

Environmental Impact of Air Traffic Flow Management Delays

**A EUROCONTROL Global Aviation Emissions Study
performed by
ENVISA**

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Background

- ➔ Air traffic in Europe is regulated by the Central Flow Management Unit (CFMU)
- ➔ Regulation of traffic mainly relies on ground delay principles for
 - ✓ Safety reasons
 - ✓ Economic reasons

Objectives (1)

- ➔ Conduct an environmental and economic assessment of ground delay practices and of airborne delay alternatives
- ➔ Initial exercise
 - ✓ Reduced traffic sample
 - ✓ A lot of assumptions
 - ✓ Very general results and conclusions

Objectives (2)

- ➔ Obtain orders of magnitudes of environmental costs of different delay strategies (ground vs. airborne) based on simplified but representative traffic samples
- ➔ Assess impacts on local and global emissions
- ➔ Consider only delays resulting from ATFM (Air Traffic Flow Management) regulation

Approach

- Define scenarios and assumptions
- Select traffic sample
- Set up environmental simulation tools
- Compute local pollution and global emissions for each scenario
- Analyze results and convert into financial terms

Definition of scenarios and assumptions – Ground Delays (1)

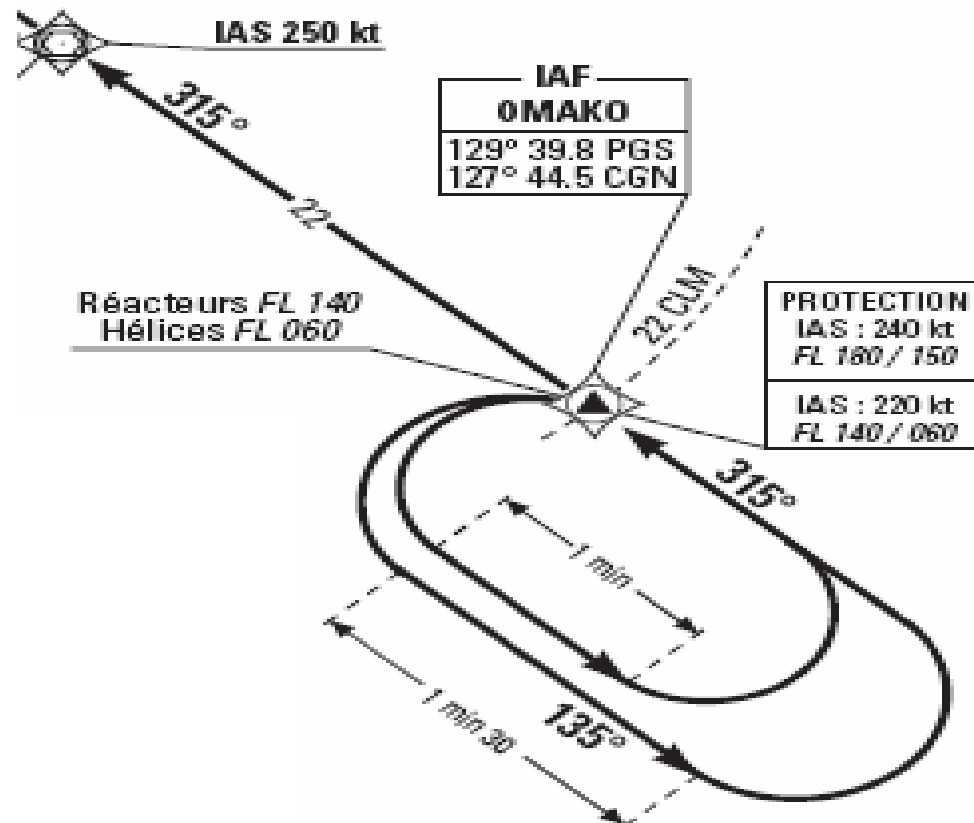
Depends on aircraft, airport, delay duration

Operating mode	Proportion of time spent
At gate with GPU only	81%
At gate with APU only	9%
Off-gate stationary ground or active taxi out	10%

Source :University of Westminster, Transport Studies Group (2004) Evaluating the true cost to airlines of one minute of airborne or ground delay

