

23/05/2018

1. General Scope

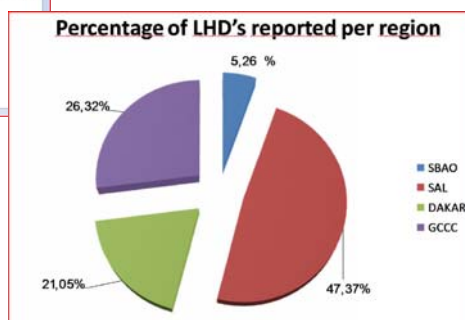
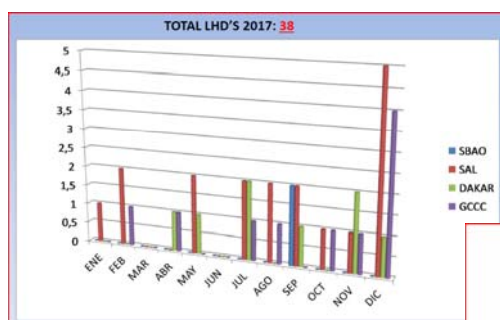


- States sent several traffic samples (August month of reference). All year reported LHD used.
- Only deviations in nominal routes or incorporating to nominal routes have been considered.
- Only crossing routes with four or more flights per month have been considered.
- Whenever time information in deviations is not known, five minutes has been considered.
- Pz obtained from Eurocontrol information: $Pz(1000)=6.04 \cdot 10^{-13}$
- Traffic growth hypothesis from STATFOR information (February 2018): 4,5%

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2. LHD 2017 Report (I)



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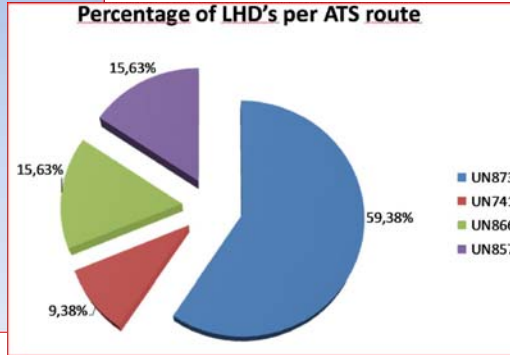
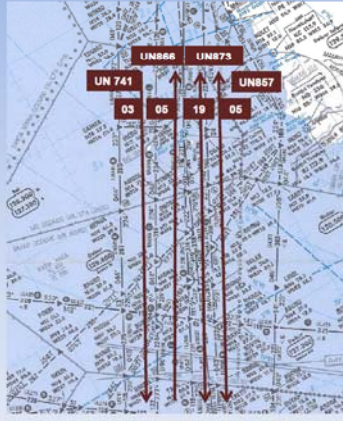
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2. LHD 2017 Report (II)



Distribution of LHD's per ATS route



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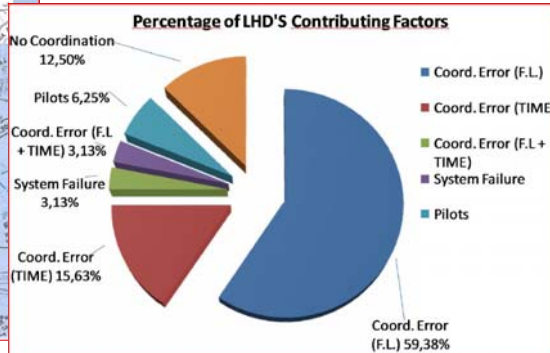
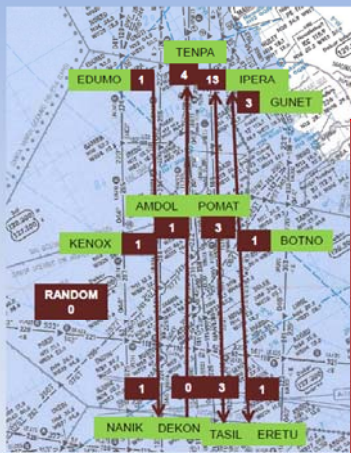
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2. LHD 2017 Report (III)



Distribution of LHD per Fix



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3. 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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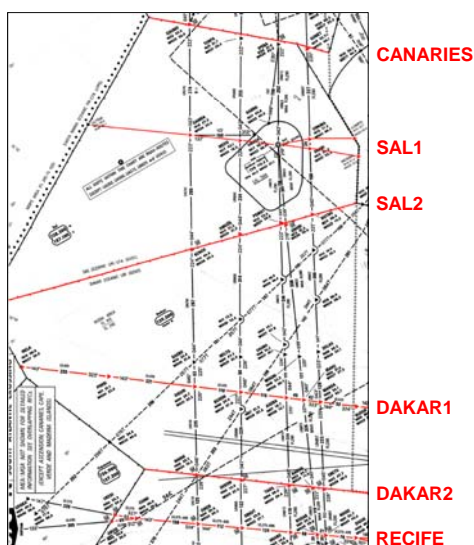
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2017 CRM results. Evaluation points



