INTERNATIONAL CIVIL AVIATION ORGANIZATION

Fifth Meeting of the APIRG Airspace and Aerodrome Operations Sub-group (AAO/SG5), virtual, 23 to 26 August 2022

Agenda Item 5: **Activities to be coordinated with the RASG-AFI SSTs (Aspects that need coordination with RASG-AFI)**

RVSM AIRSPACE

(Presented by ARMA)

SUMMARY

This working paper presents the statistics of the reported factors affecting the continued RVSM System safety within the AFI region.

Action by the meeting is at paragraph 3.

REFERENCES

TAG UCR Database

ICAO Doc 9930, 9937 and 9574

This Working Paper is related to Strategic Objective:

A – Aviation Safety

B – Air Navigation Capacity and Efficiency

1. INTRODUCTION

1.1 For the analysis of the collision risk for AFI RVSM CRA15,The estimate of the technical vertical collision risk met the technical vertical TLS of 2.5 $\times 10^{-9}$ fatal accidents per flight hour, but the estimate of the total vertical collision risk did not meet the total vertical TLS of 5×10^{-9} fatal accidents per flight hour.

1.2 The CRA 15 2020 estimate of the technical vertical collision risk was 1.28×10^{-10} fatal accidents per flight hour, i.e. approximately a factor of 19 below the technical vertical TLS. For 23 of the 27 FIRs (85%), data have been submitted. Only Addis Ababa, Asmara, Dar Es Salaam and Lilongwe no data has been received. In total 219.5 months of the 324 (67.7%) have been received and processed. This is the largest percentage for all post-implementation CRAs. If the data that could not be processed was included too, then this percentage would become 72.7%.

2. DISCUSSIONS

2.1 The implementation and use of the ICAO Strategic Lateral Offset Procedure (SLOP) within AFI should be encouraged, where applicable, to counteract the adverse effect of very accurate GNSS navigation on vertical collision risk. The safety benefits of the SLOP were not worked into CRA 15 2020 as the implementation of the SLOP has not been completed in AFI Region.

FIR/UIR	SLOP Implementation	2021 Data
Accra*	Yes	(12 +12)/2=12
Addis Ababa	Yes	3
Antananarivo	Yes	12
Asmara	No evidence provided	-
Beira	Yes	12
Brazzaville*	Yes	(12+12+12)/3=12
Cape Town	Yes	12
Dakar*	Yes	(12+12+12+11)/4=11.5
Dar Es Salaam	Yes	9
Entebbe	Yes	12
Gaborone	Yes	12
Harare	Yes	12
Johannesburg	Yes	12
Johannesburg Oceanic	Yes	12
Kano	Yes	12
Kinshasa	Yes	4
Lilongwe	No evidence provided	-
Luanda	Yes	3
Lusaka	Yes	8
Mauritius	Yes	12
Mogadishu	Yes	7
Nairobi	No evidence provided	12
N'Djamena	Yes	12
Niamey*	Yes	12
Roberts	Yes	11
Seychelles	Yes	11
Windhoek	No evidence provided	12
Total	**23**	**219.5**

Table 1: SLOP Implementation and 2021 Data return status as per FIR

2.2 There remain several factors that require the estimate of the total vertical collision risk to be treated with caution. The estimate is most likely affected by under-reporting of vertical events involving large height deviations as well as lack of details in the reporting. Continued efforts to bring the total vertical risk further down to below the total vertical TLS and to improve the event reporting in AFI must be sustained.The number of flight hours is also a factor that affects the estimate of the total vertical collision risk. The COVID-19 pandemic influenced the number of flights in the AFI region drastically.

2.3 Traffic increase shows the average amount of flights per FIR for the different months. The figure shows the significant drops in flights due to the lockdown caused by the COVID pandemic.

