AETN Airport Energy Technologies Network

Aerospace Aviation and Defence KTN Conference
MAGNA Conference Centre
21st September 2011

EPSRC

Airports and the Environment

Prof Paul Stewart
Pro Vice Chancellor Research
University of Lincoln

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Prof Paul Stewart

•Currently Pro Vice Chancellor Research at the University of Lincoln UK
•Previously Founding Head of the School of Engineering at Lincoln.

•16 years at the University of Sheffield in various capacities, in the Electrical Machines and Drives Research Group, of the Department of Electronic and Electrical Engineering
•Posts in the Rolls-Royce University Technology Centres for Control Systems, and Advanced Electrical Machines.

•Conduct research in the fields of control theory applications, electromechanical motion control, power systems, multi-objective optimisation and intelligent systems.

•Worked for 14-years in the automotive industry, latterly specialising in drivetrain development and tuning.

•Specialties
•Engineering Applications of Artificial Intelligence,
•Advanced Control systems,
•Power and Energy,
•Automotive engineering,
•Aeronautical Engineering,
•Complex System Design,
•Optimization and Search,
•Heuristics Meta-Heuristics and Hyper-Heuristics,
•Artificial Intelligence

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Engineering at Lincoln University

- Founded in 2009 in close collaboration with Siemens Industrial Turbomachinery
- £37m development with support from HEFCE
- Part funded by the European Regional Development Fund (ERDF) and Lincolnshire County Council (LCC).

- First purpose-built UK University Engineering Facility for more than 20 years
- State-of-the-art education and research facility located on the main campus of the University.
- First-phase completed in Summer 2011.

Lincolnshire COUNTY COUNCIL

Project Part-Financed by the European Union

Regional Development Fund

SIEMENS

Engineering Collaboration with The University of Lincoln

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Airport Energy Technologies Network (AETN)

- Funded by EPSRC Grant **EP/H003150/2**

- Network Director: Professor Paul Stewart – University of Lincoln
- Co-Investigator: Dr Tim Ryley – University of Loughborough

- Network runs to December 2012

- Output of Research Councils Energy Programme Sandpit Nov 2008

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University of Nottingham
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National Air Traffic Services

EPSRC Sandpit November 2008

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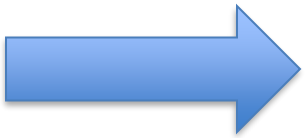

