Benefit Assessment in TAMS

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ATRICS advanced traffic solutions

Introduction

Why conduct benefit assessments?

- Specification and quantification of potentials of new concepts and systems
- Early identification of new star products and services

Why within TAMS?

- TAMS offers an innovative concept for efficient, environmentally compatible mobility in today‘s high-tech society
- Is TAMS one of these promising new products and services?

Methodology and Goal

Methodology

- Scientific to avoid judgment bias
- Well-established to ensure reliable and valid results
- Stakeholder-driven to guarantee relevance

→ European standard (E-OCVM*)

What is the potential of TAMS concerning

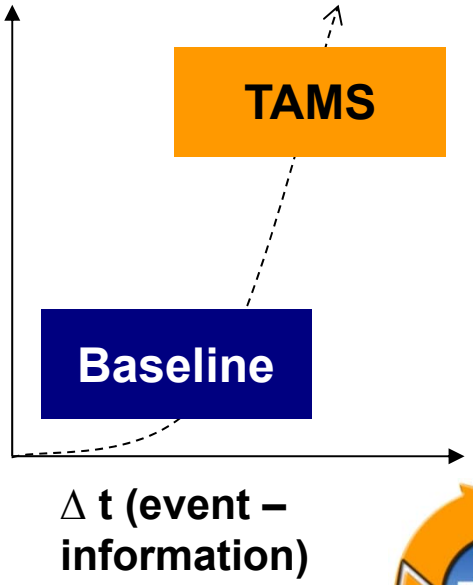
- capacity
- efficiency
- passenger comfort
- environment

