INTERNATIONAL CIVIL AVIATION ORGANIZATION

Twenty-Fourth Meeting of the AFI Planning and Implementation Regional Group (APIRG/24)
(Virtual – 2 to 4 November 2021)

Agenda Item 3: **AFI Airspace Monitoring**

RVSM AND OPERATIONAL SAFETY

(Presented by ARMA)

SUMMARY
This working paper presents the full report for RVSM Safety in the Africa Indian Ocean Region (AFI) airspace. It contains the results of the 2019 Collision Risk Assessment 14, Monitoring Burden for the AFI Region, Implementation progress for Strategic Lateral Offset Procedure (SLOP), and Identification of Non- Approved aircraft operating outside of the AFI Region. **Action required is as per paragraph 3**
REFRENCE(S): **ICAO Annex 6** **ICAO Doc 9937** **ICAO Doc 9574** **ICAO Doc 9930**
Related ICAO Strategic Objective(s): A- Safety B- Capacity and Efficiency

1. INTRODUCTION

1.1 In the post-implementation collision risk assessments for a Reduced Vertical Separation Minimum (RVSM) in the Africa - Indian Ocean (AFI) Region, the technical vertical collision risk is assessed against a Target Level of Safety (TLS) of 2.5×10^{-9} fatal accidents per flight hour, and the total vertical collision risk is assessed against a TLS of 5×10^{-9} fatal accidents per flight hour. The collection of RVSM safety assessment data is an ongoing RVSM process which is a requirement for the maintenance of RVSM safety. AFI Flight information regions (FIRs)/Area Control Centers (ACCs) are committed to capturing, compiling and submitting Safety Assessment data on a monthly basis to ARMA for this purpose. As should be recalled the continued accurate monitoring of RVSM in AFI, as in other ICAO regions, is a long-term process with ARMA requiring the full participation of all AFI FIRs.

1.2 All operators that operate or intend to operate in airspace where RVSM is applied are required to participate in the RVSM monitoring program. In their application to the appropriate State authority for RVSM approval, operators must show a plan for meeting the applicable initial monitoring requirements. Aircraft engineering work that is required for the aircraft to receive RVSM airworthiness approval must be completed prior to the aircraft being monitored. Any exception to this rule will be coordinated with the State authority. Monitoring prior to the issue of RVSM operational

approval is not a requirement.

1.3 Lateral navigation accuracy has an essential influence on the likelihood of a collision between two aircraft once vertical separation has been lost. Lateral navigation accuracy has increased significantly due to GNSS-based navigation compared to the VOR/DME-based navigation. To mitigate this effect for vertical risk due to operational errors, the ICAO Strategic Lateral Offset Procedure (SLOP) is introduced. Within the current RVSM collision risk assessments, the safety benefits of the implementation of the SLOP are not taken into account.

1.4 Non-Approved AFI Registered airframes have been identified in other Regions operating in RVSM airspace. Civil Aviation Authorities (CAAs) are encouraged to comply with Annex 6 standards that require States to take appropriate action in the event that an aircraft for which it exercises operational authority is found to be operating in RVSM airspace without approval.

2. DISCUSSION

2.1 Table 1 below represents a nine-year Collision Risk Assessments report for the Region from 2010 to 2019.

CRA	N_{az}^{total}	TOTAL VERTICAL TLS EXCEEDED BY A FACTOR OF
CRA 14 2019	10.9×10^{-9}	**3.3**
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**
CRA 6 2011	23.2×10^{-9}	**4.7**
CRA 5 2010	33.0×10^{-9}	**6.6**
POSC CRA (2008-2009)	$\mathbf{31.2 \times 10^{-9}}$	**6.2**

Table 1 : Annual AFI TLS

2.2 Table 2 below is a comparison between **CRA 13** and **CRA 14**, highlighting the risk Estimation and Target Level of Safety (TLS)

AFI Airspace – estimated annual flying hours = 552 755.72 hours *(note: estimated hours based on Dec 2019 traffic sample data)*			
Source of Risk	**Risk Estimation**	**TLS**	**Remarks**
CRA 13 Total Risk(Previous)	*75.4 x 10^{-9}*	*5.0 x 10^{-9}*	*Above TLS*
Technical Risk	7.47 x 10^{-10}	2.5 x 10^{-9}	Below Technical TLS
Operational Risk	10.1 x 10^{-9}	-	-
CRA 14 Total Risk	**10.9 x 10^{-9}**	5.0 x 10^{-9}	**Above TLS**

