



**Network Manager**  
nominated by  
the European Commission

# RAD Impact Assessment Study

Requirement, Content, Presentation

Boris Radovanovic

ATFCM and Flight Efficiency Expert

29 JAN 2018



**Network Manager**  
nominated by  
the European Commission

# Study Requirement

# RNDSG Action Requirement

<b>RNDSG/84-06 (FEB 2015)</b>	<b><u>RAD Restrictions Study</u></b> <b>1. NM to run a Network impact assessment of the RAD restrictions implemented in the States.</b> <b>2. States to study if some of the RAD restrictions were put in place to balance capacity during a specific period of the year and therefore can be deactivated during the rest.</b>	<b>States NM</b>
-----------------------------------	--	----------------------



# Content and Analyses

# Purpose and Scope

- RAD restrictions impact on the horizontal flight planning efficiency.
- Correlation of two restrictions.
- Difference in applying restrictions in planning and actual phase of flight.

# Tool and Methodology - SAAM / NEST



Network Manager  
nominated by  
the European Commission

## All calculations are done with following baseline and assumptions

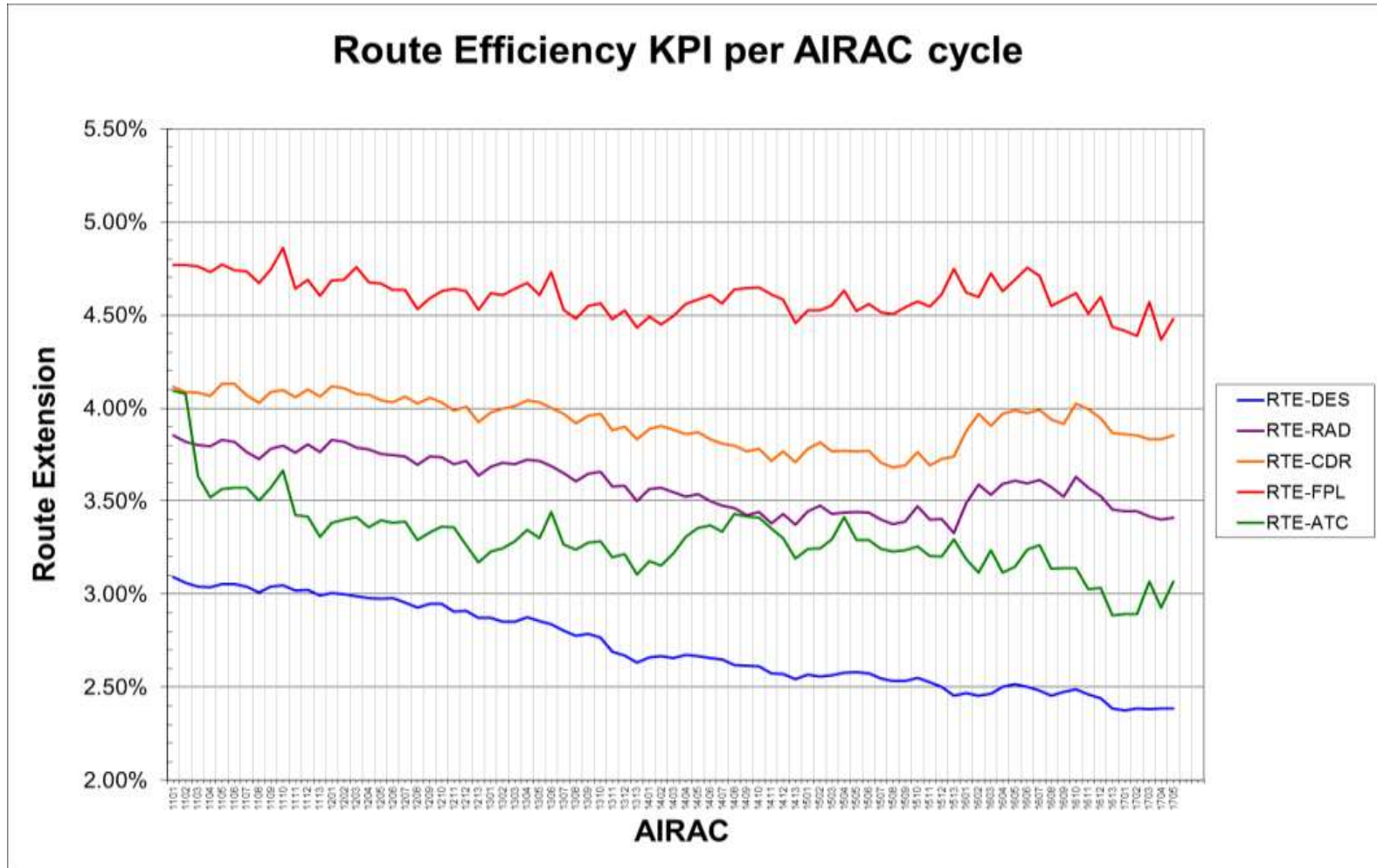
- AIRAC 1705 SAAM/NEST dataset is used;
- Traffic: 19 MAY 2017 (34001 flights);
- No flow regulations;
- Sectors configurations and capacities are not considered;
- No military activities;
- No wind constrains;
- Improved SAAM Assignment on the shortest distance between city pairs;
- Only RAD restrictions impacting horizontal trajectory are investigated in a way as they are defined in SAAM, considering how they are described in the RAD document.



