International Civil Aviation Organization

Middle East Regional Monitoring Agency Board

Fourteenth Meeting (MIDRMA Board/14)
(Khartoum, Sudan, 1 – 3 February 2016)

Agenda Item 4: RVSM Monitoring and related Technical Issues

MID RVSM SMR 2015 INITIAL RESULTS

(Presented by MIDRMA)

SUMMARY

This working paper details the results for the first draft version of the MID RVSM Safety Monitoring Report 2015 (Version 0.1) and tries to demonstrate according to the data received that the key safety objectives of the SMR in accordance with ICAO Doc 9574 were met in operational services in all the Middle East RVSM airspace except for Amman, Kuwait, Tripoli and Sana'a FIRs.

Action by the meeting is at paragraph 3.

REFERENCES

- MIDANPIRG/15 Report
- MID RVSM SMR 2014
- MIDRMA Board/13 Report

1. INTRODUCTION

1.1 The Middle East Regional Monitoring Agency presents the MID RVSM Safety Monitoring Report 2015 to the Middle East Air Navigation Planning and Implementation Regional Group (MIDANPIRG) for their endorsement.

1.2 The first draft version for the SMR 2015 (Ver 0.1) was calculated for 10 FIRs only in the ICAO Middle East Region. Amman and Kuwait were excluded temporary from the analysis because the MIDRMA focal points responsible for those FIRs submitted corrupted traffic data and they were unable to rectify the contents according to the SMR 2015 requirements which was approved by MIDANPIRG 15 for the development of the report, while the airspace of Tripoli and Sana'a FIRs will not be included in the RVSM safety analysis due to the non-submission of the required traffic data and LHD reports for more than 20 months.

1.3 The results present evidence that the key safety objectives, as set out in the MID RVSM safety policy in accordance with ICAO Doc 9574 (2nd Edition), continue to be met in the Middle East RVSM airspace except for the FIRs mentioned in 1.2.

2. DISCUSSION

2.1 Further to the outcome of MIDANPIRG/15 meeting Conclusion 15/8 concerning the development of the MID RVSM SMR 2015, the Traffic Data Sample (TDS) required for the safety analysis must be collected from 01st September 2015 until 30th September 2015 for all traffic operating within the ICAO Middle East RVSM airspace and must be submitted to the MIDRMA not later than 31st October 2015.

2.2 Although, this is the sixth Safety Monitoring Report developed for the region, the MIDRMA continued to face problems due to corrupted and late receipt of traffic data by some MIDRMA Member States. These types of problems caused the first draft version of the SMR to be presented for the meeting as incomplete and the MIDRMA was forced to exclude two of the FIRs in the ICAO Middle East region from the safety analysis due to corrupted traffic data.

2.3 Bahrain, Egypt, Lebanon Oman, Sudan, Syria, Saudi Arabia , and UAE sent their traffic data before the deadline set by MIDANPIRG/15 and MIDRMA Board/13 meetings , while Iran and Iraq sent their data so late and well after the agreed deadline set for this purpose, the remaining Member States sent corrupted/missing data which cannot be processed.

Note 1: Amman and Kuwait sent corrupted and missing traffic data which cannot be processed.

Note 2: The MIDRMA requested from the ATM SG/2 meeting (Cairo, Egypt, 30 November - 03 December 2015) to temporary exclude Tripoli and Sana'a FIRs from the RVSM safety analysis for 2015 which was approved and adopted by the meeting.

2.4 The description of the total traffic data processed for each MIDRMA Member State by the MIDRAS is depicted in the table below, a total of **193,872** flights were processed for the 10 FIRs, these flights were evaluated and processed very carefully to ensure accurate results according to the data submitted, the remaining TDS for each FIR will be reviewed and corrected by each Member State in a later stage and the results will be updated accordingly in the second draft version of the SMR.

SN	MID States	Total TDS Received for September 2015	Total TDS Processed by MIDRAS
1	Jeddah/Riyadh	40250	30686
2	Muscat FIR	37080	36698
3	Cairo FIR	29172	28754
4	Bahrain FIR	25676	25003
5	Tehran FIR	39185	37532
6	Emirates FIR	25623	24386
7	Baghdad FIR	3296	2949
8	Kuwait FIR	2139	0
9	Sana'a FIR	-	0
10	Khartoum FIR	6297	6295
11	Amman FIR	5241	0
12	Damascus FIR	1911	1522
13	Beirut FIR	47	47
14	Tripoli FIR	-	0
	Total	**215,917**	**193,872**

MID States RVSM Traffic Data*

*Note: The total number of the TDS is subject to increase once the data is corrected.

