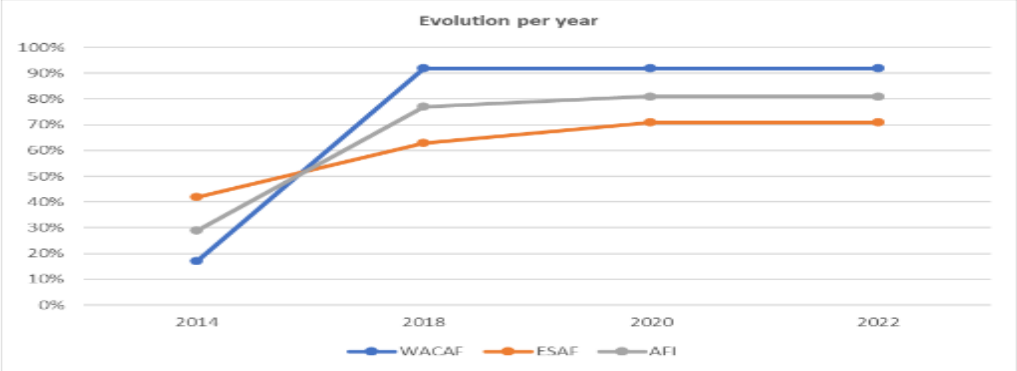
Figure 3 - National PBN plans implementation status

Reg. Office/Region	# States	# NPIPs
ESAF	24	17 (71%)
WACAF	24	22 (92%)
AFI Region	48	39 (81%)



Year	WACAF	ESAF	AFI
2014	17%	42%	29%
2018	92%	63%	77%
2020	92%	71%	81%
2022	92%	71%	81%

Figure 4 - Evolution since 2014



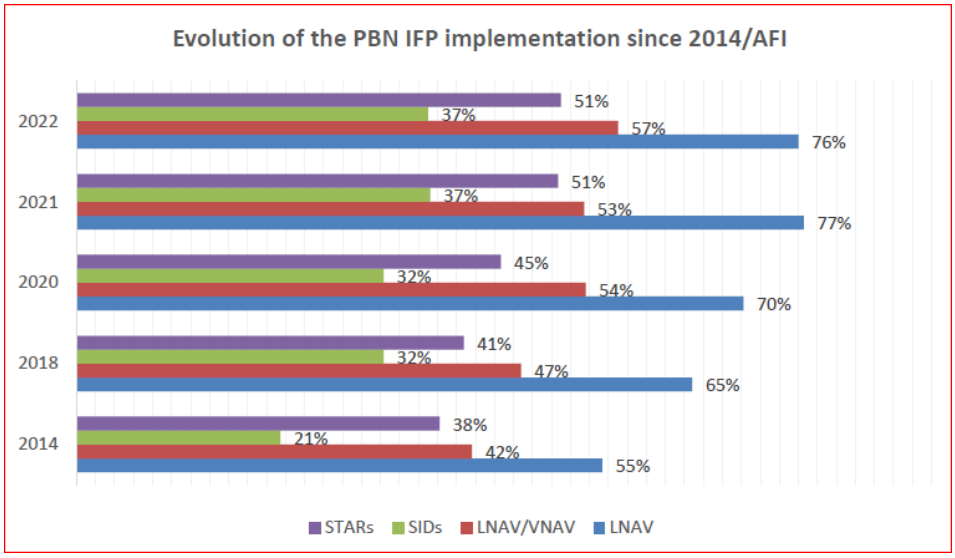
States that have not yet issued NPIPs in the AFI Region are Burundi, the Central African Republic, Djibouti, Eritrea, Eswatini, Guinea-Bissau, Lesotho, South Sudan and Zambia.

The table and chart below provide a snapshot of the PBN flight procedure implementation as of 23 August 2022.

Table 2. – PBN flight procedures implementation

Reg. Off.	# Inst. RWY	#RNP APCH	Baro VNAV	SID	CCO	STAR	CDO
ESAF	138	98	72	63	20	66	20
WACAF	90	75	59	22	06	51	08
AFI Reg.	**228**	**173**	**131**	**85**	**26**	**117**	**28**

Figure 5 - Instrument Flight procedures implementation



The following States have not yet implemented any PBN flight procedure for international airports:

a) ESAF: Burundi, Eswatini, South Sudan and Zimbabwe;
b) WACAF: Sao Tome and Principe.

> ***Note:*** *In Eswatini, Sao Tome and Principe and Cabo Verde, flight procedure design projects are ongoing.*

2.4.3. RVSM Airspace

A Reduced Vertical Separation Minima (RVSM) of 300 m (1000 ft) between FL 290 and 410 inclusive was safely and successfully implemented in the Africa-Indian Ocean (AFI) airspace on 25 September 2008. The AFI RVSM Post-Implementation Safety Case (POSC), a major deliverable by the AFI RVSM Safety Policy, a follow up from the AFI RVSM Pre-Implementation Safety Case (PISC), was accepted by APIRG/16 held in Rwanda 2007, it then forwarded to the ICAO Air Navigation Commission for consideration. It aimed to show by means argument and

supporting evidence that the on-going application of the ICAO RVSM concept in the AFI Region satisfies the key AFI RVSM Safety Objectives set out in the AFI RVSM Safety Policy.

The Africa-Indian Ocean Regional Monitoring Agency (ARMA) is the designated RMA for the provision of monitoring and safety assessment activities in 48 States. Canarias, Sal Oceanic and Dakar Oceanic FIRs were not included in the scope, as RVSM was implemented in this airspace ahead from the rest of the AFI Region, under the scope of South Atlantic Monitoring Agency (SATMA) which is responsible for providing post implementation safety assessment in that area. In 2014, Algeria made application to be accredited to the EUR RMA to join the States of Morocco and Tunisia. In 2018 the transfer process was completed and ARMA was responsible for the provision of monitoring and safety assessment activities for 27 FIRs.

The list of States and FIRs in the scope of ARMA is provided in *Appendix 2* to this report.

Figure 6: Summary of available data for AFI RVSM CRA 16 2021 submissions



Key:
Colours represent the following. ***Green:*** *information was available and could be successfully processed.* ***Black:*** *no data submitted (Eritrea and Malawi)* ***Red:*** *States part of the MIDRMA.* ***Blue****: States part of EURRMA*

The AFI Tactical Action Group (TAG) is a multidisciplinary group established under the authority of the ICAO Special AFI RAN 2008 aiming to carry out on-going safety assessment of operations in the AFI airspace above FL290 by addressing the identified problems in the air navigation system on a tactical, short-term basis. This includes the collection, compilation, discussion, classification, and directed action in relation to Unsatisfactory Condition Reports

(UCR). TAG concept encompasses all safety risk bearing events that are received from system users, ANSPs, pilots, air traffic controllers and/or the public.

The AFI TAG works in close coordination with the ARMA in the discharge of its duties. It contributed, from the provision of the data on reported safety occurrences (UCRs) and the unique and representative field of expertise of its members which include ICAO Headquarters in Montreal, WACAF and ESAF Regional Offices, ARMA, IATA, ASECNA, ATNS South Africa, Kenya, IFALPA and IFATCA. The ARMA Scrutiny Group was recommended by the ICAO Special AFI RAN 2008 under its Recommendation 6/6, in order to monitor and analyze operational errors and deviations in the AFI RVSM airspace and propose mitigation measures to control them. These include all RVSM incidents in the vertical plan and Large Height Deviations (LHD) data for incorporation into the various Collision Risk Assessments (CRAs).

States are sovereign and responsible for meeting their obligations in terms of the Convention on International Civil Aviation (Doc 7300) and in Annexes establishing international Standards and Recommended Practices (SARPs). In the RVSM context, such obligations include the operation of aircraft and operator approval processes, as per ICAO Annexes 2 and 6, and the provision of appropriate air traffic services in the airspace under their jurisdiction, together with the implementation and operation of State Safety Programme (SSP) and Safety Management System (SMS), as per ICAO Annex 11.

States are therefore, ultimately responsible for managing the safety of the on-going RVSM operations in their airspace. This responsibility includes the production of State-level post-implementation safety cases, as part of the ATS performance safety monitoring, and the reporting of operational errors and traffic data to ARMA. Where the responsibility for upper airspace has been delegated to Air Navigation Services Providers (ANSPs), the latter are responsible for carrying out their own RVSM post-implementation safety assessment as part of their SMS activity. States are responsible for overseeing this assessment in the framework of their State Safety Programmes (SSPs) activities.

As one of its core functions, the ARMA maintains the AFI Height Monitoring database and has a GMU Height Monitoring Service provider that monitors airframes that are restricted to AFI or that do not fly over the HMU installations in Europe. The AFI Height Monitoring plan is available on the ARMA website.

Over the 14-year period there has been a lot of improvements in the AFI Region regarding RVSM Airspace Safety Monitoring. States participation improved from only 14 out of 27 Flight Information Regions making Data Submissions to having 25 out of 27 Flight Information Regions submissions for the 2021 assessment year, to the increased population of RVSM Airspace Users and the compliance of ICAO Annex 6 Standard, Operation of Aircraft for Long Term Minimum Monitoring Requirements. ARMA has also developed a website which will assist users to have access to RVSM and Performance Based Communication and Surveillance (PBCS) information.

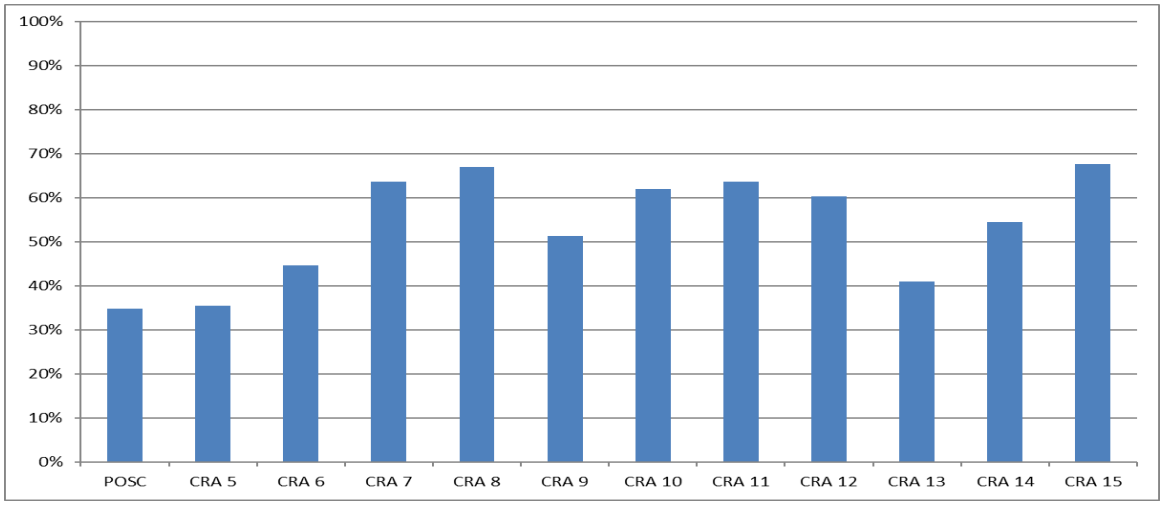


Figure 7: Histogram of the percentage of submitted and processed Form 4 data for the successive post-implementation CRAs under AFI RVSM

CRA	N_{az}^{total}	TOTAL VERTICAL TLS EXCEEDED BY A FACTOR OF
CRA 16 2021	16.6×10^{-9}	**3.3**
CRA 15 2020	71.9×10^{-9}	**14**
CRA 14 2019	10.9×10^{-9}	**2.2**
CRA 13 2018	75.4×10^{-9}	**15.0**
CRA 12 2017	58.6×10^{-9}	**11.7**
CRA 11 2016	36.4×10^{-9}	**7.3**
CRA 10 2015	141.2×10^{-9}	**28.2**
CRA 9 2014	63.7×10^{-9}	**12.7**
CRA 8 2013	31.4×10^{-9}	**6.3**
CRA 7 2012	8.0×10^{-9}	**1.6**

Figure 8: Ten-year comparison of the post-implementation CRAs under AFI RVSM

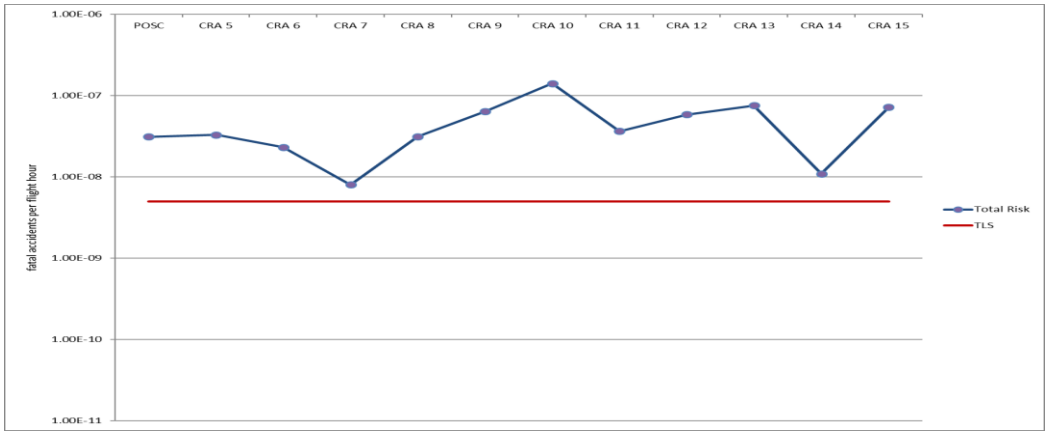


Figure 9: The total vertical collision risk estimates of the successive post-implementation CRAs on a normal scale (top figure) as well as on a logarithmic scale (bottom figure). The red horizontal lines indicate the TLS of ***5.0 × 10^{-9}*** *fatal accidents per flight hour*

