



Condor Engagement in Active Noise Abatement

ICANA 16

4th International Conference
on Active Noise Abatement

ICANA Conference November 2016



Condor

Condor Airlines – a 60 Year History in Aviation



- ✎ Founded in 1955 – most experienced and eldest charter airline worldwide
- ✎ 1962 – 63,3% market share in flying touristic in Germany
- ✎ 1966 – first long range flights to Thailand, Sri Lanka, Kenia and Dominican Republic
- ✎ 1971 – first charter airline to operate B747
- ✎ 1995 – first charter airline to support flight ops by modern technologies
- ✎ 2002 – Condor became part of Thomas Cook
- ✎ 2009 – first charter airline to install winglets



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Condor Airlines – a 60 Year History in Aviation

- ✈ Operating a fleet of
 - ✈ 13 A320
 - ✈ 7 A321
 - ✈ 13 B757-300
 - ✈ 16 B767-300
- ✈ 7 million passengers
- ✈ 75 destinations around the globe
- ✈ 52 Awards in five years
 - Brand of the year 2016
 - Best employer in 2016
 - German fairness award 2016
 - Service champion 2016



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Condor Airlines – a 60 Year History in Aviation

- 🕒 Fleet, passengers, destinations and uniforms changed, but



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Condor Airlines – a 60 Year History in Aviation

✈ Fleet, passengers, destinations and uniforms changed, but

... our Home Base
since 1955

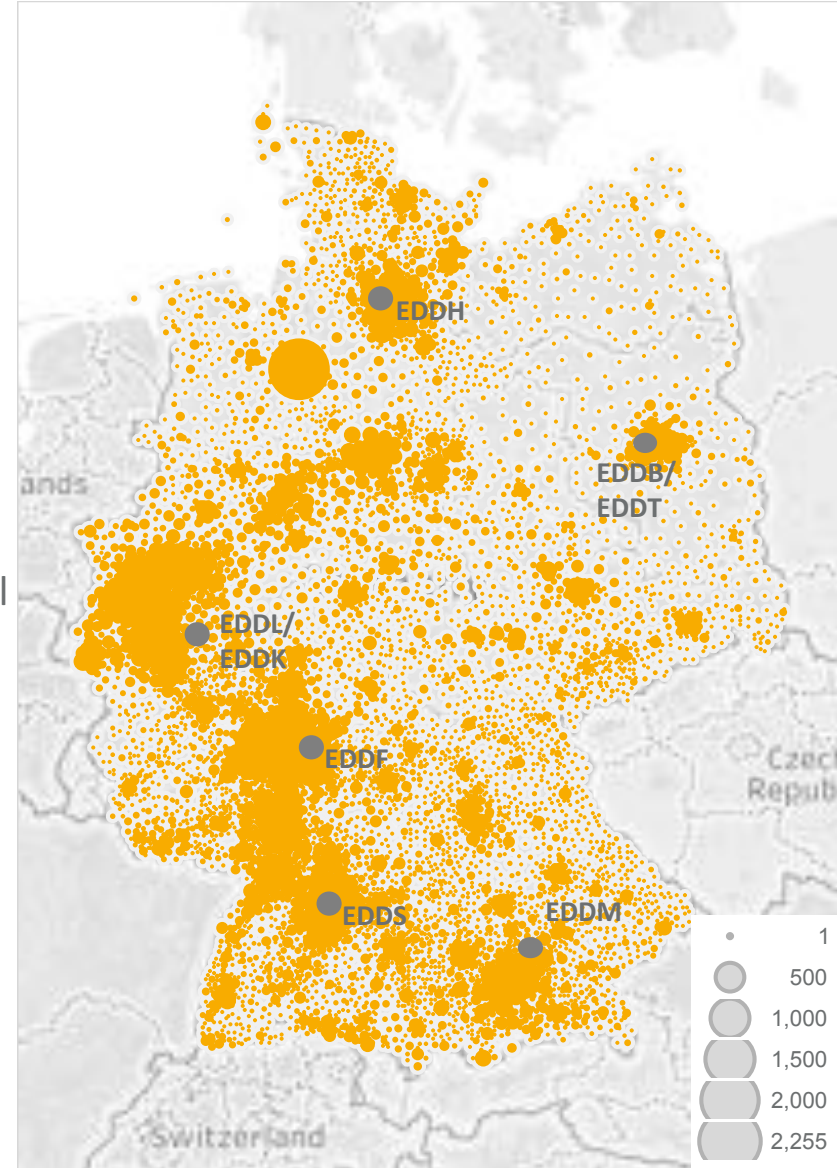
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Condor Airlines – Responsibility for the Region

- ✎ Majority of customers are living near major airports
- ✎ Ecological awareness grew over the last decades within public
- ✎ It is a strategic interest to respect growing environmental requirements and challenges
 - ✎ Reduction of CO2 emissions
 - ✎ Reduction of NOx emissions
 - ✎ Reduction of noise emissions

