EUR/SAM Corridor: 2016 Collision Risk Assessment

Systems Direction
Navigation and Surveillance Division

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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: $Pz(1000)=9.65*10^{-13}$
- Traffic growth hypothesis from STATFOR information (February 2017): 5,1%

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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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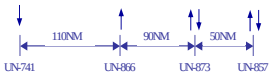
2016 CRM results. Evaluation points

- 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

2016 CRM results. Lateral risk

- It models the lateral collision risk due to the separation loss between paralel 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	$1.3982*10^{-9}$	$2.2994*10^{-9}$

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 Canaries 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, $t_{inc,same}$ (h)	Opposite direction time at incorrect level, $t_{inc,opp}$ (h)	Same direction number of crossed levels ($N_{xing,s}$)	Opposite direction number of crossed levels ($N_{xing,o}$)
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

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CRM 2016 results. Total vertical risk

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

TLS = $\mathbf{5*10^{-9}}$

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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.

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Thank you

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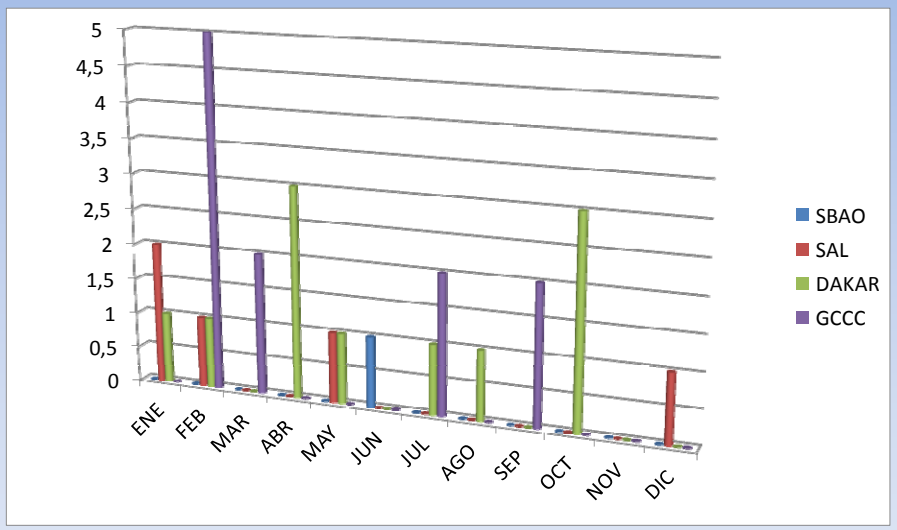
REPORT OF THE LHD MONITORING TEAM