Challenges

The AFI region continue to face a number of challenges related to RVSM, these include:

- ✓ Full Implementation of Strategic Lateral Off-Set Procedure (SLOP) in the AFI region is still pending, five States are yet to implement SLOP in their respective flight information regions.
- ✓ State-level practices and procedures related to the handling of non-RVSM civil aircraft in RVSM airspace require improvement; States need to put in place mechanisms for ensuring the monitoring at state level.
- ✓ That States' discipline with regard to RVSM approvals and traffic flow data reporting through ARMA operating procedures should be improved, some States still have challenges submitting all the 12 months data of the assessment year.
- ✓ Continuous compliance with Annex 6 for Long Term Minimum Monitoring Requirements. Some States have 0% compliance while there are States like Togo, Seychelles, Senegal and Eswatini with 100% height monitoring compliance levels for all their RVSM operating airframes which are registered in the AFI and Global RVSM Database.
- ✓ Most States still struggle with the use of F2 form; use of the new endorsed RVSM/PBCS form should be encouraged as only 4 out of 48 States fully utilizes the new F2 forms.
- ✓ An updated list of RVSM Focal points remains a challenge; correct focal point for each of the 48 AFI States require to be updated and maintained.
- ✓ Skill/Knowledge transfer; when changes are made to the National Project Managers (old NPM to new NPM), knowledge is often not transferred.
- ✓ Reporting fatigue, number of reports on RVSM events have reduced, it is not necessary an indication of no events have occurred but it could be the lack of a Just Culture and reporting fatigue because of the same occurrence with no corrective/mitigating actions taken by States.
- ✓ Trans-regional Large Height Deviation (LHD) especially at the intersection with the MID region (Eritrea, Ethiopia, Djibouti, Somalia and Yemen) remains a major challenge.
- ✓ As the AFI Height Monitoring processes are valid, States/CAAs and aircraft operators must comply with the applicable height monitoring requirements, many are still not doing so.
- ✓ Lack of Policies to guide States on how to handle RVSM and PBCS non-compliance.
- ✓ Meeting of the ICAO RVSM Target Level of Safety (TLS) **5 X $10^{-9,}$** this remains a major challenge as the implementation of SLOP and collection of 100% RVSM data is yet to be realized.

2.4.4. PBCS

2.4.4.1.Objective

The performance-based communication and surveillance (PBCS) concept provides objective operational criteria to evaluate different and emerging communication and surveillance technologies, intended for evolving air traffic management (ATM) operations. The PBCS also provides a framework in which all stakeholders (regulators, air traffic service providers, operators, communication service providers (CSP), and manufacturers) continue to collaborate in optimizing the use of available airspace while identifying and mitigating safety risks.

2.4.4.2.PBCS implementation in the AFI Region

Performance-Based Communication and Surveillance (PBCS) implementation in the Africa-Indian Ocean region (AFI) is still under development. Although some AFI registered aircraft operate in regions where PBCS is implemented mainly across the Atlantic into the Americas, the number of AFI States which have established the approval process are few.

The Twenty Second Meeting of the AFI Planning and Implementation Regional Group (APIRG/22) held in Accra Ghana, on 29 July 2019 – 2 August 2019, formed Conclusion 22/12 with regards to the establishment of the AFI Performance-Based Communication and Surveillance (PBCS) Monitoring. Performance-Based Communication and Surveillance (PBCS) operational approvals for Required Communication Performance (RCP) 240 and Required Surveillance Performance (RSP) 180 will be required for the application of reduced horizontal separation standards within portions of the Africa -Indian Ocean Region. At implementation, Aircraft operators need to obtain approvals from the appropriate State Authority/State of Registry to qualify their CPDLC performance against RCP240 and their ADS-C performance against RSP180. These approvals will allow them to indicate eligibility in their flight plans to use the reduced horizontal separation standards PBCS implementation in the Africa-Indian Ocean Region.

The AFI Regional Monitoring Agency (ARMA), along with the other RMAs around the world, are assisting the PBCS implementation with regards to collecting and maintaining the additional approvals, as well as supporting reports of aircraft with observed poor performance. The established lines of communication between States and RMAs is the most efficient and effective mechanism for Air Navigation Service Providers (ANSPs) that have identified performance issues to communicate with the States of operators throughout the world. Once State Authorities have these policies in place, they should start providing the RCP240 and RSP180 approval information to the ARMA along with the RVSM approval information. Information required to process and maintain PBCS approvals is detailed in the attached ARMA **Form F2 "Record of Approval to Operate in AFI RVSM and PBCS Airspace."** The PBCS approval information should be provided to the ARMA with the RVSM approval information.

There have been concerns identified regarding the readiness of State Authorities to have policies in place to issue the necessary approvals. All State Authorities that currently issue RVSM approvals should assess whether their operators that are using data link will require RCP240 and RSP180 approvals. States that have started issuing RCP/RSP Approvals are Malawi, South Africa, Ethiopia and Tanzania. Survey forms (see Appendix 3 to this report) were developed to provide guidance to States in order to enable them confirm their status of implementation.

2.4.5. Free Routing Airspace (FRA)

2.4.5.1. Introduction to AFI Free Routing Airspace (FRA)

The Global Air Navigation Plan, under ASBU Block 1 envisions improved operations through

optimized ATS routing with the introduction of free routing in defined airspace, where the flight plan is not defined as segments of a published route network or track system to facilitate adherence to the user-preferred profile.

2.4.5.2. Rationale for Free Routing Airspace (FRA) in the AFI Region

The APIRG 22 Conclusion 22/36 on free routing airspace encourages States with the potential to implement free routing, to incorporate the FRA concept into their national airspace concept and ATM master plan in line with B1-FRTO ASBU module.

The goal of creating the AFI FRA is to allow flight plans to be filed with a significant part of the intended route specified by the user-preferred profile. Maximize on the possibly freedom to be granted within the limits posed by the other traffic flows, with the overall benefits intended to reduce flight time, fuel consumption and CO2 emissions.

The AFI FRA will allow the AFI States / ANSPs to overcome the efficiency, capacity and environmental issues facing aviation and its full efficiency benefits will only be achieved if it is deployed over most of the continental AFI airspace, while acting appropriately to reduce its safety risks.

ICAO GANP advocates for application of FRA at Regional or sub regional level. The geographical extent of the airspace of application should be large enough; significant benefits arise when the dynamic routes can apply across flight information region (FIR) boundaries rather than imposing traffic to cross boundaries at fixed predefined points.

2.4.5.3. Progress made by the AFI Free Route Airspace Project Management Team (AFI FRA PMT)

The APIRG 22 Conclusion 22/36 led to the creation of the AFI FRA PMT whose main task is to guide and support states and the region in the implementation of FRA.

Since inception in 2019, the AFI FRA PMT has developed the first Edition and subsequent Second Edition of the AFI FRA Concept of Operations (AFI FRA CONOPS). The development of the FRA CONOPS 2nd Edition mainly addresses the standardization of FRA airspace publication.

The PMT also completed the translation of the FRA CONOPS 1st edition to French language, as well as conducted an AFI FRA gap analysis to determine the level of readiness by the AFI States for implementation of FRA.

2.4.5.4. Results of the Gap Analysis

Areas of focus in the analysis

As is informed by the Concept of Operations (AFI FRA CONOPS), the key enablers for

implementation of FRA were considered in the evaluation of the States' readiness in implementation. The six areas of focus were; *Surveillance, Communication, Coordination, Navigation, Safety nets and Airspace procedures.* The region's presentation of results are captured in Appendix 4 to this report. These areas of focus were weighted based on their application to FRA as shown below:

Criteria	Weights
VHF	10
CPDLC	8
HF	7
Space Based infrastructure (GNSS)	8
Ground Based infrastructure (VORs)	5
Ground Based infrastructure (DMEs)	5
ADS B (ground/space)	9
ADS/C	8
PSR	3
SSR	9
MLAT	4
Conflict Alert (STCA/MTCA)	6
Area Proximity Warning (APW)	6
Conflict Detection and Resolution (CD/R)	6
Monitoring Aids (MONA)	4
ATS/Aeronautical Message Handling System (AMHS)	8
Aeronautical Fixed Telecommunication Network (AFTN)	8
ATS Inter-Facility Data Communications (AIDC)-OLDI	6

Table 3. *Weighting of the facilities implemented by states.*

To ensure harmony in the implementation of the improvements required to realize FRA and eventual realization of the regional application of FRA, the PMT resolved to organize cluster meetings to deliberate further on requirements as well as develop State level action plans.

The three clusters are Western and Central Africa, Southern Africa and the Eastern Africa regional clusters. These clusters have held virtual meetings to review the gaps identified, develop and consider safety assessments at regional level and agree on the action plans.

The cluster meetings culminated in a face-to-face meeting held from 24-28 October of 2022, in Mauritius, to review the level of preparedness at regional level and agree on the implementation date as guided by the road map.

The AFI FRA Road Map as developed in 2019 and updated by the AFI FRA PMT at the fourth meeting (AFI FRA PMT/4) held on 25-28 October 2022 hosted by Mauritius

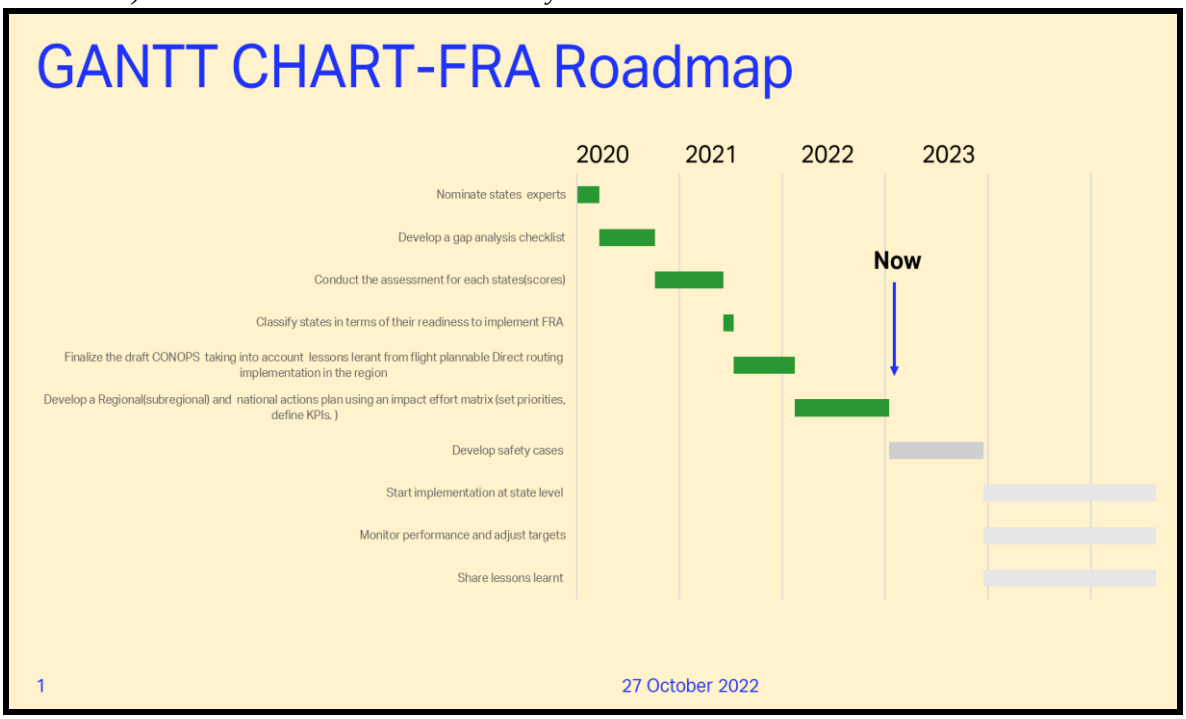


Chart 5 – AFI FRA Implementation Roadmap



The AFI FRA PMT at the Fourth meeting in Mauritius, 25-28 October 2022

The venue for the AFI FRA PMT/4 was selected based on the fact that Mauritius was a model State having taken the APIRG 22 Conclusion 22/36 to heart and implemented FRA in the oceanic airspace of the Mauritius FIR. During the workshop, the PMT had an opportunity to visit the Mauritius Area Control Center, to familiarize with newly implemented Mauritius FRA airspace operations.