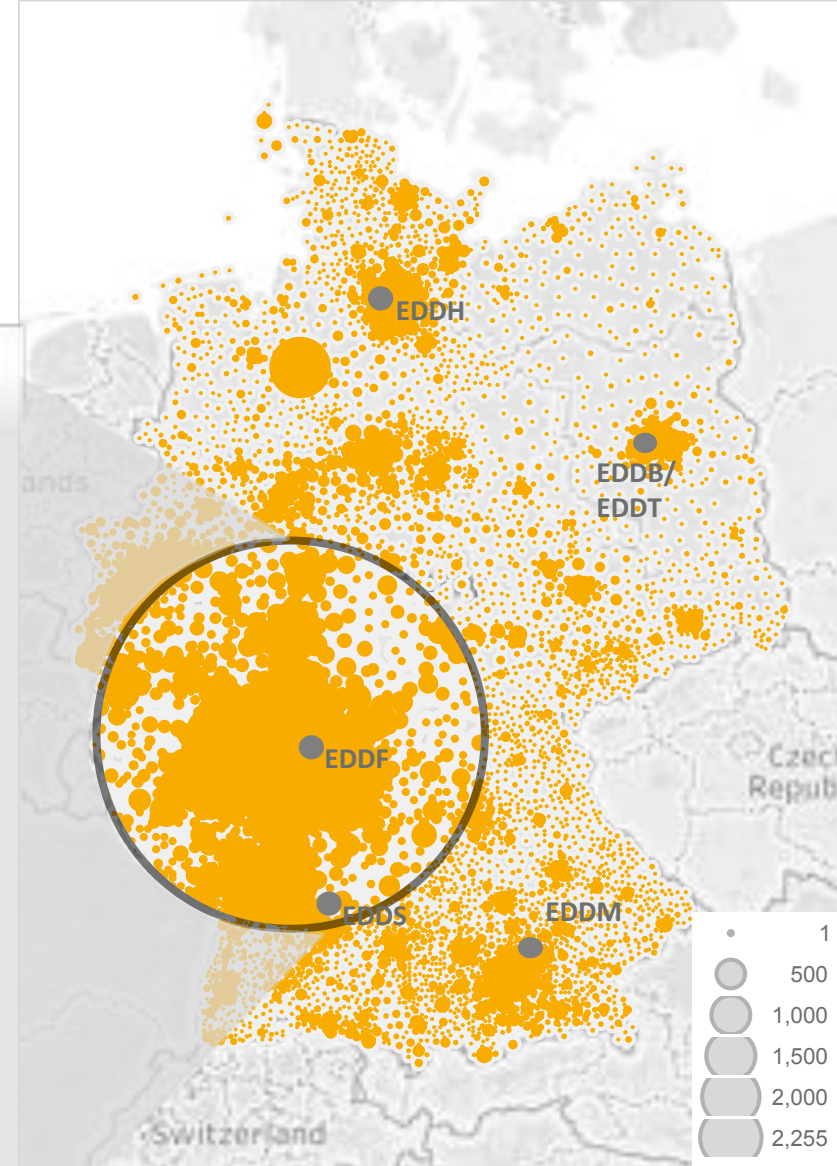
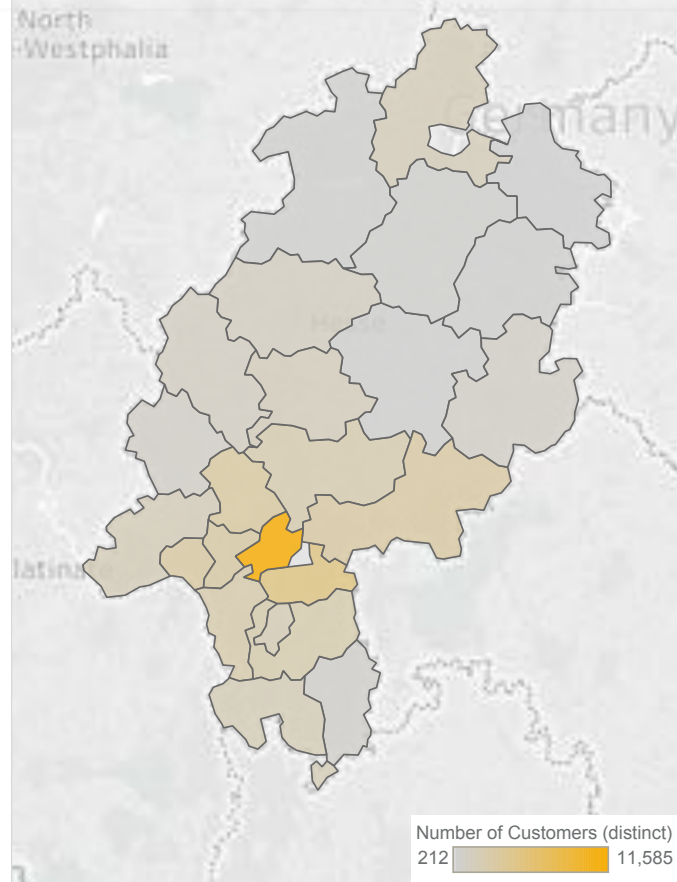


Direct Bookings 2016 - German customers

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Condor Airlines – Responsibility for the Region

- 🇩🇪 Federal State of Hessen – Rhein Main Region is region with highest concentration of customers