* European Operational Concept Validation Methodology

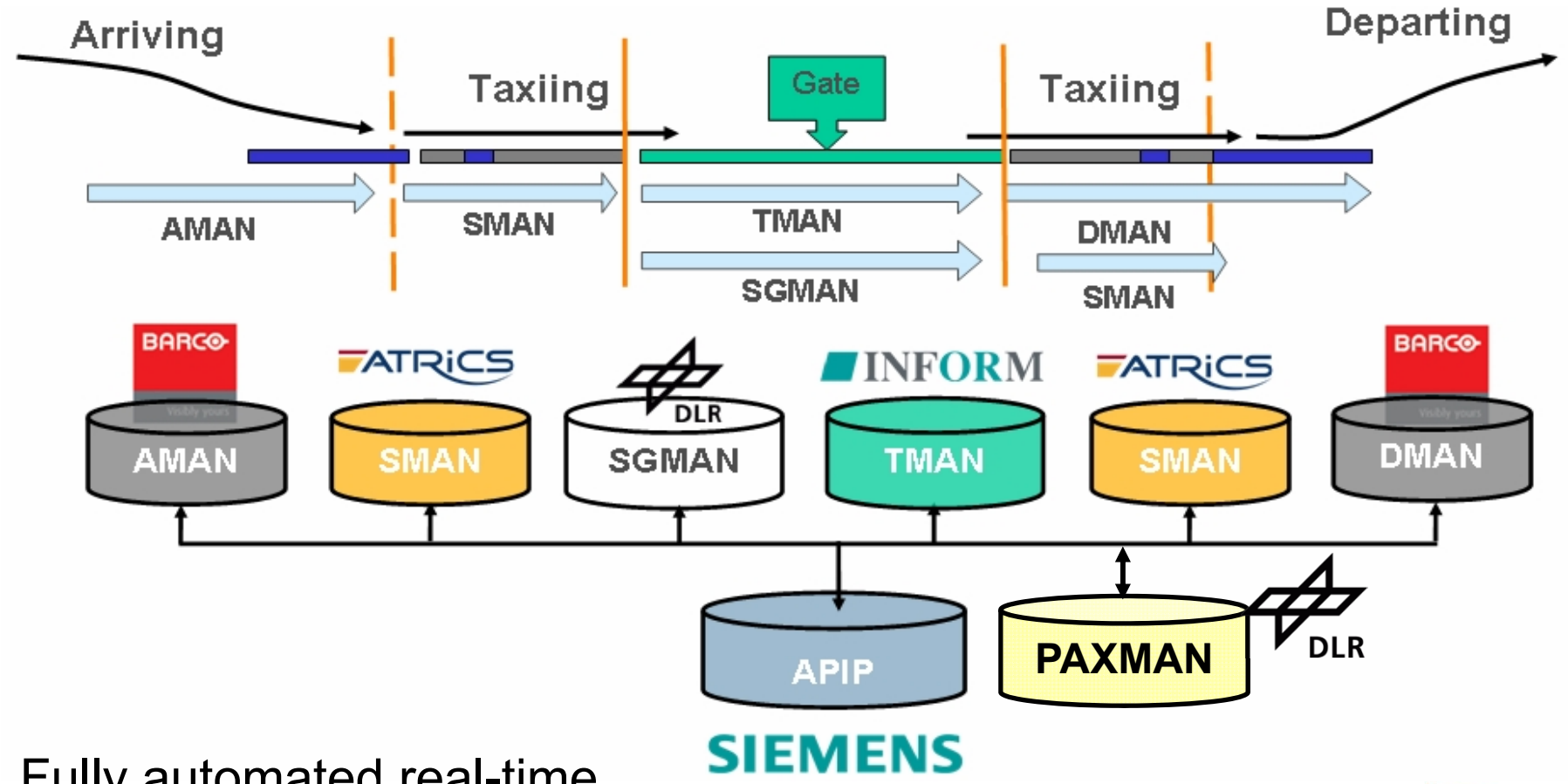
System Configurations

Experimental manipulation of information flow

- Baseline system
  - Information on process completion delivered as soon as the process has ended (no A-CDM)
  - Ad-hoc information distribution
- TAMS
  - Coupling of air- and landside assistance systems from arrival to departure ("A-CDM++")