2.5. Communications, Navigation and Surveillance (CNS)





2.5.1. Aeronautical Fixed Service -ATS/DS

In the area of Air traffic Service Direct Speech (ATS/DS), the pace of implementation of the AFI planned Circuits is satisfactory and up to **100%** thanks to the support offered by the satellite based VSAT Networks (AFISNET, NAFISAT, SADC/2 and CAFSAT). However, the performance of the service is to be improved since the components of some networks are ageing in an environment of lack of spare parts.

2.5.2. Aeronautical Fixed Service -AFTN/AMHS/ AIDC

In the area of aeronautical messages exchanges the pace of implementation of the communication infrastructure for AFTN is completed (100%) with regards to the AFI Air Navigation Plan except one circuit that is disconnected due to non-technical reasons. However, the region is still experiencing lack of operational messages such as Flights Plans, OPMETs and NOTAMs due amongst others to the technology obsolescence and operation procedures.

The implementation of Air traffic Message Handling Systems (AMHS) is ongoing although the pace has been slowed down in the COVID-19 environment. Lot of Air Traffic Services Units with AMHS capability continue to use AFTN gateways for the interconnection with neighboring centers.

The implementation of AIDC has been initiated and successfully conducted amongst some ANSPs in the AFI Region. Although ICAO Document 9694 provides clear guidelines for the implementation over AMHS of AIDC as a ground segment of the ATN the low pace of AMHS interconnection leads to AIDC implementation over the legacy AFTN.

The Status of implementation of AMHS and AIDC is presented in **the table below:**

Table 4. -Status of the implementation of AMHS, AIDC and VoIP

Number	States	AMHS	AIDC	VoIP	Remarks
1.	ANGOLA	✓			
2.	BENIN	✓	✓		AMHS node Registered at AMC
3.	BOTSWANA	✓			
4.	BURKINA FASO	✓	✓		AMHS node Registered at AMC
5.	BURUNDI				
6.	CAMEROON	❖	❖		IOT & POT testing on progress
7.	CABO VERDE	✓	❖		
8.	CENTRAL AFRICAN REPUBLIC	❖			IOT & POT testing on progress

9.	CHAD	✓	✓		
10.	COMOROS	❖			IOT & POT testing on progress
11.	CONGO	✓	✓		
12.	COTE D'IVOIRE	✓	❖		IOT & POT testing on progress
13.	DEMOCRATIC REP. OF THE CONGO		✓		
14.	DJIBOUTI				
15.	ESTWANI				
16.	EQUATORIAL GUINEA	❖			IOT & POT testing on progress
17.	ERITREA				
18.	ETHIOPIA	✓			
19.	GABON	❖			IOT & POT testing on progress
20.	GAMBIA				
21.	GHANA	✓	✓		
22.	GUINEA	✓			
23.	GUINEA-BISSAU	❖			IOT & POT testing on progress
24.	KENYA	✓			
25.	LESOTHO				
26.	LIBERIA	❖			
27.	MADAGASCAR	✓	✓		AMHS node Registered at AMC
28.	MALI	✓	✓		AMHS node Registered at AMC
29.	MAURITANIA	✓			AMHS node Registered at AMC
30.	MAURITIUS	✓	✓		
31.	MOZAMBIQUE	✓			
32.	NAMIBIA				
33.	NIGER	✓	✓		AMHS node Registered at AMC
34.	NIGERIA				
35.	RÉUNION (France)	✓			
36.	RWANDA	✓			
37.	SAO TOME AND PRINCIPE				
38.	SENEGAL	✓	✓		AMHS node Registered at AMC
39.	SEYCHELLES	✓			
40.	SIERRA LEONE	✓			
41.	SOMALIA	✓			
42.	SOUTH AFRICA	✓			
43.	SOUTH SUDAN				
44.	TOGO	✓	✓		AMHS node Registered at AMC
45.	UGANDA	✓			
46.	UNITED REPUBLIC OF TANZANIA	✓			
47.	ZAMBIA	✓			
48.	ZIMBZABWE	✓			

✓ Capability Implemented
❖ On-going project

VoIP: Not yet implemented.

2.5.3. Aeronautical Mobile Service HF & VHF coverage

The AFI region has implemented the AFI Air Navigation Plan provision for HF in particular for continental remote and oceanic air spaces. The implementation of satellite-based Networks has significantly the VHF coverage in friendly remote continental areas. However, the evolving security concern in particular in part of western and central Africa, led to the loss of remote extended VHF Stations resulting in the reduction of VHF capability.

2.5.4. Aeronautical Mobile Service CPDLC

CPDLC is implemented to supplement HF deficiencies and VHF unavailability in continental remote and oceanic airspaces. The pace of implementation in concerned FIRs in the AFI Region is satisfactory with **100%** of WACAF and 100% of ESAF concerned FIRs CPDLC capable and providing datalink service to equipped fleet.

2.5.5. Aeronautical Radio navigation Service

Aeronautical radio navigation service is provided in the AFI Region through the operation of conventional radio navigation aids (VORs, DMES and ILSs) and the Global Navigation Satellite System (GNSS) core and augmented.

The pace of completion of the implementation of Conventional NavAids is satisfactory with regards to the requirements of Recommendation 10/4 of the AFI/RAN 7th meeting on NavAids.

Core GNSS operation is ongoing for enroute operation and projects are being conducted for the implementation of SBAS. In this regard, AFCAC, with the assistance of ICAO conducted an independent Cost Benefit Analysis (CBA) for the implementation of SBAS in the Region

2.5.6. Aeronautical Surveillance Service SSR Mode S

Surveillance Secondary Radar (SSR) Mode S compatible have been implemented in compliance with the provision of the Recommendations of the 7th meeting of the AFI/RAN. In consideration of the overlapping of SSR Coverage, ICAO is promoting collaboration amongst Administration and Organization for surveillance data sharing.

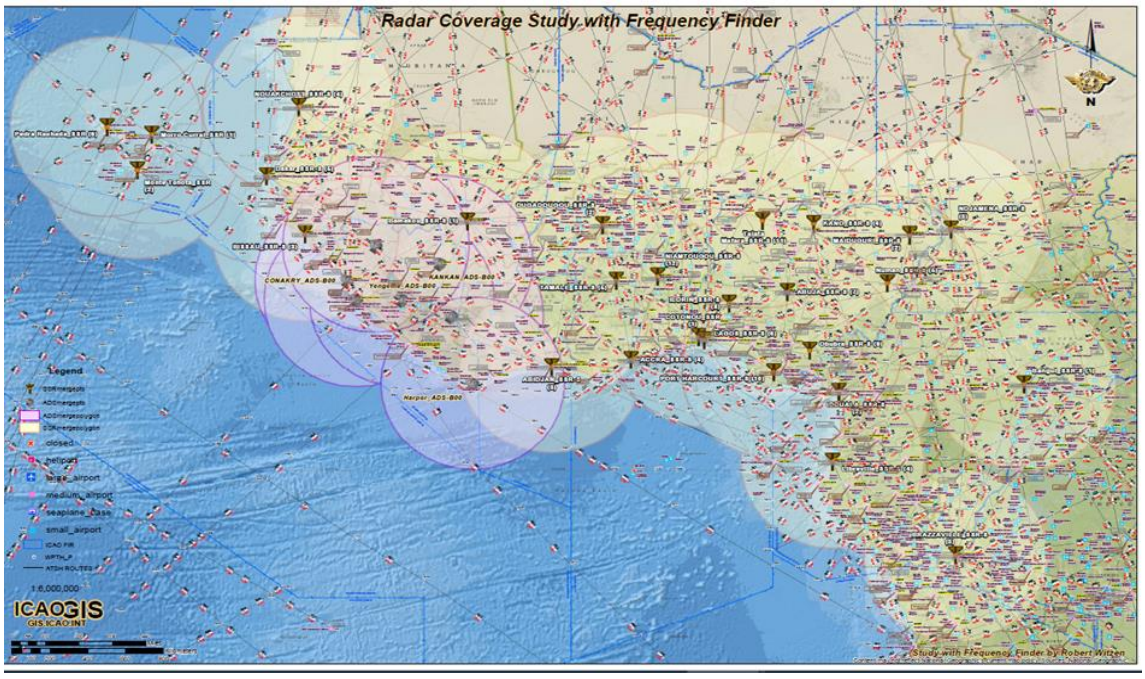


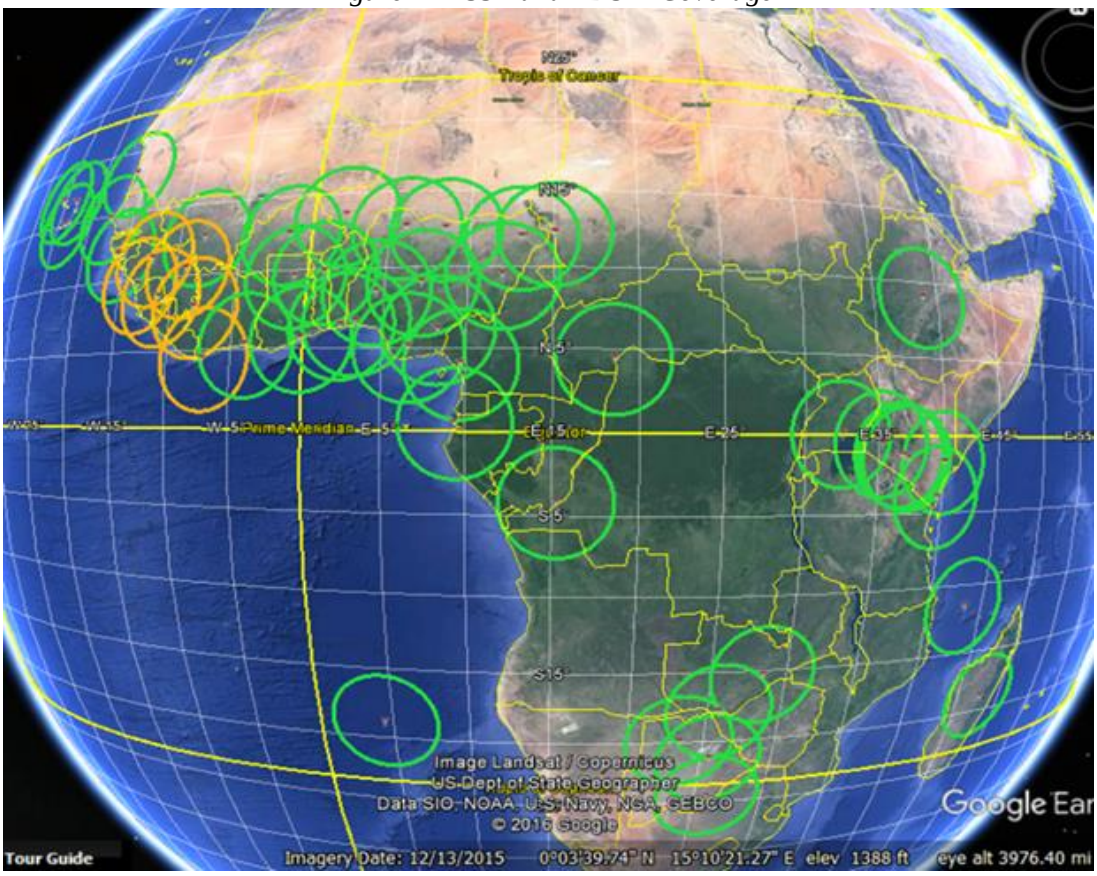
Figure 10 – SSR Mode S Coverage

2.5.7. Aeronautical Surveillance Service ADS-C &ADS-B

Automatic Dependent Surveillance by Contract (ADS-C) is generally co implemented with CPDLC for operation in continental remote and oceanic airspaces. In WACAF 8 FIRs out of 9 are fully ADS-C capable, the Roberts FIR is not operating ADS-C. In ESAF 8 FIRs out of 9 are ADS-C Capable.

The implementation of ground based Automatic Dependent Surveillance Broadcast (ADS-B) to complement SSR Mode S is ongoing based on regional requirements. The opportunity given by Space based ADS-B for extended coverage of all airspaces is taken into consideration by major ANSPs to improve surveillance coverage.

Figure 11 - SSR and ADS-B Coverage



2.5.8. PBCS

The implementation of Required Communication Performance (RCP-240) and Required Surveillance Performance (RSP-180) is at its starting phase. Although ARMA is tasked to conduct PBCS monitoring there is a need for an orderly and harmonized regional implementation Plan.

2.5.9. Spectrum

Aeronautical frequency spectrum protection is one of the concerns encountered in the AFI region where the Air Navigation Service are often subject to severe interferences on VHF operation. The emerging International Mobile Telecommunication (IMT) with the 5G remains the main threats

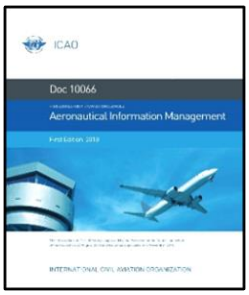
to the aeronautical spectrum in particular the 4200-4400 MHz C Band, the operated by aeronautical Radio Altimeters.

The frequency bands adjacent mainly used for downlinks from geostationary satellites operated by the AFI satellite VSAT based Networks may be also affected by the 5G.

The region is also encountering outstanding interference by FM broadcasting stations on Aeronautical VHF frequencies supporting air ground and radio navigation stations.