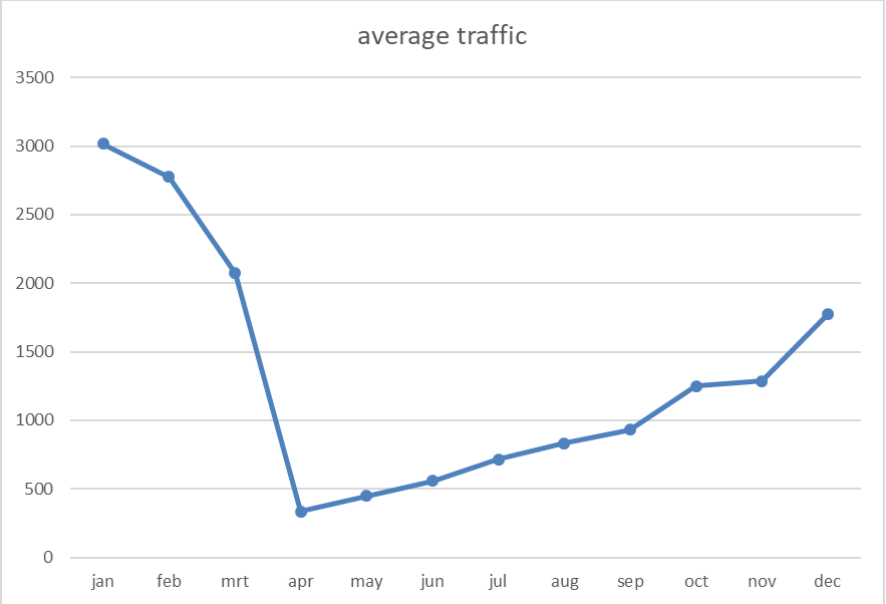

Figure 2: The average number of flights per FIR/ACC per month based on the submitted ARMA Form 4.

2.4 The distribution of the aircraft over the available flight levels of the route network in the AFI region determines the exposure to the risk due to the loss of vertical separation between aircraft at adjacent flight levels. This exposure is reflected in the frequencies of longitudinal and horizontal overlap, or passing frequencies.The use of these adjacent ACCs covering the highest passing frequency is to address the problem of high traffic flows where higher-than-average collision risk may pertain.

2.5 The most noticeable difference is caused a difference in the passing frequency, nx(equiv), increasing from 0.03633 to 0.05397. Lusaka and Harare, that form together with Gaborone the three adjacent FIRs that yield the highest passing frequency. This is an increase of 48% from the previous year.As a consequence, the technical risk increases from $0.91x10^{-10}$ to $1.28x10^{-10}$.

Figure 2: Summary of available data for AFI RVSM CRA 16 2021 submissions
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

2.6 The AFI Region measures the Target Level of Safety not in Isolation as per FIR or Area of Routing(AR) but provides a hollistic calculation of all the AFI FIR Safety contributions.
The safety of an RVSM Airspace is measured according to the ICAO TLS of **5 x10^{-9}**

CRA	N_{az}^{total}	TOTAL VERTICAL TLS EXCEEDED BY A FACTOR OF
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**

2.7 All operators of RVSM approved aircraft are required to participate in the RVSM height monitoring programme. The principle purposes of the long term height monitoring programme are to verify long term ASE stability and the efficacy of an operator's continued airworthiness programme.

2.8 For aircraft designs which have been monitored, with statistically representative data samples demonstrating stable performance, for in excess of two years, the requirement is for all operators to have a minimum of two aircraft monitored every two years or 1,000 flight hours, whichever the greater. For aircraft designs which have received a generic RVSM airworthiness approval within the last two years operators are required to have 60% of their fleets monitored every two years or 1,000 flight hours, whichever the greater. Finally if an aircraft is modified or built to a unique design and presented for RVSM airworthiness approval on an individual basis then that aircraft is required to be monitored every two years or 1,000 flight hours, whichever the greater.

2.9 States should ensure that all operators of RVSM approved aircraft under their operational authority comply with the minimum fleet monitoring targets. States should ensure that operators have implemented plans to demonstrate compliance with LTHM requirements and that the targets are met in the time frame required. States should take appropriate action with any operator which fails to comply with the LTHM requirements. Such appropriate action includes temporary revocation or suspension of an approval, complete withdrawal of approval and refusing an extension in the event that an approval has expired.

