International Civil Aviation Organization

SEVENTEENTH MEETING ON THE IMPROVEMENT OF AIR TRAFFIC SERVICES OVER THE SOUTH ATLANTIC

(Canary Islands, Spain, 18-20 April 2012)

Agenda Item 2: Air Traffic Management (ATM)

2.2 SATMA report on Traffic Statistics, Safety procedures and operational procedures in the EUR/SAM corridor:

2010 Collision Risk Assessment within the EUR/SAM Corridor

(Presented by SATMA)

SUMMARY

This paper presents the results and conclusions obtained for the 2010 Collision Risk Assessment within the EUR/SAM Corridor.

1. INTRODUCTION

SATMA was committed by SAT group to perform and present periodical studies to ensure a safe application of RVSM and RNP10 in the EUR/SAM Corridor, monitoring collision risk to check whether this value is held below the required Target Level of Safety.

This report presents the 2010 collision risk assessment made for the EUR/SAM Corridor. It assesses the current and projected lateral and vertical collision risk in the Corridor, where RNP10 and RVSM are implemented, with data of traffic between FL290 and FL410 collected from 1st January 2010 to 31st December 2010.

Two quantitative risk assessments, based on suitable versions of the Reich Collision Risk Model, have been carried out. The first assessment concerns the lateral collision risk whilst the second one concerns the vertical collision risk. Taking into account the values derived from the collision risk model and the traffic forecast for the future, it has been possible to estimate the collision risk for the following years in each UIR crossed by the Corridor.

2. DISCUSSION

2.1 DATA ASSUMPTIONS

The CRM program uses flight plan data obtained from Palestra (Aena's flight plan database), for the Canaries and traffic data from the samples provided by SAL, Dakar and Atlantic-Recife.

Data from Palestra and traffic samples from SAL and Atlantic-Recife for the entire 2010 were available for this assessment. Conversely, Dakar provided traffic samples from the first six months of the year 2010 (1st January-30th June).

Data provided by SAL, Dakar and Recife include information from aircraft overflying the airspace on the four main routes of the Corridor. With regard to crossing routes, SAL provided traffic information from airways UR-976/UA-602 whereas Dakar provided traffic data from UL-435. Conversely, Recife only provided crossing traffic information (UL375-695) from eight months out of the year.

It must be highlighted that in the data provided, sometimes there was not information of all the needed waypoints and, in some other cases, the information was incoherent. As a result, extrapolation of traffic data has been necessary in some cases in order to obtain the traffic distribution along the Corridor and on crossing routes, considering the most logical routes, flight levels and speeds.

2.2 Lateral Collision Risk

Once all the parameters related to the collision risk model have been set, it is possible to calculate the lateral collision risk for the current scenario. This value must not exceed the maximum allowed, whereby the system is considered to be safe. This threshold, denominated TLS (Target Level of Safety), is set to TLS = $5 \cdot 10^{-9}$. It means that an amount of $5 \cdot 10^{-9}$ accidents per flight hour is considered to be acceptably safe.

In the current system (with RNP10, two unidirectional and two bidirectional routes), the collision risk values obtained for both 2010 and 2020 in the different locations are the ones shown in the following table:

Locations	Lateral Collision Risk 2010	Lateral Collision Risk 2020
Canaries	$1.5028 \cdot 10^{-9}$	$2.6913 \cdot 10^{-9}$
SAL 1	$1.4226 \cdot 10^{-9}$	$2.5477 \cdot 10^{-9}$
SAL 2	$1.9344 \cdot 10^{-9}$	$3.4643 \cdot 10^{-9}$
Dakar 1	$1.6597 \cdot 10^{-9}$	$2.9723 \cdot 10^{-9}$
Dakar 2	$1.5794 \cdot 10^{-9}$	$2.8285 \cdot 10^{-9}$
Recife	$1.7827 \cdot 10^{-9}$	$3.1926 \cdot 10^{-9}$

From this table, it can be concluded that lateral collision risk is below the TLS = $5 \cdot 10^{-9}$ with the current traffic flow and it is estimated that, considering an annual traffic growth rate of 6%, it will continue to be laterally safe during the period under study.