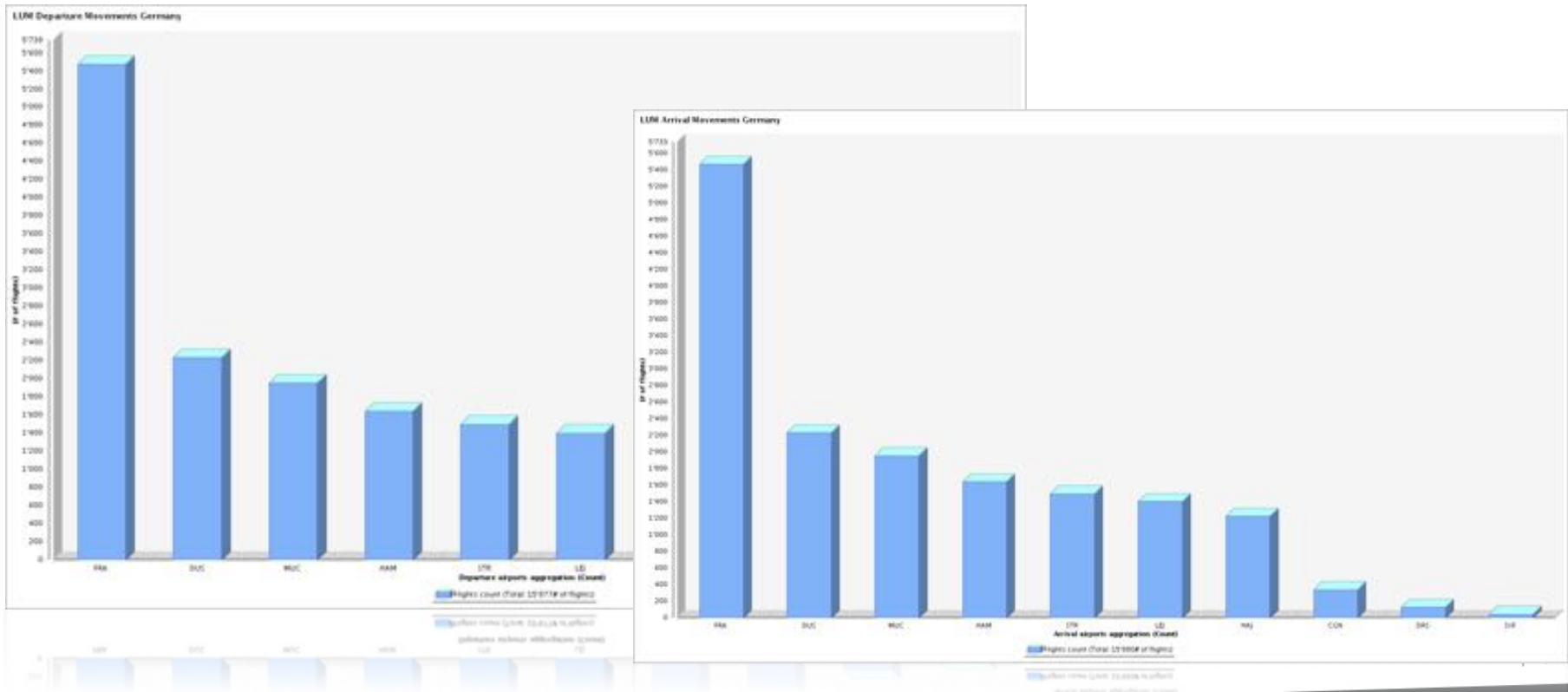


Direct Bookings 2016 - German customers

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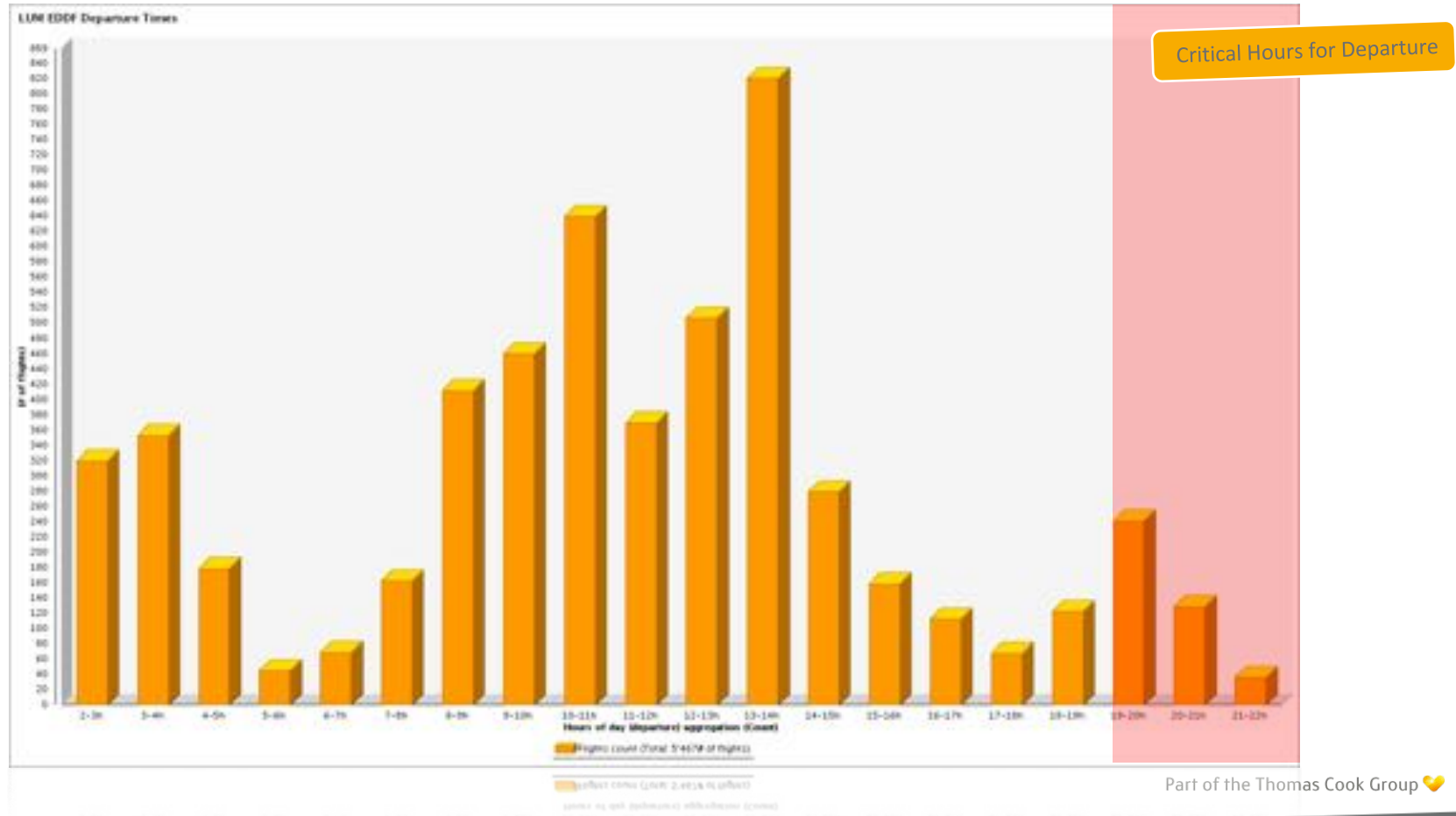
Condor Airlines – Responsibility for the Region

- ✈ Condor generates at Frankfurt Intl. Airport
 - ✈ apprx. 11.000 movements per year
 - ✈ apprx. 30 per day