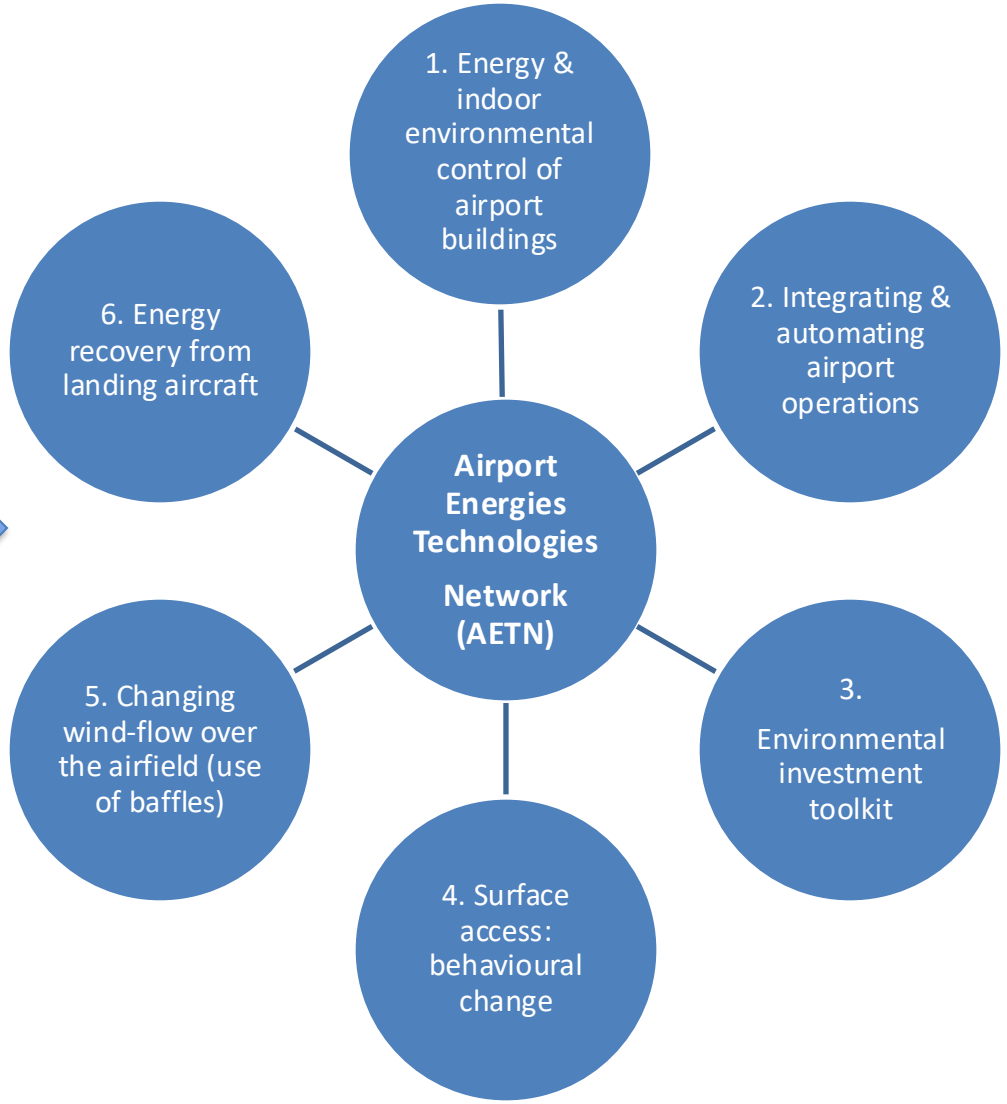

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INTEGRATION OF ACTIVE AND PASSIVE INDOOR THERMAL ENVIRONMENT CONTROL SYSTEMS TO MINIMISE THE CARBON FOOTPRINT OF AIRPORT BUILDINGS

Prof. Savvas Tassou

Brunel University

CITY UNIVERSITY LONDON

Loughborough University

dmu.ac.uk DE MONTFORT UNIVERSITY LEICESTER

Brunel UNIVERSITY LONDON

Project Aims

- This project will investigate and develop an innovative indoor thermal management system for airport terminal buildings. It will be based on active and passive indoor climate control systems and utilise phase change materials (PCMs).
- System can be easily retrofitted to existing airport buildings
- Can provide significant energy savings compared to current state of the art systems.
- Intelligent control techniques and systems will provide real time control of lighting levels and indoor climate in response to external conditions, occupancy levels and passenger flows.