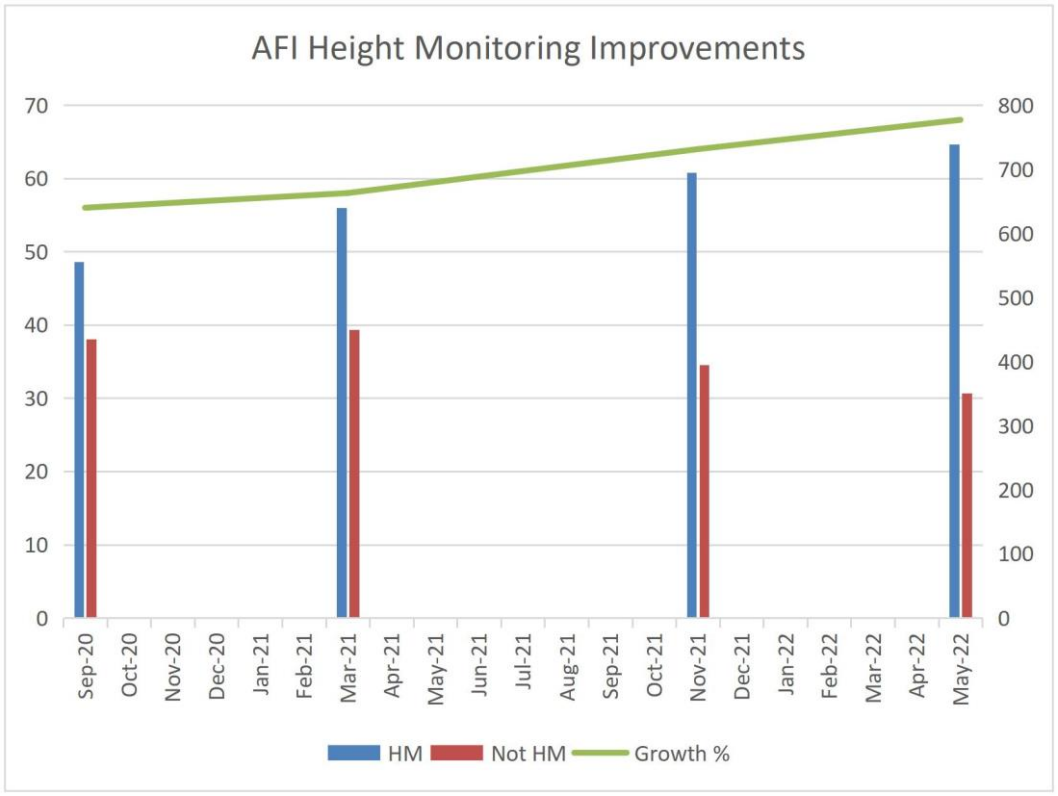

Figure 3 : Height Monitoring Improvements of AFI Registered aircraft population.

2.8 In 2019 there were 991 RVSM Approved aircraft registered and listed in the AFI RVSM Database, despite the pandemic we witnessed a growth in new RVSM approvals being sent in and many new airframes non-approved airframes operating in RVSM Airspace not just in the AFI Region but also in other Regions. We also noticed that the air-frames that once belonged to airlines that stopped operating were transferred/sold to other operators AOCs meaning the population of air-frames listed in the AFI Region did not reduce but increased to 1090 RVSM operators.

3. ACTION BY THE MEETING

The meeting is invited to:

a) Note and review the contents of this working paper;

b) Encourage 2021 and 2022 Data submission to ARMA from AFI States.2021 Data will be submitted to Mathematicians on the 01 September 2022.

c) SLOP implementation encouraged to 100% Implementation for the AFI Region so the discount can applied to the TLS; and

d) Encourage States to comply with States Height Monitoring Programs.