

Cost Benefit Analysis

Why an Airport CDM CBA?

- Is Airport CDM for you?
- What are the required investments?
- What are the expected benefits?
- Who gets which benefits?



Approach : 2nd Airport CDM CBA



Airport CDM Project

Stakeholders Involvement: Generic and local Workshops, local data collection & analysis, and regular validations

- Airport CDM Information Sharing
- CDM Turn-round Process
- Collaborative Management of Flight Updates
- Variable Taxi Time Calculation
- Collaborative Predeparture Sequence
- CDM in Adverse Condition

Input from Operational Experts

1st CBA results

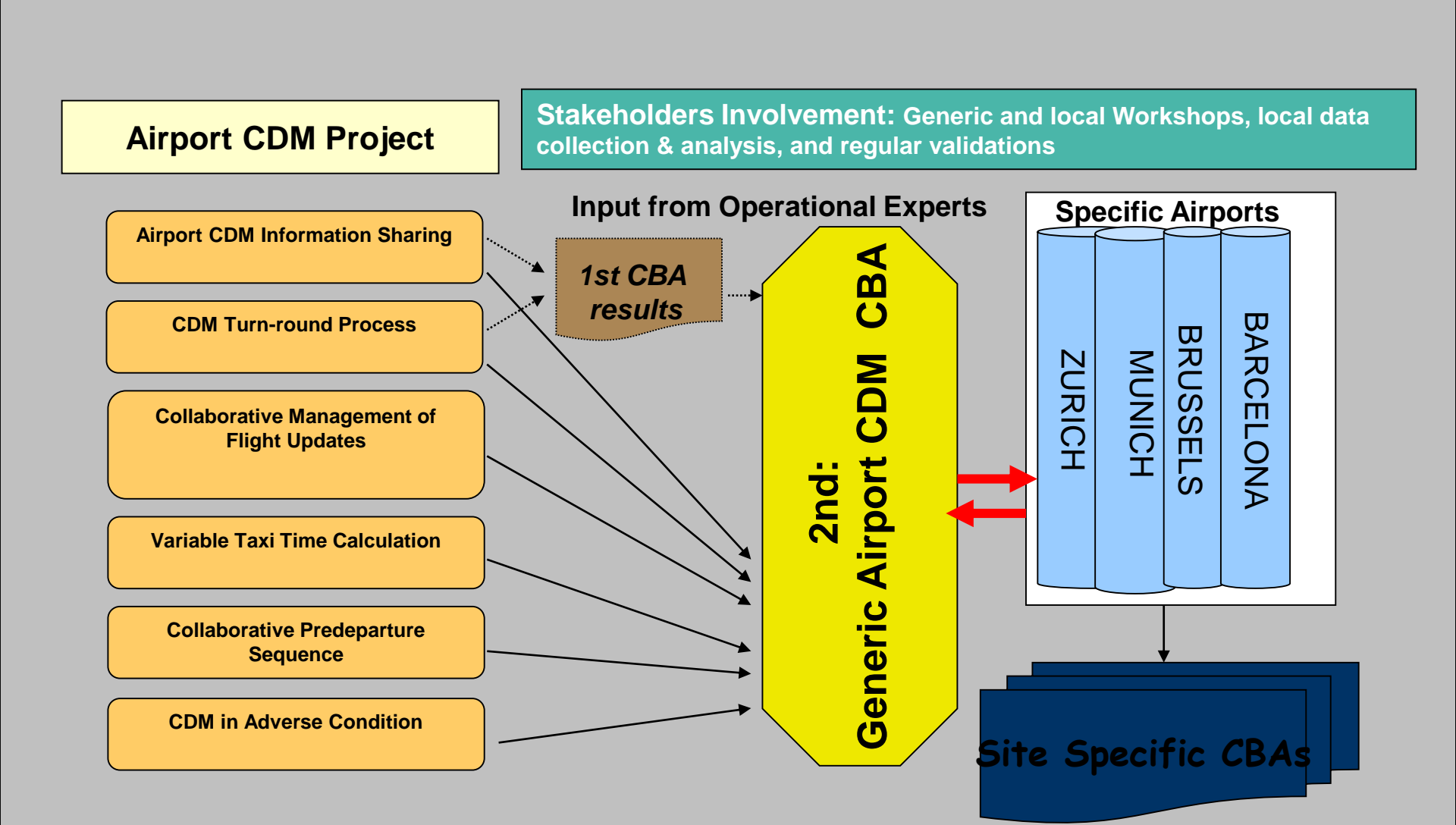
2nd:
Generic Airport CDM CBA

Specific Airports

- ZURICH
- MUNICH
- BRUSSELS
- BARCELONA

Site Specific CBAs

EMOSIA Methodology



Generic Airport Characteristics

Stakeholders Involvement: Generic and local Workshops, local data collection & analysis, and regular validations / BRU-MUC-ZRH-BCN

- Aircraft movements 280.000
- Annual Traffic Growth: 4%
- Operational Costs 2006 = 300 M Euros
- ATC Costs in Airport = 70 M Euros

Time Line Assumptions:

- 2006-2009: Implementation Period
- 2010-2016: Daily Normal Operations

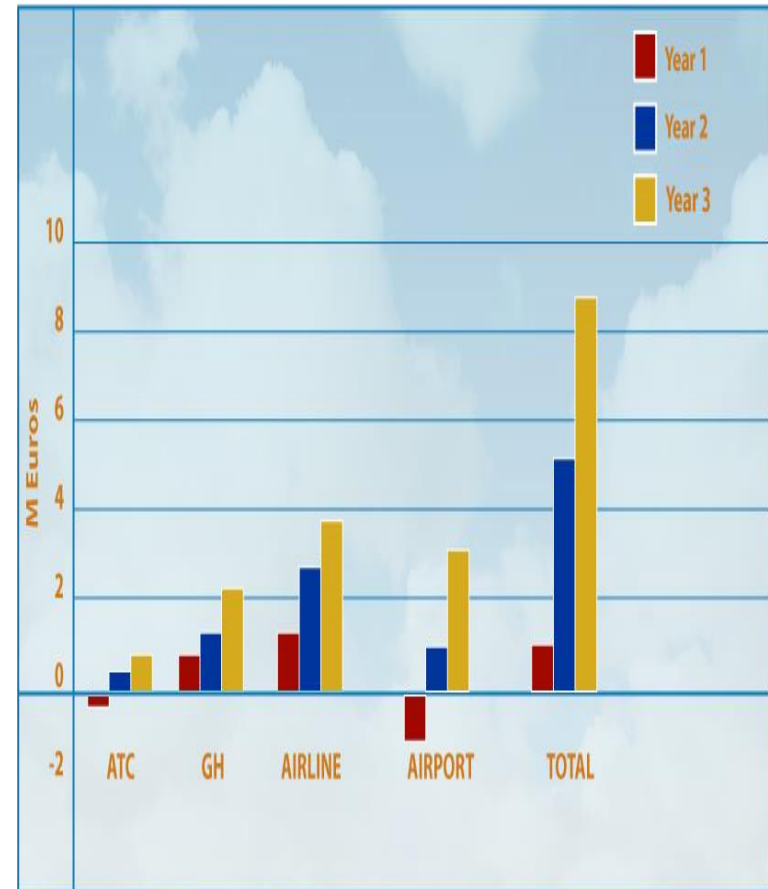
Generic Airport CDM CBA Results

- Expected benefits of 90M € (over 10 years, all Partners included)
- Benefit to cost ratio **9/1!**



