



ICAO

INTERNATIONAL CIVIL AVIATION ORGANIZATION

**Twenty Sixth Meeting of the Africa-Indian Ocean Planning and Implementation
Regional Group (APIRG/26)**

7 - 8 November 2023

**Agenda Item 3: Implementation of air navigation goals, targets, and indicators,
including the priorities set in the regional air navigation plan**

3.3 - AFI Airspace Monitoring

AFI RVSM AIRSPACE SAFETY STATUS

(Presented by ARMA)

SUMMARY
<p>This working paper presents the full report for RVSM Safety in the Africa Indian Ocean Region (AFI) airspace. It contains the results of the Collision Risk Assessment 16, Monitoring Burden for the AFI Region, Implementation requirements for Strategic Lateral Offset Procedure (SLOP), Prohibited Allocation of FL420 and Identification of LHD Categories for States awareness to improve the reporting culture as AFI States are not proactively reporting LHDs.</p> <p>Action required is as per paragraph 3</p>
<p>REFERENCE(S): Annex 6 ICAO Doc 9574 ICAO Doc 9937</p>
<p>Related ICAO Strategic Objective(s): A- Aviation Safety B- Air Navigation Capacity and Efficiency</p>

1. INTRODUCTIONS

1.1 The principal activities of a Regional Monitoring Agency (RMA) are to verify aircraft/operator RVSM approval status, conduct aircraft height keeping performance monitoring, verify the operator's compliance with the long-term monitoring requirements and provide annual airspace safety assessments.

1.2 The RMA monitors aircraft/operator compliance within the precepts of ICAO Annex 6, reporting non-compliance and any associated safety issues to the States that retain the responsibility for ensuring that appropriate remedial action is taken. To perform this function it is essential that the States provide practical support

to the RMA, particularly concerning coordinating RVSM approval data exchanges and providing operational incident reports for inclusion in the annual safety assessments.

1.3 To ensure an effective service and to minimise workload for both the RMA and individual authorities, States should ensure that the list of RVSM approvals for which it is responsible are kept up to date and communicated regularly to the RMA. The RMA collects and manages more than three types of data from 48 States/27 FIRs, this includes RVSM/PBCS Approvals, Withdrawal, Height Monitoring Data, Collision Risk Assessment Data etc

1.4 States should also ensure that they have introduced procedures for receiving reports of possible non-approved aircraft from the RMA and conducting follow up investigations to verify the true status of the aircraft reported.

1.5 In addition to transmitting new approvals to the RMA it is equally important that the RMA is informed when approvals are withdrawn or when aircraft are de-registered or re-registered.

1.6 It has been demonstrated that the most effective mechanism is for each State to maintain a single centralised database of RVSM approvals, which should be communicated to the RMA on a regular basis.