# Macroscopic Analysis

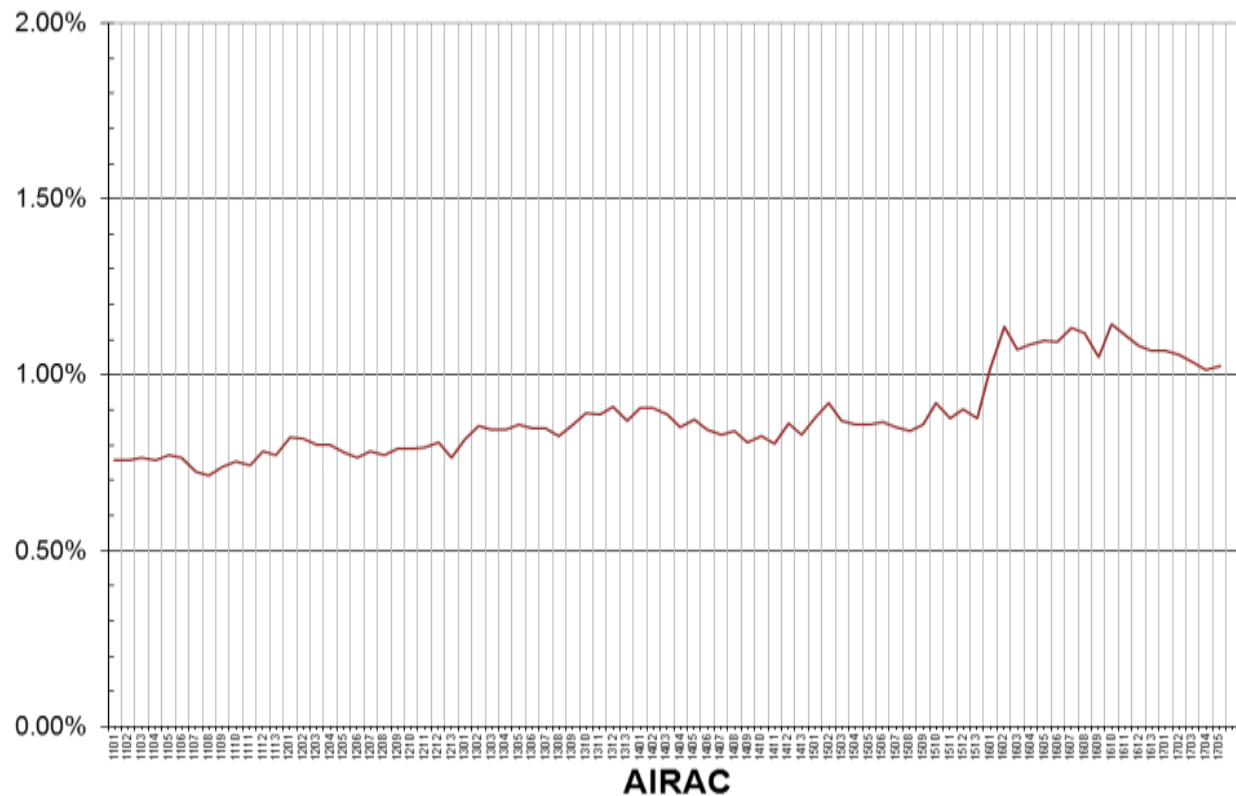


Network Manager  
nominated by  
the European Commission



# Macroscopic Analysis

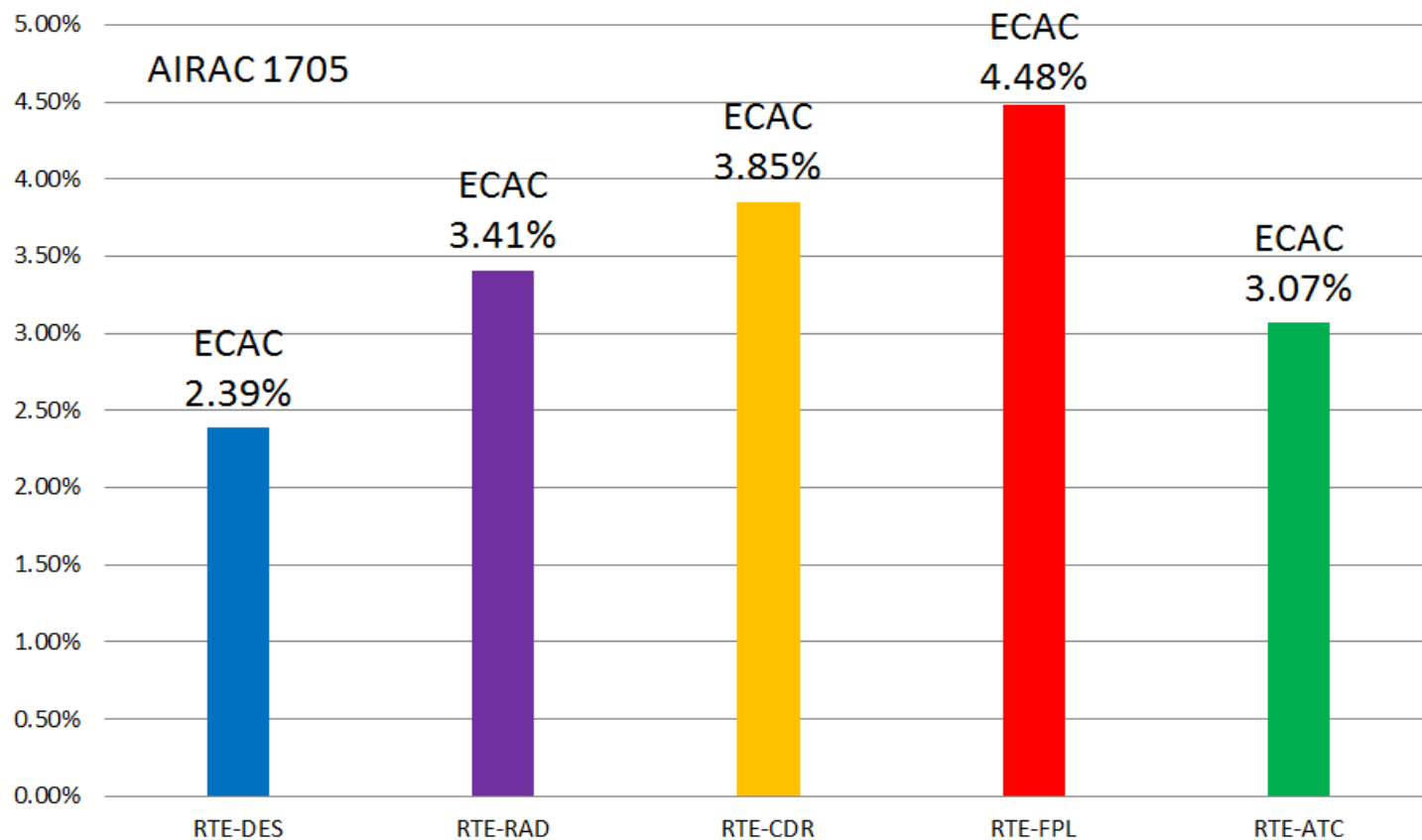
- *Difference between RTE-DES and RTE-RAD*





# Macroscopic Analysis

- Route efficiency KPI for AIRAC 1705



# RAD Restriction Utilization

- Route extension (in NM) caused by RAD restriction (horizontal)

*Significant impact on horizontal flight efficiency (total penalization)*

	Restriction ID	Total penal. (NM)	No Flights	Average (NM/flight)
1	LT2079	2592.79	319	8.13
2	EG2117	2078.84	87	23.89
3	LG2130	2025.75	80	25.32
4	EGLF1033	1612.53	317	5.09
5	LF3138	1391.94	140	9.94
6	LF3327	1388.47	154	9.02
7	EG2270	1350.33	160	8.44
8	LE2349	1279.83	99	12.93
9	LF3234	1213.15	240	5.05
10	LS2395	1186.44	133	8.92
11	ED2182	1076.15	389	2.77
12	LF5104	1026.82	117	8.78
13	LFEG1025	952.56	142	6.71
14	LF2926	900.43	127	7.09
15	LS2391	899.02	177	5.08