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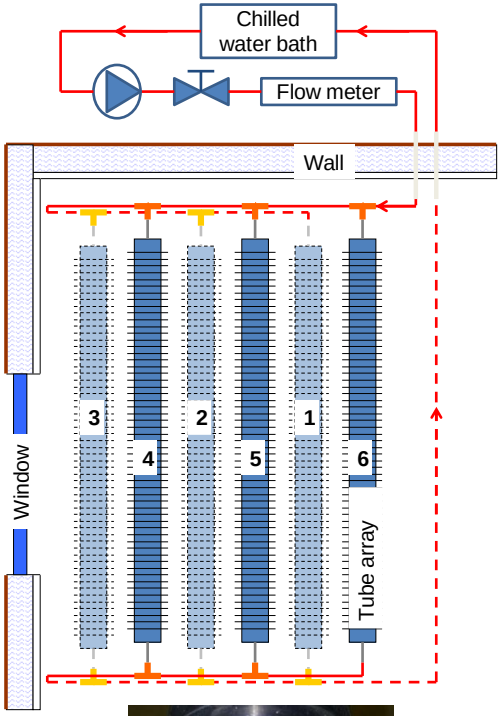
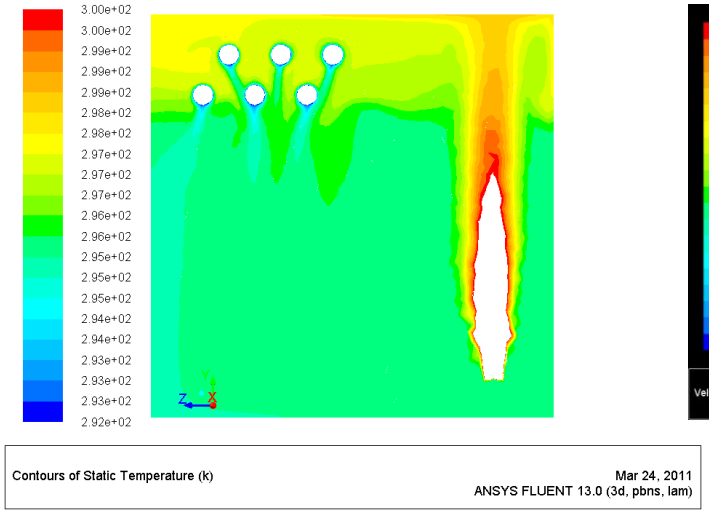
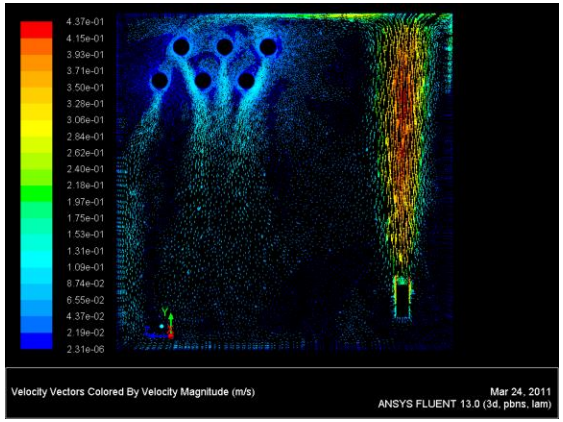
Semi-active system ‘NewMass’

Buro Happold and Brunel University – Gideon Susman

- Finned tubes of PCM with the option for active heat discharge.