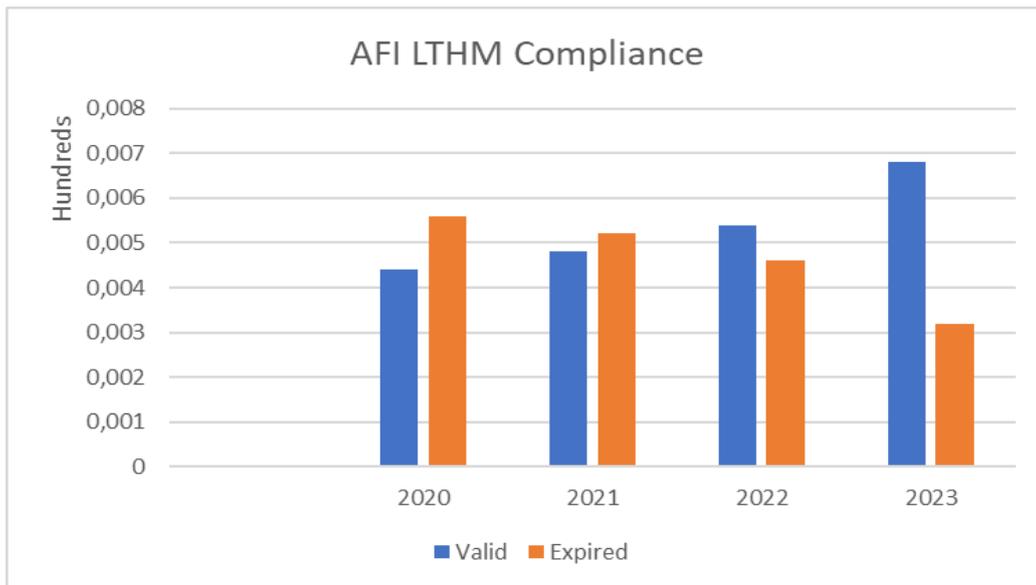
2. DISCUSSIONS

Height Monitoring

2.1 ARMA manages 2 Enhanced Generation 2 GPS-based Monitoring Units (E2GMU) in the AFI Region, one unit based in South Africa and the other in Kenya. These units help operators to meet height-keeping requirements in compliance of ICAO Annex 6. The ARMA considers, along with the support of APIRG, that the RVSM Minimum Monitoring Requirements (MMRs) adopted for global application by all ICAO Regional Monitoring Agencies (RMAs) shall be the basis for the implementation of this requirement.

2.2 In order to accomplish the ICAO Annex 6 Part 1 height-monitoring requirements, the ARMA continued to coordinate with all ARMA Member States to publish their minimum monitoring requirements through the automated MMR system and published in the ARMA website to ensure their availability always for the concerned AFI Civil Aviation Authorities and the airline operators.

2.3 All airline operators of RVSM approved aircraft are required to participate in the RVSM height-monitoring program. The principal purposes of the long-term height-monitoring program are the verification of long-term Altimetry System Error (ASE) stability and the efficacy of an operator's ICAO DOC 9930(AFI RAN) continued airworthiness program. Please take note of the current height-monitoring status in the graphs below;



Graph 1

2.4 The RMA conducts operational environment collision risk estimates using data provided by accredited member states. An event is reportable to the RMA when an aircraft makes a deviation either from a cleared level between FL 280 and FL 420 (cleared or actual) or from an ATC clearance results in a risk-bearing situation, such as loss of separation or TCAS initiated deviation. The important parameters, which must be available if the report is to be used for the quantifiable risk assessment, include the magnitude of deviation and duration, which is not made available in many cases. As much information as possible should be provided on the report to assist in the estimation of the required parameters and nature of the event.

2.5 Each authority is responsible for reporting LHD to the responsible RMA. An LHD contributes to the risk regardless of whether a loss of separation occurred or not. Detailed descriptions of LHD occurrences are crucial for the RMA to assess the risk of LHD and its duration. Each Authority should have an internal safety management system that defines an internal reporting process and the treatment of each report. The system should take into account the LHD reporting requirements.

RVSM Traffic Data returns not received

2.6 ARMA have not received data from the following FIRs for 2023:

- Lilongwe
- Kinshasa
- Windhoek
- Dar Es Salaam
- Asmara
- Gaborone
- Lusaka
- Seychelles
- N'Djamena

2.7 All states are urged to continue supporting the RVSM System Safety in the AFI region by forwarding the RVSM Traffic Data Returns to the ARMA timeously.

2.8 It is good to note that ARMA will commence making use of the AFI Air Navigations Deficiencies Database (AANDDD) for States and Air Operators that are non-compliant with ICAO Standards.

Non-RVSM Approved Aircraft Operations

2.9 Non-RVSM approved aircraft are now captured on a public non-compliant bulletin and circulated globally. A total of 19 Non-RVSM Approved aircraft operated in the AFI RVSM airspace in 2023, as indicated in Table 1 below;

Registration	Type	State
3CMAG	B763	Equatorial Guinea
3CTM06	IL76	
5NBOD	GLF4	Nigeria
5NCCI	E170	
5NAMM	B722	
5NCBZ	CRJ2	
5NIKO	H25B	
5YSKX	F70	Kenya
5TONE	B737	Mauritania
C5CAQ	B737	Gambia
D4BFE	E190	Cape Verde
D4CCJ	B738	
ETAWH	B738	Ethiopia
ETAWI	B738	
ETAWR	B738	
TNAFS	IL76	Congo
TTDFB	E35L	Chad
TUVAJ	B738	Cote d'Ivoire
ZSFGJ	B738	South Africa