System Configurations



Fully automated real-time computer simulations

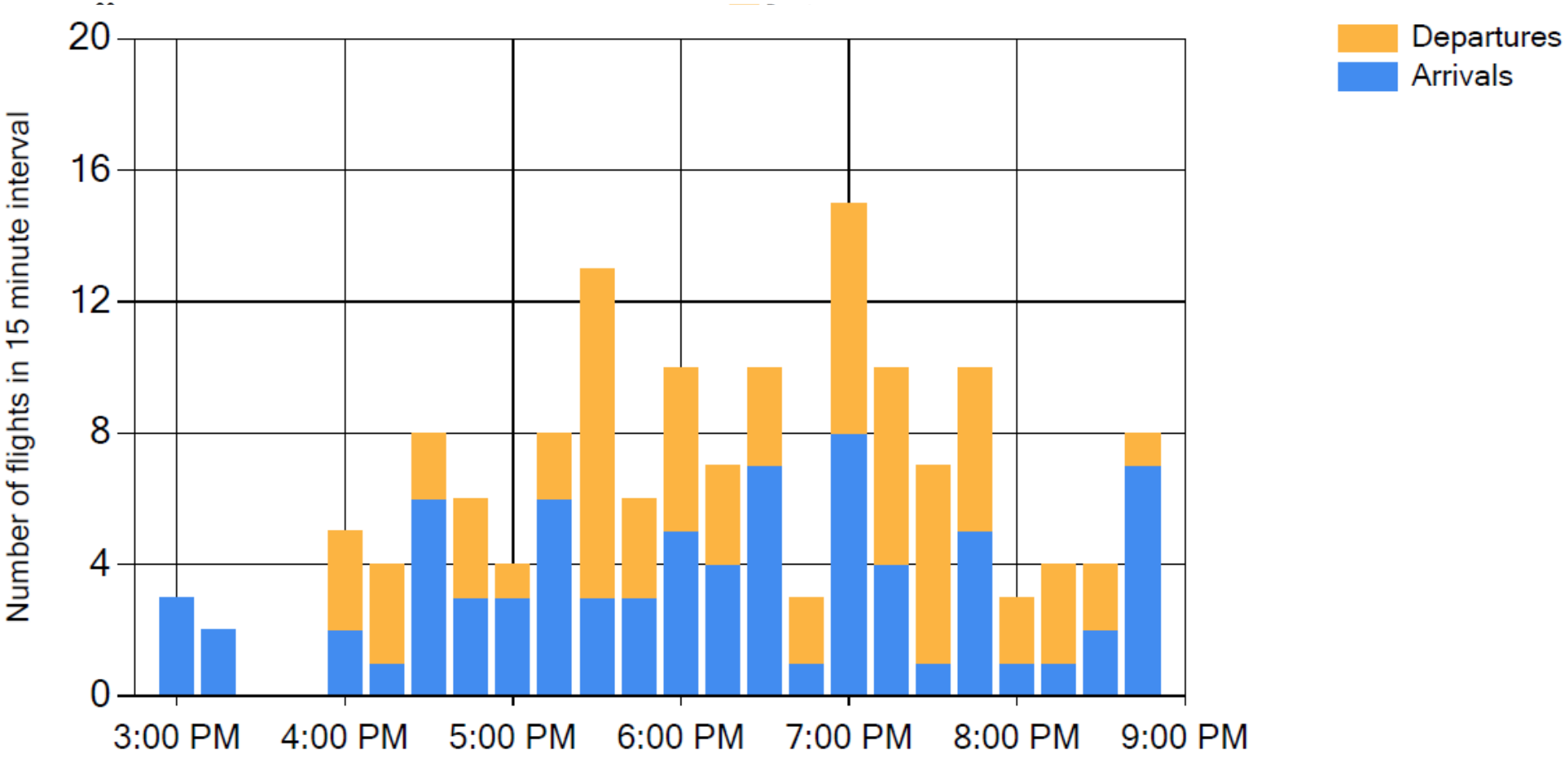
Scenarios

Confrontation of both systems with realistic test scenarios

- Real four-hour flight plan
  - ~120 flights
  - ~12,500 passengers
- Airside bottlenecks (departure and arrival peaks exceeding capacity)
- Landside bottlenecks
- Variation of randomly selected flights to generate variance for statistical analyses
  - 4 scenarios with minor changes