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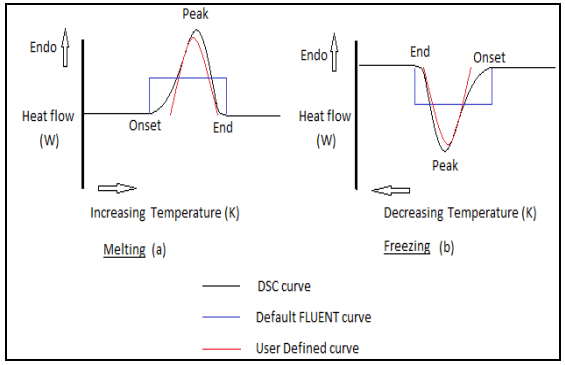
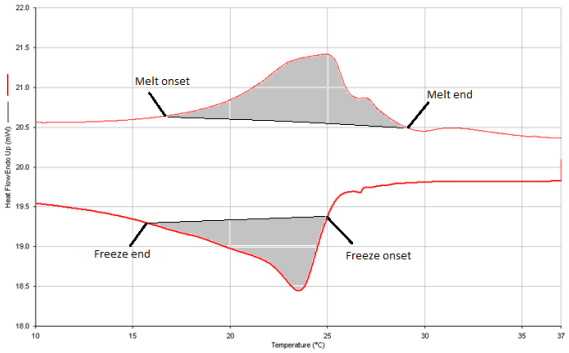
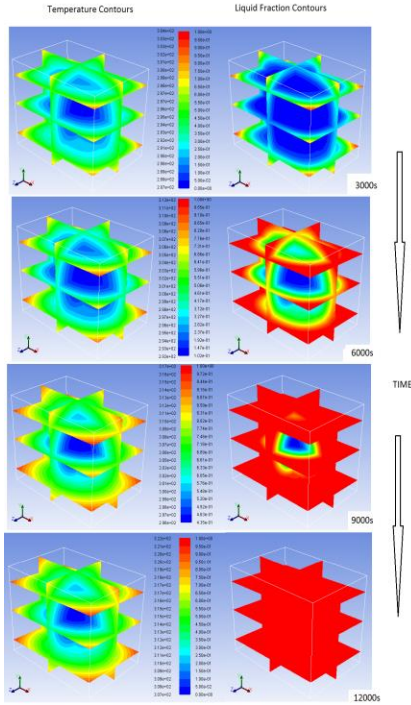
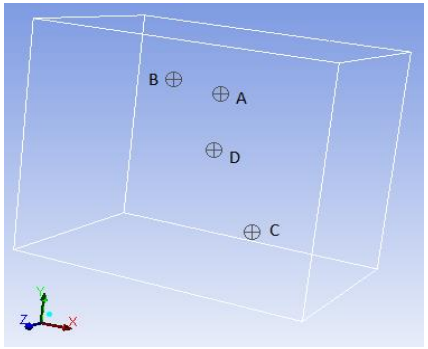
Modelling using CFD

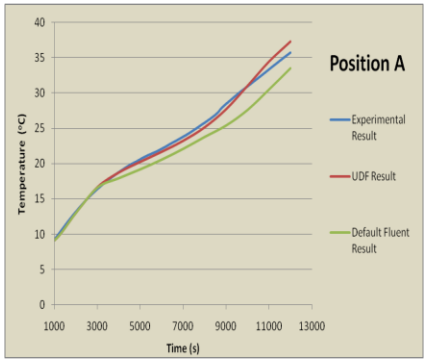
- Commercial software don't accurate model PCM melt/freeze characteristics. This introduces prediction errors of up to 10%.
- Method has been developed to accurate model these characteristics.