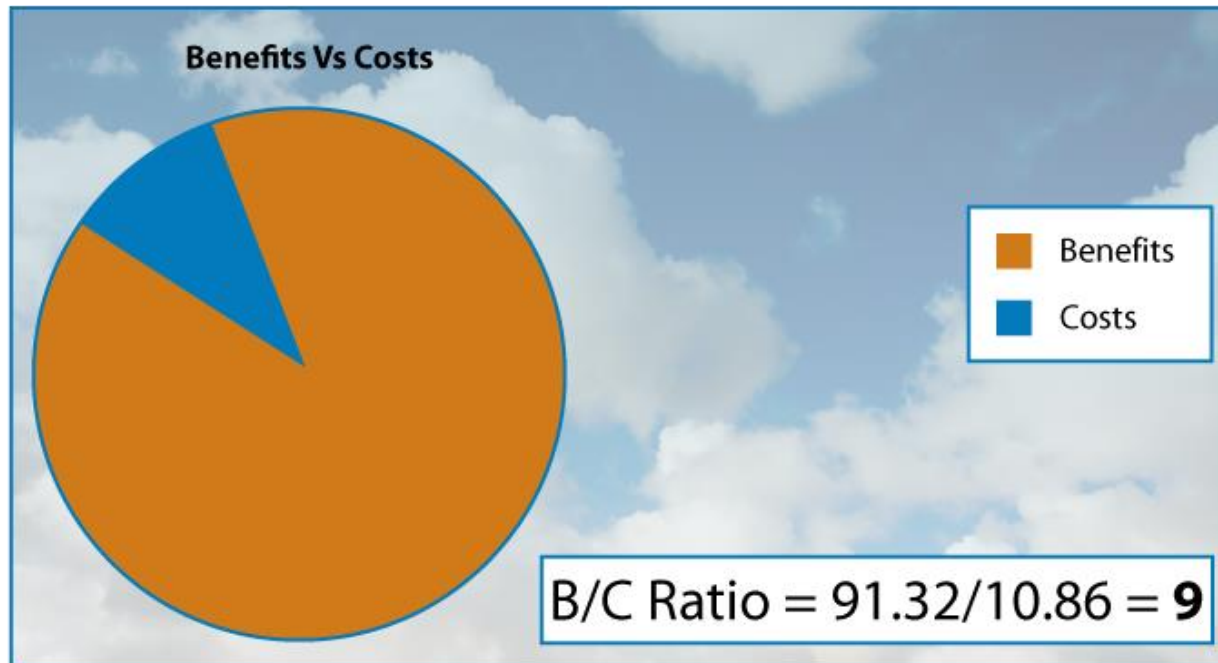
- Quick return of investment for all Partners – 2 years
- Risk of financial loss is practically non-existent

Quick return on investment

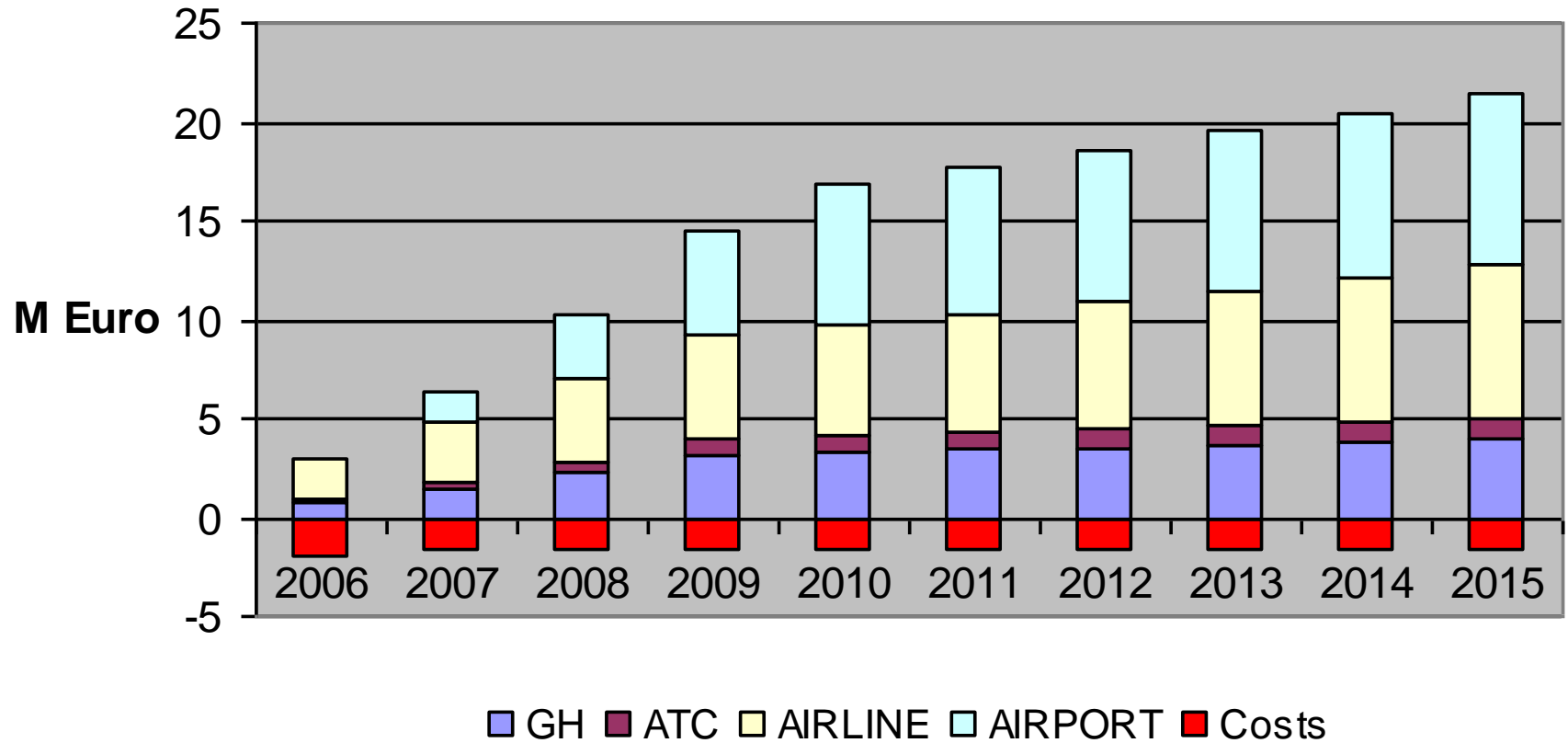


Cost effective for all partners

	Airspace Users	Ground Handlers	Airport	ATC
Net Present Value	29.92 M €	16.87 M €	29.39 M €	3.79 M €
Benefit/Cost Ratio	8	14	8	6
Payback within	1 year	1 year	2 years	2 years



Benefits per partner vs total Costs



How about the cost?

One-off Costs:

- project definition & project management
- procedures adaptation
- system integration
- staff training

Operating Costs:

- maintenance & IT Improvements
- recurrent Training
- travel Costs
- airlines: Full Time Function – ATC/ FLOW, Flight dispatch staffing



Potentially no need for expensive new systems; re-use what is

Airport Operator benefits

- Increased Departures and Arrivals punctuality and airport slot adherence
- Efficient use of infrastructure i.e. stands & gates
- Accelerated operational recovery in adverse conditions or other disruptions
- Reduced environmental nuisance e.g. emissions and noise



