

APPENDIX – E

EUR SAM Corridor Risk Assessment for 2016

02/06/2017

Considered hypothesis



- For time flight during 2016, Canaries has been used as a reference.
- Only deviations in nominal routes or incorporating to nominal routes have been considered.
- Only crossing routes with four or more flights per month have been considered.
- Whenever time information in deviations is not known, five minutes has been considered.
- Pz obtained from Eurocontrol information: $Pz(1000)=9.65 \cdot 10^{-13}$
- Traffic growth hypothesis from STATFOR information (February 2017): 5,1%

02/06/2017

Considered hypothesis



- Traffic information was not complete and did not include information about all the waypoints. → data has been extrapolated.
- In the extrapolation aircraft have been detected in the opposite directions in the same flight level at the same time.
 - As there are no corresponding deviations, errors have been assumed in the data and they have been corrected.
- Many proximate events in the same level within less than ten minutes have been detected.
 - No corresponding deviations detected → they have been taken as proximate events at different flight levels.

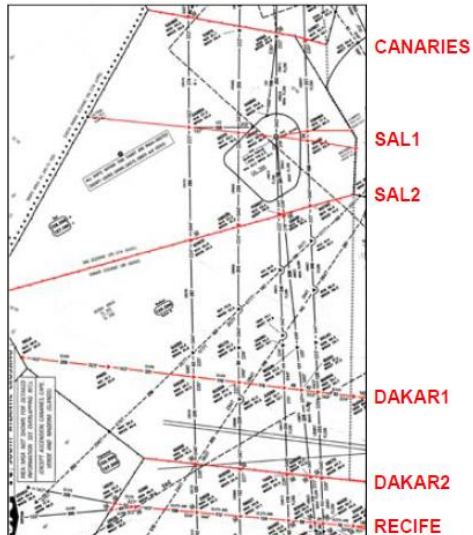
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2016 CRM results. Evaluation points



- Canaries: FIR/UIR limit
- SAL1: UR-976/UA-602
- SAL2: UIR SAL Oceanic/UIR Dakar Oceanic
- Dakar1: UL-435
- Dakar2: UIR Dakar Oceanic/Atlantic FIR
- Recife: UL-375/UL-695

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- It models the lateral collision risk due to the separation loss between parallel routes at the same flight level.
- TLS=5*10⁻⁹



FIR	Lateral Collision Risk 2016	Lateral Collision Risk 2026
Canaries	1.0451*10 ⁻⁹	1.7186*10 ⁻⁹
SAL1	2.6422*10 ⁻⁹	4.3450*10 ⁻⁹
SAL2	2.5015*10 ⁻⁹	4.1136*10 ⁻⁹
Dakar1	2.9251*10 ⁻⁹	4.8102*10 ⁻⁹
Dakar2	2.8721*10 ⁻⁹	4.7230*10 ⁻⁹
Recife	1.3982*10 ⁻⁹	2.2994*10 ⁻⁹

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2016 CRM results. Vertical technical risk



- Vertical risk: technical vertical risk + operational risk
 - Vertical technical risk models the risk due to vertical separation loss between aircraft at adjacent flight levels due to normal deviations
 - Operational risk models risk due to large height deviations (LHDs)
- TLS
 - Vertical technical risk: TLS=2.5*10⁻⁹
 - Total vertical risk: TLS=5*10⁻⁹



FIR	Technical Collision Risk 2016	Technical Collision Risk 2026
Canaries	1.8148*10 ⁻¹³	2.9844*10 ⁻¹³
SAL1	0.3183*10 ⁻¹³	0.5234*10 ⁻¹³
SAL2	0.7633*10 ⁻¹³	1.2553*10 ⁻¹³
Dakar1	0.8563*10 ⁻¹³	1.4082*10 ⁻¹³
Dakar2	1.1793*10 ⁻¹³	1.9393*10 ⁻¹³
Recife	0.9089*10 ⁻¹³	1.4946*10 ⁻¹³

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2016 CRM results. Vertical operational risk



- Operational risk includes:
 - Risk due to aircraft climbing or descending a flight level
 - Risk due to an aircraft at a wrong flight level
 - Large height deviations not involving whole numbers of flight levels
- Depends on the reported LHD by the States
- All LHDs are due to coordination errors between ATC units:
 - No transfer notified
 - Transfer at an unexpected flight level.
- Two LHD imply aircraft that crossed an UIR without coordination: one in Canarias and other in Dakar at wrong level.
- No reported LHD implying climbing or descending at a RVSM flight level or involving whole numbers of flight levels.

FIR	Same direction time at incorrect level, $t_{\text{cross}}(h)$	Opposite direction time at incorrect level, $t_{\text{cross}}(h)$	Same direction number of crossed levels (N_{cross})	Opposite direction number of crossed levels (N_{cross})
Canaries	1.63	0	0	0
SAL	0.25	0	0	0
Dakar	1.33	1.00	0	0
Recife	0.08	0.03	0	0

CRM 2016 results. Total vertical risk



FIR	Overall vertical Collision Risk 2016	Overall vertical Collision Risk 2026
Canaries	$1.0468 \cdot 10^{-7}$	$1.7214 \cdot 10^{-7}$
SAL1	$2.7494 \cdot 10^{-8}$	$4.5213 \cdot 10^{-8}$
SAL2	$1.7021 \cdot 10^{-8}$	$2.7991 \cdot 10^{-8}$
Dakar1	$1.4628 \cdot 10^{-6}$	$2.4055 \cdot 10^{-6}$
Dakar2	$1.9907 \cdot 10^{-6}$	$3.2737 \cdot 10^{-6}$
Recife	$8.1989 \cdot 10^{-8}$	$13.4830 \cdot 10^{-8}$

$$\text{TLS} = 5 \cdot 10^{-9}$$

Conclusions and recommendations



- Lateral risk and vertical technical risk have similar values in all the FIR/UIR and their values are below TLS.
- Vertical operational risk is above TLS, as it includes LHDs contribution.
- Main LHDs source is identified: coordination error between ATC units. Correction measures should be applied.
- Accuracy and reliability if the studies depend on the availability and accuracy of data: more accurate information should be made available, both for traffic measures and LHDs.