2.6. Aeronautical Information Management (AIM)







The object of the aeronautical information service (AIS) is to ensure the flow of aeronautical data and aeronautical information necessary for global air traffic management (ATM) system safety, regularity, economy, and efficiency in an environmentally sustainable manner.

The role and importance of aeronautical data and aeronautical information changed significantly with the implementation of area navigation (RNAV), performance-based navigation (PBN), airborne computer-based navigation systems, performance-based communication (PBC), performance-based surveillance (PBS), data link systems and satellite voice communications (SATVOICE). Corrupt, erroneous, late, or missing aeronautical data and aeronautical information can potentially affect the safety of air navigation.

To better ensure its important role, it has been necessary for the AIS to evolve globally to aeronautical information management (AIM).

2.6.1. AIS Basic Building Blocs

As part of the Basic Building Blocks framework, the following services are fundamental for the provision of all aeronautical information necessary for the safety, regularity, and efficiency of air navigation:

- Aeronautical Information Publication Service,
- Cartographic Service,
- NOTAM Service,
- Pre-Flight Briefing Service, and
- Post-Flight Briefing Service.

In the AFI Region, these services are ensured either by a Service Provider for individual States or by joint Agencies for groups of States. But the quality of the information provided through these services is still to be improved in the Region.

The following graphics illustrates the status of old and very old NOTAM yet to be solved respectively by ESAF and WACAF States, as of October 2022.

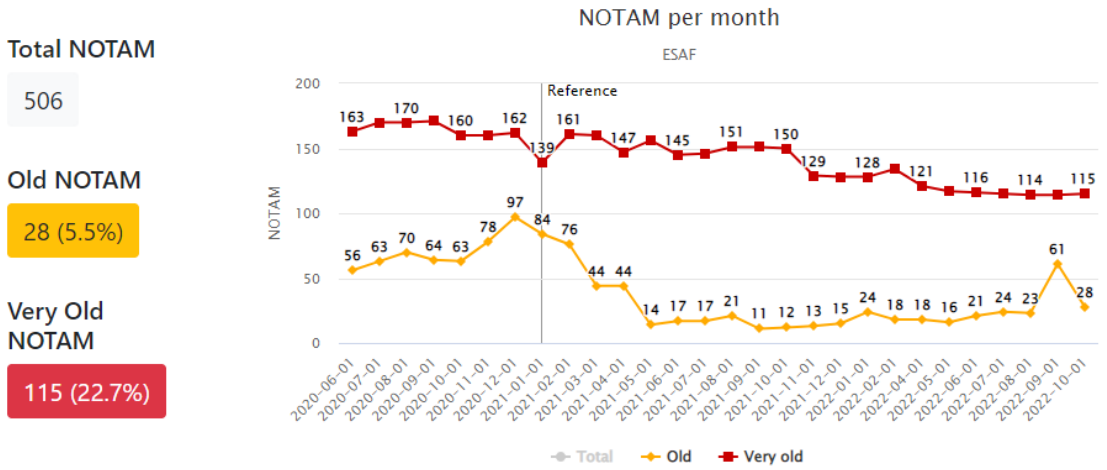


Figure 12 – Status of old and very old NOTAM for ESAF States

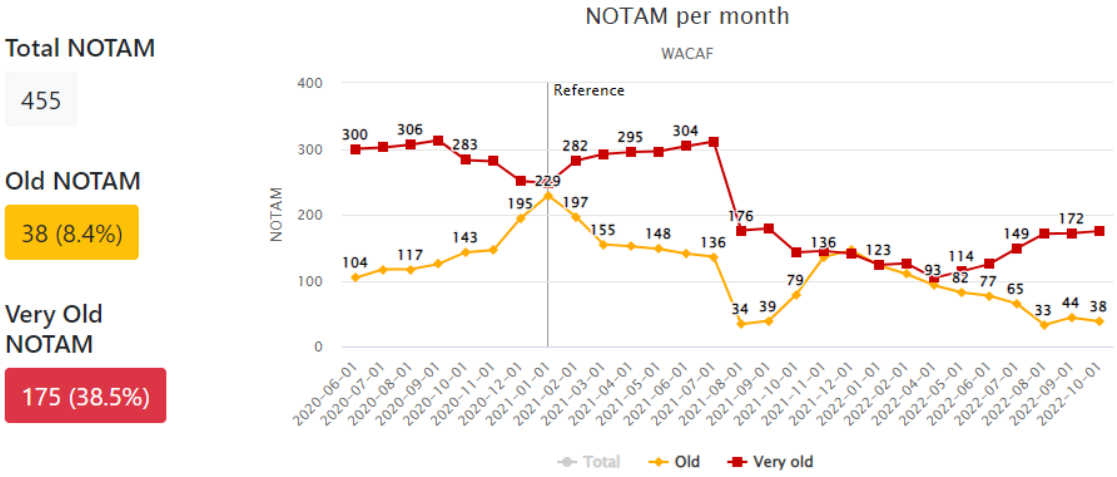


Figure 13 – Status of old and very old NOTAM for WACAF States

2.6.2. Transition from AIS to AIM

The transition from AIS to AIM introduces significant changes in the way aeronautical data and aeronautical information is processed and managed. Even though some of the principles remain the same, AIM is significantly different from traditional AIS. This transition introduces not only automation into the current paper-based environment, but also the required business transformation to make the change to a data-centric environment. The goal is to create and distribute quality assured aeronautical data and aeronautical information in digital form to satisfy the more stringent demands of an ever-increasing number of users.

AFI States are making efforts towards this transition. The graphic below shows the level of implementation of Quality management system and the Aeronautical Information Exchange Model

(AIXM) database which constitute the pillars for the provision of quality assured data-centric products and services.

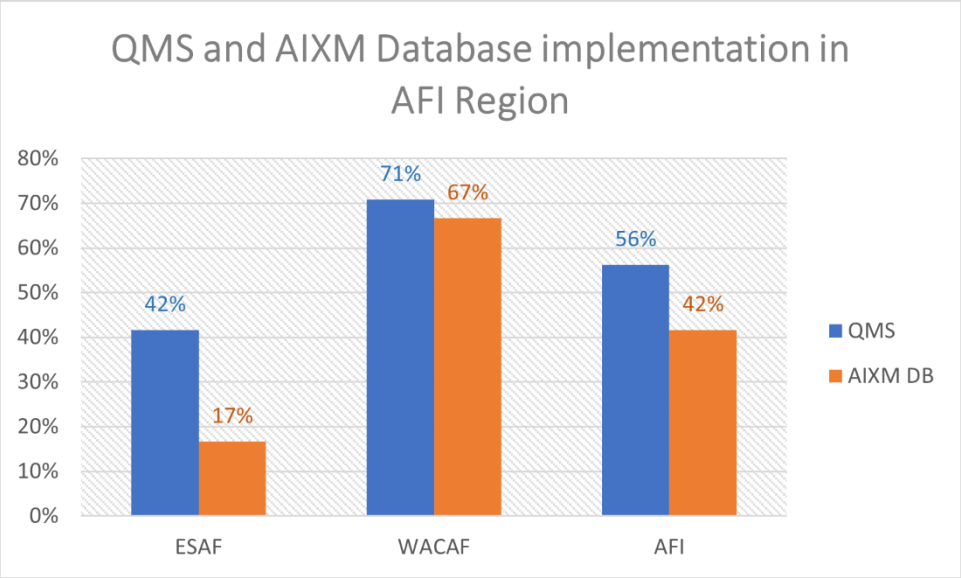


Figure 14 – Status of implementation of QMS and AIXM databases in AFI Region

2.6.3. Regional implementation initiatives

The AFI States and Services providers are making efforts to improve the aeronautical information services. However, the Region identified the need to leverage the various efforts through regional projects to foster the harmonized implementation of facilities and services. To this end, the AIM Result Based Implementation Support (AIM RBIS) project was established in the framework of the AFI Plan to assist States in implementing Quality Management System (QMS), Aeronautical Information Exchange Model (AIXM) and digital Terrain and Obstacle Data (TOD). This project covers the ASBU elements DAIM-B1/1, DAIM-B1/2, DAIM-B1/3 and DAIM-B1/4.

Furthermore, two other projects were recently established under the APIRG project approach, to cover the implementation of the ASBU elements DAIM-B1/5, DAIM-B1/6 and DAIM-B1/7.

2.7. Aeronautical Meteorology (MET)

Storms & Misc.:		
	Squall	SQ
	Thunderstorm (thunder is heard or lightning detected, even if no precipitation)‡	TS
	Lightning	
	Funnel Cloud	FC
	Tornado or Waterspout	+FC
	Dust Devil (well developed)	PO
	Sand Storm	SS
	Dust Storm	DS





The objective of meteorological service for international air navigation is to contribute towards the safety, regularity and efficiency of international air navigation. This objective shall be achieved by supplying the following users: operators, flight crew members, air traffic services units, search and rescue services units, airport managements and others concerned with the conduct or development of international air navigation, with the meteorological information necessary for the performance of their respective functions.

2.7.1. MET Basic Building Blocks

The Basic Building Blocks (BBBs) in MET, so called essential services (ES) in MET consist of a set of MET services recognized by ICAO Member States as necessary to contribute for international civil aviation to develop in a safe and orderly manner, and as such, shall be provided in accordance with ICAO Standards. Any departures from complying with ICAO SARPs in providing the essential services result in a deficiency to be reported.

The following MET ES are fundamental to implement required minimum capabilities and facilities by States to fulfill the objectives of meteorological services for Air navigation as indicated above.

- Aerodrome weather services
- Services of the meteorological watch office
- World/Regional Center Meteorological Services

Not implementing the ES in compliance with MET related SARPs may result in air navigation deficiencies in MET field that may adverse safe operations of aircraft. To assist States in identifying and addressing potential safety risks related to MET deficiencies, a set of relevant Minimum Reporting Areas have been determined for MET and endorsed by APIRG/23 through the Conclusion 23/32.

2.7.2. Key achievements in MET

Key achievements include assistance to States through workshops, trainings, development of guidance materials and summarized in the following graphics.

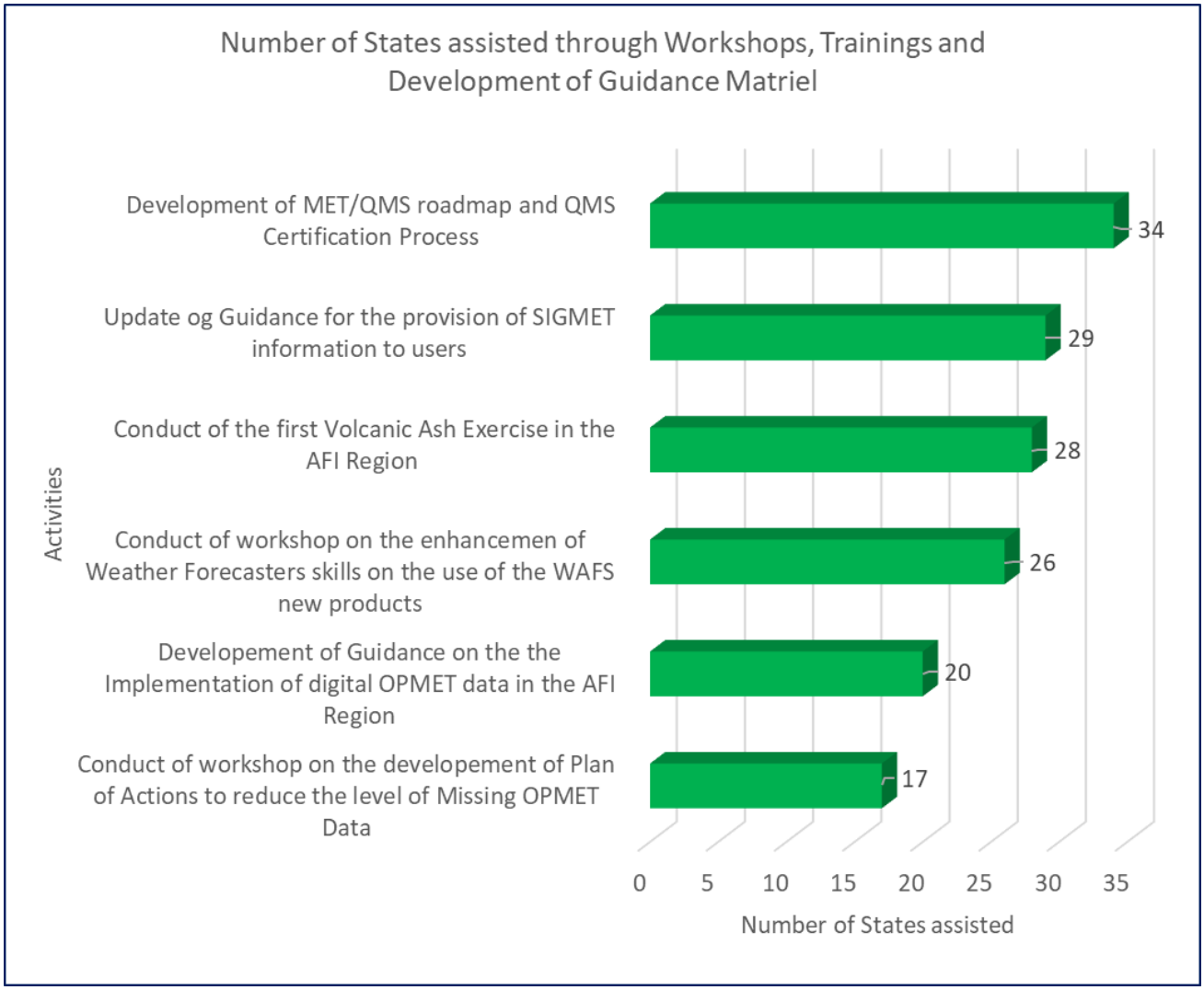


Figure 15: Key achievements in MET

2.7.3. Regional implementation initiatives are captured in Appendix 5 to this report.

2.8. Search and Rescue (SAR)





2.8.1. Search and Rescue System, the AFI regional development.

The need for the provision of effective Search and Rescue (SAR) services and regional collaboration to achieve same, have become important global agenda items following recent aircraft accidents and the challenges encountered in the provision of SAR. The development of the search and rescue system in the Africa-Indian Ocean region (AFI) have been slow, hampered with a lot of challenges both at national and regional levels.