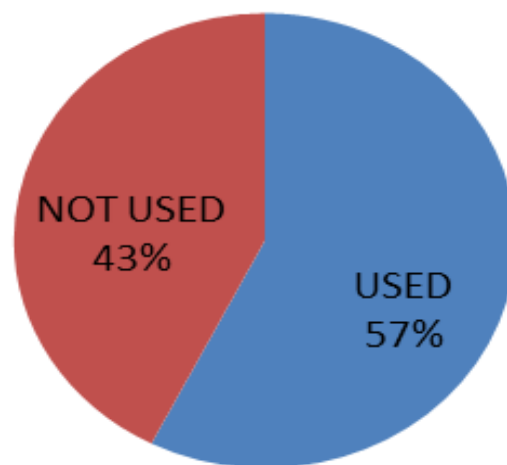
*Significant impact on horizontal flight efficiency (average penalization, more than 50 flights impacted)*

	Restriction ID	Total penal. (NM)	No Flights	Average (NM/flight)
1	LG2130	2025.75	80	25.32
2	EG2117	2078.84	87	23.89
3	LE2349	1279.83	99	12.93
4	ED3148	621.06	51	12.18
5	EB2112	532.70	52	10.24
6	LT2070	712.82	70	10.18
7	LF3138	1391.94	140	9.94
8	LT2017	758.27	77	9.85
9	LF2103	622.68	64	9.73
10	LF3327	1388.47	154	9.02
11	LS2395	1186.44	133	8.92
12	EG2270	1350.33	160	8.44
13	LT2079	2592.79	319	8.13
14	LE2341	811.571	114	7.12
15	LF2926	900.425	127	7.09



# Macroscopic Analysis

- Percentage of used RAD Pan-European Annex restrictions in SAAM/NEST assignment.



- Used restrictions** - all RAD Pan-European annex restrictions defined in the SAAM/NEST dataset that have been considered during any of the assignment steps.
- Not used restrictions** - all RAD Pan-European annex restrictions that were not involved in any of the assignment computations.
- As an average, 6 RADAN restrictions have to be considered per CP (flights on CP EDDM\_EGGB have to consider 32 different RADAN restrictions with all branches taken in consideration).

# RAD Restriction Utilization

- Route extension (in NM) caused by RAD restriction (horizontal)

*Significant impact on horizontal flight efficiency (number of flights)*

*City-pairs per number of different RAD Pan-European annex restrictions considered (main branch)*

	Restriction ID	Total penal. (NM)	No Flights	Average (NM/flight)
1	ED2182	1076.15	389	2.77
2	LF2423	632.87	372	1.70
3	LF2183	~0	354	~0
4	ED2173	421.13	342	1.23
5	EG2382	869.78	321	2.71
6	ED3021	276.26	320	0.86
7	LT2079	2592.79	319	8.13
8	EGLF1033	1612.53	317	5.09
9	EGEB1000	504.77	288	1.75
10	EG2334	671.81	272	2.47
11	ED3272	102.51	270	0.38
12	ED2880	197.67	269	0.73
13	ED3272	102.51	270	0.38
14	ED2215	109.815	263	0.42
15	LF2280	614.323	250	2.46

	City Pair	Number of RADAN
1	EDDL_LOWS	7
2	LTAC_EDDK	5
3	LIMC_EGHH	5
4	LOWI_EDDF	4
5	LIPE_EDFM	4
6	LEIB_EGKK	4
7	LDZD_EGBB	4
8	LFPG_EDDB	4
9	EKBI_EDSB	4
10	LFPG_EINN	4



# RAD Restriction Utilization

- Route extension (in NM) caused by RAD restriction

*City-pairs significantly impacted by RAD  
(total length difference between restricted  
and not restricted assignment)*

	City Pair	Number of Flights	Total Length Diff (NM)	Average
1	EGPH_EGLC	13	1560.9	120.07
2	EIDW_EGLC	12	1280.85	106.74
3	ENZV_ENGM	25	981	39.24
4	UKBB_UGTB	2	691.8	345.90
5	UGTB_UKBB	2	683.97	341.99
6	EDDL_LEPA	15	682.31	45.49
7	LEBL_EGKK	15	658.18	43.88
8	EDDH_EDDF	18	620.92	34.50
9	UDYZ_UKBB	2	586.66	293.33
10	UKBB_UDYZ	2	585.11	292.56