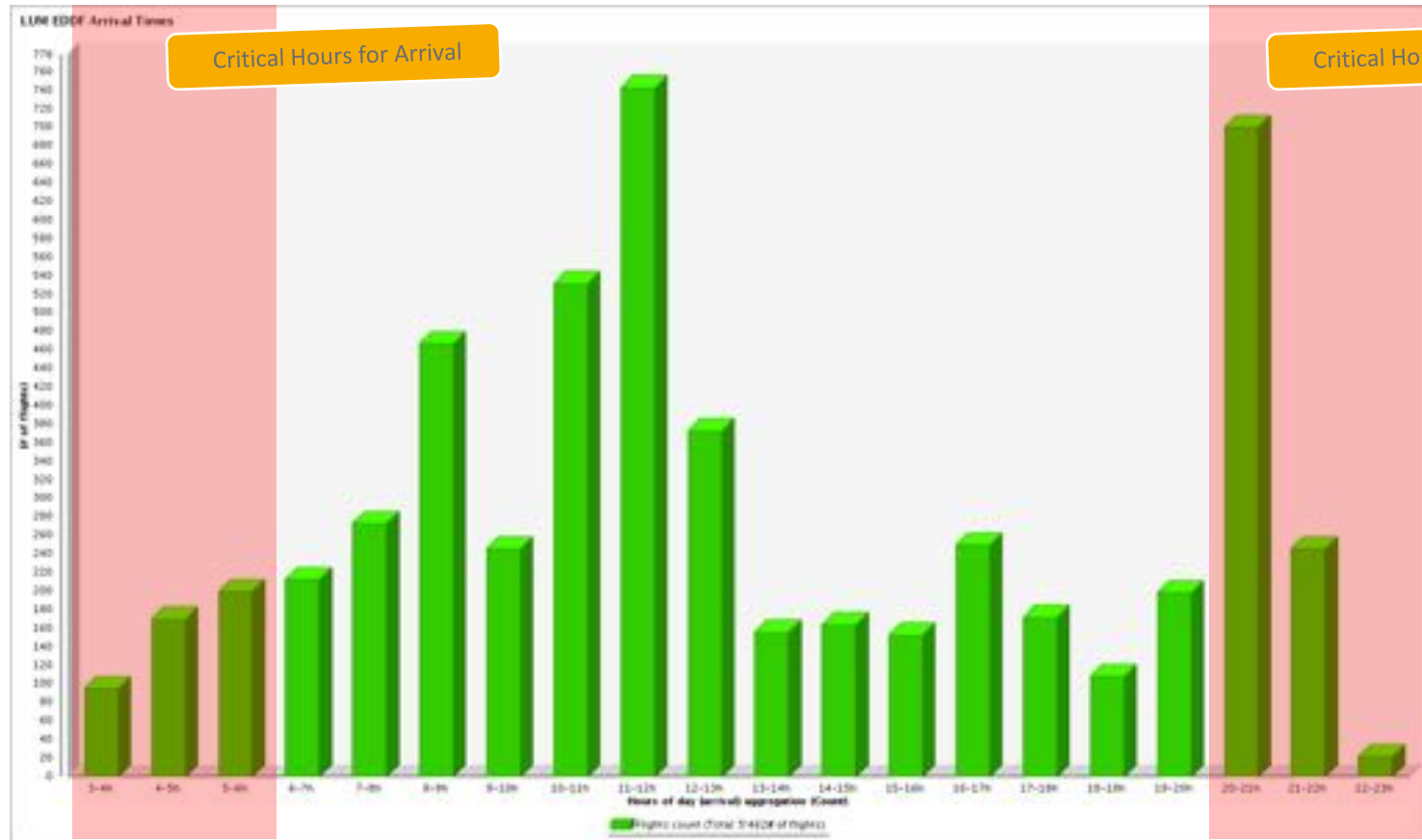
Condor Airlines – EDDF Operational Hours vs. Network Structure

🕒 EDDF Departure Times



Condor Airlines – EDDF Operational Hours vs. Network Structure

🕒 EDDF Arrival Times



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Condor Airlines – EDDF Operational Hours vs. Network Structure

- ✈ Network charter operation
- ✈ mid range flights (4h plus)
- ✈ transit times apprx. 1:30h
- ✈ Total rotation apprx. 10:30h
- ✈ Operating window in EDDF 18:00h
- ✈ two mid range flights not possible by one aircraft during operating window



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Condor Airlines – EDDF Operational Hours vs. Network Structure

- ✈ Network charter operation
- ✈ Combination of one short range flight with one mid range flight to keep productivity as high as possible (during summer season) difficult



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Condor Airlines – Noise Abatement Initiatives

- ✈ Target is:
 - ✈ to demonstrate and live corporate responsibility
 - ✈ to work with system partners in innovative solutions
 - ✈ to keep night shoulder hours in effective use while minimizing environmental impact



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Condor Airlines – Noise Abatement Initiatives

Flight Procedures	Aircraft Modifications	Fleet Renewal	Flight Planning	R & D
 Use of modern navigational technologies PBN Pilot training CDO/ CCO	 Winglets/ Sharklets Airbus vortex generators Boeing upgrade with latest flight deck avionics under evaluation	 Renewal of mid range fleet by A321 CEO incl. state of the art avionics Renewal of long range fleet under evaluation in context of - performance - fuel efficiency - noise limit regulation	 Mission Management Concept - avoid late landings - avoid delayed flights due to night curfew	 Steep Segmented Approach LNAS – low noise augmentation system

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Condor Airlines – Noise Abatement Initiatives

Example PBN Pilot Training

- ④ PBN is performance based navigation is key technology to support environmental friendly flight procedures
- ④ started to implement GPS based navigation in 2002 already
- ④ Training consists of
 - ④ Train-the-trainer courses
 - ④ Simulator training
 - ④ Integration into line check topics
 - ④ Computer based training
 - ④ Written documentation



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Condor Airlines – Noise Abatement Initiatives

Airbus A320 Vortex Generators

- 2014 - First German airline to have entire Airbus fleet retrofitted
- Reduction of annoying whistle noise created by vent holes on lower side of wing