Results from Analysis - Airports

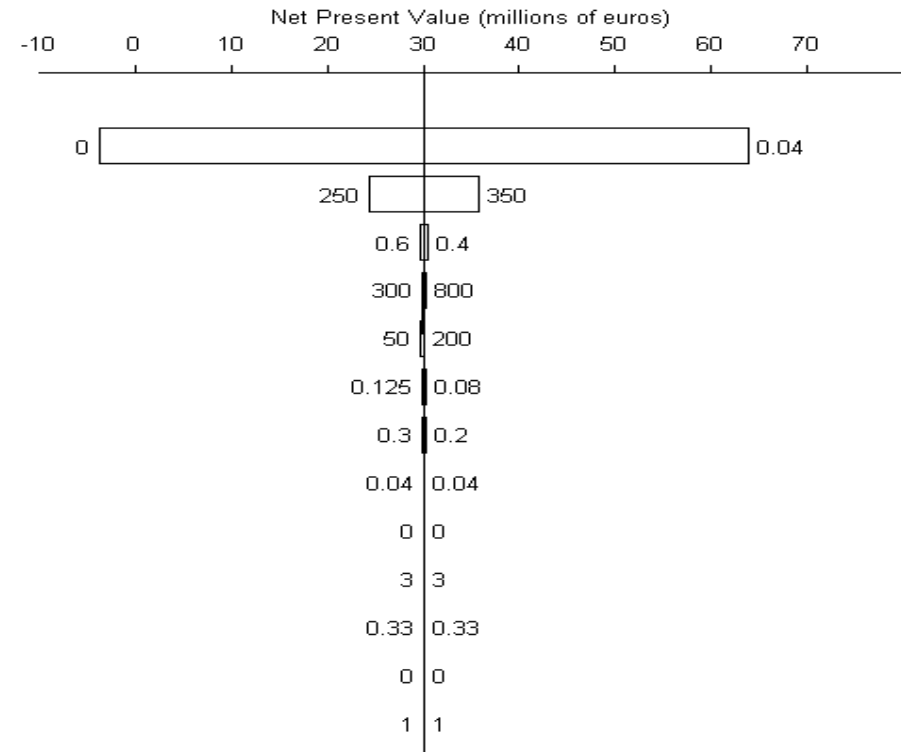


NPV: €M 29.9

Benefit / Cost Ratio: 8

Sensitivity Analysis Results - Airports

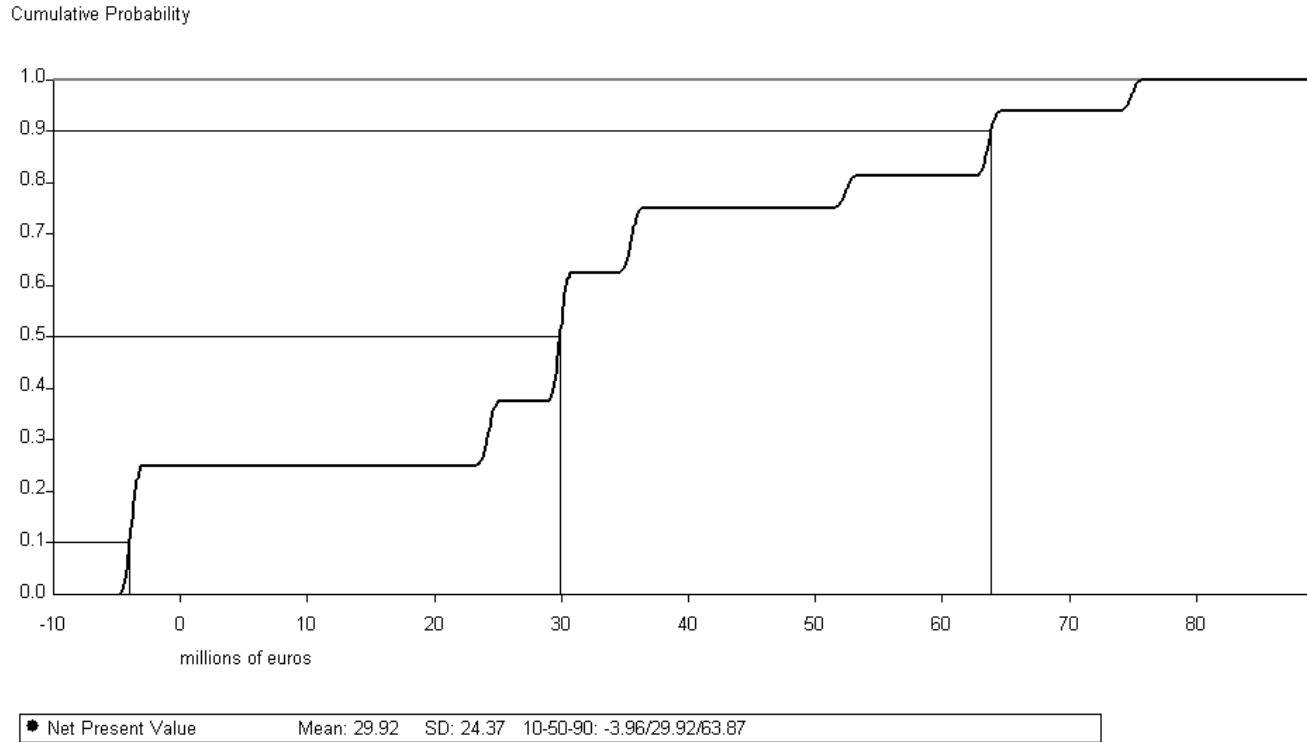
Variable	Base Case	Variance Contribution(%)
Operating Cst Avoid %	0.02	97.2
Operating Cost 2006	300	2.7
Annual Ops Cost	0.5	0.0
Value of Cancel Flight	600	0.0
Cancellations Avoided	200	0.0
IT Improvements (Annual)	0.1	0.0
Develop Planning system (annual)	0.25	0.0
Operating Cost Growth	0.04	0.0
Pre-Imp Duration	0	0.0
Imp Duration	3	0.0
Preparation Annual (steering group)	0.33	0.0
S1 Ann Pre-Imp Cst M-Eu	0	0.0
Benefits Lag	1	0.0



Base Case Value: 30.09

Main Conclusion:

Critical Variable: % Operating Cost Avoidance

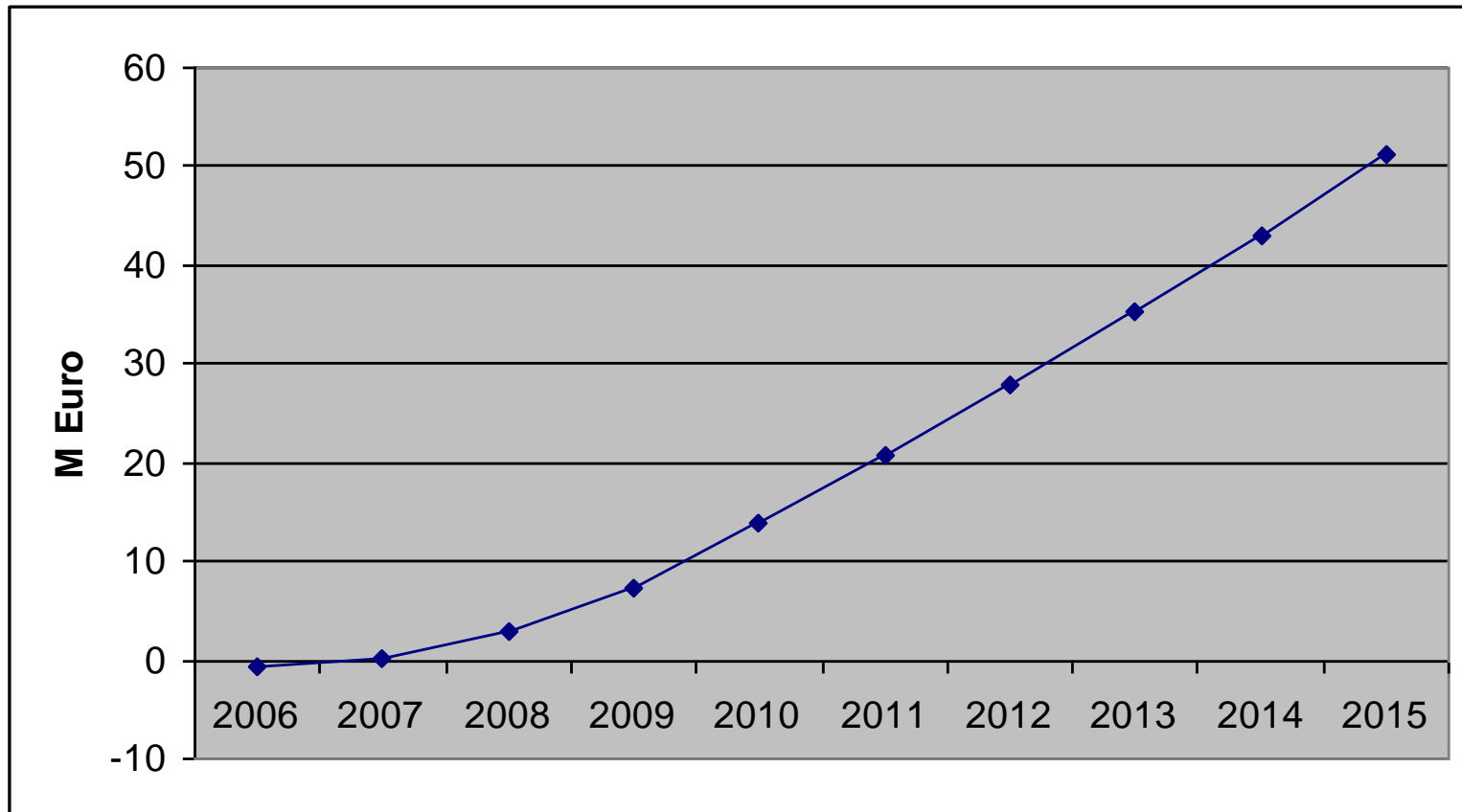


Main Conclusion:

Very safe investment with very limited risk:
80% probability of positive result

Cumulative Cash Flow Analysis – Airports

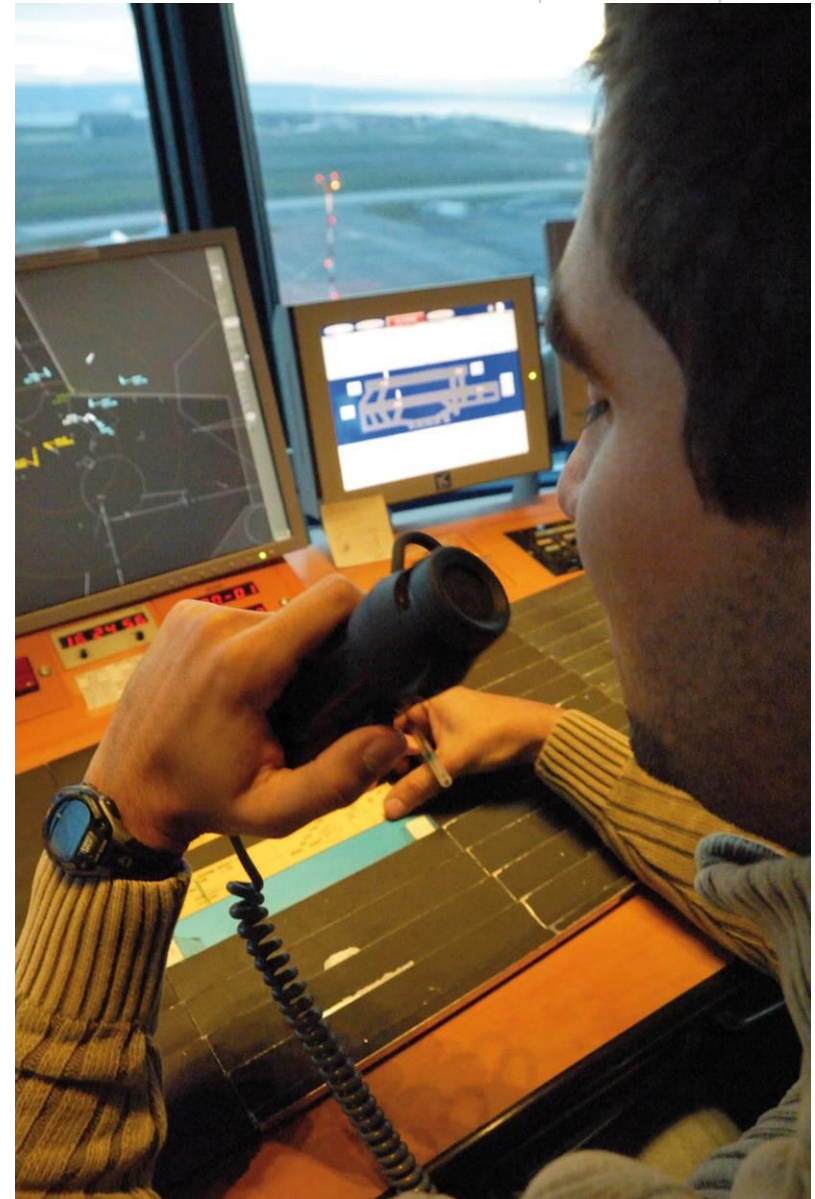
Payback Period Within 2 years





ATC benefits

- Flexible pre-departure planning
- Reduce apron and taxiway congestion
- Smooth flow of traffic eases air traffic controllers' workload



Results from Analysis - ATC

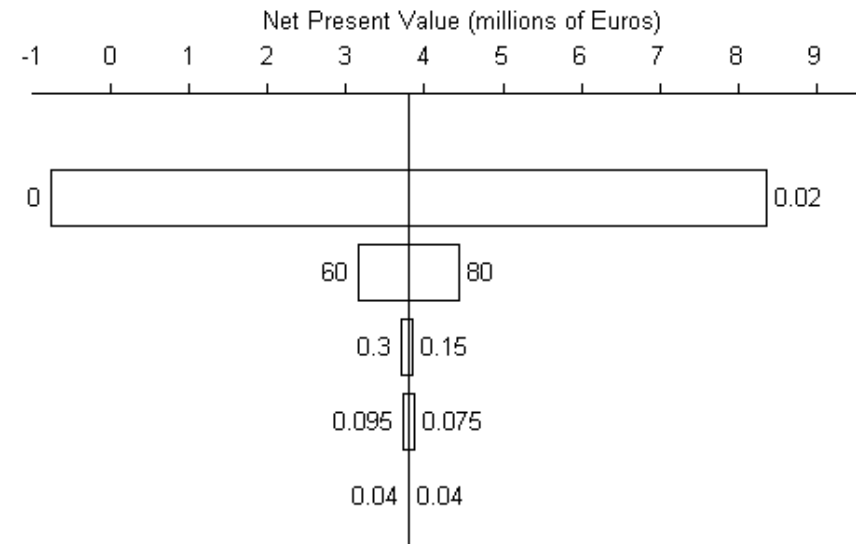


NPV: €M 3.79

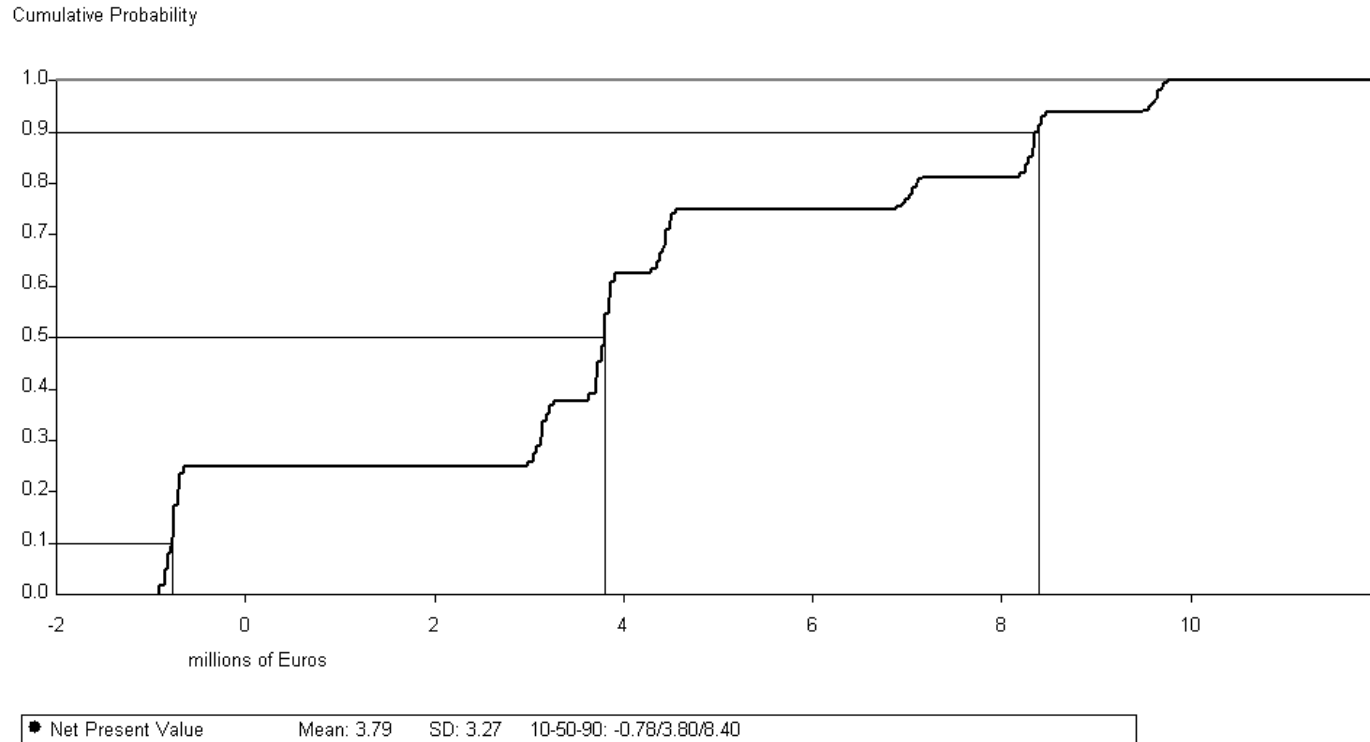
Benefit / Cost Ratio: 6

Sensitivity Analysis Results - ATC

Variable	Base Case	Variance Contribution(%)
Percentage Improvement (CDM)	0.01	97.9
BL Operating Cost	70	1.9
IT Costs	0.2	0.0
Annual Maintenance cost	0.085	0.0
Operating Cost Growth	0.04	0.0