*City-pairs per number of different RAD  
(average length difference between restricted  
and not restricted assignment)*

	City Pair	Number of Flights	Total Length Diff (NM)	Average
1	EGPH_EGLC	13	1560.9	120.07
2	EIDW_EGLC	12	1280.85	106.74
3	EGKK_EGAA	11	580.1	52.74
4	LEPA_EGKK	10	521.88	52.19
5	LFPG_LSGG	10	499.36	49.94
6	EDDL_LEPA	15	682.31	45.49
7	EBBR_LSGG	10	450.01	45.00
8	EGLL_LSGG	13	581.23	44.71
9	LEBL_EGKK	15	658.18	43.88
10	EHAM_LSGG	11	453.49	41.23

# RAD Restriction Utilization

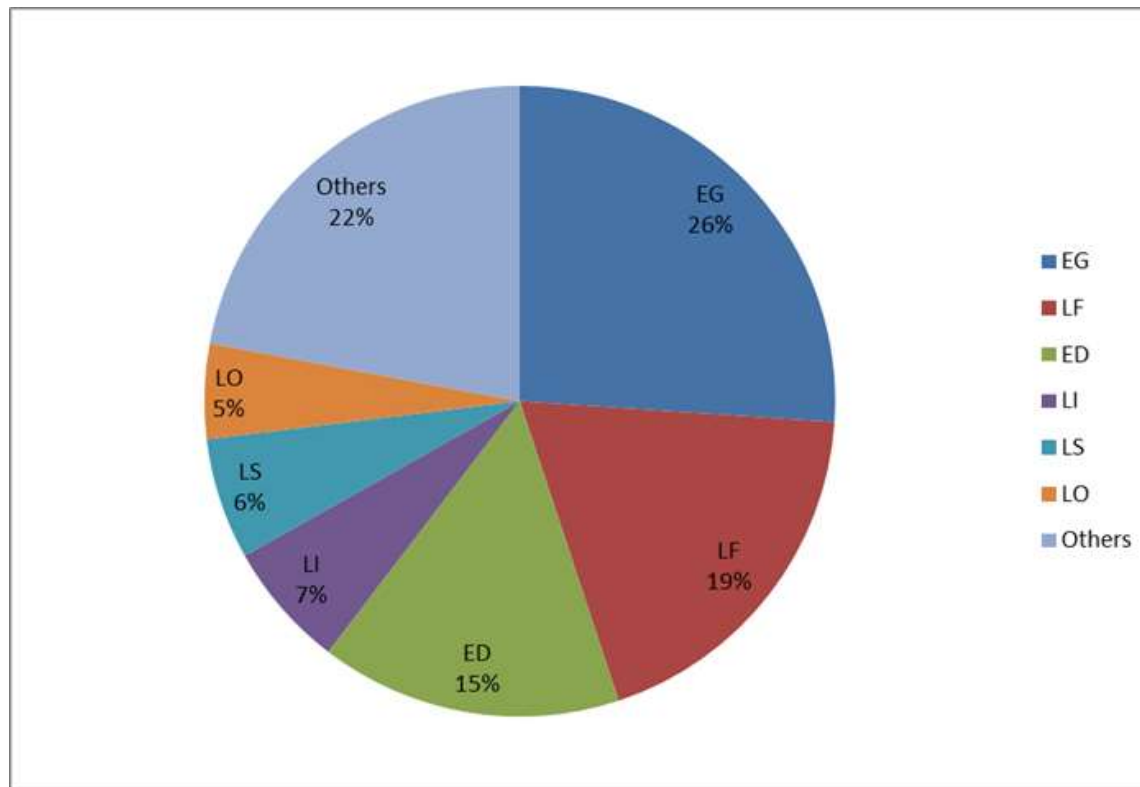
## Possible correlation with other RAD restrictions

- pivot - by resolving this RAD restriction others restrictions at the same step will be resolved as well
- periphery - restrictions that were in the same step as pivot, but were not selected for computation; their conditions were satisfied by resolving the pivot restrictions.