Table 1

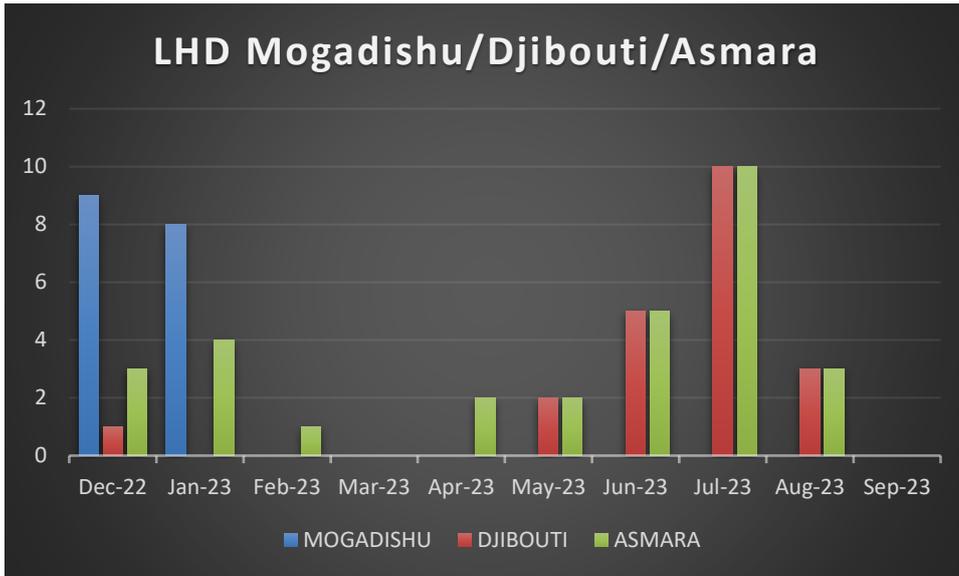
ICAO Target Level of Safety:

	TOTAL VERTICAL L TLS	TOTAL VERTICAL TLS EXCEEDED BY A FACTOR OF
CRA 16	16.6×10^{-9}	
CRA 15	71.9×10^{-9}	
CRA 14	10.9×10^{-9}	2.2
CRA 13	75.4×10^{-9}	15.0
CRA 12	58.6×10^{-9}	11.7
CRA 11	36.4×10^{-9}	7.3
CRA 10	141.2×10^{-9}	28.2
CRA 9	63.7×10^{-9}	12.7
CRA 8	31.4×10^{-9}	6.3
CRA 7	8.0×10^{-9}	1.6

Graph 3

Coordination failures and LHDs – Eastern Focus (Horn of Africa)

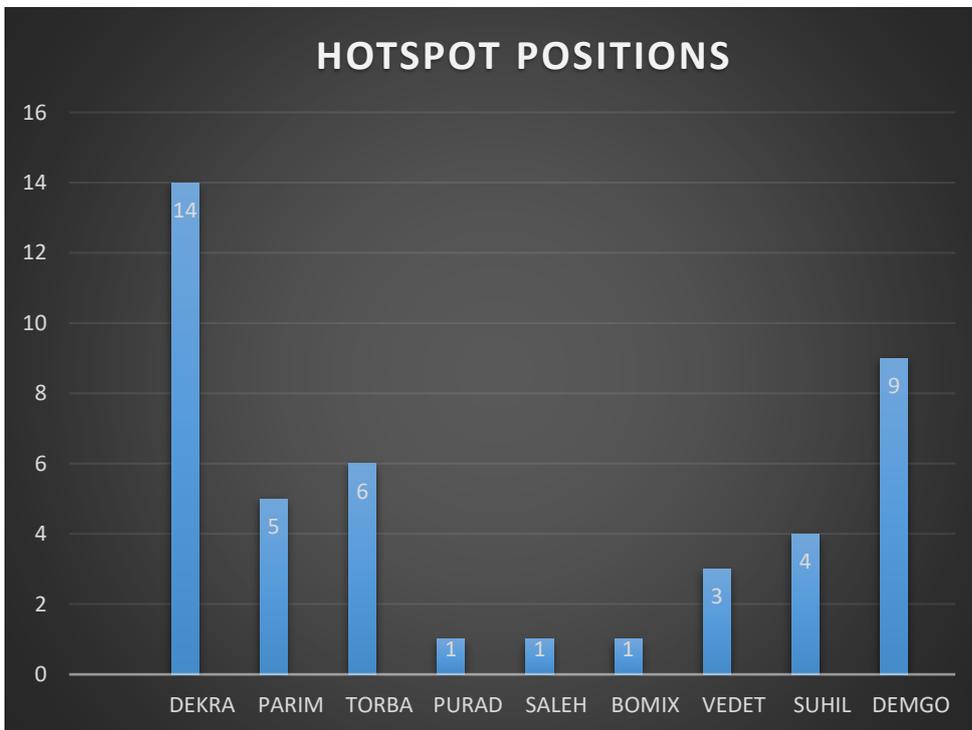
2.10 The Eastern part of the AFI region still faces a challenge regarding coordination failures, we are continually receiving coordination failure reports from the 2 neighbouring Regional Monitoring Agencies, The MIDRMA and the MAAR whose FIRs are adjacent to the Asmara, Addis Ababa (Djibouti airspace) and Mogadishu FIRs.