EUR/SAM Corridor

ANNALISYS OF REPORTED LHD DURING 2016

Number of LHD's reported

TOTAL LHD'S 2016: 28



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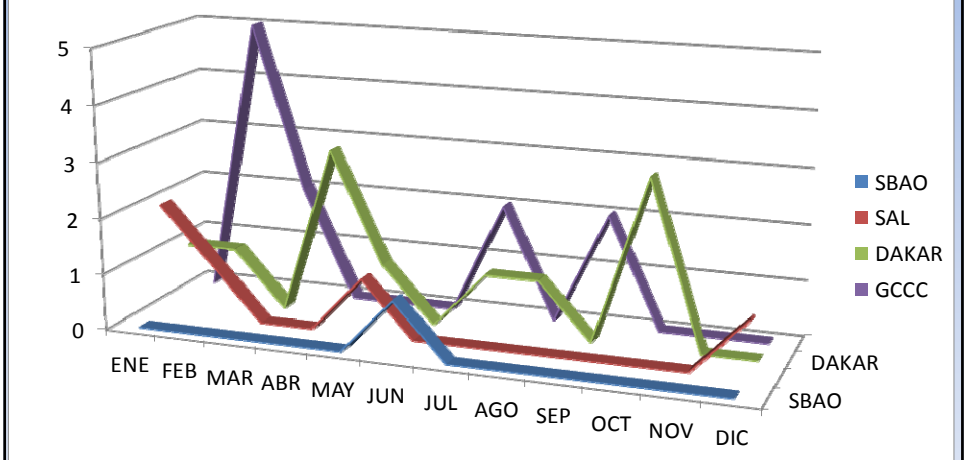
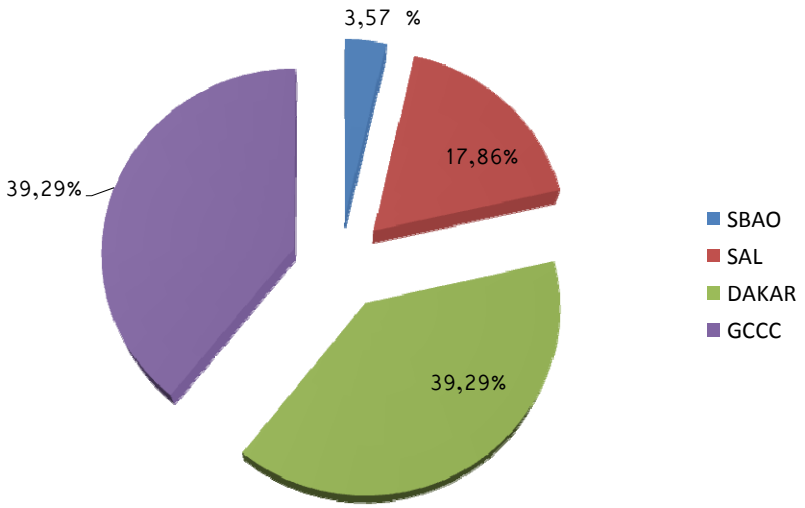
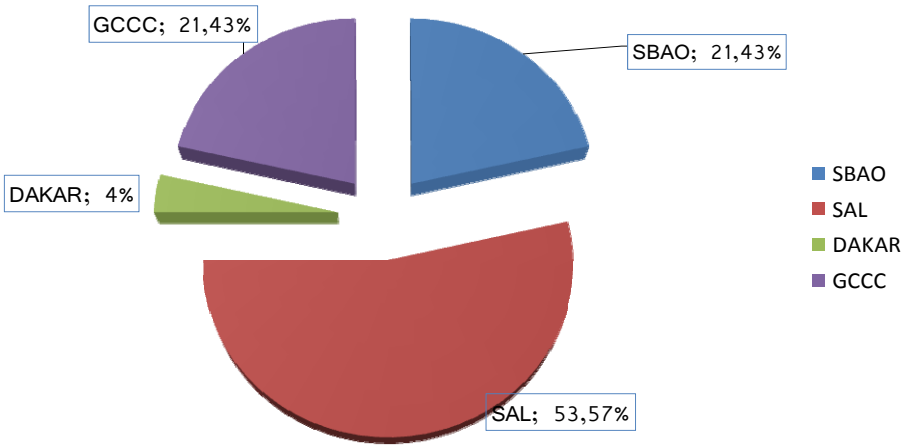