Pivot RAD restriction ID: LS2189							
		<p>Not available for traffic</p> <p>1. DEPLSGS/MS ARRLFLB/LI/LP,LSGG</p> <p>2. DEPLSGG, LFLI via NITAM</p> <p>3. ARRLSGK/GL/GP/GY</p> <p>a. Above FL155 except via LSAZCTA/UTA</p> <p>b. Above FL245 via LSAZCTA/UTA</p> <p>4. ARRLFLI/HN Above FL155</p> <p>5. DEPLSGY</p> <p>a. Above FL155 except via LSAZCTA/UTA</p> <p>b. Above FL245 via LSAZCTA/UTA</p> <p>6. DEPLSGL/GP, LFHM/HN/HUHZ/KA/KD/KX/LE/LI/LJ Above FL155</p> <p>7. DEPLSGS/MS Above FL245</p> <p>8. ARRLSGS/MS Above FL155</p> <p>-----</p> <p>Compulsory for traffic</p> <p>1. Via ED or LF or LI or LS</p> <p>a. ARRLSGK/GL/GP/GY Except via MOLUS or VADAR or FRI</p> <p>b. DEPLSGL/GP Except via MOLUS or PAS</p> <p>c. DEPLSGK Except via VADAR or TELNO or FRI</p> <p>d. ARRLFLI except via GVA/GOLEB/NDIS/BELUS</p> <p>e. DEPLFHM/HUHZ/KA/KD/KX /LE/LJ Not via Airspace Sectors LSAG/LFMMLE Except via PAS</p> <p>f. DEPLSGS/MS except via ROCCA or GOLEB</p> <p>g. DEPLFLI Except via PAS or GVA or MOLUS</p> <p>2. DEPLSGS/MS ARRE*LF* except NICE_GROUP, CHAMBERY_GROUP, TOULON_GROUP, LFLI, LFK*, LE*, LP*</p>				<p>1. ARRLFLB/LP shall file GOLEB Y52 SALEV LSGG LFLI shall file GOLEB only</p> <p>2. This traffic shall file SID ROCCA M135 LURAG</p> <p>3. To be counted in the appropriate sectors</p> <p>4. To be counted in the appropriate sectors</p> <p>5. To be counted in the appropriate sectors</p> <p>6. To be counted in the appropriate sectors</p> <p>7. To be counted in the correct sectors</p> <p>8. Only for Y flights over SPR, intending to take the Rhône valley</p> <p>-----</p> <p>1. All traffic intending to join or leave in LF, LS, LI, ED (REFLOC) airspace shall file Z/Y over specific points</p> <p>2. Traffic should file:</p> <p>a) F240 SPR/F260+UH10</p> <p>b) F240 SPR/F250+UZ65</p> <p>c) F240 SPR/F260+Z64</p>	
	SPR		H24	LS2189 ----- LS2547		LS	
Periphery RAD restriction ID: queries							
		<p>Compulsory for traffic</p> <p>DEPLSGS/MS</p> <p>With ARRLFLB/LI/LP,LSGG</p> <p>With RFL above FL135</p>		H24	LS2206	<p>SID requirement</p> <p>ARRLFLB/LP shall file GOLEB-Y52-SALEV</p> <p>ARR.LSGG.LFLI shall file GOLEB only</p>	LS
Correlation: 100%, 2 queries							
For Flights with RFL above FL135, if SPR is forbidden then via GOLEB is only available							


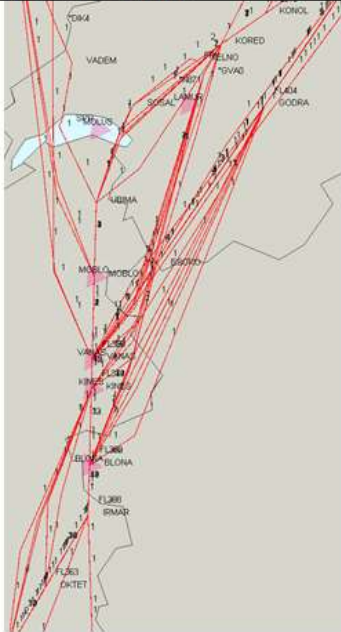
# RAD Restriction Utilization

- Deviation from the RAD restrictions on ATC
  - *Distribution of RAD restrictions from which flights were exempted in m3 (per country of origin)*