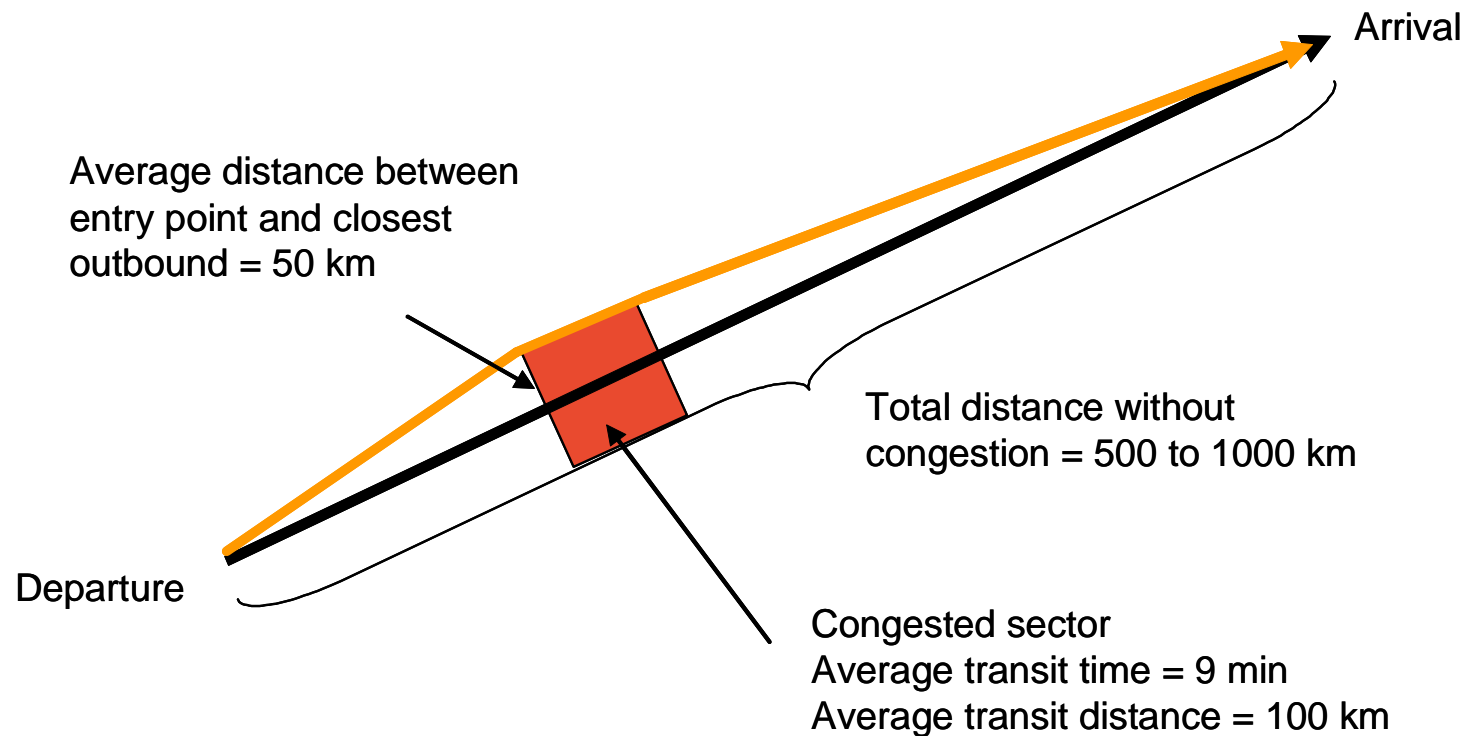
Definition of scenarios and assumptions – Airborne Delays (1)

→ Holding description



Definition of scenarios and assumptions – Airborne Delays (2)

→ Flight re-routing assumptions



Definition of scenarios and assumptions – Airborne Delays (3)

Depends on airport, delay duration

	Location of the regulation	
	En-route (50% of CFMU statistics)	Arrival airport (50% of CFMU statistics)
Holding stack	0%	100%
Rerouting	100%	Not possible

Speed control alternative not investigated in this study.