Main Conclusion:
Critical Variable: % Improvement (CDM)

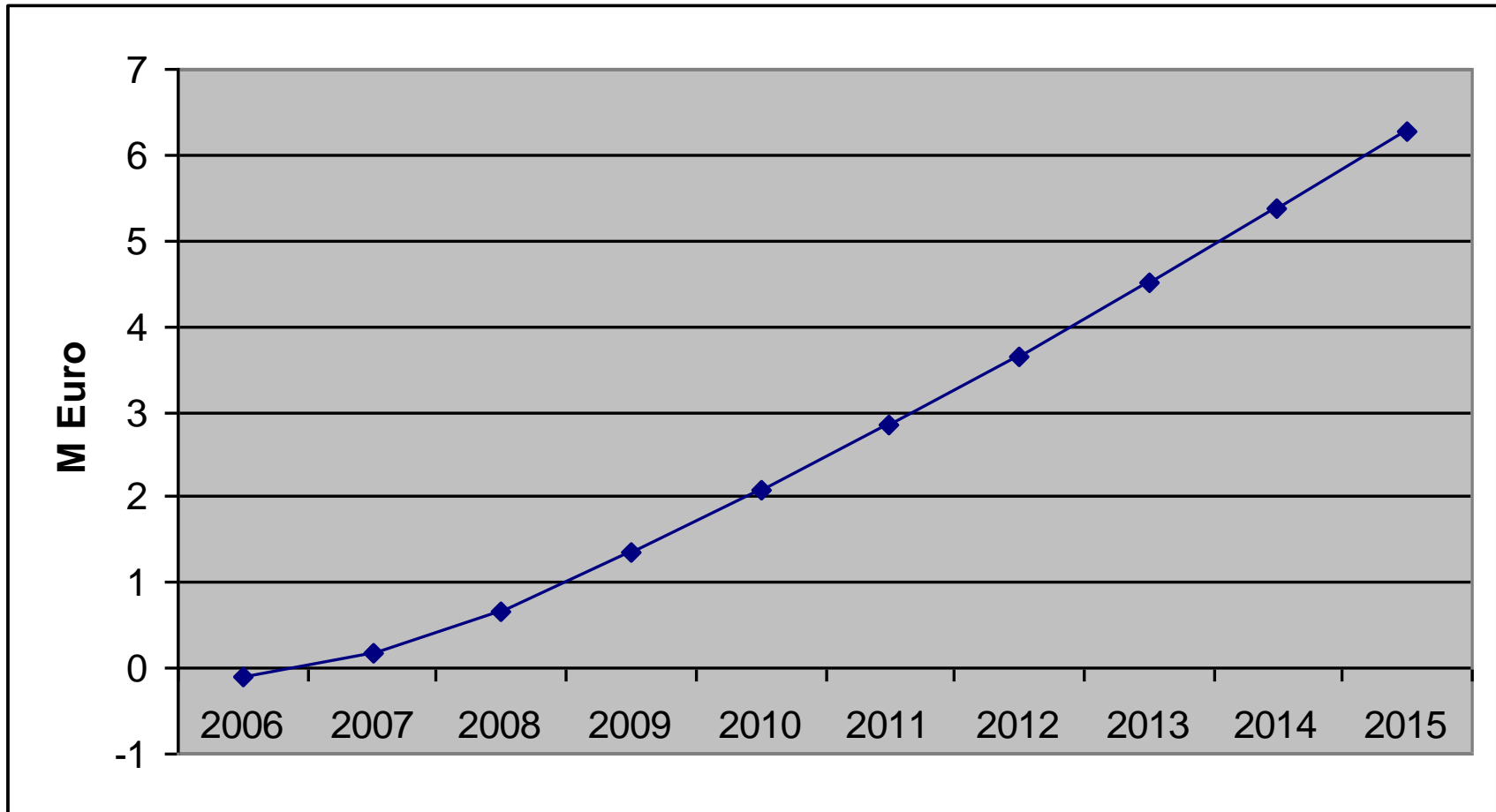


Main Conclusion:

Very safe investment with very limited risk:
80% probability of positive result

Cumulative Cash Flow Analysis – ATC

Payback Period Within 2 years



Aircraft Operator benefits

- Daily programme of flight operations and turn-round times on schedule – enhanced punctuality
- Possible schedule disruptions predicted early, thus managed efficiently
- Preferences and priorities taken into account
- Fuel and time savings with reduced taxi and holding time

Results from Analysis - Airlines

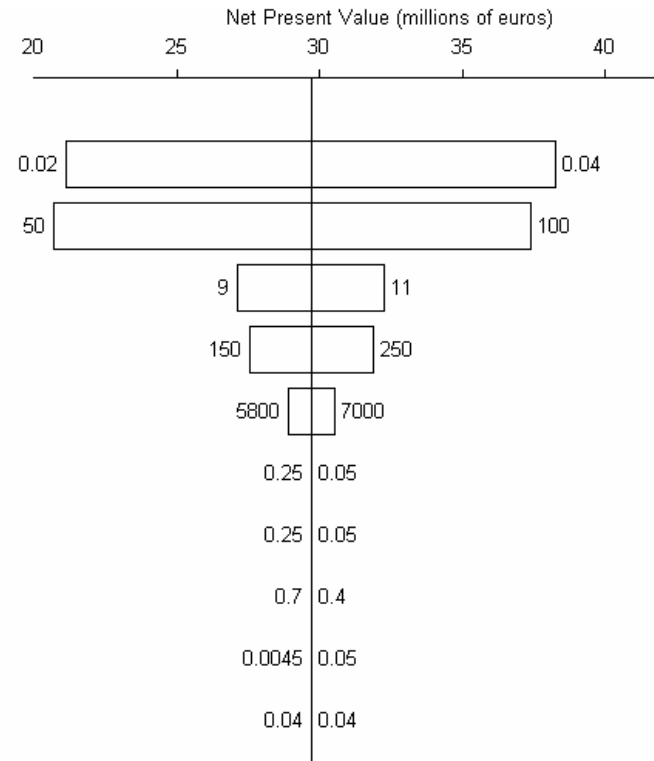


NPV: €M 29.39

Benefit / Cost Ratio: 8

Sensitivity Analysis Results – Airlines

Variable	Base Case	Variance Contribution(%)
Average Delay reduction	0.03	47.3
Cost of minute of delay	77	44.9
BL Delays	10	4.2
Cancellations avoided	200	2.9
Value of cancel flight	6380	0.4
Ann Imp M-Eu	0.15	0.0
Ann ATC FLOW	0.15	0.0
Ann Flight dispatch staffing	0.5	0.0
Ann Travel Cost	0.005	0.0
Ann Flight Growth	0.04	0.0

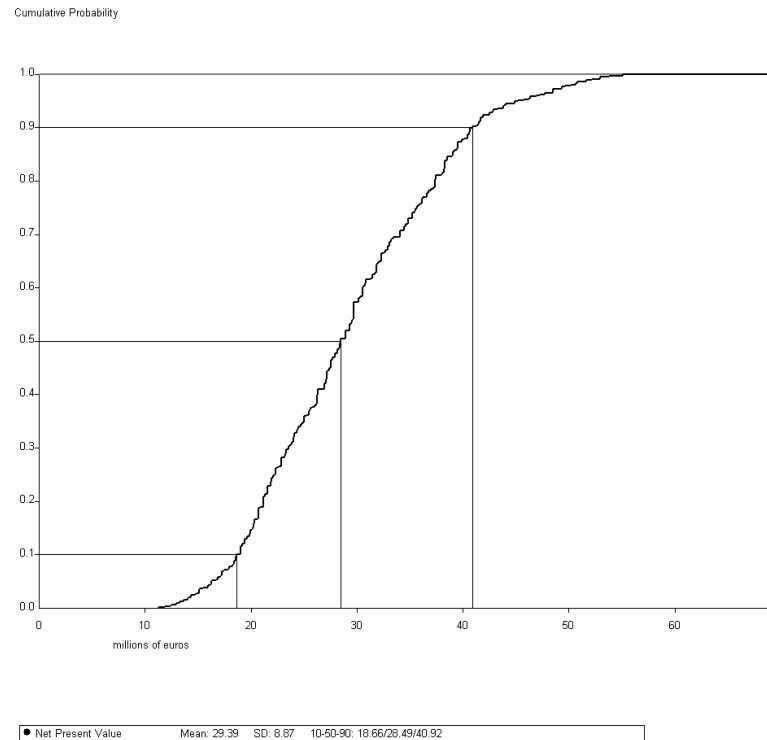


Base Case Value: 29.71

Main Conclusion:

Critical Variables - Average delay reduction, Cost of 1 minute delay, Baseline (situation without Airport CDM) of delays minutes per flight, Cancellations avoided

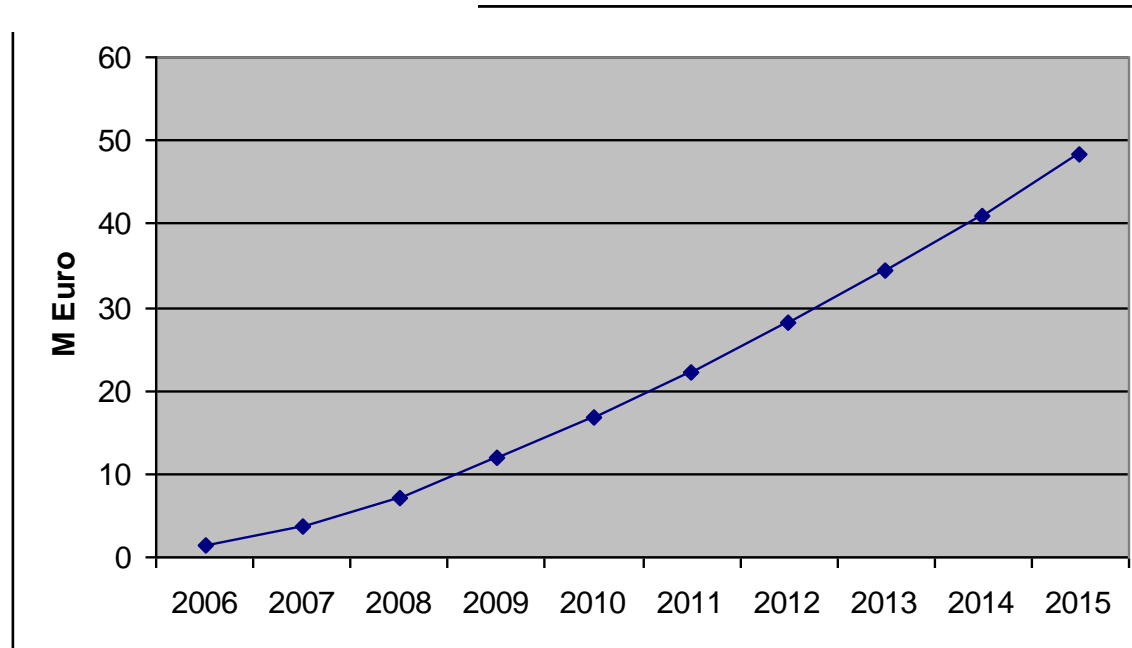
Probabilistic Analysis – Airlines



Main Conclusion:
No risk of losing money

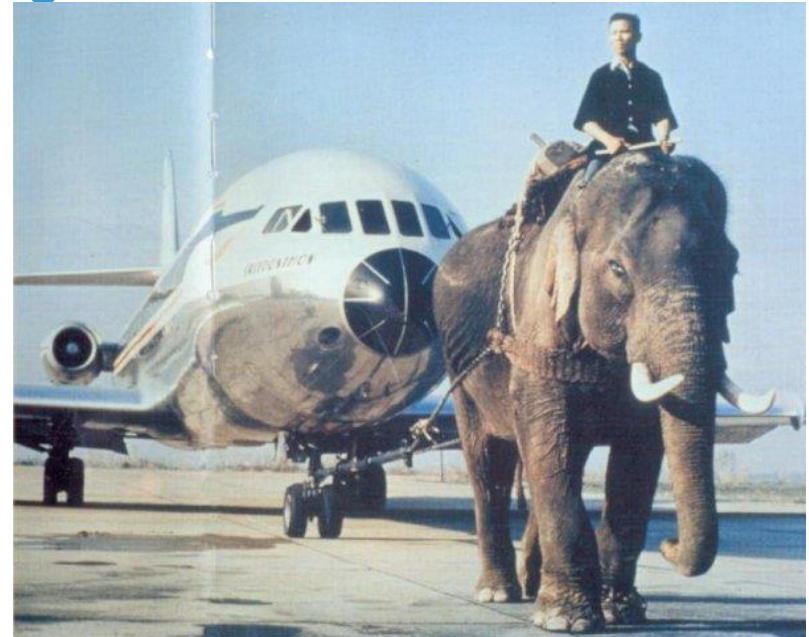
Cumulative Cash Flow Analysis – Airlines

Payback Period Within 1st year



Ground Handling benefits

- Enhanced punctuality of operations
- Maintaining Service Level Agreements
- Optimised resource management