In order to enhance the regional SAR system, a special group, AFI Technical Experts Team (TET), as support for the implementation of APIRG recommendations and global best practices was set up. The TET made up of technical experts from Cameroon, Cote d'Ivoire, Kenya, Mauritius, Senegal, South Africa, Togo and Uganda, and assisted by other experts from the region was tasked with the development of a regional plan. The membership of the AFI SAR Plan Project Team includes South Africa (Chairperson), Kenya, Uganda, ASECNA, Zambia, Mauritius and ICAO. This team has since developed:

i. The African – Indian Ocean (AFI) Regional Search and Rescue Plan, First Edition.
ii. The AFI SAR Agreement Template
iii. The AFI National SAR Plan Template
iv. The AFI SAR RCC Standard Operating Procedures Template.
v. AFI SAR Information Form and Questionnaire

2.8.2. Regional SAR promotions and regional Survey

The region has carried out promotional workshops in the area of Satellite Aided Distress Tracking System (SARSAT); the first workshop conducted by the Joint Workshop Group (JWG) on 15-16 September 2021, followed by two others hosted virtually by South Africa on 17-18 August 2022 and by WACAF Regional Office on 25-26 October 2022. These promotions have improved the level of registration with COSPAS SARSAT, as well as increased the numbers of notified SAR points of contacts (SPOC) at State level.

The region however continues to struggle with establishment of robust and effective SAR systems at State levels, thus SAR in the region remains a major concern. To improve this, the region

established a SAR project under the AFI Plan to assist the States in this field. To date 12 ESAF States and 16 WACAF States have been assisted through this project.

Whereas some States have National SAR Regulations in place and have developed National SAR Plans in accordance with the requirement of Annex 12, the implementation of these plans continue to be a challenge. ICAO and AFCAC carried out a survey to determine the level of implementation in 2018.. Out of the Targeted 53 states, report was received from only 30 States, representing 57% reporting.

Based on data collected as part of the AFI Plan project, twenty five (25) SAR agreements have been signed between States and 35 new draft agreements have been developed to either supersede old agreements or formalized cooperation where this has been lacking. Eight (8) States have developed National SAR Plans and two (2) States have draft National SAR Plans in place. *(Source: AFI Plan data - ICAO)*

Follow up workshops were carried out by ICAO to build capacity at State level in 2019, 2020 and 2021. Minimal improvement was realized, the results for 2021 are indicated in the Table below:

Table 5. *SUMMARY OF AFI STATUS OF STATE IMPLEMENTATION OF SAR*

FI: Fully Implemented **PI**: Partially Implemented **NI**: Not Implemented N/A: Not Applicable

LEVEL OF IMPLEMENTATION	Regulatory framework	Organisation	Aeronautical / maritime SAR coordination	Publication of SAR information	Funding	SAR Conventions and Agreements	Operational procedures	Equipment / Communications	Personnel, training and exercises	SAR services oversight / Improving services
FI	21	18	10	9	7	8	11	3	3	1
	70 %	60 %	33.33 %	30 %	23.33 %	26.67 %	36.67 %	10 %	10 %	3.33 %
PI	6	10	13	19	13	17	13	22	23	18
	20 %	33.33 %	43.33 %	63.33 %	43.33 %	56.67 %	43.33 %	73.33 %	76.67 %	60 %
NI	3	2	2	2	10	5	6	5	4	11
	10 %	6.67 %	6.67 %	6.67 %	33.33 %	16.67 %	20 %	16.67 %	13.33 %	36.67 %
N/A	0	0	5	0	0	0	0	0	0	0
			16.67 %							

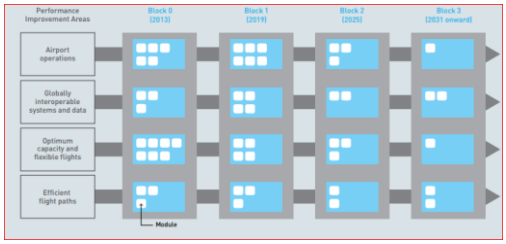
The results indicate the need for AFI States to put emphasis on the support of national SAR organizations through equipping the organization with SAR equipment and communication facilities as well as funding personnel training. Also noted as a major challenge is the lack of effective oversight of SAR organizations. This could be attributed to the fact that these organizations are often under the Military. This makes it difficult for the established oversight bodies to access the SAR centers. To enable adequate oversight, there is need for facilitation through amendments

to the regulations that govern the established SAR organizations, incorporating the requirement for the oversight by established civil aviation oversight agencies.

The results of the survey have been demonstrated in the pie-charts for comparison as indicated in Appendix 6 to this report.

2.9. Aviation System Block Upgrades (ASBU) Implementation Status





APIRG 19 meeting held in 2013 in Dakar Senegal through Conclusion 19/06 adopted 18 ASBU modules to be implemented in the region. Meanwhile, the 40th session of ICAO Assembly endorsed the 6th edition of the GANP as the global strategic direction for air navigation. The new edition GANP is a multilayers document including Level 1-*Global strategic,* Level 2-*Global technical,* Level 3-*Regional,* Level 4-*National.* The global technical contains two frameworks, namely the Basic Building Blocks (BBB) and an updated version of ASBU with some changes to its architecture and content.

The implementation status of the Block - 0 elements in the last six years are captured under each operational area below.

2.9.1. AOP ASBU

2.9.1.1 AOP Applicable ASBU elements

Aerodrome Operations (AOP) has few identified ASBU elements to be implemented by the region. The only element in Block -0 is the Airport – Collaborative Decision Making (A-CDM). Due to its' importance the region categorized A-CDM with Priority 1 for implementation.

2.9.1.2. Status of implementation

ASBU implementation in the area of Aerodrome Operations (AOP) has been low in the region. The results of the recent survey carried out by the Secretariat on the Status of implementation of A-CDM revealed that four states had started the implementation of A-CDM at their international Airports. The slow progress in the implementation is due to the lack of sensitization on the ACDM ASBU element. In most of the Airports, there is an element of practicing a collaborative approach in decision making which is not well structured and therefore needs to be formalized while in others it is missing.

It is anticipated that the completion of development of the electronic Volume III of the AFI Air Navigation Plan (AFI eANP) will assist with the update of the Status.

2.9.2. ATM ASBU

The implementation status of ASBU Block 0 and 1 Elements related to ATM in the AFI region as reported by AFI States has been slow. Although continuous follow-up has been made by APIRG secretariat on State reporting it remains as major challenge, only few States continue to provide data; as it stands the actual level of implementation in the region cannot be clearly determined.

With the development of the AFI eANP Volume III, the region identified more ASBU elements in Block-0 and Block-1 to be incorporated into the regional implementation plan. Table 6 below indicates the full list of identified ATM related ASBU elements for Block 0 and 1.

Table 6 – ATM related ASBU elements applicable to the AFI Region

ELEMENT IDENTIFICATION	ELEMENT TITLE
BLOCK 0	
ACDM – B0/1	Airport CDM Information Sharing (ACIS)
ACDM – B0/2	Integration with ATM Network function
APTA – B0/1	PBN Approaches (with basic capabilities)
APTA – B0/2	PBN SID and STAR procedures (with basic capabilities)
APTA – B0/3	SBAS/GBAS CAT I precision approach procedures
APTA – B0/4	CDO (Basic)
APTA – B0/5	CCO (Basic)
APTA – B0/6	PBN Helicopter Point in Space (PinS) Operations
APTA – B0/7	Performance based aerodrome operating minima – Advanced aircraft
APTA – B0/8	Performance based aerodrome operating minima – Basic aircraft
FRTO – B0/1	Direct routing (DCT)
FRTO – B0/2	Airspace planning and Flexible Use of Airspace (FUA)
FRTO – B0/3	Pre-validated and coordinated ATS routes to support flight and flow
FRTO – B0/4	Basic conflict detection and conformance monitoring
NOPS – B0/1	Initial integration of collaborative airspace management with air traffic flow management
NOPS – B0/2	Collaborative Network Flight Updates
NOPS – B0/3	Network Operation Planning basic features
NOPS – B0/4	Initial Airport/ATFM slots and A-CDM Network Interface
NOPS – B0/5	Dynamic ATFM slot allocation
OPFL – B0/1	In Trail Procedure (ITP)
RSEQ – B0/1	Arrival Management
RSEQ – B0/2	Departure Management
RSEQ – B0/3	Point merge
SNET – B0/1	Short Term Conflict Alert (STCA)
SNET – B0/2	Minimum Safe Altitude Warning (MSAW)
SNET – B0/3	Area Proximity Warning (APW)
SNET – B0/4	Approach Path Monitoring (APM)
SURF – B0/1	Basic ATCO tools to manage traffic during ground operations
SURF – B0/2	Comprehensive situational awareness of surface operations
SURF – B0/3	Initial ATCO alerting service for surface operations
TBO – B0/1	Introduction of time-based management within a flow centric approach
BLOCK 1	
ACAS-B1/1	ACAS Improvements
APTA-B1/1	PBN Approaches (with advanced capabilities
APTA-B1/2	PBN SID and STAR procedures (with advanced capabilities)
APTA-B1/4	CDO (Advanced)
APTA-B1/5	CCO (Advanced)
CSEP-B1/1	Basic airborne situational awareness during flight operations (AIRB)
CSEP-B1/2	Visual Separation on Approach (VSA)

CSEP-B1/3	Performance Based Longitudinal Separation Minima
CSEP-B1/4	Performance Based Lateral Separation Minima
RATS-B1/1	Remotely Operated Aerodrome Air Traffic Services
FRTO-B1/1	Free Route Airspace (FRA)
FRTO-B1/2	Required Navigation Performance (RNP) routes
FRTO-B1/3	Advanced Flexible Use of Airspace (FUA) and management of real time airspace data
FRTO-B1/4	Dynamic sectorization
FRTO-B1/5	Enhanced Conflict Detection Tools and Conformance Monitoring
FRTO-B1/6	Multi-Sector Planning
FRTO-B1/7	Trajectory Options Set (TOS)
GADS-B1/1	Aircraft Tracking
GADS-B1/2	Contact directory service
NOPS-B1/1	Short Term ATFM measures
NOPS-B1/2	Enhanced Network Operations Planning
NOPS-B1/3	Enhanced integration of Airport operations planning with network operations planning
NOPS-B1/4	Dynamic Traffic Complexity Management
NOPS-B1/5	Full integration of airspace management with air traffic flow management
NOPS-B1/6	Initial Dynamic Airspace configurations
NOPS-B1/7	Enhanced ATFM slot swapping
NOPS-B1/8	Extended Arrival Management supported by the ATM Network function
NOPS-B1/9	Target Times for ATFM purposes
NOPS-B1/10	Collaborative Trajectory Options Program (CTOP)
OPFL-B1/1	Climb and Descend Procedure (CDP)
RSEQ-B1/1	Extended arrival metering
SNET-B1/1	Enhanced STCA with aircraft parameters
SNET-B1/2	Enhanced STCA in complex TMAs
SURF-B1/1	Advanced features using visual aids to support traffic management during ground operations
SURF-B1/2	Comprehensive pilot situational awareness on the airport surface
SURF-B1/3	Enhanced ATCO alerting service for surface operations
SURF-B1/4	Routing service to support ATCO surface operations management
SURF-B1/5	Enhanced vision systems for taxi operations
TBO-B1/1	Initial Integration of time-based decision-making processes

2.9.3. CNS ASBU

2.9.4. AIM ASBU

2.9.4.1 AIM Applicable ASBU elements

The following ASBU elements have been identified through the Volume III of the AFI Regional Air navigation plan as applicable to the Region, in the area of Aeronautical information management:

Element ID	**Element Title**
DAIM-B1/1	Provision of quality-assured aeronautical data and information

DAIM-B1/2	Provision of digital Aeronautical Information Publication (AIP) data sets
DAIM-B1/3	Provision of digital terrain data sets
DAIM-B1/4	Provision of digital obstacle data sets
DAIM-B1/5	Provision of digital aerodrome mapping data sets
DAIM-B1/6	Provision of digital instrument flight procedure data sets
DAIM-B1/7	NOTAM improvements

Table 7 – ASBU elements applicable to the AFI Region in AIM

2.9.4.2 Status of implementation of ASBU elements

The table below shows details of status of implementation of ASBU elements DAIM-B1/1 – Provision of quality-assured aeronautical data and information, and DAIM-B1/2 – Provision of digital Aeronautical Information Publication (AIP) data sets. It provides an overview of the number of States having fully or partially implemented the various components of these ASBU elements and summarizes their average percentage of regional implementation.