2.5 The MIDRMA decided to go ahead with the calculations of the SMR safety parameters without the Member States mentioned in 2.3 and estimated the risk of collision associated with RVSM and compare this risk to the agreed RVSM safety goals, the Target Level Safety (TLS) taking into consideration that the key issue for the assessment of RVSM safety is the satisfaction of the three Safety Objectives defined for the MIDRMA, the remaining member States (Kuwait and Jordan) which were excluded temporary from the SMR first draft version will be included in the second draft version which will be presented for review by the ANSIG/2 meeting before its endorsed by MIDANPIRG/16, hoping the data required for the remaining FIRs will be received on time.

2.6 The MID RVSM safety assessment work is accomplished through the collection of the TDS related to the operations in the RVSM airspace and with the help of the MID RVSM Scrutiny Group which will convene during this meeting , all received LHD reports will be reviewed, analyzed and validated for the SMR 2015 reporting period.

2.7 The table below presents the fidelity with which the MIDRMA Member States provided Large Height Deviation Reports for the SMR 2015 reporting period. Since January 2015 the MIDRMA has received LHD reports for each month from all Member States except for Libya and Yemen. The MIDRMA continues to request that ATS providers forward reports of large height deviations as soon as they occur by using the LHD online reporting tool.

MID STATES	Submitted LHD in 2015
Bahrain	553
Egypt	98
Iran	10
Iraq	179
Jordan	24
Kuwait	409
Lebanon	NIL Report
Libya	0
Oman	39
Qatar	N/A
Saudi	91
Sudan	5
Syria	NIL Report
UAE	64
Yemen	0

2.8 The LHD reports are separated by categories based on the details provided for each deviation. There are two such categories: large height deviations contributing to technical risk and large height deviations contributing to operational risk. The above table reflects the LHD reports received which contributed for operational risk but the vast majority of these reports have no direct or serious risk to the RVSM airspace. There was only one reported event related to technical risk.

2.9 A sharp decrease in the total LHD duration was observed from the last SMR reporting period, so far only 6 events contributed to operational risk and only one event contributed to technical risk, the total LHD duration is 5 minutes and 22 seconds, taking into consideration that the reporting period for this SMR is not closed yet.

2.10 **Safety Monitoring Report 2015 (First Draft Version)**

RVSM Safety Objective 1:

2.10.1 The risk of collision in MID RVSM airspace due solely to technical height-keeping performance meets the ICAO target level of safety (TLS) of 2.5 x 10^{-9} fatal accidents per flight hour.

2.10.2 The 2015 value computed for technical height risk is **3.1152 × 10^{-10}**. This meets RVSM Safety Objective 1.

2.10.3 According to the technical risk values as shown in the table below from the previous SMRs, the TLS value increased from the last SMR but safe comparing to the ICAO TLS **2.5 x 10^{-9}**.

*Note: The calculated result measured without Kuwait, Amman, Sanaa and Tripoli FIRS

Technical Risk Values						
Year 2006	Year 2008	Year 2010	Year 2012	Year 2013	Year 2014	**Year 2015**
2.17x10^{-14}	1.93x10^{-13}	3.96x10^{-15}	5.08 x 10^{-14}	6.37x10^{-12}	3.18x10^{-12}	**3.1152 x 10^{-10}**

Pz(1000) Compliance:

2.10.4 The Pz(1000) is the probability that two aircraft at adjacent RVSM flight levels will lose vertical separation due to technical height keeping errors. The value of the probability of vertical overlap Pz(1000), based on the actual observed Altimetry System Error (ASE) and typical Assigned Altitude Deviation (AAD) data is estimated to be of **2.4405 x 10^{-09}** . This value meets the Global System Performance Specification that the probability of two aircraft will lose procedural vertical separation of 1000ft should be no greater than **1.7x10^{-8}**.

Middle East RVSM Airspace Horizontal Overlap Frequency (HOF):

2.10.5 The estimate of the frequency of horizontal overlap is based on the number of proximate events, which is defined as the occurrence of two aircraft passing within a horizontal distance R whilst separated by the vertical separation minimum, and based on the range of different geometries and relative velocities seen across the set of proximate events, the probability that the proximity is less than a distance equal to the size of the average aircraft, given that it is within the distance R, is calculated. This probability, combined with the proximity frequency, gives the horizontal overlap frequency.

a) The calculated horizontal overlap frequency for all the MID RVSM airspace was estimated to be **3.69x 10^{-6}** per flight hour.