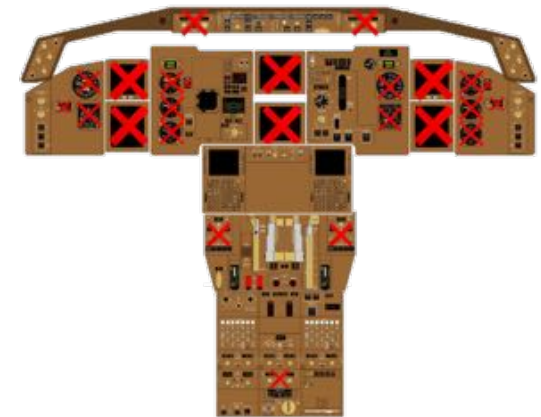


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Condor Airlines – Noise Abatement Initiatives

Analysis of potential to retrofit Boeing fleet with new avionics and display system

- ✈ Upgrades Boeing fleet to latest avionics standard
 - ✈ GBAS
 - ✈ SBAS (?)
 - ✈ RNP AR
 - ✈ Navigation performance scale
- ✈ Improved operation on PBN nav specs with smaller tolerance areas

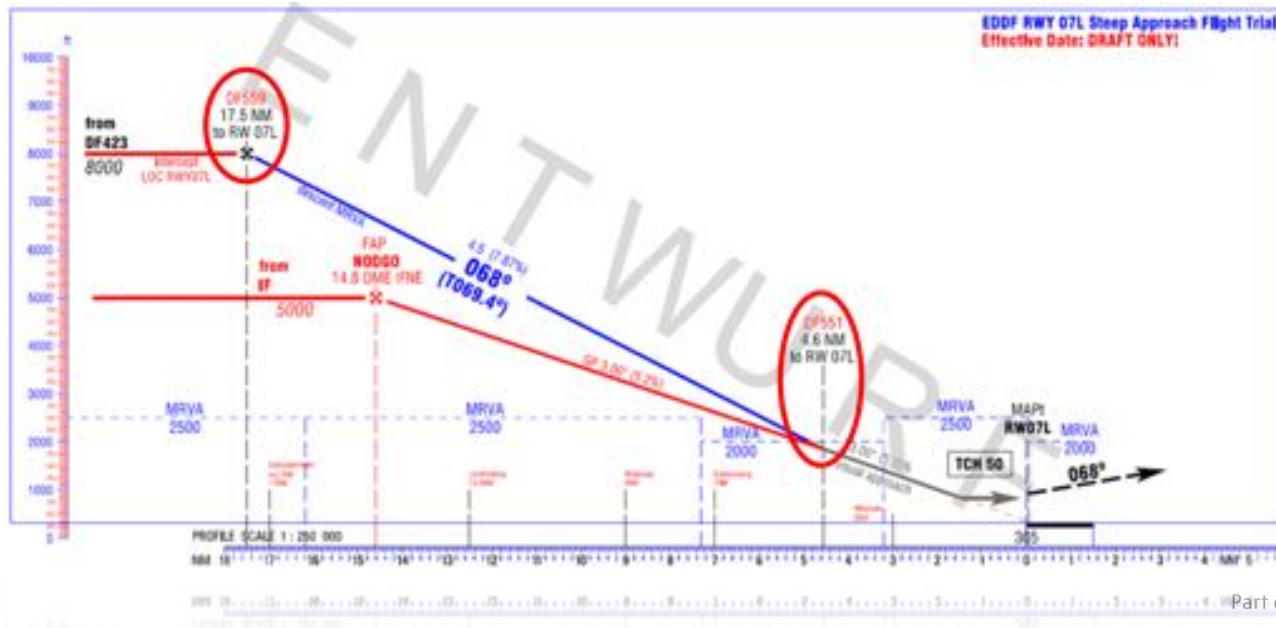


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Condor Airlines – Noise Abatement Initiatives

Steep Segmented Approach

- ⌚ Research & Development project in 2013
- ⌚ Project led by DLR
- ⌚ Condor primary industry partner
- ⌚ Reduces noise on final approach (range 20NM-8NM) by up to 8dB



Condor Airlines – Noise Abatement Initiatives

Steep Segmented Approach

- ✈ Research & Development project in 2013
- ✈ Project led by DLR
- ✈ Condor primary industry partner
- ✈ Reduces noise on final approach (range 20NM-8NM) by up to 8dB
- ✈ Support with simulator trials
- ✈ Intensive analysis and mitigation support
- ✈ Support in live trial in EDDF on October, 4th 2013
 - ✈ D-ABUZ 10 Approaches onto EDDF RWY07L



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Condor Airlines – Noise Abatement Initiatives