Delay distribution

- 8.5% of 8.9 million flights in 2004 were delayed by at least 5 minutes because of ATFM regulations

Delay duration (minutes)	% total traffic	Number of flights
0 – 4	91.4	Not considered delayed
5 – 15	4.6	409,400
16 – 30	2.7	240,300
31 – 60	1.0	89,000
> 60	0.2	17,800

Traffic sample selection

- ➔ In 2004, 14.9 million ATFM delays in Europe
- ➔ The 16 most congested airports generate 80% of European airport delays
- ➔ The top 16 aircraft types operating at these airports were identified

Setting up environmental simulation tools

- ➔ Ground delays: ALAQS database
 - ✓ Aircraft type grouped by category (turboprop, jet regional, jet small, jet medium, jet large)

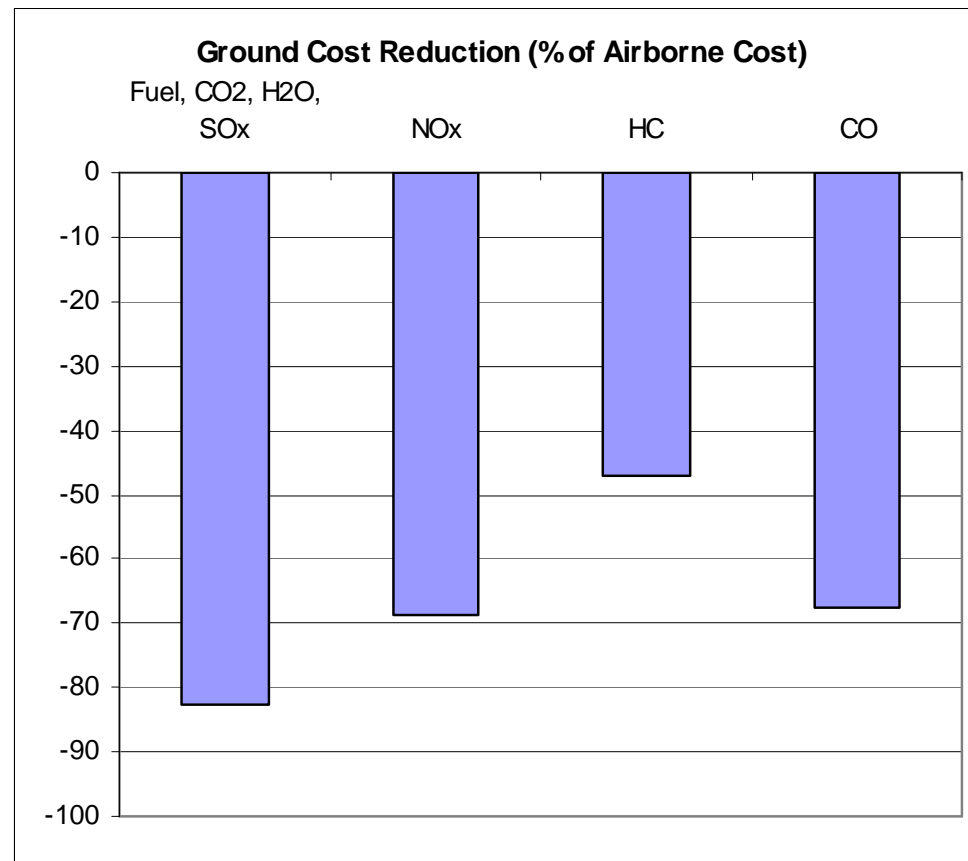
- ➔ Airborne delays: AEM methodology
 - ✓ BADA 3.6
 - ✓ ICAO Engine Exhaust Emissions Data Bank
 - ✓ Boeing Method 2

Conversion into financial terms

Unit costs (€/tonne)	Low	Base	High
CO ₂	11	37	65
H ₂ O	2.8	8.3	14
NO _x	4,460	6,414	10,693
SO _x	2,110	6,094	11,133
HC	2,569	5,543	8,518
CO	104	142	205

Conclusions (1)

Relative cost reduction of ground delay vs. airborne delay by pollutant



Conclusions (2)

- The impact of ground delays varies with the power source used during the delay
- Applying ground delays rather than airborne delays results in immediate environmental benefits

	Airborne delay vs. Ground delays
Fuel consumption	X 6
Non linear emissions	X 3
Cost	X 5

Conclusions (3)

- ➔ The application of the ground delay principle in EUROPE saves 80M€ annually including
 - ✓ 60M€ in fuel savings and
 - ✓ 20M€ in emission cost savings

Thank you



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