Scenarios

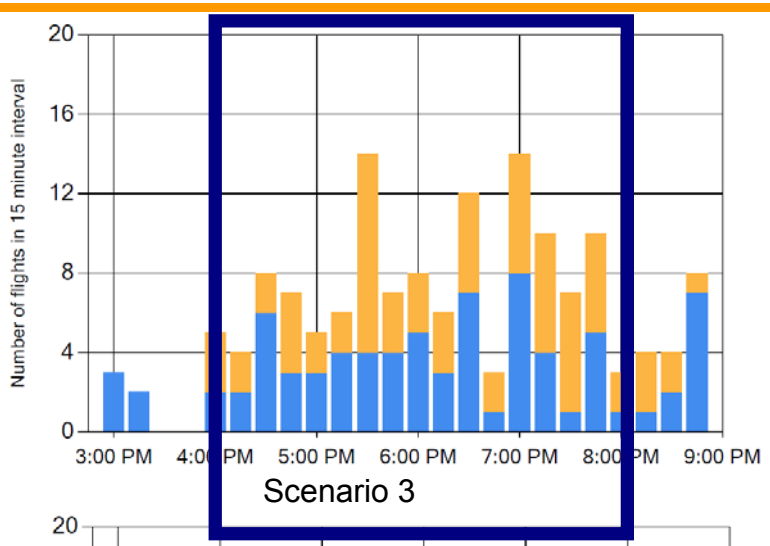
648 flights used for analyses



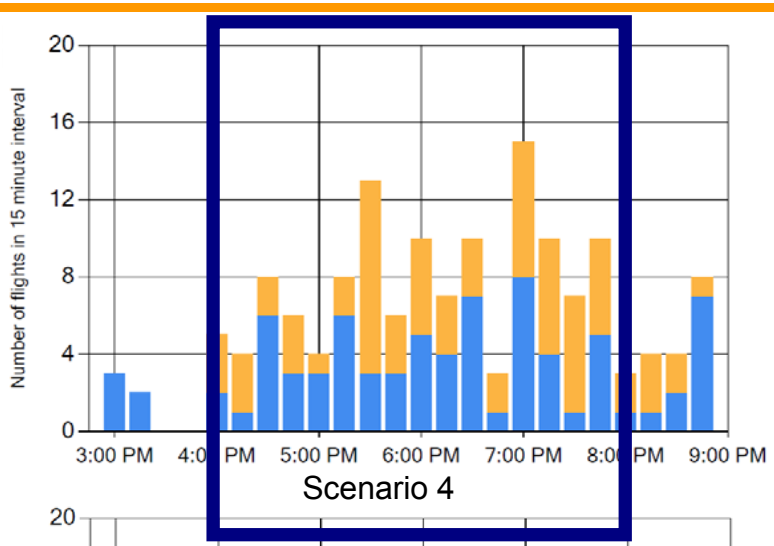
Scenario 4

Scenarios

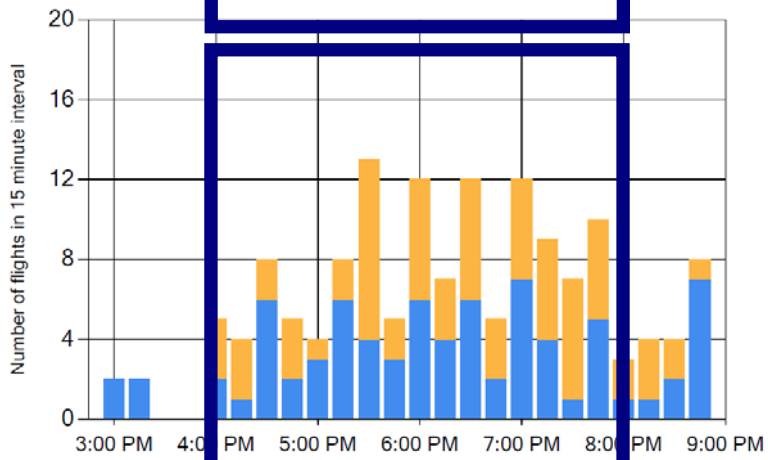
648 flights used for analyses



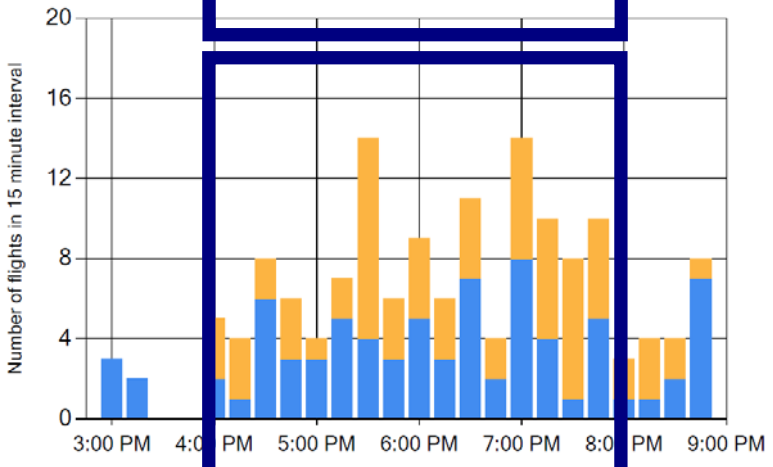
Scenario 3



Scenario 4



Scenario 2



Scenario 1

Airport Simulation Environment

Generic International Airport (GIA)

- Mid-sized, highly complex airport
  - 2 dependent crossing runways
  - 35 stands
  - 30 gates
  - 4 terminals

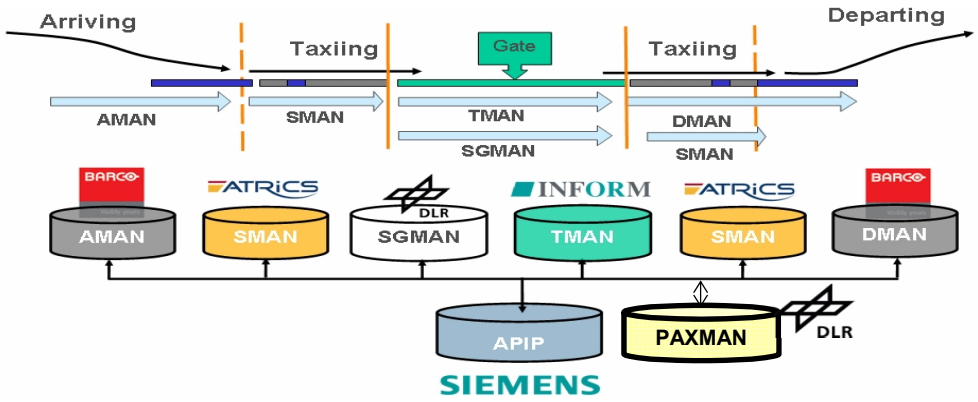
Simulation at DLR Airport and Control Centre Simulator