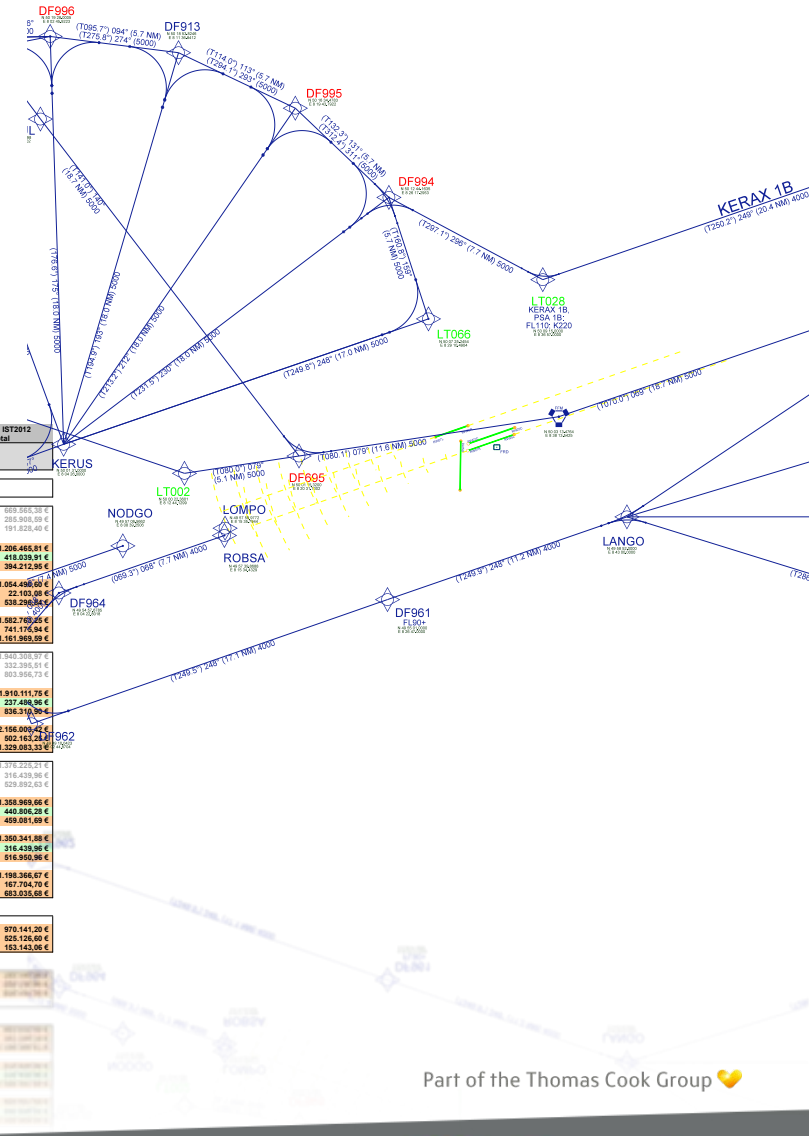
EDDF 3-1-X
AD2 EDDF Point Merge Rwy07
Alternative 3
Variation: 1°E (1.47°E / 2013)

Analysis Point Merge Arrivals

- Several simulator trials to analyze
- Flyability
- Economical and capacity impact

Zusammenfassung

	Variante	Time	Time Based Cost	Fuel Burn	Fuel Cost	Total	Delta zu Reference Single Flight	Delta zu Reference BT57 per Year	Delta zu Perfect Flight DE6475	Delta zu Perfect Flight BT57 per Year	Delta zu IST2012 Average	Delta zu IST2012 Total
BT	IST2012 UNOKO	0:22:50	591,00 €	452	712,40 €	1.303,48 €						
	IST2012 PSA	0:10:50	280,40 €	397	339,92 €	619,33 €						
	IST2012 KERAX	0:14:20	370,99 €	409	343,54 €	714,53 €						
	DE6475 Perfect UNOKO Perfect PSA	0:13:00	338,48 €	333	281,77 €	618,25 €						
UNOKOZSR	Reference	UNOKOZSR Transition Max	0:27:20	707,48 €	1100	930,77 €	1.638,25 €		1.919,39 €	2.039.988,99 €	334,78 €	869.588,33 €
	Reference	UNOKOZSR Transition Min	0:18:41	483,99 €	800	676,92 €	1.160,51 €		542,26 €	1.084.814,91 €	142,89 €	285.948,99 €
						Mittelwert	1.399,38 €		781,13 €	1.562.251,90 €	95,91 €	191.822,40 €
	PM53	UNOKO1D Max	0:31:10	806,70 €	1300	1.100,00 €	1.996,70 €	268,45 €	1.298,44 €	2.576.883,32 €	603,23 €	1.296.468,00 €
	PM53	UNOKO1D Min	0:19:24	502,14 €	700	692,31 €	1.094,44 €	66,07 €	476,19 €	993.393,99 €	239,92 €	420.292,40 €
						Mittelwert	1.893,67 €	101,19 €	882,32 €	1.764.638,45 €	197,11 €	341.271,90 €
	PM55	UNOKO1M Max	0:31:30	815,33 €	1200	1.015,38 €	1.830,71 €	192,46 €	1.212,46 €	2.424.914,10 €	627,25 €	1.094.400,00 €
	PM55	UNOKO1M Min	0:24:38	637,59 €	800	670,92 €	1.314,52 €	154,01 €	696,26 €	1.392.526,98 €	11,89 €	221.010,00 €
						Mittelwert	1.572,61 €	173,23 €	954,38 €	1.908.720,34 €	239,15 €	302.300,00 €
	PM56	UNOKO1R Max	0:35:10	910,23 €	1400	1.184,62 €	2.094,88 €	456,69 €	1.476,69 €	2.953.156,78 €	791,38 €	1.582.700,00 €
	PM56	UNOKO1R Min	0:28:43	743,28 €	1100	930,77 €	1.674,08 €	513,54 €	1.055,80 €	2.111.899,44 €	270,89 €	741.176,64 €
						Mittelwert	1.884,45 €	485,07 €	1.266,20 €	2.532.295,10 €	530,99 €	1.161.969,99 €
PSA2SR	Reference	PSA2SR Transition Max	0:25:20	655,71 €	1100	930,77 €	1.586,48 €		970,11 €	1.940.338,97 €		
	Reference	PSA2SR Transition Min	0:07:35	198,28 €	300	253,85 €	450,13 €		166,20 €	312.358,91 €		
						Mittelwert	1.018,30 €		401,98 €	803.896,73 €		
	PM53	PSA1D Max	0:24:45	640,61 €	1100	930,77 €	1.571,38 €	15,10 €	930,77 €	1.910.111,75 €	958,06 €	
	PM53	PSA1D Min	0:09:25	243,73 €	300	253,85 €	457,58 €	47,45 €	118,74 €	237.496,94 €		
						Mittelwert	1.024,48 €	16,18 €	32,364,17 €	418,16 €	636,10,96 €	
	PM55	ASPA1R Max	0:29:30	763,56 €	1100	930,77 €	1.694,33 €	107,85 €	1.216,00 €	2.156.000,42 €	1.078,00 €	
	PM56	ASPA1R Min	0:17:10	444,33 €	500	423,08 €	867,41 €	417,28 €	251,08 €	902.183,28 €	251,08 €	
					Mittelwert	1.259,97 €	202,66 €	928.126,00 €	664,54 €	1.329.083,33 €		
KERAX2SR	Reference	KERAX2SR Transition Max	0:21:30	556,49 €	1000	846,15 €	1.402,65 €		888,11 €	1.376.225,17 €		
	Reference	KERAX2SR Transition Min	0:08:25	217,85 €	400	338,46 €	556,31 €		188,22 €	316.439,96 €		
						Mittelwert	979,48 €		284,93 €	629.892,63 €		
	PM53	KERAX1D Max	0:21:10	547,86 €	1000	846,15 €	1.394,02 €	9,63 €	679,48 €	1.368.889,66 €		
	PM53	KERAX1D Min	0:08:17	240,28 €	300	253,85 €	454,02 €	62,18 €	229,49 €	440.895,28 €		
						Mittelwert	944,67 €	35,41 €	229,54 €	459.081,69 €		
	PM55	SOLVU1M Max	0:21:00	543,55 €	1000	846,15 €	1.399,70 €	12,94 €	675,17 €	1.360.341,88 €		
	PM56	SOLVU1M Min	0:08:25	217,85 €	400	338,46 €	556,31 €	- €	188,22 €	316.439,96 €		
					Mittelwert	973,01 €	6,47 €	12.941,67 €	95.990,96 €			
PM56	SOLVU1R Max	0:21:20	552,18 €	900	761,54 €	1.313,72 €	88,93 €	698,18 €	1.198.366,67 €			
PM56	SOLVU1R Min	0:14:30	375,31 €	500	423,08 €	798,39 €	242,07 €	83,85 €	167.704,70 €			
					Mittelwert	1.055,93 €	76,67 €	153.143,06 €	241,62 €	683.625,69 €		
							Average UNOKO 202.384,65 € 346.468,44 € 970.141,20 €					
							Average PSA 32.354,17 € 625.158,60 € 1.531.43,00 €					
							Average KERAX 70.910,94 € 12.941,67 € 153.143,00 €					