Implementation Status: FI - Fully implemented (100%) PI - Partially implemented (50%)			***DAIM-B1/1*** *- Provision of quality-assured aeronautical data and information*				***DAIM-B1/2*** *- Provision of digital Aeronautical Information Publication (AIP) data sets*		
			QMS	**SLA**	**AIRAC**	**WGS-84**	**AIXM DB**	**eAIP**	**AIP Data sets**
# States having the given implementation status	**ESAF**	FI	**10**	**0**	**0**	**0**	**4**	**3**	**0**
		PI	**3**	**13**	**24**	**24**	**0**	**1**	**0**
	WACAF	FI	**17**	**0**	**0**	**0**	**16**	**16**	**0**
		PI	**0**	**17**	**24**	**24**	**0**	**0**	**0**
% Regional Implementation status	**ESAF**	%	**48**	**27**	**50**	**50**	**17**	**15**	**0**
	WACAF	%	**71**	**35**	**50**	**50**	**67**	**67**	**0**

Table 8 – Detailed implementation status of elements DAIM-1/1 and DAIM-1/2

As done above for the elements DAIM-B1/1 and DAIM-B1/2, the implementation data has been consolidated also for the other applicable ASBU elements ranging from DAIM-1/3 to DAIM-B1/7. The following graphic provides an overview the status of implementation the said ASBU elements in the AFI Region.

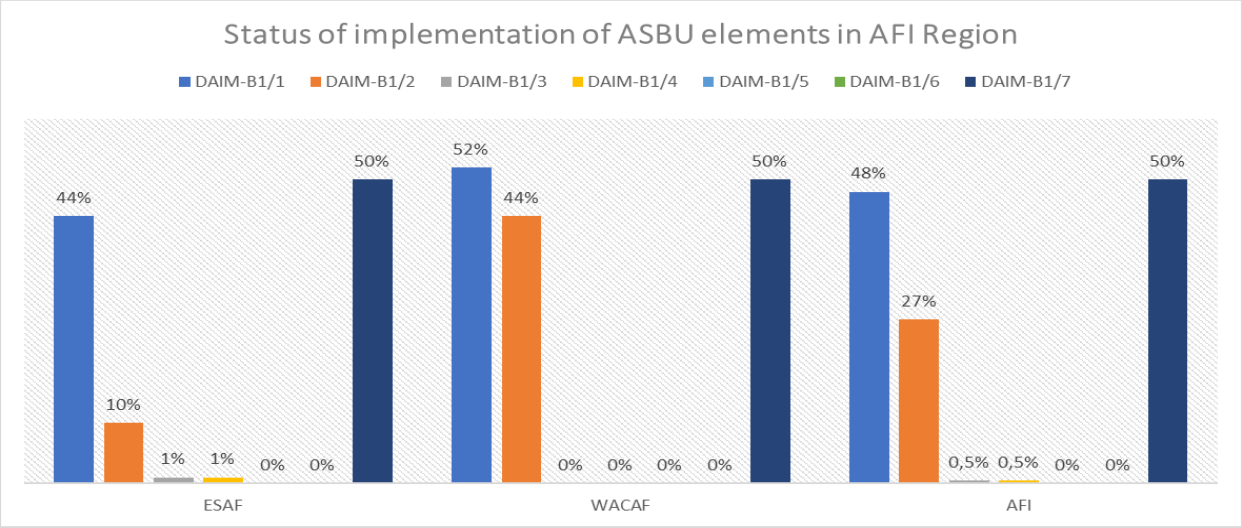
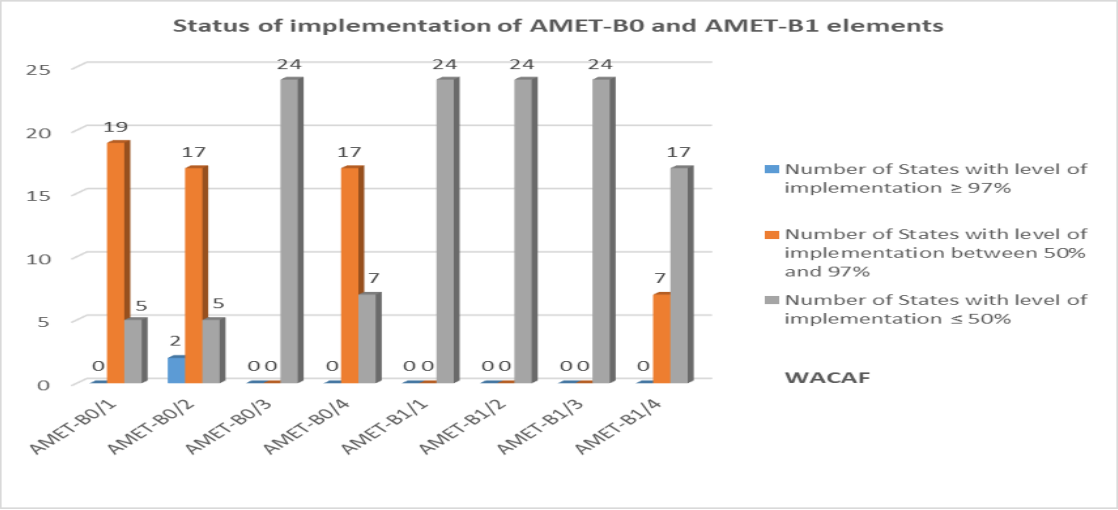


Figure 16 – Status of implementation of AIM ASBU elements in AFI Region

2.9.5. MET ASBU

Figure 17: Status of implementation of AMET-B0 and AMET-B1 elements



2.9.6. SAR ASBU

The changes to the ASBU modules include the introduction of GADS in Blocks 1 and 2. GADS modules are related to the Global Aeronautical Distress and Safety System which aims at enhancing the SAR services by use of satellite for the tracking and location of distress craft. It supports the search and rescue system at global level by providing critical safety information for the management of SAR. AFI states have adopted GADS B1/1-Aircraft Tracking and GADS B1/2-Operational Control Directory to be applicable in the region.

3. ENVIRONMENTAL PROTECTION





3.1. Air Navigation developments related to Environmental Protection

Several activities related to environmental protection have been conducted in the AFI region to support States. The ICAO Regional Offices developed a capacity building strategy in 2019 that aims to provide direct support to States, through workshops and regular coordination with the States' Focal Points (FPs).

In relation to climate change, ICAO formulates policies, develops and updates Standards and Recommended Practices (SARPs) on aircraft emissions. The launch of the State Action Plan (SAP) initiative in 2010 is also a means to provide States with the capacity and tools to act. This initiative enables all ICAO Member States to establish a long-term strategy on climate change for the international aviation sector, involving all interested parties at national level. This involves the selection of appropriate emissions mitigation measures from ICAO's basket of measures which includes Operational Improvements. The term "operations" reflects changes to Air Traffic Management (ATM) procedures and improvements to infrastructure and operations. It describes activities such as the flying of the airplane, the control and/or monitoring of the aircraft by the air traffic management system, and the conduct of various airport activities.

In the SAPs developed/updated by AFI States, 'Operational Improvements' is the most implemented among the basket of measures. The ICAO Global Air Navigation Plan (Doc 9750) facilitates the implementation of air traffic management improvements, through the implementation of the Aviation System Block Upgrade (ASBU) methodology. The ASBUs elements related to ATM have environmental benefits that are realized by States and are reported through the SAP initiative. The AFI Region is involved in various initiatives, including PBN, CCO, CDO, Free Route Operations (FRTO) and the expansion of Flexible Use of Airspace (FUA). Some of the environmental benefits are:

- Fuel efficient descent profiles,
- Fuel efficient climb profiles, and
- Reduced delays and associated fuel consumption

The ATM operational measures are based on different ways of operating aircraft that are already in service. They are popular in the AFI Region as a measure for SAPs because they do not necessarily require the introduction of new equipment or the deployment of expensive technologies.

4. COORDINATION AND COOPERATION

4.1.Interregional Coordination

4.1.1. Interregional SAR Workshops

The AFI region has participated in two interregional SAR workshops in the last six years. The joint workshops involving four ICAO regions (APAC, ESAF, MID and WACAF) with the aim of improving cross region coordination during SAR events was first introduced in 2016 hosted by Seychelles with the second workshop held in 2019 hosted by Oman in Shalala. Both workshops brought together SAR experts from civilian and military entities, ranging from Governments, CAA, ANSPs, air operators, and international organizations. During these two workshops an implementation action plan was developed. The plan included hosting an interregional cross-border SAR exercise (SAREX) in 2021, unfortunately with the onset of COVID-19, the SAREX was put on hold to be conducted once the environment is conducive.



SAREX at the interregional SAR workshop in Shalala, Oman 2019

4.2. Coordination between APIRG and RASG-AFI

The 18th meeting of APIRG through conclusion 18/04 established the basis for the coordination of activities between APIRG and RASG-AFI by defining a clear delineation between activities of both regional bodies.

The RASG-AFI deals with matters related to accidents and incidents analysis and States Safety Programme (SSP).

APIRG work programme includes RVSM safety monitoring, Quality Management System (QMS) for meteorological and aeronautical information services, Civil-military coordination, and SAR.

Both regional bodies coordinate on issues related to English Language Proficiency (ELP), Safety Management System (SMS) implementation, Runway Safety, Unsatisfactory Condition Reports (UCRs) and Airspace contingencies. The two entities meet once every year in join sessions and back-to-back with outcomes in the form of joint conclusions pertaining to their common area of interest.

4.3. Air Navigation Services Providers Peer Review Initiatives

The African Peer Review Programme

On 4 February 2015, in Montreal at the coordination meeting of the African Air Navigation Service Providers (ANSPs), the ICAO Council President called upon the regional Air Navigation Service Providers (ANSPs) to consider holding peer review between them as "a very tangible mechanism to improve the capabilities of ANSPs as part of ICAO's **No Country Left Behind (NCLB)** goal." Heeding the call, the African ANSPs agreed to the establishment of an African Peer Review Programme to facilitate the development of a regional framework of cooperation and a peer review mechanism aimed to improve air navigation operational performance in Africa.

The Montreal meeting established a Technical Group to be assisted by ICAO, comprising ANSPs from Ghana, Nigeria, South Africa, ASECNA and CANSO, as well as any other volunteering ANSPs. The established Technical Group was tasked to develop a regional framework of cooperation and peer review, as well as terms of reference to benchmark performance in specific areas, and to identify best practices that could be shared to improve air navigation performance. It was also requested to submit an information paper on its work to the Fifteenth Meeting of the AFI Comprehensive Regional Implementation Plan for Aviation Safety in Africa (AFI Plan), during the second AFI Aviation Week in Maputo, Mozambique in May 2015. As a follow-up, the team agreed that the Technical Group would meet in Madrid, Spain on 7 March 2015 prior to the CANSO Global ATM Congress to which several AFI ANSPs were expected to participate.

The African Peer Review Programme was thus launched on 7 March 2015 in Madrid at the African ANSPs coordination meeting where an agreement on establishment of the African ANSP Steering Group (AASG); the members of which included ASECNA, ATNS, Ghana, Kenya, Mozambique, Nigeria, CANSO, ICAO and AFCAC (observer).