# RAD Restriction Utilization


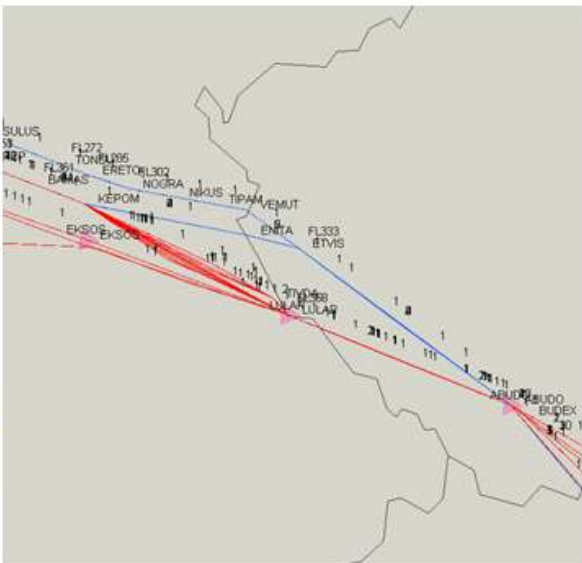
- Deviation from the RAD restrictions on ATC

Restriction ID: LSLF1017									
UN853	IRMAR	MOBLO	Only available for traffic 1. Via IRMAR UN853 MOLUS 2. Via MOBLO UZ662 LAMUR 3. ARR GENEVA_GROUP, GENEVA_AREA 4. Via <del>MOBLO DCT SONOM</del> 4. 5. Via GODRA	H24	LSLF1017	To prevent creative flight planning		LSAG LFMM	LS
M1 Traffic sample					M3 Traffic sample				
									
City-pairs: > 80 (LEPA_ESSA/EKBI/EDDP/EDDF; LEBL_EDDB/EDDV/EKBI;LFMN_EDDF)									
Potential savings: 1250 NM per day									
Number of influenced flights/day (NEST assignment): 184 flights									
Number of deviated flights/day: 106									
remove / redefine restriction (night traffic only/weekend); define airspace structure									



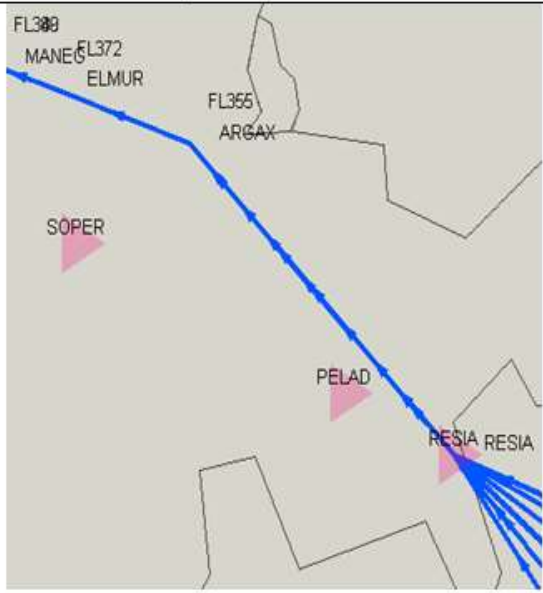
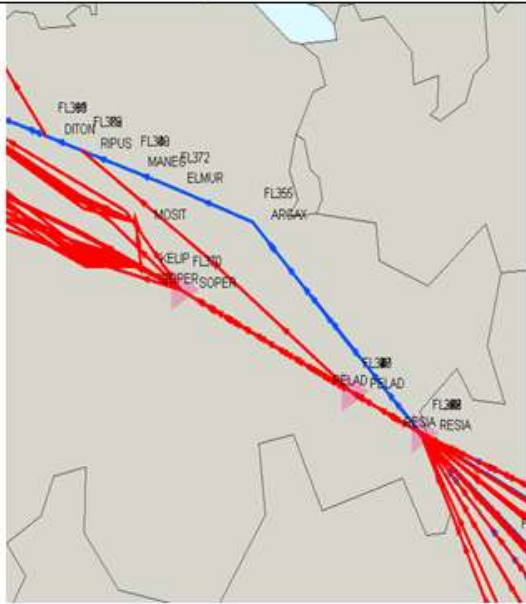
# RAD Restriction Utilization

- Deviation from the RAD restrictions on ATC

Restriction ID: ED2931										
Z/UZ205	OSBIT	ABUDO		Only available for traffic ARR LOWW, LHBP, LZIB	H24	ED2931	To segregate arriving traffic from overflights Z/UZ205 refers to OSBIT UZ205 LULAR (ED) and LULAR Z205 ABUDO (LK)		EDUUUAC	ED
M1 Traffic sample					M3 Traffic sample					
										
City-pairs: 117 (EGKK/LL-OM/OK/OT; EDDL-LT;EBBR-OM;ELLX-OB/OK/OM)										
Potential savings: 575 NM per day										
Number of influenced flights/day (NEST assignment): 223										
Number of deviated flights/day: 16										
remove / redefine restriction (night traffic only/weekend); define airspace structure										