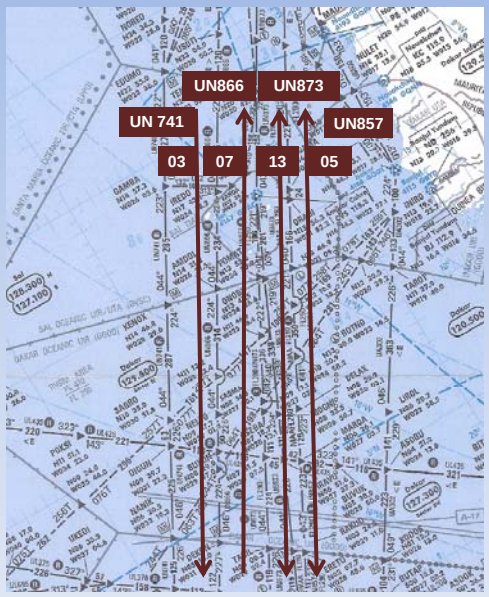
Percentage of LHD's reported per region

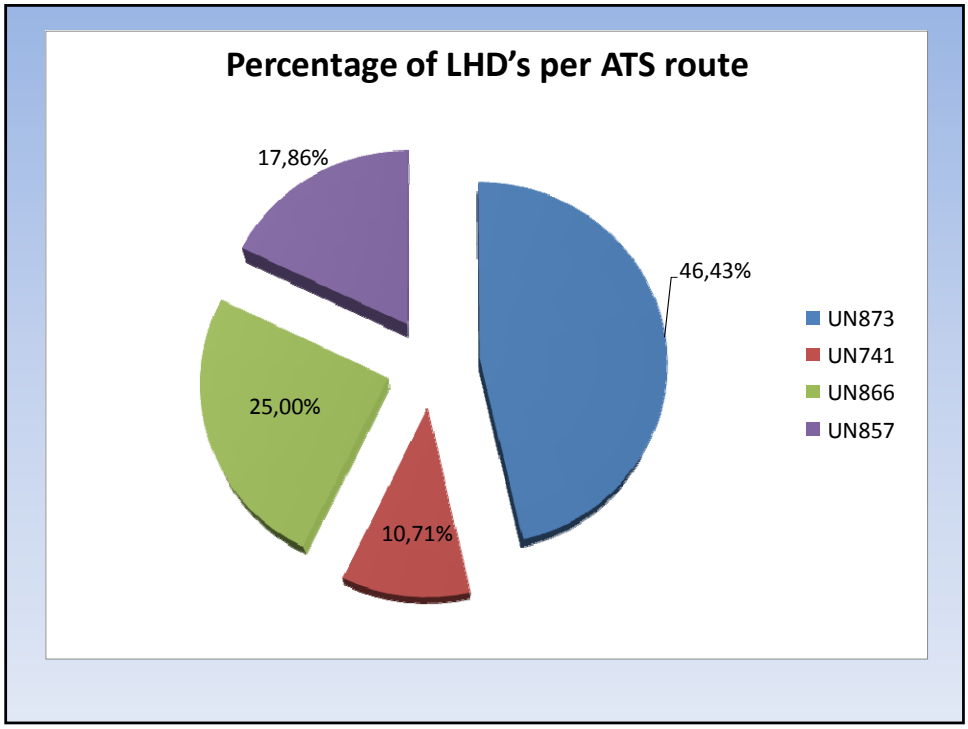


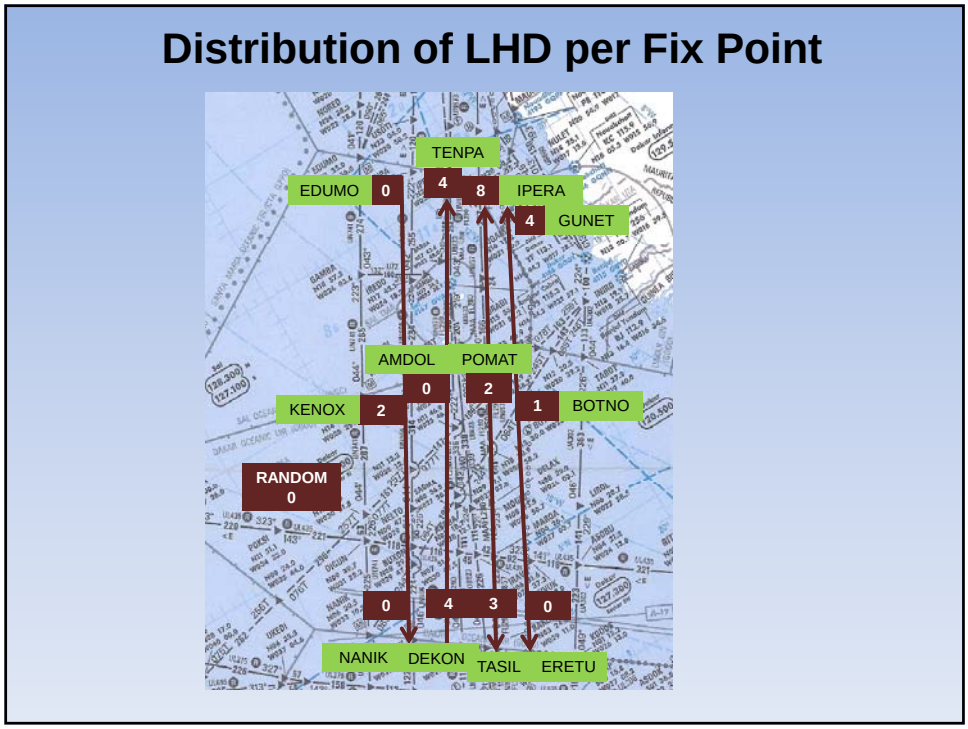
Percentage of LHD's Contribution per region