The Region setup five peer review teams and conducted reviews as follows:

Team 1: ASECNA, Air Traffic & Navigation Services (ATNS), Civil Aviation Authority of Botswana (CAAB) and Swaziland Civil Aviation Authority (now Eswatini)

Team 2: CAA Uganda, Tanzania CAA (TCAA), Kenya CAA (KCAA), Rwanda CAA (RCAA) and Burundi CAA (BCAA)

Team 3: Nigerian Airspace Management Agency (NAMA), Roberts F.I.R and Ghana Civil Aviation Authority (GCAA)

Team 4: Aeroportos de Moçambique, E.P., Zambia Airports Corporation Limited

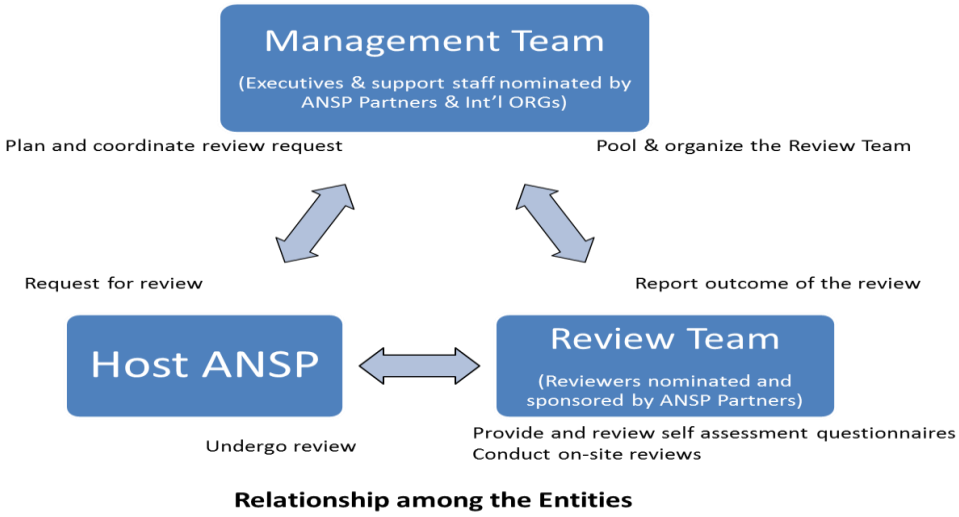
Team 5: ONDA (ANSP of Morroco), (group members to be finalized by ONDA)

On 12 June 2015, at another African ANSPs coordination meeting in Durban, South Africa the Terms of Reference (ToR) - (ANS Safety and Quality Assurance) was adopted. On 1 December 2015, at Yamoussoukro, Cote d'Ivoire the AASG started work on the development of framework based on CANSO Standard of Excellence (SoE) in safety Management Systems (SMS), ICAO Annexes and Safety Management Manual to draft the regional Peer Review Manual.

Figure 18 – Structure of ANSP Peer support Programme



Figure 19 – Relationship between Peer support entities



From the inception of the Peer Review Programme, there were several initiatives by the regional ANSPs. However, after two years, it became apparent that a coordinated effort was required. The African ANSPs Meeting held in Freetown, Sierra Leone on 3-5 May 2017 aligned the

various efforts made on the African Peer Review Programme since inception to allow for a coordinated approach to planning and development of the programme.

At the Sierra Leone meeting, it was noted that some of the challenges experienced in the last two years included language barrier, financial mechanism, and auditors' profile. The meeting aimed to discuss and propose operational solutions to address some of the air navigation challenges the region was facing. It was to identify necessary actions regarding the key areas identified to standardize the elements of the safety management systems in line with peers for improvement of ANSP in AFI region, as well as evaluate the status of the implementation of the key areas identified at the Montreal.

CANSO Africa ATM Safety Peer Review Initiative

As a member of the African ANSP Peer Review Programme, CANSO Africa identified safety as a priority area to promote amongst CANSO Members and as such meet global safety goals.

The CANSO Africa ATM Safety Peer Review Initiative is a joint initiative between African air navigation service providers (ANSPs) to improve aviation safety across Africa. The initiative was launched in February 2015 following an agreement between ICAO and CANSO on the need to address critical safety issues in ATM. It works by encouraging African ANSPs to work in partnership to assess Safety Management Systems (SMS) and other operations requirements, share experiences and learn about measures for improvement in safety and operational performance.

The CANSO Africa initiative aims to address primarily safety-related ATM issues in the region, these include lack of proper infrastructure and maintenance, inadequate training and development of the operational staff and lack of standardized policies and procedures or means to evolve and implement best practice in safety management. The initiative goes far beyond conducting simple safety audits, leveraging the power of partnership and peer-to-peer learning to improve ATM performance across the region.

Advancing the African Peer Review Programme

As benefits are realized by participating ANSPs through the programme the region calls on more State ANSPs to engage in the initiatives as the region aims to reduce ANS deficiencies and incidents.

5. INDUSTRY ACHIVIEMENTS AND INITIATIVES

5.1. Air Navigation Services Providers

5.7.1. CABO VERDE: *ATM DEVELOPMENT IN THE SAL FIR*

There have been marked development in the Cabo Verde air navigation system over the years. The Directorate of Air Navigation (DNA) is responsible for ensuring, in accordance with national and international policies and regulations, the provision of air navigation services in the Oceanic FIR and Terminal Area (TMA) of SAL as well as domestic airports. The DNA in its mandate to ensure improved services has developed policies to set the best conditions for the safe, efficient and quality management of the air traffic services in the SAL Oceanic FIR, TMA and controlled national airports.

5.7.1.1. ATM:

The Cabo Verde air navigation service provider, Aeroportos e Segurança Aérea (ASA) plans to invest on future proof technologies/systems that provide greater automation, digitalization, scalability, and flexibility for the coming years. Cabo Verde which sits at a strategic point as the Gate way to the AFI region from the Americas, plays an important role of managing traffic in the EUR/SAM Corridor as well as the traffic from/to the Americas to/from the AFI region.

a) Automation of ATS Systems:

In 2022 ASA embarked on a project that will modernize its ATM system, with full implementation intended to take place by July 2023; this new system is expected to improve the Human Machine Interface (HMI), with the latest technology making it user friendly, reducing workload of the air traffic control personnel.

The new ATM system includes:

- Appropriate safety nets (Medium-Term Conflict Detection (MTCD), Short-Term Conflict Alert (STCA), Area Proximity Warning (APW), Cleared Level Adherence Monitoring (CLAM), Route Adherence Monitoring (RAM).
- Flight Data Processing System (FDPS) in support of safer operations and FRA.
- Performance monitoring of communication and surveillance systems (in support of PBCS)
- Tactical controller tool (TCT) to help with conflict resolution and clearance verification.
- Automated system-supported coordination – AIDC and OLDI
- Sufficient flexible, offering scalability and modularity to ensure it is future proofed, and able to cope with planned sectorization with increases in traffic within Sal FIR in the future and with existing and planned ICAO requirements.

b) PBN

For enroute traffic, the specification currently used in Sal's FIR is RNP10 outside of radar coverage. However, with the implementation of the new ATM system, SAL FIR will be able to move to Required Navigation Performance with the specification of RNP4 in accordance with EUR/SAM corridor requirements. Cabo Verde has four international airports, PBN procedures are fully implemented in 2 (two) of the international airports GVSV (São Vicente) and GVBA (Boa Vista). Procedures for the other 2 airports GVNP (Praia) and GVAC (Sal) have recently been approved and are expected to be published in 2023. In the PBN procedures, the state has ensured the incorporation of the CCO and CDO operations at GVNP (Praia) and GVAC (Sal).

c) Airspace structure

To ensure that maximum benefits are realized with the improvements made to the system, ASA has engaged a consultant to restructure the Cabo Verde airspace, plans expected to commence at the beginning of 2023. In line with the airspace restructuring, Cabo Verde has implemented flexible routing in the RVSM airspace. Traffic flying within the SAL FIR can either use the ATS routes already published or fly direct routing from any entry point to any exit point, West of ATS route UN741. Currently, ASA (Cabo Verde) is assessing its system capabilities towards the full implementation of Free Route Airspace (FRA) in the latter part of the airspace.

d) PBCS operation and monitoring

The new ATM system has the specifications of monitoring the Required Communication Performance – RCP240 and Required Surveillance Performance – RSP180. Thus, with the full implementation of the new ATM system, Cabo Verde will be able to comply with PBCS specification requirements.

e) Capacity building

i) PANS-OPS: conventional and RNP IFFPS design, operation, and maintenance

ASA has one (1) certified PANS OPS designer and two (2) trainees awaiting OJT.

ii) MAPs

ASA has five (5) trained Cartographer, and AIS works with the chart software, BENTELY.

5.7.1.2. AIM: transition from AIS to AIM and QMS implementation

ASA purchased a centralized database system – the Aeronautical Information Concept Model (AICM) / Aeronautical Information Exchange Model (AIXM) 5.1 which is used to manage aeronautical data, this allowed the implementation of the eAIP (Electronic Aeronautical Information Package).

The eAIP was published on 24 March 2022 and became applicable on 19 May 2022. It is a functional eAIP with data generated from a database; this will bring benefits regarding data integrity

and improved security. With the acquisition of the said system, most of the 21 steps of the ICAO roadmap for the transition from AIS to AIM were met, remaining implementation:

- Electronic PIB;
- Digital NOTAM.

These two steps will be implemented following the acquisition in 2023 of a new system for dynamic information components, being, ePIB (2024) and Digital NOTAM (2028).

ASA has also implemented QMS, with process like CHAIN implemented (facilitating Data integrity monitoring by monitoring data from originator, through the data process chain, to eventual publication)."

5.7.1.3. CNS

a) Communication: GROUND/GROUND (AFTN/AMHS, ATS/DS, VOIP, AIDC), AIR GROUND (HF/VHF, CPDLC), RCP 240 implementation

To improve coordination between neighboring FIRs, ASA is in the process of implementing AIDC with Dakar Oceanic FIR and Santa Maria FIR which is expected to be fully implemented on the first quarter of 2023. RCP 240 requirements will be achieved with the full implementation of the new ATM system. ASA is currently using AMHS only for AFTN to transfer aeronautical and meteorological information between centers. However, ASA hopes to update its AMHS soon.

b) Navigation: Conventional NAVAIDs, GNSS (CORE & AUGMENTED-SBAS) implementation and maintenance

ASA has a project on going to modernize its VOR/DME in Sal airport, which will enhance the navigation redundancy into the airport.

c) Surveillance: Secondary Surveillance Mode S, ADS-C, ADS-B (Ground and space based) implementation and maintenance, RSP 180 implementation

Improve surveillance capabilities: ADS-B (ongoing and to be fully implemented on the first quarter of 2023). ASA has planned to reduce their ADS-C contract with a maximum periodic interval of 14 minutes to achieve requirements for reducing separation to 30 NM. RSP180 requirements will be achieved with the full implementation of the new ATM system.

5.7.1.4 Cyber Security for the ANS System

ASA has implemented Self-protection of the ATM system against threats aiming at the ATM system and its facilities (including network, personnel, and information/data).

Other initiatives taken in relation with ANS implementation operation, maintenance and monitoring include certification of ATS, CNS and AIS which is fully implemented by ASA.

5.7.1.5. Aeronautical Meteorology

The Aeronautical Meteorology Service is provided by the Institute of Meteorology and Geophysics of Cabo Verde. There are meteorological centers at all international airports in Cabo Verde and aeronautical meteorology service at all aerodromes. The Services comply with the provisions of CV-CAR 16 (Regulation on Aeronautical Meteorology) and with Annex 3 of ICAO, respectively.

At all aerodromes in Cabo Verde, automatic stations are installed that complement the classic stations and data from other sources, namely meteorological satellites. The Institute of Meteorology and Geophysics - INMG has an H24 volcanic data monitoring system. The QMS system is however still in the implementation phase.



Sal's Oceanic Control Center-Cabo Verde

5.7.2. KENYA: *Celebrating 20 Years of Safe Skies*

On 24 October 2022, the Kenya Civil Aviation Authority (KCAA) celebrated 20 years since establishment. The Authority which was established through the Civil Aviation (Amendment) Act of 2002 and took over from the then Directorate of Civil Aviation with the primary functions towards Regulation and Oversight of Aviation Safety and Security, Provision of Air Navigation Services, Training of Aviation Personnel, Economic regulation of air services and development of Civil Aviation has reason to celebrate this milestone. The 20 years have seen a marked growth not only in actualizing its mandate but also its internal growth.

The improvements the Authority made over the years include the construction of Kenya Civil Aviation Headquarters which moved the services from the former establishment under the Ministry of Transport to the airport and nearer to the key customers. In Aviation Safety and Security Oversight, the 2018 ICAO Universal Safety Oversight Audit Programme (USOAP CMA) saw the State attain a score of 78.02% and the 2015 ICAO Universal Security Audit Programme (USAP CMA) score of 88.9%. The State also attained the FAA's IASA CAT Status

in 2017 amongst others. On 27 May 2022, the KCAA registered a mean score of 91.77% following a recent USAP activity, marking it as the highest score recorded in the region.

In the area of Air Navigation Services provision, the KCAA have strived to improve the services by modernizing air navigation facilities and equipment, with key installations including:

- Construction of a new Air Traffic Control Tower at Wilson airport, one of the busiest General Aviation and training airports in the region and establishment of a mobile Control Tower at Ukunda airport, Diani, a key tourist destination.
- Construction of a new Air Navigation Services Headquarters, which strengthened the de-linking of the ANSP from the CAA, construction of a new Area Control Center and Disaster Recovery Center soon to be operationalized.
- Installation and commissioning of a New ATM system at Jomo Kenyatta International Airport (JKIA), new HF Communication Systems, ADS-B and MLAT systems, new Digital Airport Terminal Information System (D-ATIS) at Wilson Airport, new AIS/AIM system, an expanded VHF Area cover and a new Search and Rescue (SAR) system in the JKIA Rescue Coordination Center.

The above improvements have boosted the availability of equipment from 94.5% in 2017/2018 to 99% by 2021.



Aerial View of Wilson Airport



The New ATC Tower at Wilson Airport

The East African School of Aviation (EASA), a renowned regional approved training organization, has also made strides in the last 20 years, attaining the status of Training Centre of excellence (TCE) and being categorized into Platinum putting it amongst the four TCEs globally.