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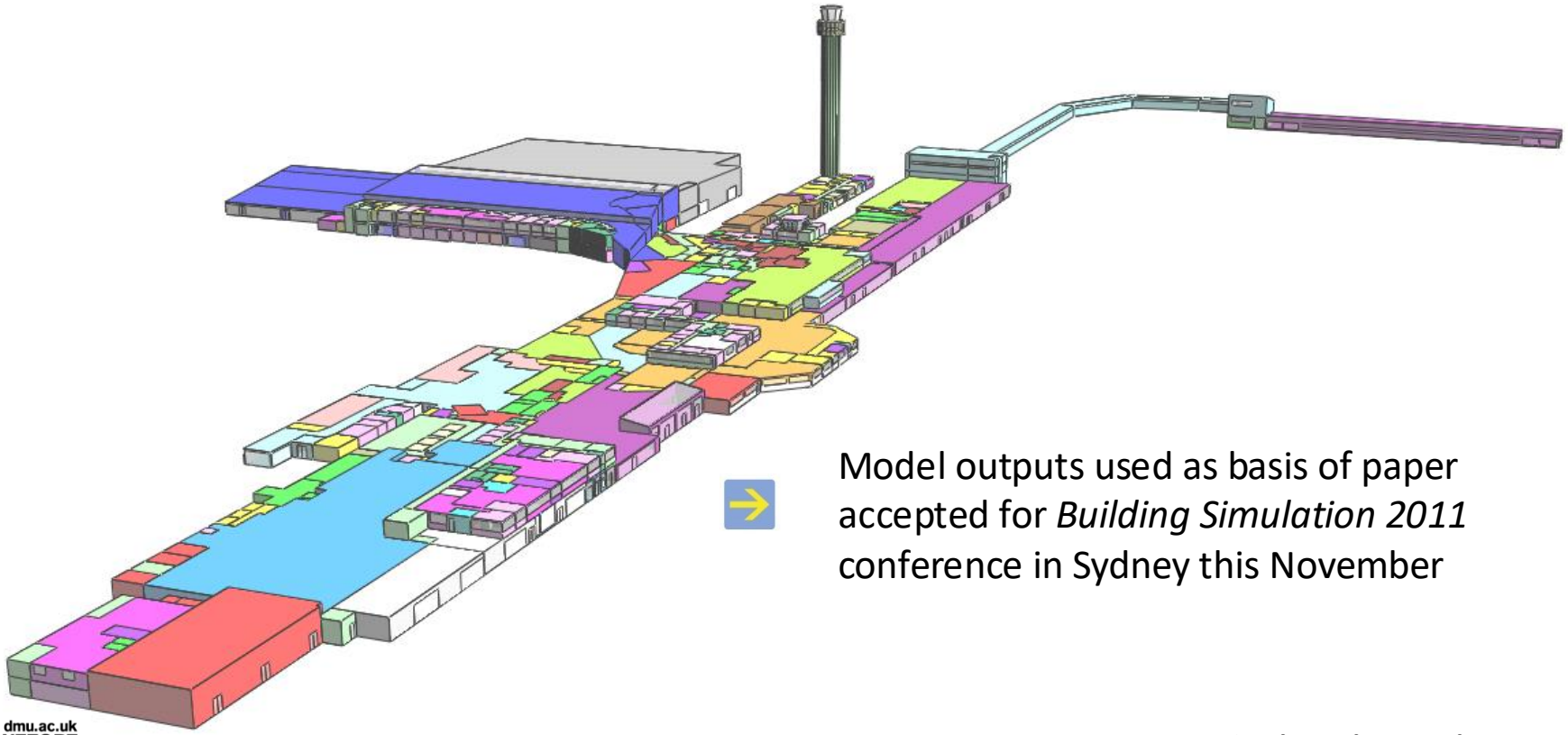
Reducing the carbon footprint of existing buildings at airports

James Parker – De Montfort

- Focus on terminal buildings: completed model for East Midlands airport calibrated with actual consumption data from 2010



- Model outputs used as basis of paper accepted for *Building Simulation 2011* conference in Sydney this November

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MANCHESTER 1824

The University of Manchester

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Engineering and Physical Sciences Research Council

Airports Environmental Investment Toolkit

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UNIVERSITY OF CAMBRIDGE UCL Cranfield UNIVERSITY

AETN Meeting, Lincoln
8 September 2011

MANCHESTER 1824

The University of Manchester

Progress to Date and Work Ahead

- Understanding the field:
  - How do airport operators currently make decisions? What are the current criteria used and why? (Manchester)
  - What are the current investment returns for what airport operators do? (UCL)
  - What are the current emissions from airports and what are the likely consequences? (Cambridge)
- Challenging the field:
  - What is a better process and how can we improve the criteria? (Manchester)
  - What is a better investment model? (UCL)
  - What can we do about the emissions to limit the consequences? (Cambridge)

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AETN meeting, Lincoln
8th September 2011

THE 'ABC' PROJECT. AIRPORTS AND BEHAVIOURAL CHANGE: TOWARDS ENVIRONMENTAL SURFACE ACCESS TRAVEL

Dr Tim Ryley, Loughborough University
with inputs from colleagues at Cranfield University, University of Leeds & Loughborough University

ABC
Airports and Behavioural Change Towards Environmental Surface Access Travel

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‘ABC’ project summary

- ‘ABC’ is an EPSRC 36-month project (October 2009 – September 2012)
- The **project aim**, is to “encourage better environmental behaviour of individuals to and from airports”.
- This can be broken down into **three objectives**:
  1. To determine the deeper motivations and attitudes of individuals in terms of environmental behaviour
  2. To determine ways to reduce the carbon footprint for journeys to and from the airport, and at the individual level (broken down into population segments)
  3. To generate carbon reduction outputs for the intervention measures, such as the emissions impact and values of change.