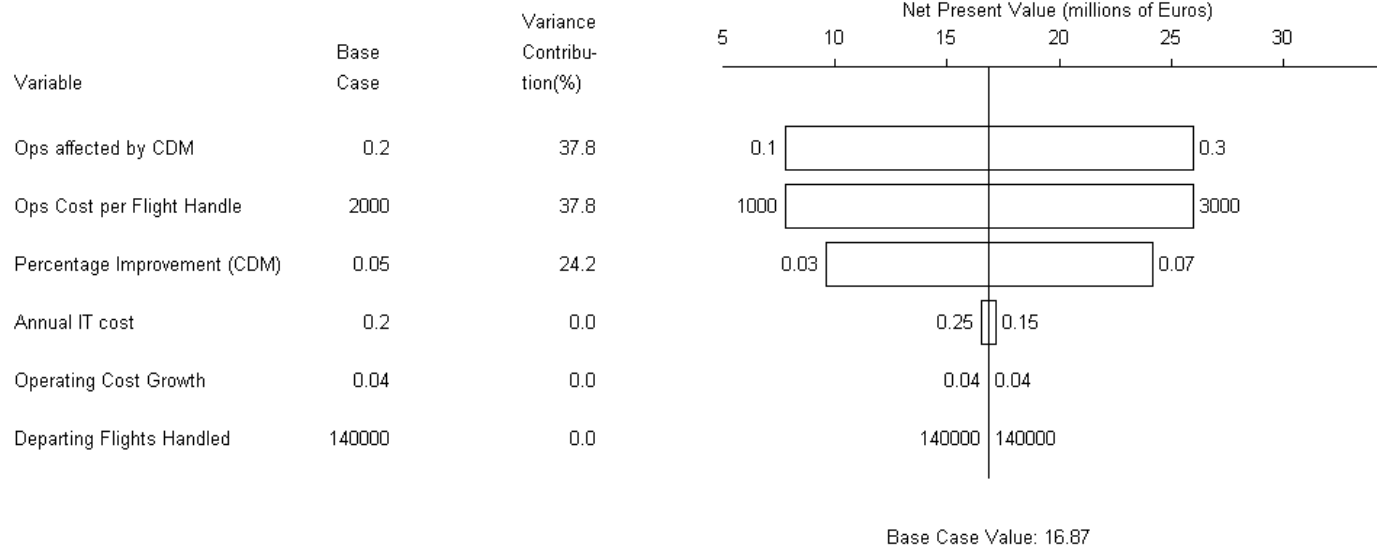
Results from Analysis – Ground Handlers



NPV: €M 16.87

Benefit / Cost Ratio: 14

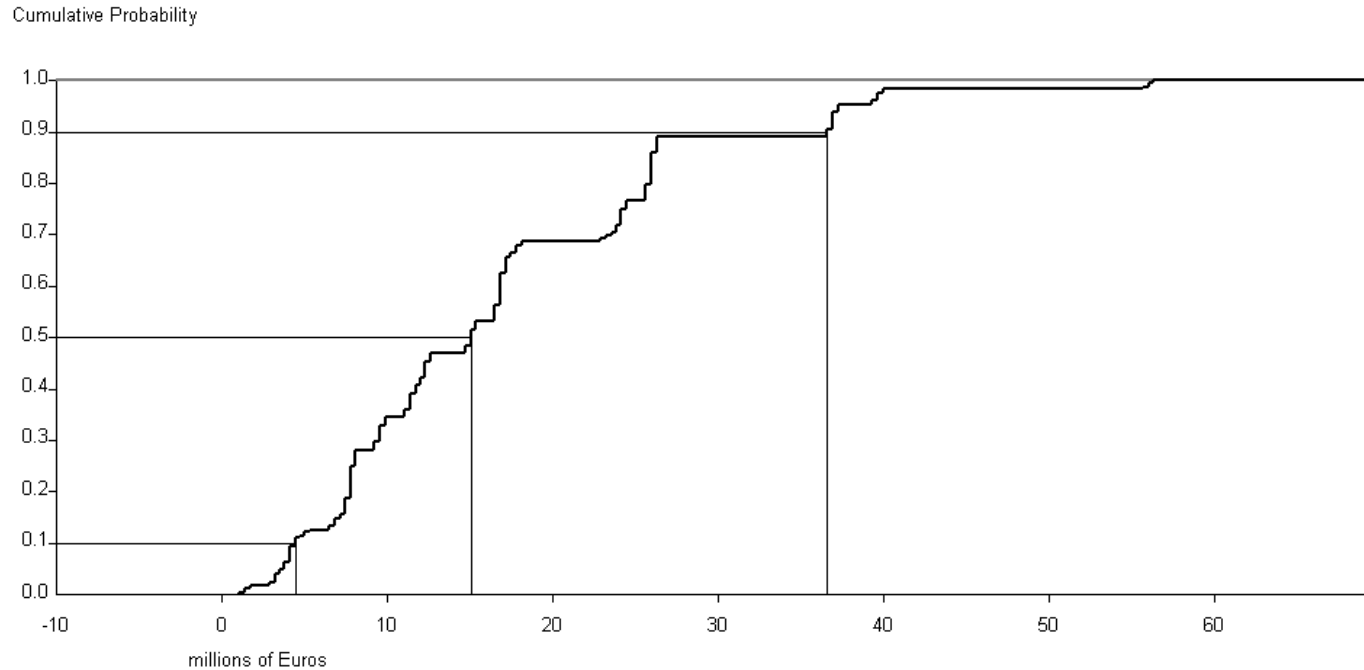
Sensitivity Analysis Results— Ground Handlers



Main Conclusion:

critical Variables - % Ops affected by CDM, Ops Cost per flight handled, Improvement in Ops Costs thanks to CDM

Probabilistic Analysis – Ground Handlers

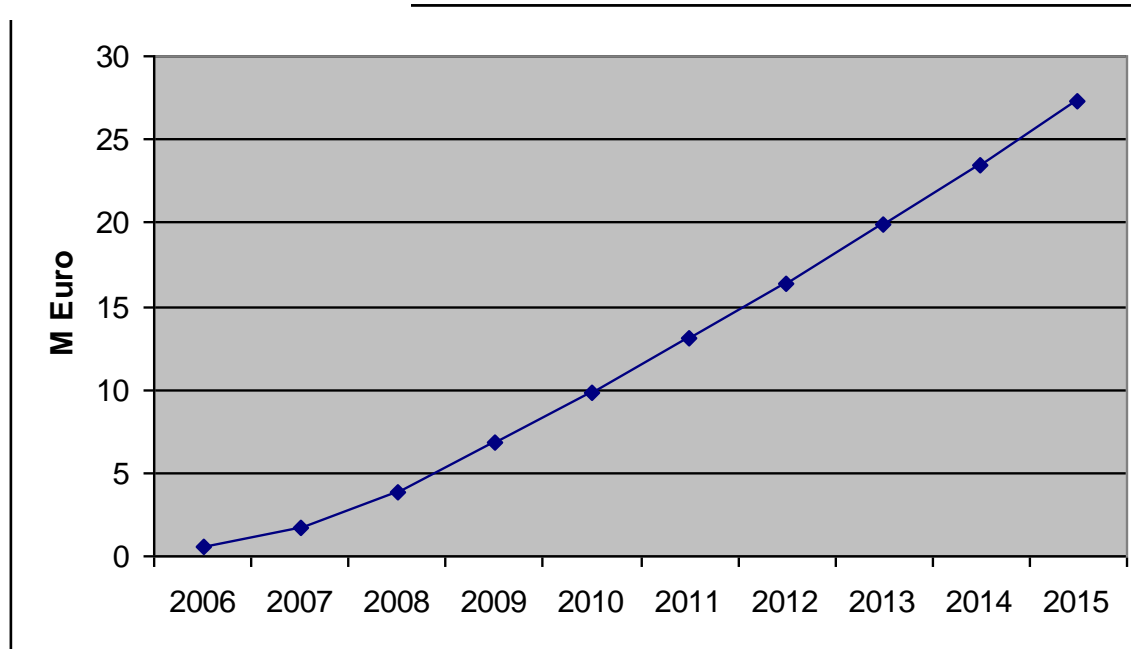


• Net Present Value Mean: 16.87 SD: 11.03 10-50-90: 4.46/15.05/36.57

Main Conclusion:
No risk of losing money

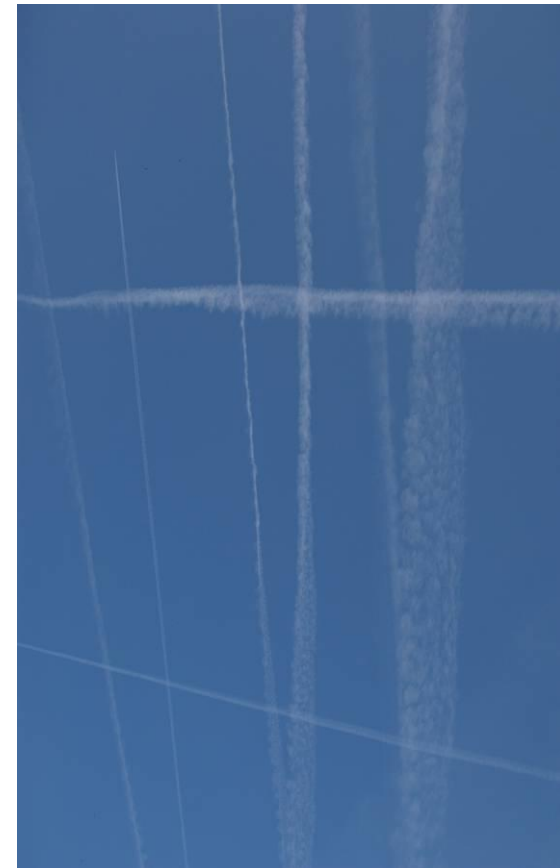
Cumulative Cash Flow Analysis – Ground Handlers

Payback Period Within 1st year



Benefits for NMOC and ATM Network

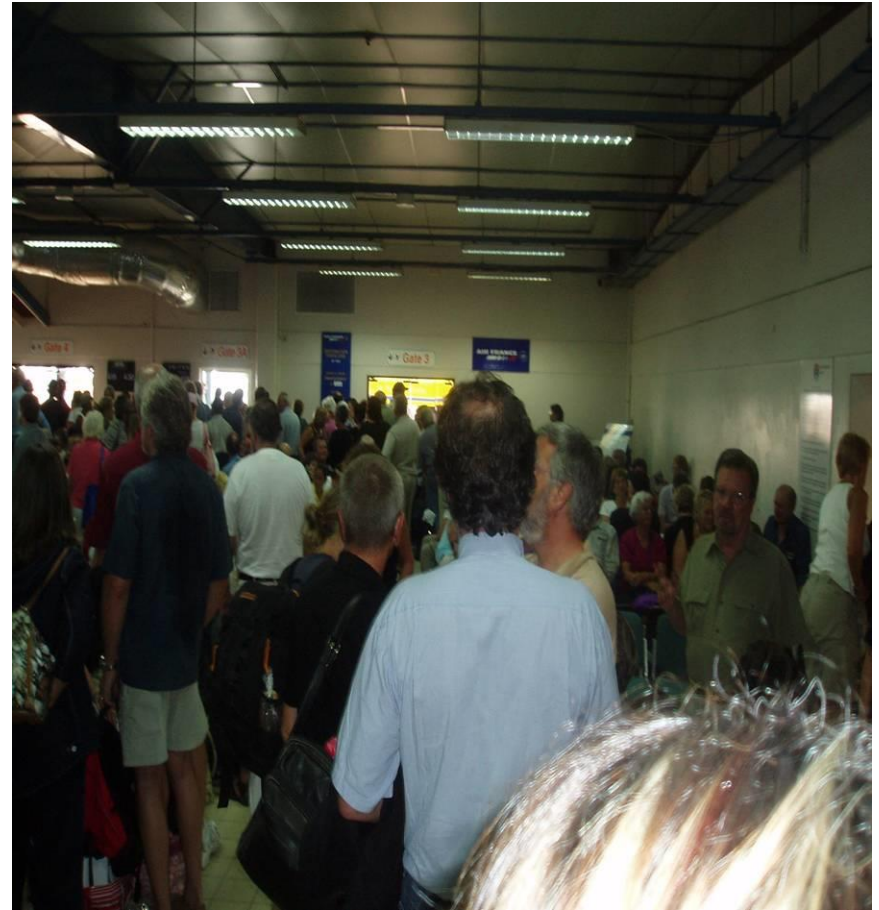
- Accurate departure estimates → better demand calculation
- Better demand calculation → better flow and capacity management
- Enhanced ATFM slot compliance → reduce number of wasted slots
- More accurate information → 0.5 % en-route capacity increase
- ANSP Net Present Value = 73.72 Million euro