- 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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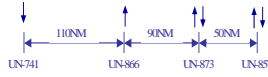


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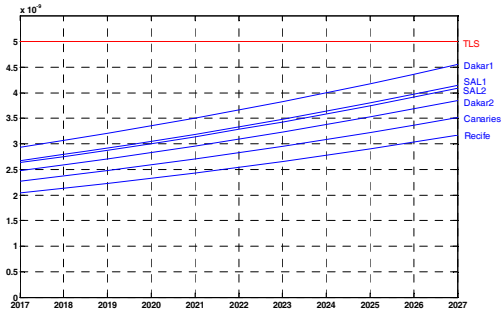
2017 CRM results. Lateral risk



- It models the lateral collision risk due to the separation loss between parallel routes at the same flight level.
- $TLS=5 \times 10^{-9}$



FIR	Lateral Collision Risk 2017	Lateral Collision Risk 2027
Canaries	2.2664×10^{-9}	3.5197×10^{-9}
SAL1	2.6724×10^{-9}	4.1501×10^{-9}
SAL2	2.6340×10^{-9}	4.0905×10^{-9}
Dakar1	2.9374×10^{-9}	4.5617×10^{-9}
Dakar2	2.4797×10^{-9}	3.8509×10^{-9}
Recife	2.0403×10^{-9}	3.1686×10^{-9}



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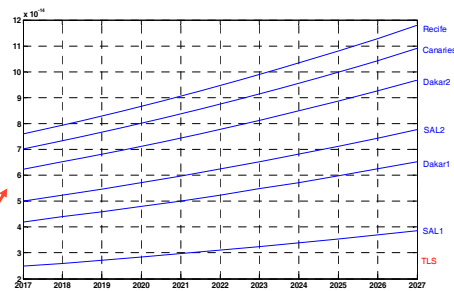
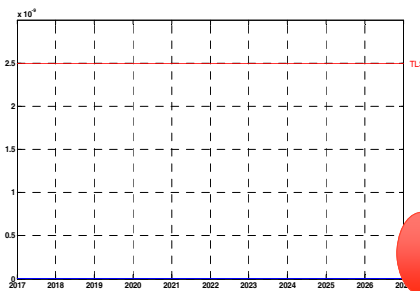
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2017 CRM results. Vertical technical risk



- 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: $TLS=2.5 \times 10^{-9}$
 - Total vertical risk: $TLS=5 \times 10^{-9}$

FIR	Technical Collision Risk 2017	Technical Collision Risk 2027
Canaries	7.0235×10^{-14}	1.0907×10^{-13}
SAL1	2.4904×10^{-14}	3.8674×10^{-14}
SAL2	5.0082×10^{-14}	7.7776×10^{-14}
Dakar1	4.2027×10^{-14}	6.5267×10^{-14}
Dakar2	6.2399×10^{-14}	9.6903×10^{-14}
Recife	7.5962×10^{-14}	1.1797×10^{-13}



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2017 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.
- No reported LHD implying aircraft that crossed an UIR without coordination
- Have been reported a LHD in Dakar implying climbing at a RVSM flight level involving whole numbers of flight levels.

FIR	Same direction time at incorrect level, t_{crossed} (h)	Opposite direction time at incorrect level, t_{crossed} (h)	Same direction number of crossed levels (N_{crossed})	Opposite direction number of crossed levels (N_{crossed})
Canaries	1.13	0	0	0
SAL	0.25	0	0	0
Dakar	0.83	0	1	2
Recife	0.17	0	0	0

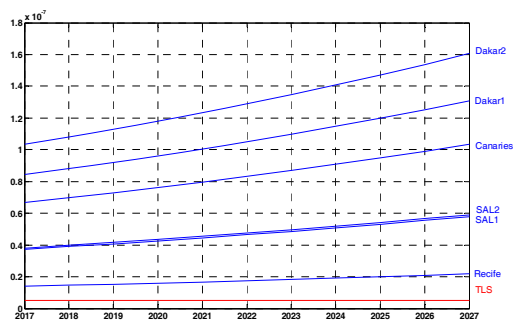
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CRM 2017 results. Total vertical risk



FIR	Overall vertical Collision Risk 2017	Overall vertical Collision Risk 2027
Canaries	6.6713×10^{-8}	1.0360×10^{-7}
SAL1	3.7315×10^{-8}	5.7949×10^{-8}
SAL2	3.8062×10^{-8}	5.9109×10^{-8}
Dakar1	8.4238×10^{-8}	1.3082×10^{-7}
Dakar2	1.0343×10^{-7}	1.6062×10^{-7}
Recife	1.4048×10^{-8}	2.1815×10^{-8}



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Conclusions and recommendations



- Lateral risk and vertical technical risk have values 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.

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Thank you



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