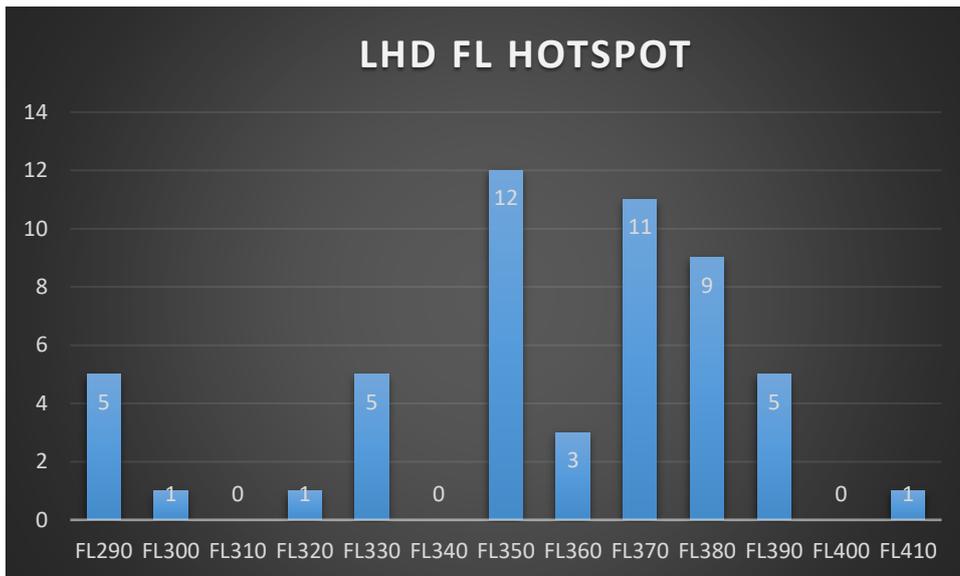
Graph 4

Hotspot Positions and Flight Levels: Horn of Africa

2.11 A new hotspot emerged in 2023 in the Asmara FIR at position PURAD. However, position DEKRA and DEMGO continued to have the most occurrences. The co-ordination failures occurring between flight levels is concerning as this increases the risk of mid-air collisions probabilities.