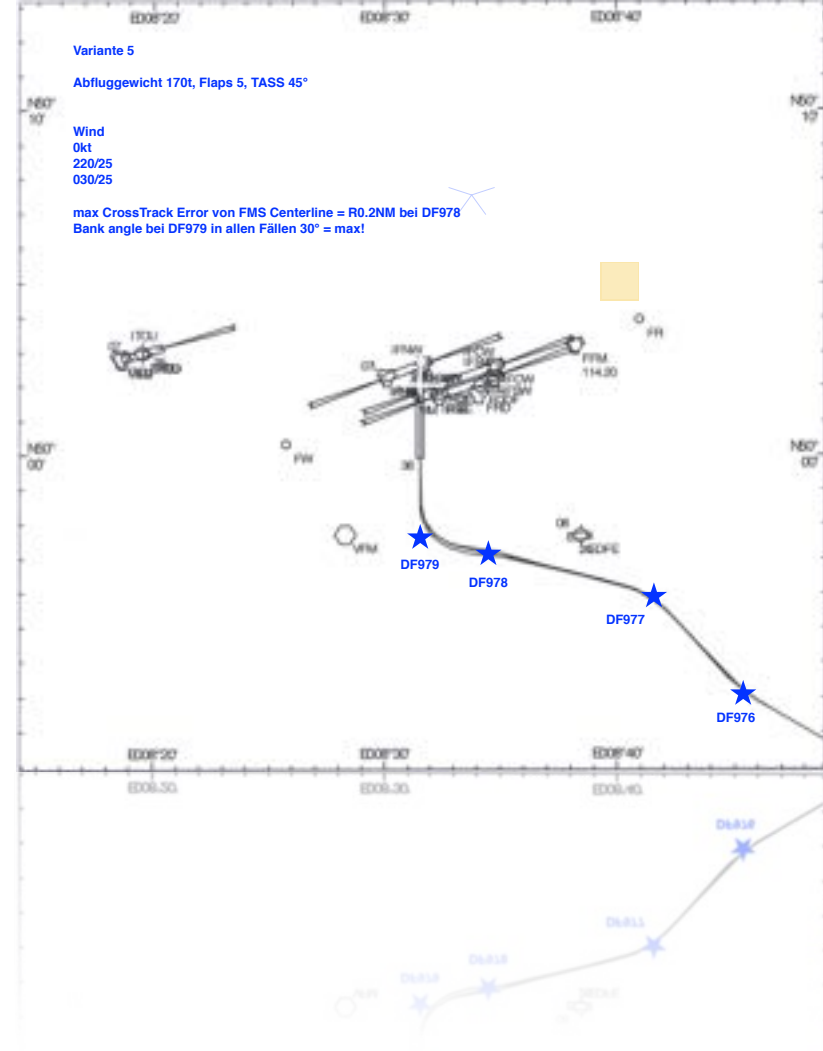
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Condor Airlines – Noise Abatement Initiatives

Analysis FMS – Aircraft behaviour on modified SID's

- ✈ simulator trials to analyze
 - ✈ Flyability
 - ✈ Track keeping accuracy
 - ✈ Several options tested
 - ✈ Impact of speed, wind and aircraft weight



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Condor Airlines – Noise Abatement Initiatives

DLR project LNAS – Low Noise Augmentation System

- ④ Condor is primary industry partner selected by UNH
- ④ Commitment to install system on 6 A321 if test results positive
 - ④ Provision of 6 crew for trial on DLR A320 simulator
 - ④ Provision of 6 crew for live trial on D-ATRA in SEP 2016
 - ④ Results are promising – under analysis at present



Condor Airlines – Noise Abatement Initiatives

Flight Procedures	Aircraft Modifications	Fleet Renewal	Flight Planning	R & D
 Use of modern navigational technologies PBN Pilot training CDO/ CCO	 Winglets/ Sharklets Airbus vortex generators Boeing upgrade with latest flight deck avionics under evaluation	 Renewal of mid range fleet by A321 CEO incl. state of the art avionics Renewal of low noise aircraft under evaluation	 Mission Management Concept	 Segmented approach Low noise mission system

How to translate all initiatives into a concept?