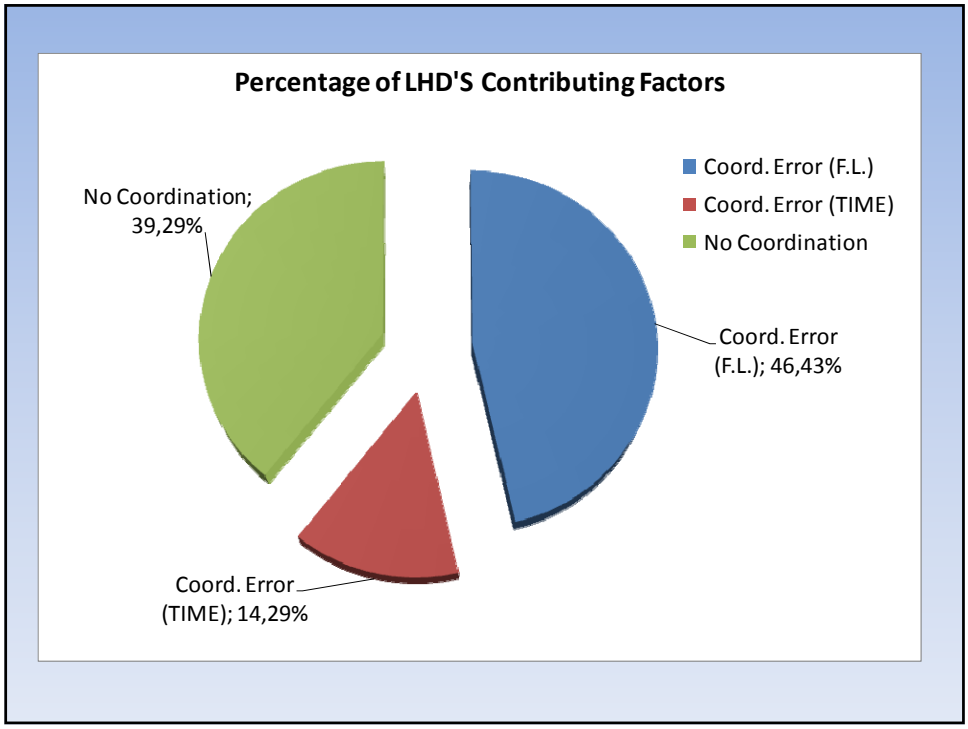


Distribution of LHD's per ATS route




Percentage of LHD's per ATS route
17,86%
46,43%
25,00%
10,71%
UN873
UN741
UN866
UN857


Distribution of LHD per Fix Point
TENPA
EDUMO
0
4
8
IPERA
4
GUNET
AMDOL
POMAT
0
2
KENOX
2
1
BOTNO
RANDOM
0
0
4
3
0
NANIK
DEKON
TASIL
ERETU


Percentage of LHD'S Contributing Factors
Coord. Error (F.L.)
Coord. Error (TIME)
No Coordination
No Coordination; 39,29%
Coord. Error (F.L.); 46,43%
Coord. Error (TIME); 14,29%