Horizontal Overlap Frequency (HOF)						
Year 2006	Year 2008	Year 2010	Year 2012	Year 2013	Year 2014	**Year 2015**
6.99x10^{-3}	5.1x10^{-11}	2.88x10^{-6}	6.49x10^{-5}	4.34x 10^{-8}	5.04x 10^{-9}	**3.69x 10^{-6}**

b) With the new feature added in the MIDRAS (MID Risk Analysis Software), the MIDRMA is able to measure the HOF for all the Middle East RVSM airspace which gave the MIDRMA the ability to continuously monitor each individual FIR.

RVSM Safety Objective 2:

2.10.6 The overall risk of collision due to all causes which includes the technical risk and all risk due to operational errors and in-flight contingencies in the MID RVSM airspace meets the ICAO overall TLS of 5 x 10^{-9} fatal accidents per flight hour.

2.10.7 The computed overall risk of collision due to all causes which includes the technical risk and all risk due to operational errors and in-flight contingencies in the MID RVSM airspace is **7.4544×10^{-10}** which meets the ICAO overall TLS of **5×10^{-9}** fatal accidents per flight hour, the table below reflects a comparison with the overall risk values calculated for the previous SMRs.

*Note: The calculated result measured without Baghdad, Cairo and Tripoli FIRs.

Overall Risk Values						
Year 2006	Year 2008	Year 2010	Year 2012	Year 2013	Year 2014	**Year 2015**
N/A	4.19×10^{-13}	6.92×10^{-12}	1.04×10^{-11}	3.63×10^{-11}	4.91×10^{-11}	**7.4544×10^{-10}**

*Note: The calculated result measured without Kuwait, Amman, Sanaa and Tripoli FIRs.

RVSM Safety Objective 3:

2.10.8 Address any safety-related issues raised in the SMR by recommending improved procedures and practices; and propose safety level improvements to ensure that any identified serious or risk-bearing situations do not increase and, where possible, that they decrease. This should set the basis for a continuous assurance that the operation of RVSM will not adversely affect the risk of en-route mid-air collision over the years.

2.10.9 Conclusions for RVSM Safety Objective 3:

a) The MIDRMA improved its monitoring capabilities with the new Enhanced GMUs which gave the ability to respond for more height monitoring requests even from outside the Middle East Region.

b) The MIDRMA will continue to include in its work program briefings to the focal points appointed for airworthiness issues to ensure their follow up with their monitoring targets and to resolve any non-compliant RVSM approved aircraft. At the same time the MIDRMA will coordinate with the focal points appointed for ATC issues to deliver RVSM safety assessment briefing as necessary or when requested.

c) The MIDRMA shall continue to carry out continuous survey and investigation on the number and causes of non-approved aircraft operating in the MID RVSM airspace.

d) The MIDRMA will continue to encourage States to submit their Large Height Deviation Reports using the MIDRMA online reporting tool which has been continuously upgraded to improve the level of reporting.

e) The MIDRMA completed the Hot Spot feature in the (MIDRAS) Software and started to address the results in the SMR.

f) The MIDRMA will continue to enhance the (MIDRAS) Software and started phase 3 of the upgrade project to add visualization features in 4D.

g) Current risk-bearing situations have been identified by using the MIDRAS and actions will be taken to ensure resolving all violations and information which will be collected during the MID RVSM Scrutiny Group meeting in order to identify operational issues and potential mitigations.

Therefore, it is concluded that this Safety Objective is currently met.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) review and discuss the first draft version of the MID RVSM SMR 2015;

b) urge Kuwait and Jordan to resend their corrected traffic data according to the required format; and

c) urge concerned States to correct their relevant remaining TDS which were not processed for the safety analysis.

APPENDIX A

Description of TVR for each FIR:

Bahrain

Number of Flights involved: 25003
Flying Time: 8,528 hours
Flying Distance: 3,764,928 NM
Average Speed: 438.22 kts
Passing Frequency (n_equiv): 1.01120E-002

Probability of Lateral Overlap (Py(0)): 0.16481

Technical Vertical Risk (N_az):
(*) Probability of Vertical Overlap (Pz(1000)): 1.2914E-09
(*) TVR due technical: 4.429E-12

Bahrain FIR Total Vertical Collision Risk 3.4612E-10

Egypt

Number of Flights involved: 28754
Flying Time: 24,260 hours
Flying Distance: 11,242,484 NM
Average Speed: 454.96 kts
Passing Frequency (n_equiv): 2.34226E-001

Probability of Lateral Overlap (Py(0)): 0.14726

Technical Vertical Risk (N_az):
(*) Probability of Vertical Overlap (Pz(1000)): 2.2398E-09
(*) TVR due technical: 1.5878E-10