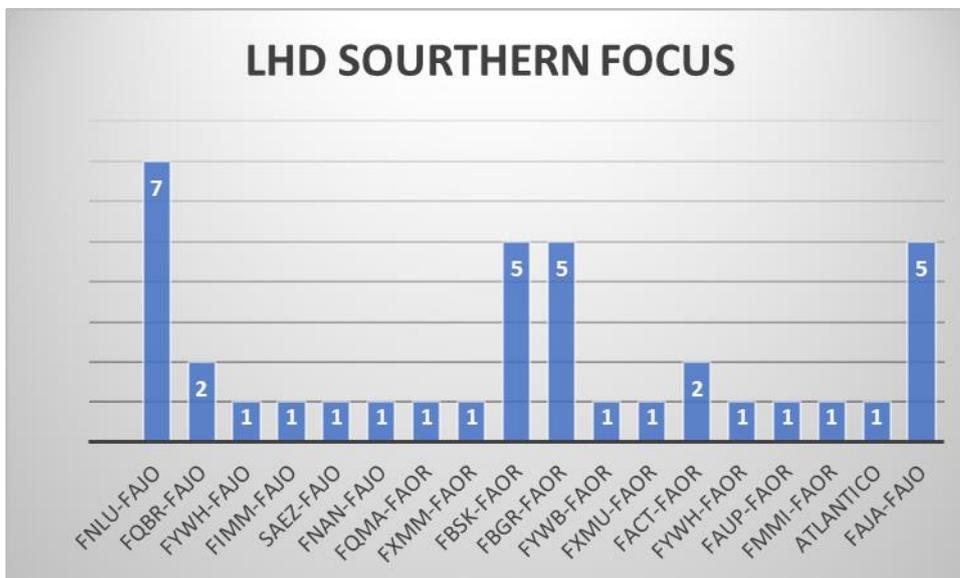
Graph 5



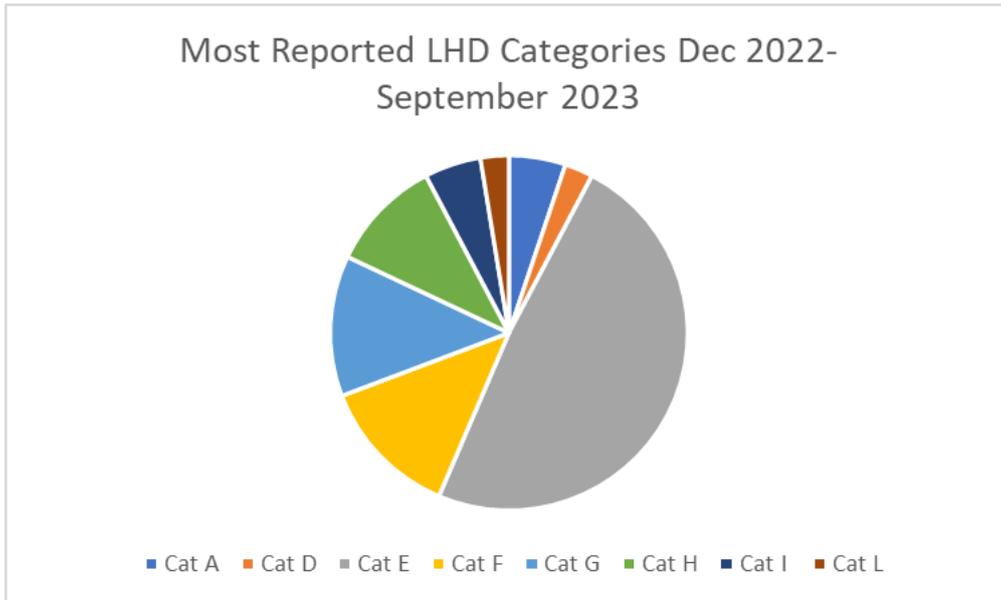
Graph 6

Co-ordination Failures and LHDs – Southern Focus

2.12 Graph 7 depicts the number of reported incidents from December 2022 until September 2023 in Southern Africa RVSM Airspace. There were 39 events that occurred. Majority of the LHD was attributable to ATC coordination failure by Human Factors. Coordination failures with neighbouring FIR’s are depicted as follows:



Graph 7

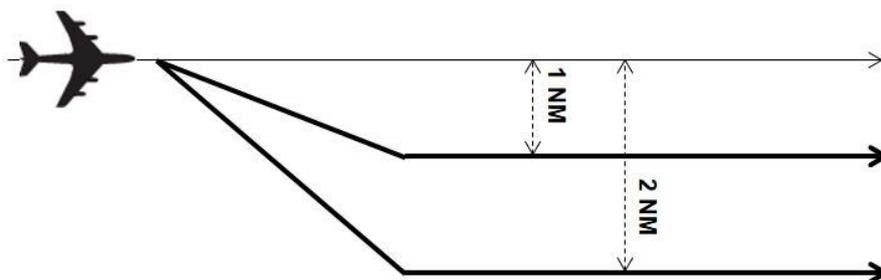


Strategic Lateral Offset Procedure (SLOP):

2.13 Strategic Lateral Offset Procedure (SLOP) is no longer limited by ICAO to oceanic and remote continental airspace outside ATS surveillance coverage and there should be no basis for States with surveillance to oppose a properly-implemented SLOP regime in regular continental airspace with ATS surveillance in accordance with ICAO provisions.