In its bid to modernize the facility, EASA constructed a Modern Library facility and Chapel. It has also upgraded the following training equipment with the installation of new:

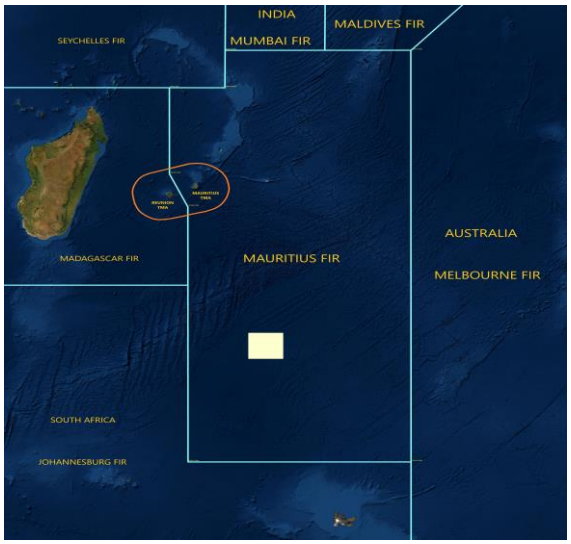
- ATC simulators
- Engineering Laboratory Equipment
- Hydraulic Laboratory Equipment, and
- Search and Rescue Training Equipment.

Also to note in KCAA's achievement is the construction of a modern Aviation Medicine facility which is expected to serve the region.

As it marks the 20 years anniversary the KCAA Director General, Mr. Emile Nguza Arao reported the Authority's continued commitment to continuous engagement with stakeholders to better and uphold its services to the highest standards.

5.7.3. MAURITIUS: *IMPLEMENTING FREE ROUTE AIRSPACE*

In 2020 and in line with the APIRG 22 Conclusion 22/36 on implementation of Free Routing Airspace within the AFI continental airspace, and being one of the identified case study airspace, Mauritius backed on a process to upgrade her airspace and implement the much-desired free routing within the large oceanic area.



Mauritius is situated around the point 20° 15 South and 057° 30 East

Mauritius FIR is bounded within AFI Region

Northwest: Seychelles Is.

West: Madagascar

Southwest and South: South Africa

APAC Region

East: Australia

Northeast: Maldives Is.

North: India

Mauritius Flight Information Region (FIMP FIR) had previously established.

- *EUROCAT System in 2003 for ATC, ADS-C, CPDLC, RNP 10 and AIDC enabling automatic handover of traffic to Melbourne ACC.*
- *Basic RNAV SIDS and STARS in TMA in 2008*
- *Strategic Lateral Offset Procedure (SLOP) in 2020, and*
- *User Preferred Routes (UPR) within the Indian Ocean.*

However, all ATS routes within the FIMP FIR started or ended at the PLS VOR, their location of entry/exit points on the FIR (east) and implementation of RNP 10 meant the routes were not laterally separated. With the traffic increase it became difficult to control traffic, aircraft often had to maintain higher or lower levels for more than 2 hours. In order to alleviate this, constrain, Mauritius undertook a major airspace restructure in 2018, and this was to include:

i. New Control Zone configuration
ii. Implementing ASBU Blocks 0 and 1
iii. Implementing RNP 1 SIDs and STARs in the TMA with Continuous Descent Operations (CDOs) and Continuous Climb Operations (CCOs).

iv. Introducing parallel unidirectional RNP 4 routes with new waypoints equidistant along FIR boundary:
    - But the regional ATS routes UM318 (Reunion-Seychelles), R348 (Antananarivo-KADAP/Melbourne FIR) and R212 (Seychelles-PIBED/Melbourne FIR) remain bidirectional with new way point as they cross new RNP 4 routes.
    - Upgrade of ATS routes R348 and R212 to RNAV routes
    - Remove ATS routes UG652, A333, G451 and B585 which were only within Mauritius FIR.
v. Introducing RNP-AR approaches
vi. Direct routing for Enroute traffic overflying the TMA (No routes above the TMA).
vii. Free Route Airspace south of Latitude 25° South

In 2021, Mauritius FIR, to ensure that the plans were implemented in accordance with best practices, commenced the coordination with key stakeholders which included the airspace users, neighboring FIRs and ICAO. Following no objection from all parties, the State applied for the amendment of the AFI air Navigation Plan to realign with the proposed airspace amendment.

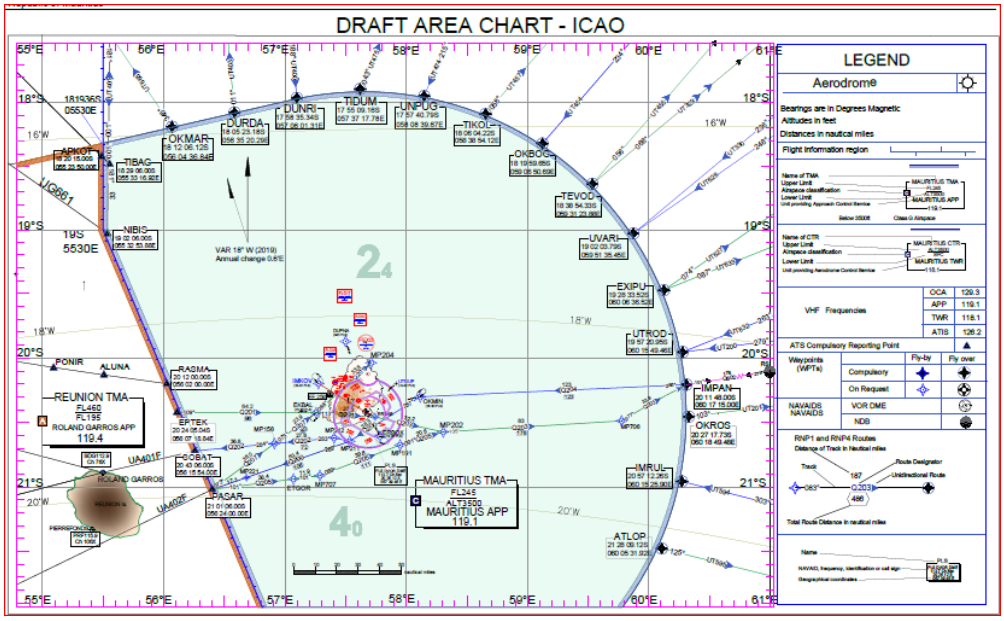


Figure 6 - Mauritius Area map indicating the new airspace configuration

In November 2022, Mauritius finally obtained the green light to go ahead with the plans as the amendment of the air navigation plan was approved.

5.7.4. SOMALIA: *TRANSITION FROM CLASS G TO CLASS A AIRSPACE*

The Somalia airspace, herein referred to as the Mogadishu FIR, has been providing Flight Information Service (FIS) in a Class G airspace following its down grade in the early 1990s as a result of civil unrest which led to the breakdown of the ATM system. To ensure continuity in

provision of air navigation services over the airspace, ICAO under the Somalia Caretaker Agency (CACAS) based in Nairobi, Kenya took over the service provision as a temporary measure. With the political environment in Somalia stabilizing the transfer of the provision of services back to the Somalia Government begun as early as 2002. To realize this, the Somali government embarked on preparations to transfer the services back to Mogadishu and in consultation with ICAO it was agreed that the handover of service delivery would take place as soon as adequate facilities were in place. In 2011 an agreement was reached, and the proceeding started for the transfer to Mogadishu, and it was not until 2017 when the move of the services final began to enable provision of the services from the facilities in Mogadishu. The handover from ICAO to the Somalia government under the newly set up Somalia Civil Aviation Authority was to take a little longer, however on 31 July 2019, the Somalia Civil Aviation Authority (SCAA) based in Mogadishu finally took over officially the provision of air navigation services.

With the recent development of the Air Traffic Management (ATM) system in Somalia, the Somalia CAA was ready to provide an improved air traffic services over the Mogadishu FIR. In line with this, the CAA shared with key stakeholders the plans to transition the upper airspace above FL245 from Class G to Class A and the provision of services from Flight Information Service (FIS) to Air Traffic Control Services (ATCS).

Following a consultative meeting held between the Somalia CAA and the stakeholders on 6 January 2022, a decision was taken to establish a special team that would support the State with safe transition as expected. The Somalia Airspace Special Coordination Team (SASCT) was thus setup as support team for this purpose, it comprised of technical experts from neighboring ANSPs, IATA, ICAO, representatives of airlines and ATM experts.

The transition plan developed by the Somalia CAA included:

- *Qualification of Personnel to provide ATC service: Competency and Capacity building.*
- *Improvement of Infrastructure (CNS/ATM); including extended VHF cover and surveillance, CPDLC and AIDC systems.*
- *Procedures and documentation*
- *Approvals (Oversight Obligations)*
- *Notification; timely notification of the changes.*
- *Operational Trials; to be carried out before full implementation.*

The primary objective of the SASCT was to engage key stakeholders in the transition process. The focus being to address the gaps identified in the transition plan and provide technical support to develop procedures for safe transition, this included:

1. Identification of Current Operational Constraints
2. Review of the Transition Plan

3. Development of the Work Programme/and transition Road Map
4. Inter-FIR coordination and amendments to Letters of Procedures/Agreements (LOP/A).
5. Recommend improvement to the plan and support the transition.

After one year of consultation and development of procedures, services and documentation, the Somalia CAA with the support of the SASCT was happy to announce the transition from Class G to Class A and provision of air traffic control service in the airspace above FL245 within the Mogadishu FIR with effect from 26 January 2023.

The transition from Class G to Class A airspace over the Mogadishu FIR was necessary, many airspace users in the past constantly called on the state to upgrade the services; due to the limited provision of ATS this airspace was an island of limited services in the region and famous for reports of Large Height Deviations (LHD). Following the improvement made by the state to air navigation, marked reduction in LHD have been recorded in the last one year, a key sign that the airspace is ready to transition.




Aden Abdulle International Airport, Mogadishu

5.7.5. SOUTH AFRICA: *ASBU IMPLEMENTATION PLAN*

Heeding the call for States to develop ASBU implementation Plans to enable harmonized and efficient implementation of the identified ASBU elements in line to the sixth edition of the Global Air Navigation Plan, ATNS South Africa has developed an elaborate plan, incorporating all the elements of ASBU that the State identified as essential for the improvement of the service delivery in South Africa.

The detailed plan is captured in Appendix 8 to this report.

6. CHALLENGES AND OPPORTUNITIES

The AFI region faced many challenges that hamper the development of the air navigation system in a harmonized and efficient manner. The large continent is home to some well-developed economies as well as some struggling and less developed economies. The political arena differs from point to point, while some of the States have a long history of stabilities others are in constant turmoil both internally and externally.

In the hope of harmonizing the development of the air navigation system across the region, several initiatives have been floated, amongst them the Abuja Safety Targets. These targets, however, only address a very small portion of the air navigation system as they are skewed towards safety.

Whereas some progress has been made towards harmonization of implementation through the various APIRG projects, the region continues to be hampered by lack of reporting. State letters (SLs) sent from the APIRG Secretariat urging States towards implementation of key areas of the Global Air Navigation Plan (GANP) through the ASBU elements remain unanswered or attended to, only few States in the region constantly adheres to the requirements of SLs.

The States continue to struggle with funding for ANS activities more so in personnel training and innovation. Several ANSPs and aerodrome operators in the region were adversely affected during the COVID-19 Pandemic which ravished many of the economies. There are key areas of the air navigation system in the region that require urgent attention and support if the region is to realize the unification of the airspace and unified air transport as envisaged by the Single African Air Transport Market (SAATM), these include:

a. Civil/Military Cooperation in Air Traffic Management
b. Aeronautical Search and Rescue
c. Training of aviation personnel
d. Air Navigation regulations
e. Policies to enhance coordination across the FIRs and ATS units.
f. Reporting and addressing deficiencies and ATS incidents.

7. RECOMMENDATIONS

The improvement of the AFI air navigation system depends on collaboration at all levels. All States, ANSPs and RSOOs, need to enhance coordination of procedures and processes. Beyond development of documents and procedures, stakeholders should take a step further with the implementation of these procedures.

The key areas highlighted under the challenges must be addressed. More emphasis should be put in:

a. Timely investigation if the region is to realize improvement in reduction of Loss of Separation (LoS) events in the AFI Airspace.

b. The States' need to update ANS regulations and incorporate the requirements for cooperation with other entities as well as advancement in technology.

c. The States' need to review the Search and Rescue (SAR) regulations to ensure that irrespective of the entity tasked with providing the SAR service, the regulations incorporate the requirements for cooperation and coordination for smooth and efficient handling of a SAR event; this includes reviewing of Military regulations to incorporate cooperation with the civil entities during SAR.

d. Funding of personnel training, including refresher and developing trainings.

e. States willingness to enhance the mechanism for responding to SLs and actioning of APIRG Conclusions. This will ensure the reduction of deficiencies not only at State level but across the entire region.

f. The regional peer review programme to assist the less capable States in the implementation process through the assistance given by other more able States.

g. Programmes that support the effective implementation at State level, e.g., capacity building through specific training workshops designed to meet certain needs of a particular State or group of States.

h. Prioritization of the implementation of ASBU Block 0 elements related to PBN to foster the deployment of Free Route Airspace, CCO/CDO as well as Flexible Use of Airspace.