Simulation

Benefit assessment runs

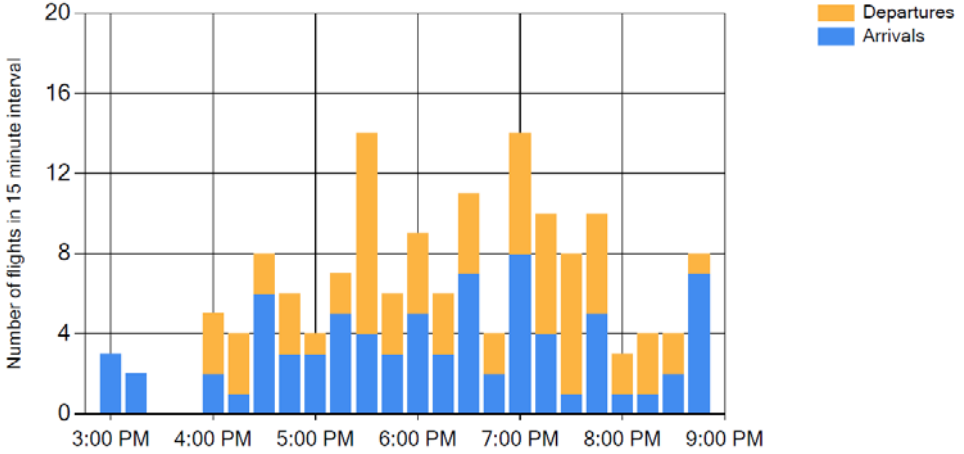
- 2 system configurations
  - baseline system
  - TAMS
- 4 scenarios

→ 8 simulation runs



Measurement of relevant (key) performance indicators

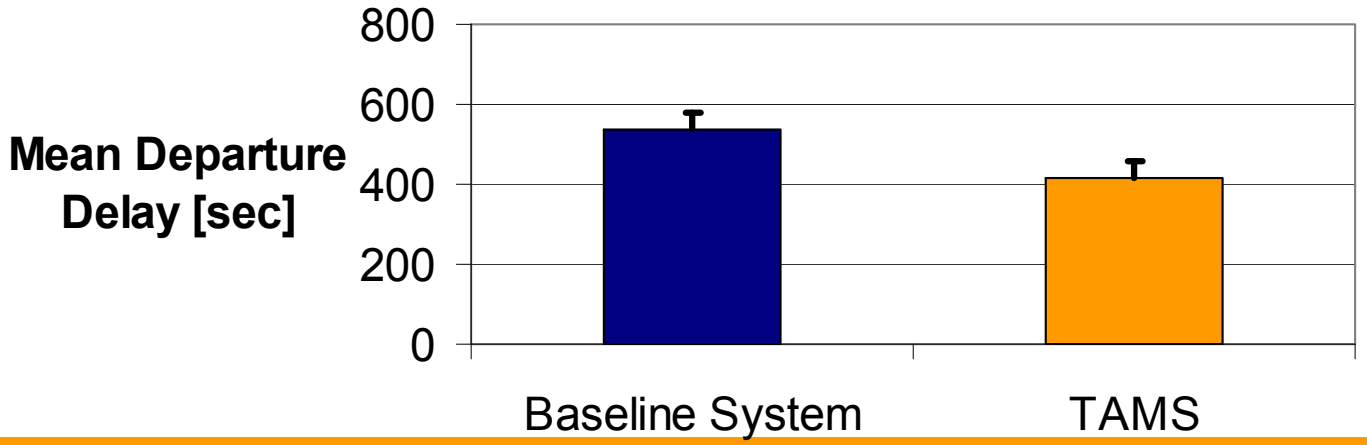
- punctuality
- passenger missing rate
- waiting time at runway
- engine running time
- etc.



Results

Departure Punctuality

- TAMS reduces the number of delayed departures significantly.
  - 47% decrease in number of flights delayed for more than 15 min
  - $\chi^2(1) = 6.90$, $p = 0.01$
- TAMS reduces departure delay significantly.
  - Mean delay for each flight: 563 sec (baseline) vs. 417 sec (TAMS)
  - 26% delay reduction with TAMS