2.14 ICAO provisions for SLOP have evolved over time: originally, SLOP was limited to aircraft in oceanic non-surveillance airspace, but it may now be implemented in all en-route airspace. When SLOP is implemented, the magnitude of the offset is determined by the route spacing and separation minima that applies in the airspace.

2.15 With the advent of global navigation satellite systems (GNSS) and advanced flight management systems, the accuracy with which aircraft are navigated along their intended route has improved significantly. Today aircraft navigating using GNSS are often no further than their wingspan away from the published route centreline; therefore, aircraft that are operating along the same route are much more likely to laterally overlap one another. In the case of an operational error or blunder (such as an aircraft operating at a level not expected by the controller) aircraft on the same route could collide, with potentially catastrophic consequences.



2.16 FIRs that have not communicated status of SLOP implementation are:

- Addis Ababa
- Asmara

- Dar es Salaam
- Lilongwe
- Lusaka
- Mauritius
- Nairobi
- Windhoek

2.17 The higher the usage of SLOP the greater the resulting collision risk reduction. However, even a small uptake of SLOP, has a significant effect. A single aircraft applying SLOP provides a reduced risk, not only for itself, but also for all the other encountered aircraft, even though they were not participating in any form of offset.

2.18 The vertical collision risk results can be reduced by SLOP implementation and application. With SLOP, the collision risk can be reduced to an estimate of up to 30%. The safety benefit increases slightly with the remaining vertical deviation times limited to 5 minutes before being intervened. When SLOP is considered, the vertical collision risk estimate falls to below the Target Level of Safety (TLS) of 5×10^{-9} fatal accidents per flight hour.

Allocation or use of FL420:

2.19 In 2022 we discovered that FL420 was being assigned to aircraft, and the required separation standard was not being applied meaning these events were a loss of separation. Above FL410, RVSM does not apply, and vertical separation reverts to a minimum of 2000 feet with only odd-numbered flight levels. Thus, FL420 is not a valid cruising level anywhere globally, and you cannot plan to fly at that altitude. The next available flight level above FL410 is FL430 and not FL420. 2000FT vertical separation is applicable above FL410 due to altimetry system inaccuracies. In the event that two aircraft cross each other, one at FL410 and the other at FL420, a reduction in vertical separation is deemed to have occurred. This event will thus pose a risk to RVSM and en-route safety. Air Navigation Service Providers and Aircraft Operators must ensure that FL420 is not allocated or utilised as a cruising level. Further to this, the allocation and use of FL420 should be immediately brought to the attention of ARMA for discussion with the relevant parties. RVSM and en-route safety is of paramount importance.

Performance Based Communication Surveillance (PBCS)

2.20 Annex 6, Parts I, II and III requires States to ensure that an aircraft operator meets the requirements prescribed in the Required Communication Performance (RCP) and Required Surveillance Performance (RSP) specifications for PBCS operations. To assist in this task, the NAT ANSPs assessed an assessment of actual communication and surveillance performance against RCP and RSP specifications. Details of the aircraft, which did not meet the required specifications, were brought to the attention of ARMA and these reports of non-compliance were shared with the relevant State of Registry/Operator for further investigation and action if deemed necessary. No feedback has been received by ARMA.

2.21 AFI Registered operators that are PBCS Approved and operate in PBCS Airspace in other region have not been able to meet the benchmark of RSP 180 Actual Surveillance Performance (ASP) ≤ 90 sec. This has been a concern as all the reports from 2021 to May 2022 have a majority of the airframes not being able to meet this criteria however for RCP 240 Actual Communication Performance (ACP) ≤ 180 sec

has been met continuously. ARMA has recommended the airframes that are not performing to the required PBCS standard should not continue to file PBCS identifiers.

2.22 Every ATSP must remember it is responsible for developing its own local PBCS monitoring program and should document a process to compile and analyse data measuring Actual Surveillance Performance (ASP) and Actual Communication Performance (ACP) and prepare reports with non-compliant airframes monthly. The non-compliance data must be transmitted to the RMA.