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Press Release: January 2010

E.g. Skyport article

PUCKERING UP AT THE DEPARTURE GATE MAY BE BANNED TO CUT CO_2 EMISSIONS

BY AILSA DIXON
Reporter
ailsadixon@trinitysouth.co.uk

SCIENTISTS are embarking on research into the environmental costs of a goodbye kiss at the airport.

Teams from two universities and a leading engineering research body will spend three years establishing the size of the carbon footprint of a flying farewell.

The study, billed as the first of its kind in the world, will consider innovative measures to cut emissions, including setting up video links in terminals so that people can wave off loved ones virtually rather than in person.

Dr Tim Ryley, of Loughborough University, explained: "Aviation is a significant source of carbon emissions, but it's not just the planes that are a problem.

"Travelling to and from airports also has a big impact, but no one has yet quantified it or identified how to reduce it. This study will address that gap in our understanding."

Also on the list of possible solutions is building luggage-drop zones in city centres and railway stations in the hope of deterring families from taking the trip all the way to the check-in desk.

TURNING HEADS: University researchers have been charged with recommending measures to cut carbon emissions, including passengers being waved off via video links in terminals Contributed

The study is being carried out by a team from the universities of Loughborough, Cranfield and Leeds, with funding from the Engineering and Physical Sciences Research Council.

The study will focus on two types of airport in the UK – one international and one regional – with tips being taken from the aviation industry, airport authorities and policy-makers on how we can cut our carbon footprint.

The study will look at every kind of journey to and from airports, including those made by airport staff, passengers and 'waver-offers'.

Dr Ryley added: "There's no point developing and implementing a carbon-reduction measure if it won't work in the real world, perhaps because it involves people paying more than they're prepared to pay.

"So developing a realistic understanding of attitudes and motivations with respect to people's environmental behaviour will be key to delivering a practical set of recommendations."

The study, The ABC Project – Airports and Behavioural Change, is due to deliver its conclusions by the end of 2012.



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EDITORIAL

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Recycled paper made up 68.6% of the raw material for UK newspapers in 2003.

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Gatwick: 10,000
Stansted: 4,000

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Recovering the kinetic energy from landing passenger aircraft

EPSRC Grant: EP/H004351/1

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Introduction

- Pressures on industries to reduce carbon emissions
  - E.U., U.K., global and economic
- For a typical Airbus A320:
  - Peak powers of up to 4 MW
  - Average powers up to 1 MW (multiple landings)

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Tel: +44 (0) 1522 837915

Introduction

- Up to 10 times more power available

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Methods for recovering the kinetic energy

- Ground-operated energy recovery system
- Regenerative braking
- Hydraulic and pneumatic technologies
- Piezoelectric technology
- Arrestor cables
- Flywheels
- Moving run-way

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The University of Nottingham

asap research
automated scheduling optimisation & planning

Ground Movement at Airports

Stefan Ravizza

Edmund Burke, Jason Atkin

Project: Integrating and Automating Airport Operations

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Loughborough University

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Airport Operations

- SESAR predicts a **doubling** in the number of flights between 2005 and 2020
- Airside airport operations are **highly connected**
  - » Runway sequence
    - Departure
    - Arrival
  - » Gate assignment
  - » Ground movement