Cairo FIR Total Vertical Collision Risk: 1.7677E-09

Iran

Number of Flights involved: 37532
Flying Time: 49,516 hours
Flying Distance: 21,390,270 NM
Average Speed: 427.42 kts
Passing Frequency (n_equiv): 7.29866E-001

Probability of Lateral Overlap (Py(0)): 0.16623

Technical Vertical Risk (N_az):
(*) Probability of Vertical Overlap (Pz(1000)): 2.7451E-09
(*) TVR due technical: 6.8593E-10

Tehran FIR Overall Vertical Risk 6.8593E-10

Iraq

Number of Flights involved: 2949
Flying Time: 1,249 hours
Flying Distance: 593,632 NM
Average Speed: 478.45 kts
Passing Frequency (n_equiv): 4.04474E-002

Probability of Lateral Overlap (Py(0)): 0.1246

Technical Vertical Risk (N_az):
(*) Probability of Vertical Overlap (Pz(1000)): 1.0951E-08
(*) TVR due technical: 1.1328E-10

Tehran FIR Total Vertical Collision Risk 1.1328E-10

Lebanon

Number of Flights involved: 47
Flying Time: 5 hours
Flying Distance: 1,948 NM
Average Speed: 386.88 kts
Passing Frequency (n_equiv): 0.00000E+000

Probability of Lateral Overlap (Py(0)): 0.08431

Technical Vertical Risk (N_az):
(*) Probability of Vertical Overlap (Pz(1000)): 1.6809E-10
(*) TVR due technical: 0

Beirut FIR Total Vertical Collision Risk 0

Oman

Number of Flights involved: 36698
Flying Time: 22,894 hours
Flying Distance: 10,679,441 NM
Average Speed: 462.06 kts
Passing Frequency (n_equiv): 2.70162E-001

Probability of Lateral Overlap (Py(0)): 0.16669

Technical Vertical Risk (N_az):
(*) Probability of Vertical Overlap (Pz(1000)): 1.2111E-09
(*) TVR due technical: 1.1208E-10

Muscat FIR Total Vertical Collision Risk 1.1208E-10

Saudi Arabia

Number of Flights involved: 30686
Flying Time: 30,732 hours
Flying Distance: 13,666,309 NM
Average Speed: 456.86 kts
Passing Frequency (n_equiv): 6.75695E-002

Probability of Lateral Overlap (Py(0)): 0.15035

Technical Vertical Risk (N_az):
(*) Probability of Vertical Overlap (Pz(1000)): 1.8255E-09
(*) TVR due technical: 3.8115E-11

Jeddah FIR Total Vertical Collision Risk 3.8115E-11

Sudan

Number of Flights involved: 6295
Flying Time: 9,483 hours
Flying Distance: 4,430,992 NM
Average Speed: 461.41 kts
Passing Frequency (n_equiv): 2.37858E-001

Probability of Lateral Overlap (Py(0)): 0.1694

Technical Vertical Risk (N_az):
(*) Probability of Vertical Overlap (Pz(1000)): 7.1848E-09
(*) TVR due technical: 5.9493E-10

Khartoum FIR Total Vertical Collision Risk 5.9493E-10

Syria

Number of Flights involved: 1522
Flying Time: 313 hours
Flying Distance: 128,474 NM
Average Speed: 426.50 kts
Passing Frequency (n_equiv): 1.51458E-001

Probability of Lateral Overlap (Py(0)): 0.1243

Technical Vertical Risk (N_az):
(*) Probability of Vertical Overlap (Pz(1000)): 4.8846E-12
(*) TVR due technical: 1.893E-13

Damascus FIR Total Vertical Collision Risk 1.893E-13

UAE

Number of Flights involved: 24386
Flying Time: 5,598 hours
Flying Distance: 2,182,613 NM
Average Speed: 363.47 kts
Passing Frequency (n_equiv): 8.65818E-002

Probability of Lateral Overlap (Py(0)): 0.16071

Technical Vertical Risk (N_az):
(*) Probability of Vertical Overlap (Pz(1000)): 9.7352E-10
(*) TVR due technical: 2.8038E-11

Emirates FIR Total Vertical Collision Risk 4.3615E-09

Overall

Number of Flights involved: 193926
Flying Time: 152,578 hours
Flying Distance: 68,081,088 NM
Average Speed: 443.71 kts
Average Passing Frequency: 3.47417E-001

Technical Vertical Risk (N_az):
(*) Average Probability of Vertical Overlap (Pz(1000)): 2.4405E-09
(*)TVR due technical: 3.1152E-10

MID RVSM Airspace Overall Vertical Collision Risk 7.4544E-10*

- END -