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Condor Airlines – Noise Abatement Initiatives

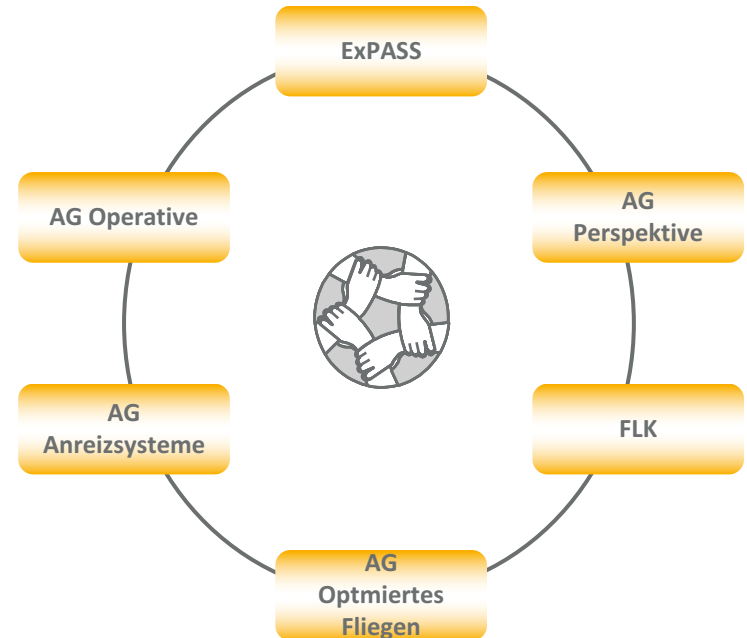
- ✎ A corporate environmental concept for the region requires:
 - ✎ Executive commitment
 - ✎ Resources
 - ✎ Budget
 - ✎ Engagement



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Condor Airlines – Noise Abatement Initiatives

- ✎ A corporate environmental concept for the region requires:
 - ✎ Executive commitment
 - ✎ Resources
 - ✎ Budget
 - ✎ Engagement
- ✎ Condor is part of relevant working groups in the region

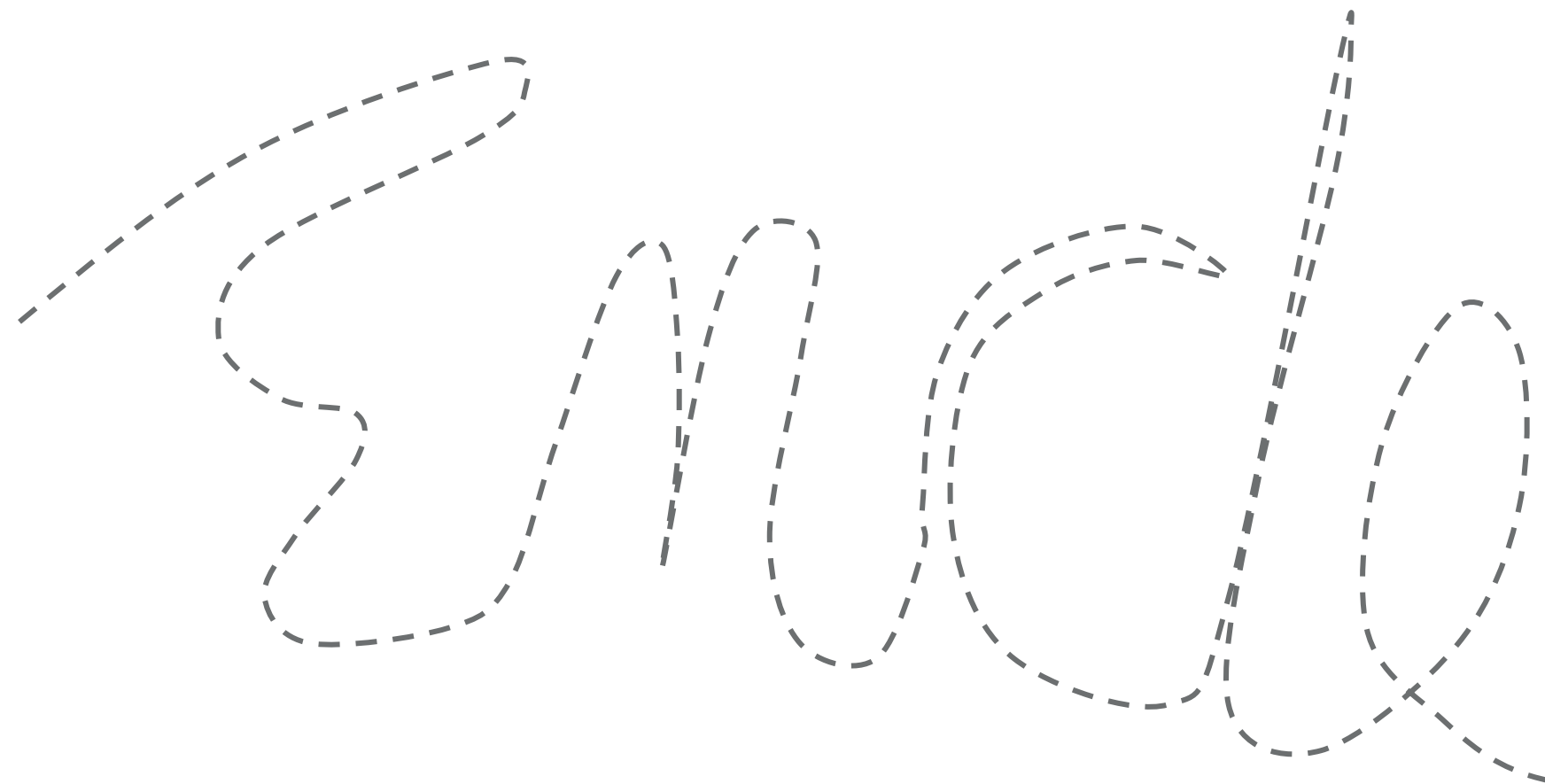


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