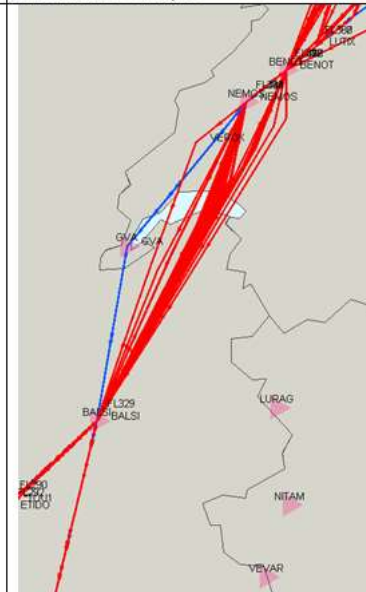
# RAD Restriction Utilization

- Deviation from the RAD restrictions on ATC

Restriction ID: LS2562							
Z50	RESIA	SOPER	Only available for traffic 1. ARR LSZH/MD/ME/MA/ZC 2. DEP LSZS	H24	LS2562	1. To segregate inbound traffic and split the flows 2. To facilitate flight planning	LS
M1 Traffic sample				M3 Traffic sample			
							
City-pairs: 22 (LGIR/LIPZ/LYTV/LGEL/LGAV_LFSB; LIPE_EGKK/LL)							
Potential savings: 155 NM per day							
Number of influenced flights (NEST assignment): 30							
Number of deviated flights: 22							
Remove / Redefine restriction (night traffic only/weekend) / add airspace structure							

# RAD Restriction Utilization

- Deviation from the RAD restrictions on ATC

Restriction ID: LS5097																		
NEM	OS	G	VA	3	8	5	5	0	0	Y es	Compulsory for traffic Via BENOT and BALSILURAG/VEVAR/NITAM Via LSAGL7 Except DEP LSZS/ZA/ZL/ZR/ML, LFST, EDDS/SB/JA/FM/NL/NY/TB/OT/D/TF/TG/TL/TM/TN/TO/T P/TQ/TR/TS/TU/TW/TX/TY/TZ, ETHEL	To offer shorter conne ction	FR	AS	O	dd	LSA*	ACC
										H	24	LS5	097					
M1 Traffic sample										M3 Traffic sample								
																		
City-pairs: (ESSA/EKCH/EDDF_LEBL/LEPA)																		
Potential savings: 190 NM per day																		
Number of influenced flights (NEST assignment): 5 (ARR LSZH - not possible)																		
Number of deviated flights: 38																		
Remove / Redefine restriction (night traffic only/weekend) / add airspace structure																		



**Network Manager**  
nominated by  
the European Commission

# Previous Presentations

# skyguide - NM DRA/RAD Workshop

## 12 SEP 2017



- The purpose of the discussion was to provide skyguide the general overview of how the Swiss RAD restrictions relate to RAD restrictions of other NM countries, and to use skyguide's explanations to the findings to finalise the document as well as the way of presenting the study to other external partners.
  
- The study gives interesting insights for Switzerland. In order to further analyse the Swiss situation and identify actions that could be taken by skyguide, the following was agreed upon:
  - The NM will visualise the deviation of the actual flight path from filed flight plan (as visualised by the 14 examples in the paper) for another date in September to see whether optimisation of the March DCT implementation will be visible;
  - The NM will share more examples where in Switzerland the actual flight path differs from filed flight plan to possibly take into consideration as input to further optimise the DRA/FRA design;
  - Skyguide will provide NM with comments on this document.

# RMG/30

## 9 - 10 NOV 2017

- Extensive discussions took place, some ANSPs made statements on the tools used, their capabilities, methodology used and individual different interpretations of the results. Additionally, some ANSPs clearly indicated that this study is of academic value and that from some results it is difficult to make practical conclusions. It was also stated that these States do not want the results to be wrongly interpreted by their management and other decision making bodies. For that reason RMG/30 agreed ANSPs to provide feedback on the document in order to inform that will be presented further. NM will provide additional information and results on request, if required by ANSPs to facilitate their feedback.
- Relevant Action was included in the Action List.



RMG/30-06-A	<b><u>RAD Network Impact assessment study</u></b> The NRCs, AOs and CFSPs to provide relevant feedback on presented methodology, results and conclusions.	NM RAD Team	MAR - MAY 2018	OPEN
-------------	--	-------------	----------------	------

**Currently no any comments received**



**Network Manager**  
nominated by  
the European Commission

# ***QUESTIONS and COMMENTS***