More airports, Increased Network Benefits, Increased Local Benefits

Benefits for Passengers

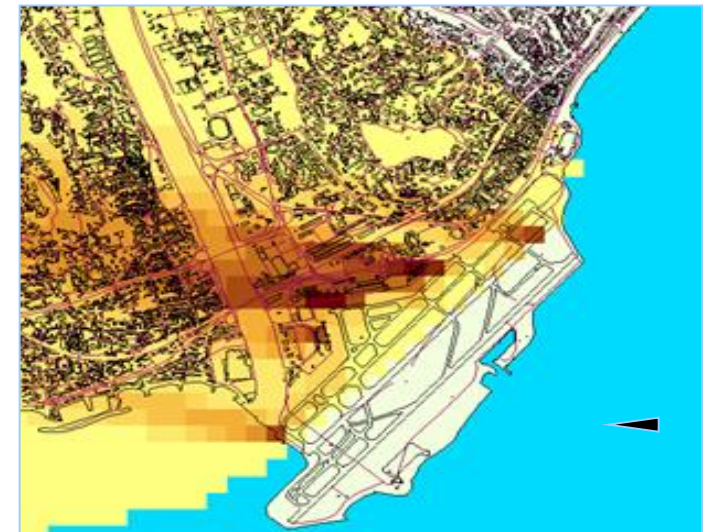
- Reduction of delays
- Increased passenger satisfaction as a result of improved punctuality
- Fewer missed connections
- Better information and services during periods of disruption



Benefits for the Environment

Reduction on:

- Fuel use
- Carbon Dioxide (CO₂) emissions (climate change)
- Oxides of Nitrogen (NO_x) (the key air quality pollutant and a greenhouse gas)
- Particulates (important air quality pollutant)
- 'Ground noise' (disturbance)
- Associated mitigation costs (noise insulation or compensation)
- Risk of environmental constraints



Potential Fuel and Emission Savings at Istanbul Ataturk Airport

STUDY based on taxi-times from CODA, Standard ICAO emissions values for individual engine type – data taken from Sophos tool

1 minute reduction in taxi time @ Istanbul - Sep 2010

(24.358 movements, ARV and DEP – taxi time reduction half a minute on taxi-in and half a minute on taxi-out – fuel price 500€ per tonne)

Saves per month;

- 188 tonnes fuel
- 93.855 € fuel cost
- 592 tonnes of CO₂ (climate change)
- NO_x
- Reduced ground noise

Saves per year, even with downturn in seasonal demand;

- Almost 2.000 tonnes fuel , 1.000.000 € fuel cost and 6.000 tonnes CO₂

- Improved punctuality = improved airport image
- Improved ground handling processes
- Reduced queuing due to more stable traffic flows and reduced taxi times
- Better arrival times and sequence information = better awareness and use of resources
- Improved communication and situational awareness

Munich airport: *fully implemented since June 2007*

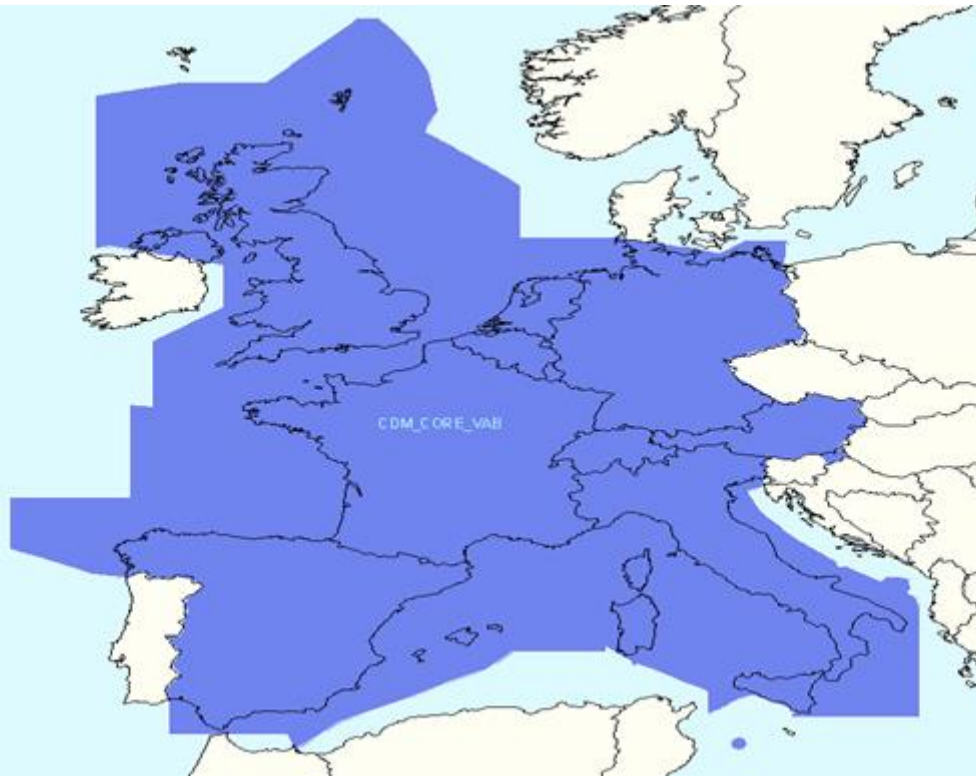
- Enhanced operational efficiency
- Reduction in induced delays
- Improved use of resources
- 10 % average reduction in taxi times for departures
- 90 % ATFM slot adherence
- Decrease of ATFM delay
- Improved matching of local and ATFM constraints
- 2.65 MEUR / year in fuel saving

Paris CDG: *implemented since Nov 2010*

- Average taxi time reduced (13%)
- Holding time at the runway (40%)
- Average taxi out time reduction = 2 minutes

Zurich airport:

- Absorbing delay at the stand: environmental benefit
- Less capacity waste for everyone due to improved runway and capacity planning
- Improved airport slot monitoring and adherence
- Improved use of stands and gates



SCOPE:

Traffic

Flights in the ECAC area,
including over-flights

ECAC Core Area

- ✓ Belgium (EB),
- ✓ Germany (ED),
- ✓ Maastricht (EDY),
- ✓ United Kingdom (EG)
- ✓ The Netherlands (EH)
- ✓ Luxemburg (ELL)
- ✓ Spain (LE)
- ✓ France (LF)
- ✓ Italy (LI)
- ✓ Austria (LO)
- ✓ Swiss (LS)

*Traffic Sample: NMOC data
21st-27th of July 2007*

- Some sectors are not saturated anymore
- Reduced uncertainty
- Enables reduction of sector capacity buffers, maintaining safety levels
- Allows increase in sectors declared capacity
- Up to 4 % overall Network capacity improvement (1 or 2 additional flight / sector)
- 42 CDM airports = a potential reduction of 18 to 23 % of minutes of ATFM delays

It is a WIN-WIN situation for all partners

Airport CDM help us to meet the challenge!

