

International Civil Aviation Organization  
Eastern and Southern African Office

**Eleventh Meeting of the APIRG Air Traffic Services, Aeronautical  
 Information Services and Search and Rescue Sub-Group  
 (ATS/AIS/SAR/SG/11)  
 [Nairobi, Kenya 26 – 30 April 2010]**

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**Agenda Item 5: RVSM operations and Monitoring Activities**

**AFI RVSM POST OPERATIONAL CRA**

(Presented by ARMA)

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| <b>SUMMARY</b>  |
| This Working Paper Discusses and Provides Insight into the<br>AFI RVSM CRA (No 4) |

**1. INTRODUCTION**

1.1 The Fourth Collision Risk Assessment is the first full Assessment after the implementation of RVSM in AFI and covers the time period from the 25 September 2008 until the end of September 2009. The CRA also forms part of the POSC. The assessment addresses two of the AFI RVSM Safety Policy objectives, namely an assessment of the technical vertical collision risk against a Target Level of Safety (TLS) of  $2.5 \times 10^{-9}$  fatal accidents per flight hour, and an assessment of the total vertical collision risk against a TLS of  $5 \times 10^{-9}$  fatal accidents per flight hour. Along with the process various important observations are made which will be briefly discussed in the paper.

**2. DISCUSSION**

2.1 The estimate of the technical vertical collision risk meets the technical vertical TLS of  $2.5 \times 10^{-9}$  fatal accidents per flight hour but the estimate of the total vertical collision risk does not meet the total vertical TLS of  $5 \times 10^{-9}$  fatal accidents per flight hour.

2.2 The total vertical TLS was found to be exceeded by a factor of approximately 6. The dominant component of the total vertical risk was the risk due to aircraft having levelled off at the wrong flight level. This had to be estimated conservatively due to a lack of precise information on the duration of the pertinent events. 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 incidents involving large height deviations. Measures are required to ensure proper incident reporting.

2.3 The estimate of the technical vertical collision risk is affected by a number of limitations in the traffic flow data used for estimating the passing frequency parameter of the collision risk model. Steps must be taken to make the passing frequency estimates more reliable.

2.4 Whilst the pre-implementation CRAs showed that the technical vertical TLS was met, it is necessary to confirm that this TLS has continued to be met on the basis of recent post-implementation data during the first year of AFI RVSM operations. For the technical vertical collision risk assessment, this data concerns the aircraft population on the one hand and the traffic flows on the other. The aircraft population plays a part with regard to the overall Altimetry System Error (ASE) distribution, the lateral navigation accuracy, and the definition of average aircraft dimensions. Traffic flows (together with navigation accuracy) determine the exposure of the aircraft to the loss of vertical separation.

2.5 The Assessment was made more difficult to compile due to the absence of data from various FIR's. The collection of data from ALL FIR's cannot be over emphasized. Data was only received from a limited number of FIR's. For 16 FIR's, the quality of the data was such that the passing frequency and aircraft population could be determined. This constitutes only 34% of the total that should have been available from the 30 participating FIR's. The quality of the available information varied strongly.

2.6 Based on the available and processable data set, a total of 313,652 flight hours for the AFI region was calculated for the RVSM flight level band FL290 – FL410 inclusive for a one-year period of time from 25 September 2008 to 24 September 2009 inclusive. This appears to represent only a very limited proportion of the total. For example, the number of scheduled flights in the AFI region for the year 2003 was estimated in the initial CRA (CRA 1) as 1,108,000 flights. It must be concluded, therefore, that the available set of information represents only a fraction of all flights in the AFI region due to limited data collection.

2.7 This technical risk estimate calculated is expressed in fatal accidents per flight hour and is compared with the ICAO technical vertical TLS of  $2.5 \times 10^{-9}$  fatal accidents per flight hour. It can be concluded that the technical vertical TLS is met. Moreover, it is being met with a factor of approximately 10.

2.8 The Total Vertical Collision Risk can now be calculated which includes the Technical Vertical Collision Risk. In the same manner as for the pre-implementation CRAs, incident data has been used to estimate the vertical collision risk due to the broad causes listed below:

- ATC error;
- Pilot error;
- ACAS events;
- Non-RVSM approved aircraft;
- Equipment failure;
- Turbulence/weather;

- Unknown civil aircraft;
- Unknown military aircraft operating outside designated military areas; and
- Aircraft contingency events.

2.9 We should recall that Large Height Deviations are any deviations of 300FT or more which are derived from the ARMA Form 1 titled Large Height Deviations and then any event which is analyzed to be a Large Height Deviation from the AIAG data. Eight out of the thirty FIR's did not provide any information in Form 1 which is a dismal return.

2.10 A total of 36 height deviations were reported to ARMA on the ARMA Form 1 of which seven were confirmed LHD's and included in the CRA. Compared with the last pre-implementation CRA the number of FIR's actually reporting one or more deviations in ARMA Form 1 has increased from 4 to 11 and the number of reported deviations increased approximately in proportion from 13 to 36 which is encouraging. AFI in this case has 27% of FIR's not reporting to ARMA which will need to be addressed.

2.11 When processing the AIAG data the results of the classification applied to the 70 AIRPROX reports ultimately analysed, namely 41 vertical events, 20 horizontal events, 5 no error/risk events, and 4 TCAS nuisance alerts. This shows a considerable increase in the number of vertical events compared with that for the last pre-implementation CRA 3, for which there were 13 vertical reports and 34 horizontal reports. It is encouraging to note that the horizontal events have decreased probably due to the awareness campaign and then the availability of additional flight levels.

2.12 Further to the above mentioned observations it was calculated that incorrect flight level crossings was approximately 12% larger than in the last pre-implementation CRA.

2.13 It is thus evident that vertical incidents have increased since the implementation of RVSM which can largely be attributed to aircraft operating at the wrong flight levels. This aspect appears to be coupled to lapses in ATM. A concerted effort from ATM will be required to rectify this tendency.

2.14 The Total Vertical Risk estimate calculated is expressed in fatal accidents per flight hour and is compared with the ICAO TLS of  $5 \times 10^{-9}$  fatal accidents per flight hour. It can be concluded that the Total Vertical Risk is not met. Moreover, it is not being met by a factor of approximately 6.

2.15 As has been discussed in previous CRA's the horizontal events which are not related to RVSM were very high and it is encouraging to observe that these events have decreased. This could be attributed to the awareness campaign that was launched when it was first identified and is also coupled to ATM.

2.16 All ACC's and operators in the AFI region will have to maintain a sharper RVSM awareness attitude whilst operating in RVSM airspace in order to bring the Total Vertical Risk back towards the TLS. RVSM vigilance cannot be over emphasized.

### **3. ACTION BY THE MEETING**

3.1 The meeting is requested to:

- Take general note of the content of the WP for application within RVSM operations where applicable
- Support the accurate reporting of all RVSM safety assessment data
- Support ATM procedures towards the continued reduction of horizontal events.
- Support all measures that will contribute towards reducing vertical incidents.

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