2.3 Vertical Technical Collision Risk

In the case of the vertical technical collision risk, the TLS is set to TLS = $2.5 \cdot 10^{-9}$. The collision risk values obtained for both current and projected traffic flow can be seen in the following table:

Locations	Technical Vertical Collision Risk 2010	Technical Vertical Collision Risk 2020
Canaries	$0.0124 \cdot 10^{-9}$	$0.0222 \cdot 10^{-9}$
SAL 1	$0.0048 \cdot 10^{-9}$	$0.0086 \cdot 10^{-9}$
SAL 2	$0.0073 \cdot 10^{-9}$	$0.0130 \cdot 10^{-9}$
Dakar 1	$0.0098 \cdot 10^{-9}$	$0.0176 \cdot 10^{-9}$

Dakar 2	$0.0090 \cdot 10^{-9}$	$0.0160 \cdot 10^{-9}$
Recife	$0.0088 \cdot 10^{-9}$	$0.0158 \cdot 10^{-9}$

It should be noted that the estimates of the technical vertical risk are below the technical TLS even in 2020, being the values obtained for all the locations similar to each other.

2.4 Total Vertical Collision Risk

The total vertical risk is the sum of the technical risk and the risks due to large height deviations involving whole numbers of flight levels (both climbing/descending aircraft and levelling off at a wrong level aircraft) and the risk due to large height deviations not involving whole numbers of flight levels. It is assumed that the same type of collision risk model applies to the different risk components, being only different the probability of vertical overlap, $P_z(S_z)$, and the average relative vertical speed used in each case.

LHD reports sent by the States enable to develop an estimation of the operational vertical collision risk. To do this, it is necessary to know the magnitude of the different deviations reported, their cause and their duration in order to compute the total number of crossed levels, N, and the total time spent at incorrect flight level, t_{wl}, in each UIR. Only data from Atlantic-Recife include an estimation of the time at incorrect flight level, and therefore, it has been necessary to use default values for deviations in the rest of the UIRs. The criteria for these default values have been set by the LHD Monitoring Team to the following ones:

a) Coordination errors (no notification of the transfer or transfer at unexpected flight level) and detection of the aircraft when entering the UIR: 10 minutes

b) Coordination error (no notification of the transfer) and undetected aircraft in the UIR: the duration of the flight in that UIR, taking into account its speed.

It is remarkable that 3 of the LHD reports received stated that the aircraft levelling off at incorrect level were also flying at a not permitted FL on a bidirectional route. Taking all this information into account, the parameters and the final results for the total vertical collision risk are the ones presented in the following tables:

Locations	**Same direction time at incorrect level, $t_{wl,same}$ (h)**	**Opposite direction time at incorrect level, $t_{wl,opp}$ (h)**	**Same direction number of crossed levels (N_{same})**	**Opposite direction number of crossed levels (N_{opp})**
Canaries	1.5000	0.1667	1	0
SAL	5.9500	0.1667	0	0
Dakar	5.9668	0	1	1
ATL - Recife	0.4500	0.2000	0	0

Locations	**Total Vertical Collision Risk 2010**	**Total Vertical Collision Risk 2020**
Canaries	$0.5528 \cdot 10^{-6}$	$0.9900 \cdot 10^{-6}$
SAL 1	$1.1537 \cdot 10^{-6}$	$2.0661 \cdot 10^{-6}$
SAL 2	$0.9070 \cdot 10^{-6}$	$1.6244 \cdot 10^{-6}$
Dakar 1	$0.7532 \cdot 10^{-6}$	$1.3489 \cdot 10^{-6}$
Dakar 2	$0.8109 \cdot 10^{-6}$	$1.4667 \cdot 10^{-6}$

Recife	$0.2274 \cdot 10^{-6}$	$0.4073 \cdot 10^{-6}$

Besides the coordination errors, the main cause of the LHDs, and the resulting failure to comply with the TLS, four deviations are due to ATC loop errors and not related to coordination errors between ATC units. Moreover, it is noteworthy that there is traffic in conflict in 3 out of all the deviations reported by the States.

The existence of situations with traffic in conflict in this assessment makes necessary to strongly insist on the need of implementing adequate corrective actions to reduce operational errors in the Corridor.

Apart from the LHDs studied, special issues have been analyzed during this study. First, a situation where an aircraft crossed an UIR without contact and aircrew got a response from an answering machine when tried to contact by SATCOM. On the other hand, a report has been received where an ATC unit tried to contact to the next ATC without success during 27 minutes.

3. ACTIONS BY THE MEETING

The SAT/17 Meeting is invited to:

a) Note the need of implementing corrective actions in order to reduce operational coordination errors affecting operational risk, especially taking into account that, in this study, there are situations with traffic in conflict.

b) Consider the need of monitoring the LHDs due to ATC loop errors and the identification of their causes in order to propose, if applicable, the adequate corrective actions.

c) Take note of the need of accurate flight progress data and deviation reports from all FIR/UIRs including as much information as possible. As the accuracy of the assessment greatly depends on the availability and accuracy of the data provided, it would be desirable that data were periodically received, being due before the day 15th of the following month.

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