2.23 State oversight authorities should designate a point of contact for any required follow up action, make those contact details available to RMAs and create an email inbox for the purposes of receiving and processing the PBCS non-compliance performance data received from the RMA. The State Oversight Authorities should maintain a list of contacts from the operators registered in their respective states. The contacts should have specific responsibility for PBCS operations.

2.24 The three phases below will be part of the pre-implementation process so that each stakeholder understands their roles and functions:

Phase 1 - ATSP: This phase covers initial monitoring and reporting by the Air Traffic Service Provider (ATSP) at a local level. The ATSP is responsible for the collection, analysis and classification of non-compliant performance data as well as the transmission of that data, in the agreed format, to the Regional Monitoring Agency (RMA).

Phase 2 - RMA: This phase captures the administration of the regional monitoring requirements and the mechanism to achieve global reporting. The RMA is responsible for the collection and collation of the data reported by ATSPs for transmission to, either, the States within their region of responsibility, or to other RMAs for transmission to States within their own regions of responsibility.

Phase 3 - State Oversight Authority: This phase covers the State Oversight Authority's role in the management of reports of non-compliance. The State Oversight Authority is responsible for the oversight of all airframes registered in their respective states and ensuring that the performance of those airframes meets the required standards.

Windhoek	No											
ZZ Abidjan	Yes											
ZZ Antananarivo	Yes											
ZZ Bamako	Yes											
ZZ Brazzaville	Yes											
ZZ Dakar*	Yes											
ZZ Douala	Yes											
ZZ Libreville	Yes											
ZZ Lome	Yes											
ZZ N'djamena	Yes											
ZZ Niamey	Yes											
ZZ Nouakchott	Yes											
ZZ Ouagadougou	Yes											

Traffic Data Sample 2023:

FIR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Accra	Yes											
Addis Ababa	No											
Asmara	No											
Beira	Yes											
Cape Town	Yes											
Da Es Salaam	No											
Entebbe	Yes	Yes	Yes	Yes	Yes	Yes						

Gaborone	No												
Harare	Yes	Yes	Yes	Yes									
Johannesburg	Yes												
Johannesburg Oceanic	Yes												
Kano	No												
Kinshasa	No												
Lilongwe	No												
Luanda	Yes												
Lusaka	No												
Mauritius	Yes												
Mogadishu	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes					
Nairobi	Yes	Yes	Yes	Yes	Yes	Yes							
Roberts	Yes	Yes	Yes	Yes	No	No	No						
Seychelles	No												
Windhoek	No												
ZZ Abidjan	Yes	Yes	Yes	Yes	Yes	No	No						
ZZ Antananarivo	Yes	Yes	Yes	Yes	Yes	Yes	No						
ZZ Bamako	Yes	Yes	Yes	Yes	Yes	Yes			Yes				
ZZ Brazzaville	Yes	Yes	Yes	Yes	Yes	Yes	No						
ZZ Dakar*	Yes												
ZZ Douala	Yes												
ZZ Libreville	Yes												
ZZ Lome	Yes												
ZZ N'djamena	No												

ZZ Niamey	Yes												
ZZ Kigali	No	No	No	Yes									
ZZ Nouakchott	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes				

ZZ Ouagadougou	Yes												
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3. ACTION BY THE MEETING

3.1 The meeting is invited to note the content of the working paper provided and

- a) Encourage Member States to comply with safety standards in all activities supporting continued safe use of RVSM Airspace in the AFI Region.
- b) Urge all Member States to submit LHD reports and attend an online LHD Training by ARMA on 06 December 2023.
- c) Encourage Member States to use correct forms when submitting data, forms accessible on www.arma.africa
- d) Note that States that do not produce data as required will be added onto the AFI Air Navigation Deficiencies Database (AANDD).
- e) Urge States that have not implemented SLOP to communicate their intentions and provide evidence of reasons for not doing so.
- f) Urge States to provide ARMA with Height Monitoring Targets compliance levels for their State
- g) Urge the States to encourage ANSPs to conduct awareness training and safety promotions on prohibiting FL420 use in their en-route airspace.

....END....