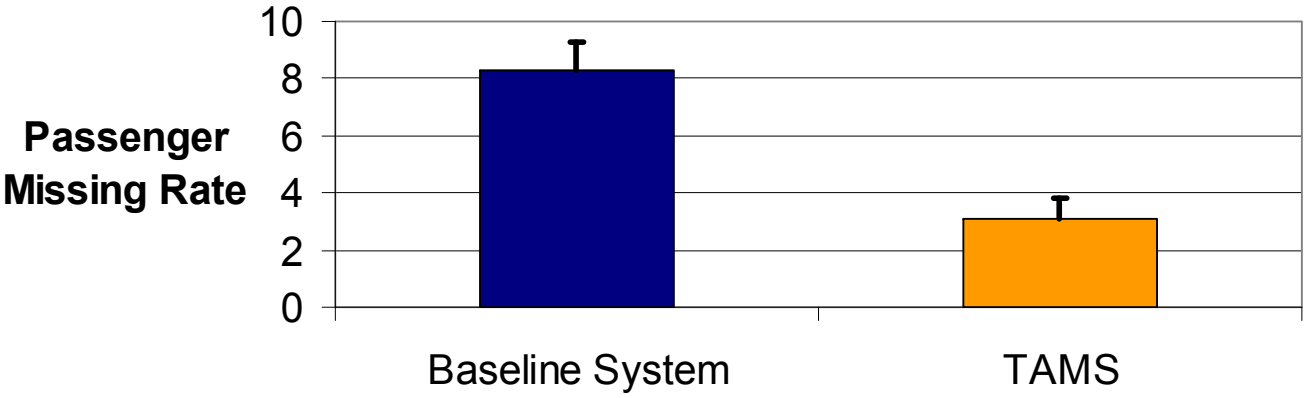


$F(1, 28) = 5.30$
$p = 0.01$
$\eta^2 = 0.16$

Results

Passenger Missing Rate

- Percentage of passengers left behind
- TAMS reduces the percentage of passengers left behind significantly without increasing resource costs.
  - Mean rate per flight: 8.37% (baseline) vs. 3.10% (TAMS)
  - Reduction of 63%

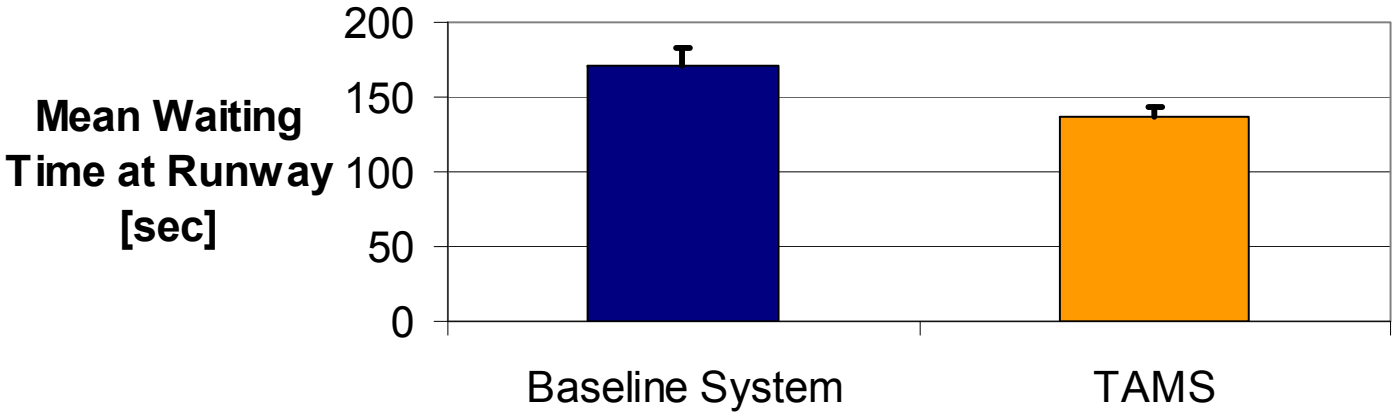


$F(1, 37) = 12.39$
$p = 0.00$
$\eta^2 = 0.25$

Results

Waiting Time at Runway

- Time between end-of-taxiing and take-off
- TAMS reduces mean waiting time at runway significantly.
  - Mean waiting time per flight: 172 sec (baseline) vs. 136 sec (TAMS)
  - 21% reduction of mean waiting time at runway with TAMS