Table 2: 2019 TLS

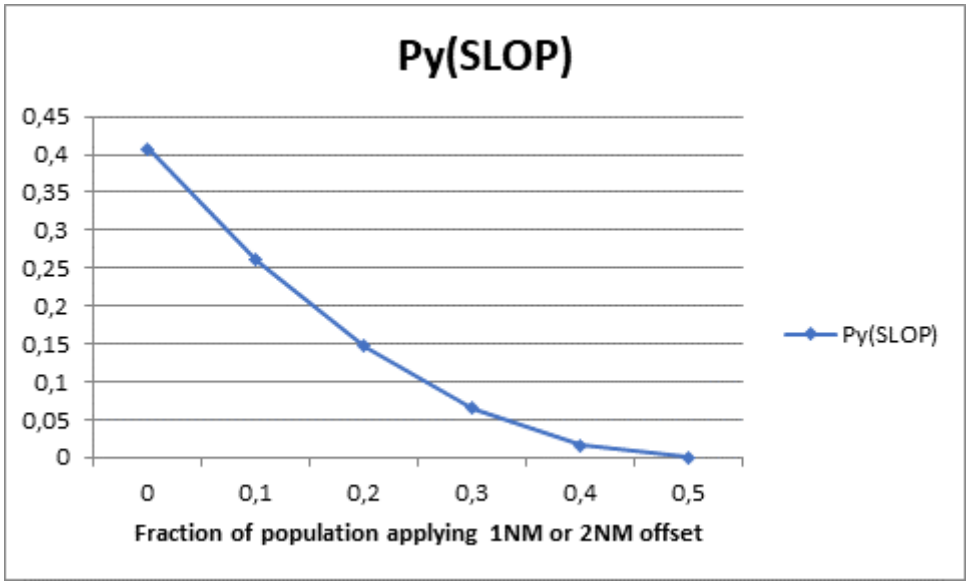
2.3 A review of the May 2021 RVSM height monitoring maintained by the ARMA on behalf of ICAO determined that the total number of RVSM approved aircraft totalled 926 as at end of May 2021.

2.4 When calculating the minimum monitoring requirements using the total of approved aircraft this results in a total monitoring burden of 577 aircraft. The current outstanding burden is 336 aircraft; this represents an increase of 134 outstanding aircraft.

2.5 The outstanding monitoring burden represents aircraft that have either been monitored with the currency expiring or with aircraft that have never been monitored in order to comply with the minimum monitoring requirements.

Defaulting AFI STATES	BURDEN	UNMONITORED
Burkina Faso	**5**	**5**
Cote d'Ivoire	**10**	**10**
DRC	**19**	**19**
Djibouti	**2**	**2**
Eritrea	**1**	**1**
Ghana	**17**	**17**
Mali	**7**	**6**
Sao Tome	**7**	**7**
Tanzania	**4**	**3**

2.6 SLOP reduces the rate of collisions due to the loss of planned longitudinal and vertical separation, by 38.19 per cent. It is a safety net in both RVSM and PBCS airspace when either vertical or longitudinal separation has been lost.



2.7 For aircraft travelling on unidirectional routes, the use of offsets also reduces, by 38.19 per cent, the rate of collisions due to the loss of planned vertical separation.

2.8 For aircraft travelling on bi-directional routes, the use of offsets reduces the rate of collisions due to the loss of an even number of flight levels of vertical separation, by 38.19 per cent; and it reduces the rate of collisions due to the loss of an odd number of flight levels of planned vertical separation, by 41.04 per cent.

2.9 For aircraft travelling in opposite directions on the same flight level of adjacent parallel routes, and having opposite-direction traffic on the left, the use of offsets reduces the rate of collisions due to the loss of planned lateral separation, by 2.85 per cent.

FIR	Implemented SLOP (Yes/No)
Accra	Yes
Addis Ababa	No
Antananarivo	Yes
Asmara	No
Beira	Yes
Brazzaville	Yes
Cape Town	No
Dakar Terrestrial	Yes
Dar Es Salaam	Yes
Entebbe	Yes
Gaborone	No
Harare	Yes
Johannesburg	Yes
Johannesburg Oceanic	Yes
Kano	Yes
Kinshasa	Yes
Lilongwe	No
Luanda	Yes
Lusaka	Pending
Mauritius	Yes
Mogadishu	Yes
Nairobi	No
N'djamena	Yes
Niamey	Yes
Roberts	Yes
Seychelles	Yes
Windhoek	No
Percentage of Implementation	**74%**
Percentage Not Implemented	**26%**
Total Implemented	**20**
Total Not Implemented	**7**
Pending Implementation Awaiting Evidence	**1**
Total FIR's	**27**

Table 3: SLOP Implementation status

2.10 Table 4 below represent the list of Operators and aircraft that have been operating in RVSM airspace without approval.

Operator ICAO code	Operator Name	Aircraft ICAO type	Reg. No.	AC Reg. State	Designated RMA	RMA of first observation	Authority State
LRK	Skyjet Aviation Services Ltd	E35L	5NLRK	DN	ARMA	EUR RMA	Nigeria
LRK	Skyjet Aviation Services Ltd	E35L	5NKAS	DN	ARMA	EUR RMA	Nigeria
LRK	Skyjet Aviation Services Ltd	LJ45	5NKAA	DN	ARMA	EUR RMA	Nigeria
	Unknown Operator	H25B	5HETM	HT	ARMA	EUR RMA	Tanzania
	Unknown operator	CL60	5NATA	DN	ARMA	EUR RMA	Nigeria
	UNITED AVIATION SERVICES	B735	5YSHA	HK	ARMA	EURASIA RMA	Kenya
	AIR DIRECT CONNECT-KENYA	B732	5YJHS	HK	ARMA	EURASIA RMA	Kenya

Table 4: Non-Approved Aircraft.

3. ACTION BY THE MEETING

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

a) Urge States to continue to support the ongoing RVSM programme by complying with ICAO Doc 9930 documented commitments from the Special AFIRAN Meeting in 2008;

b) Urge States to ensure monitoring plans are enforced by States for operators to comply with Long Term Height Monitoring Requirements as per Annex 6 Standards;

c) Encourage remaining States to implement SLOP so as to ensure implementation in the entire AFI RVSM Airspace for the discount to be added onto the next Collision Risk Assessment for the ICAO required Target Level of Safety is reached; and

------End---------