



European Wake Vortex Mitigation Benefits Study

EuroBen

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Aims of Study

- Establish which European airports could benefit from: **ATC-Wake, CREDOS, TBS**
 - High-level analysis of modifications/additions to systems
 - Estimation of no. of movements affected/gained
 - NB 'gained' movements weather dependent –used to mitigate delays
- **Starting point for further studies on individual airports at greater detail**
 - European Conops Team

CNS/ATM System

ATM

Airborne
CNS/ATM
Component

AirSpace
Management
(ASM)

ATFM

Flight Data
Processing

CNS/ATM
Support

Aeronautical
Environment
Processing

ATC Tools
& CWP

CNS

Communications

Navigation

Surveillance

Services Providers

MET

AIS

Items	Basic Implementation			Advanced Implementation		
	TBS	CREDOS	ATC-Wake	TBS	CREDOS	ATC-Wake
Trajectory Prediction Integration				✓		✓
Sequence Manager Integration				✓		✓
SNET Integration				✓		✓
WVMC Tool (HMI SW)	✓		✓	✓	✓	✓
Data Link – Based Tech.				✓	✓	✓
Precision Landing (ILS/MLS/GNSS)	✓		✓	✓		✓
RNP/RNAV			✓	✓	✓	✓
Precision Approach Radar (PAR)			✓	✓		✓
A-SMGCS					✓	✓
MET Sensors ¹	✓	✓	✓	✓	✓	✓
WV Sensors ¹			✓	✓	✓	✓

Airport

EGLL

EDDF

EHAM

LFPG

LEMD

EDDM

LIRF

LSZH

LEBL

EGKK

EGCC

11 airports selected

- High Demand (available spacing)
- Aircraft separated close to minima
- High percentage of Wake Vortex pairs
- Headwinds cause delay

ATC-Wake

- General assumptions (All concepts)
 - No separations less than standard IFR minima
 - SFC wind only
 - Simplistic/idealised concepts
 - No consideration of operational & regulatory constraints
- Benefit only when:
 - 6kts crosswind at SFC
 - Airport has high demand
- 3NM and 2.5NM

ATC-Wake

<i>Airport</i>	<i>3Nm</i>	<i>2.5Nm</i>
<i>EGLL</i>	10,858	26,280
<i>EDDF</i>	3,923	11,315
<i>EHAM</i>	1,277	5,565
<i>LFPG</i>	638	1,916
<i>LEMD</i>	547	4,653
<i>EDDM</i>	0	0
<i>LIRF</i>	0	0
<i>LSZH</i>	0	365
<i>LEBL</i>	0	0
<i>EGKK</i>	0	0
<i>EGCC</i>	0	0

- Annual no. of arrivals
- Favourable met. conditions
- Extra movements are not schedulable but allow mitigation of delays
 - Extra movements when:
Crosswind at times of demand where high % of WV pairs

CREDOS

- Benefit only when:
 - 6kts crosswind at SFC
 - Airport has high demand
- Separations
 - 80s (average SID separation at EGLL)
 - 90s

	ATC-Wake		CREDOS	
<i>Airport</i>	<i>3Nm</i>	<i>2.5Nm</i>	<i>80s</i>	<i>90s</i>
<i>EGLL</i>	10,858	26,280	9,490	6,843
<i>EDDF</i>	3,923	11,315	91	0
<i>EHAM</i>	1,277	5,565	638	547
<i>LFPG</i>	638	1,916	0	0
<i>LEMD</i>	547	4,653	456	273
<i>EDDM</i>	0	0	0	0
<i>LIRF</i>	0	0	0	0
<i>LSZH</i>	0	365	0	0
<i>LEBL</i>	0	0	0	0
<i>EGKK</i>	0	0	0	0
<i>EGCC</i>	0	0	0	0

TBS

- Benefit only when:
 - 10kts headwind at SFC
 - 10-20, 20-30, 30+ kts
 - Airport has high demand
- Recovered throughput

	ATC-Wake		CREDOS		TBS
<i>Airport</i>	<i>3Nm</i>	<i>2.5Nm</i>	<i>80s</i>	<i>90s</i>	
<i>EGLL</i>	10,858	26,280	9,490	6,843	1,788
<i>EDDF</i>	3,923	11,315	91	0	2,801
<i>EHAM</i>	1,277	5,565	638	547	431
<i>LFPG</i>	638	1,916	0	0	0
<i>LEMD</i>	547	4,653	456	273	169
<i>EDDM</i>	0	0	0	0	0
<i>LIRF</i>	0	0	0	0	26
<i>LSZH</i>	0	365	0	0	0
<i>LEBL</i>	0	0	0	0	0
<i>EGKK</i>	0	0	0	0	0
<i>EGCC</i>	0	0	0	0	0

Future Demand

<i>Airport</i>	ATC-Wake, 3Nm		CREDOS, 80s	
	<i>Current Demand</i>	<i>Constant Demand</i>	<i>Current Demand</i>	<i>Constant Demand</i>
EGLL	10,858	12,318	9,490	10,220
EDDF	3,923	6,002	91	3,011
EHAM	1,277	9,307	638	5,200
LFPG	638	13,961	0	3,832
LEMD	547	1,460	456	1,095
EDDM	0	273	0	91
LIRF	0	1,733	0	912
LSZH	0	912	0	547
LEBL	0	273	0	91
EGKK	0	4,471	0	2,372
EGCC	0	9,125	0	5,110

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People



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Questions?

Summary

- High-level study
 - Relative indications of magnitude of benefit
 - Future demands could increase benefit significantly
- Basis for more detailed studies
 - Heathrow used as test-case
 - Focus for European Conops Team