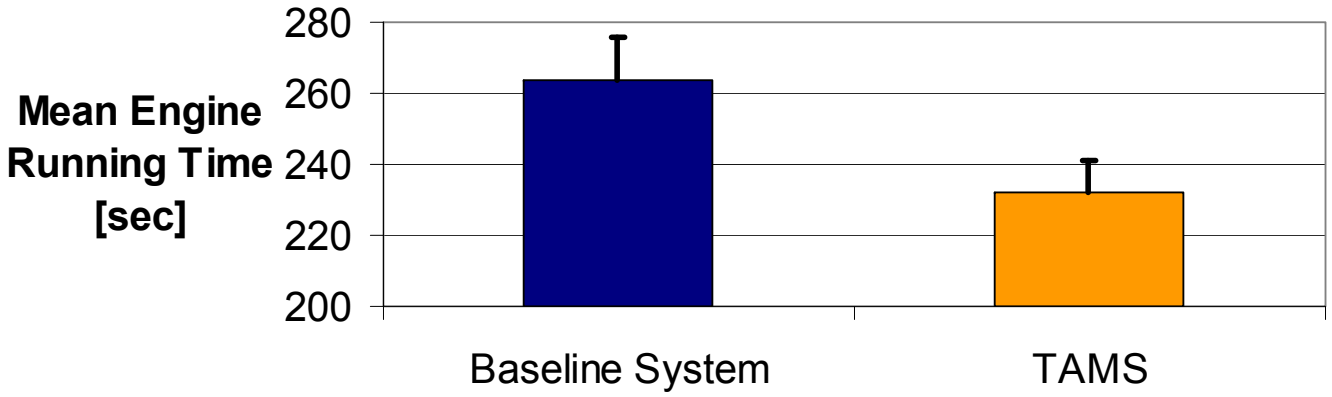


$F(1, 37) = 6.24$
$p = 0.01$
$\eta^2 = 0.14$

Results

Mean Engine Running Time

- Time engines run between off-block and take-off.
- TAMS reduces mean engine running time significantly.
  - Mean time per flight: 263 sec (baseline) vs. 231 sec (TAMS)
  - 12% reduction of mean engine running time



$F(1, 37) = 4.34$
$p = 0.02$
$\eta^2 = 0.11$

Summary

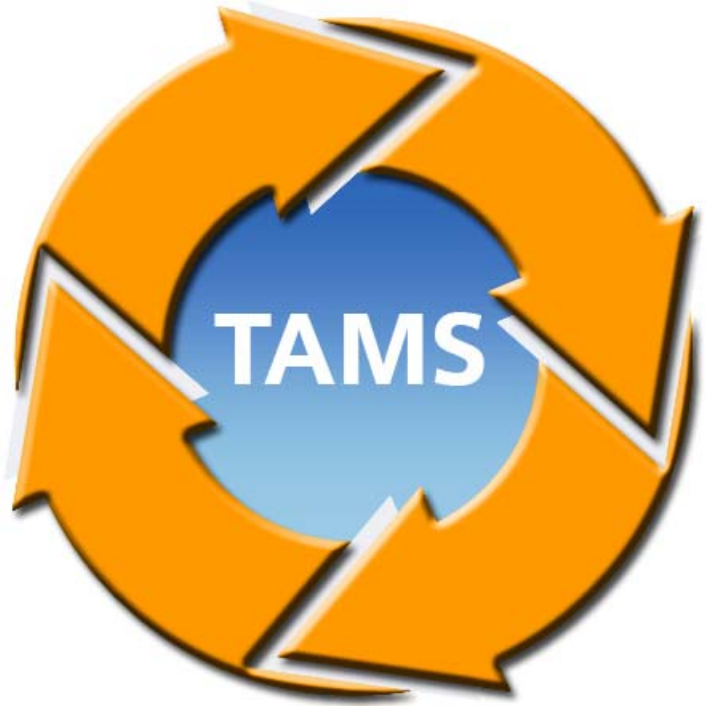
TAMS Benefit Assessment

- Application of a sound methodology based on a well-established European standard
- Integration of passenger simulation
- Demonstration of TAMS potentials by means of computer-simulated benefit assessment runs
- Statistical data analyses have revealed a large number of significant effects generated by TAMS

Conclusions

What is the potential of TAMS?

- TAMS increases capacity. ✓
  - TAMS reduces average departure delay.
- TAMS increases efficiency. ✓
  - TAMS increases the number of punctual flights.
  - TAMS reduces mean engine running time.
- TAMS has a positive impact on the environment. ✓
  - TAMS reduces emissions by reducing waiting time at runway.
- TAMS increases passenger comfort. ✓
  - TAMS reduces the number of passengers left behind.

Yes, 

can!

Thank you for your attention!

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- Slides 2-7: Stuttgart Airport
- Slide 7: DLR
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