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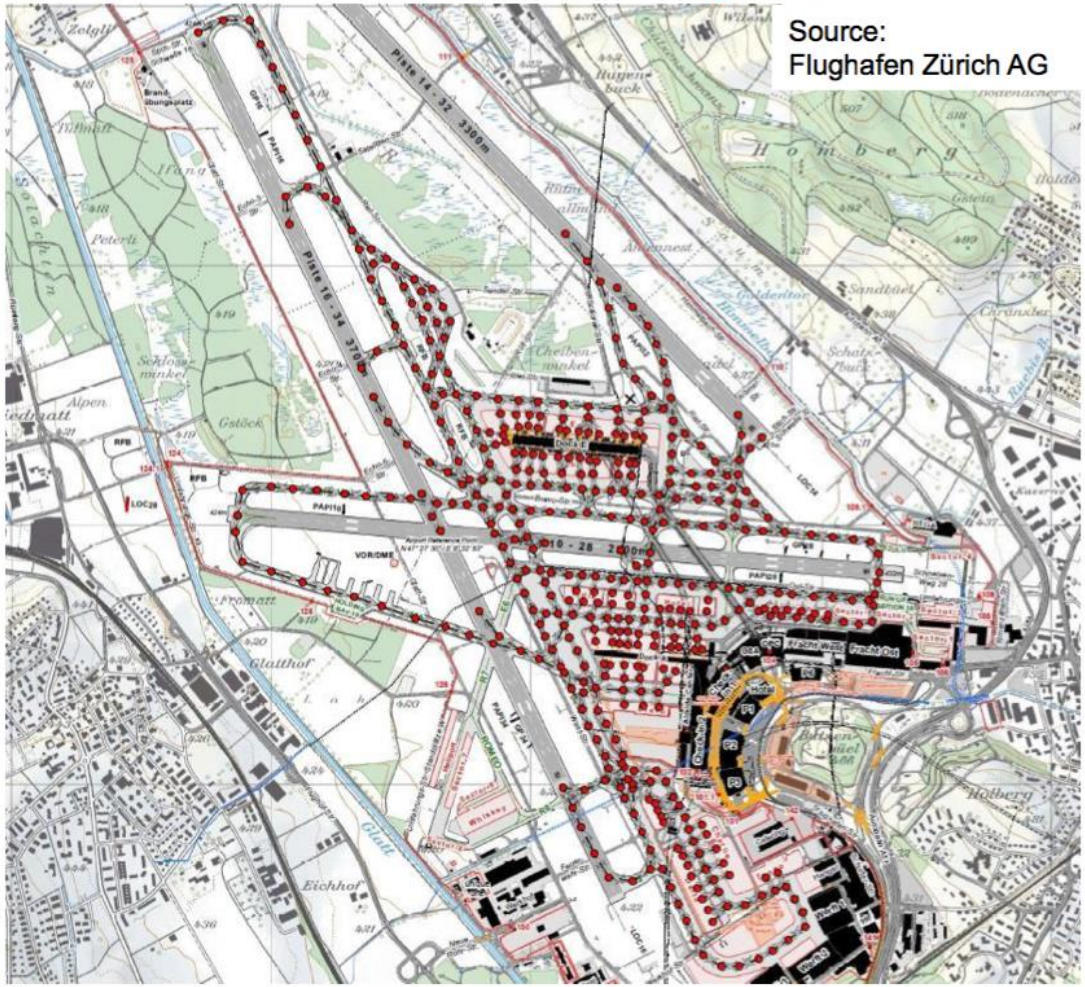
Data Set: Zurich Airport



Source:
Flughafen Zürich AG

Scenario

- 3 runways
- 88 gates

- 446 nodes
- 520 edges

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Enhancing exhaust jet lift-off with an array of baffles

Lincoln University
8 September 2011

Mike Bennett, Simon Christie, Angus Graham
Manchester Metropolitan University

Kevin Garry, Stefan Velikov, Ian Poll
Cranfield University

Malcolm Smith, *Southampton University*

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Nozzle SFB tests: Setup

Cranfield UNIVERSITY

S. Velikov

Pitot-static tube

Nozzle (10 dia. long)

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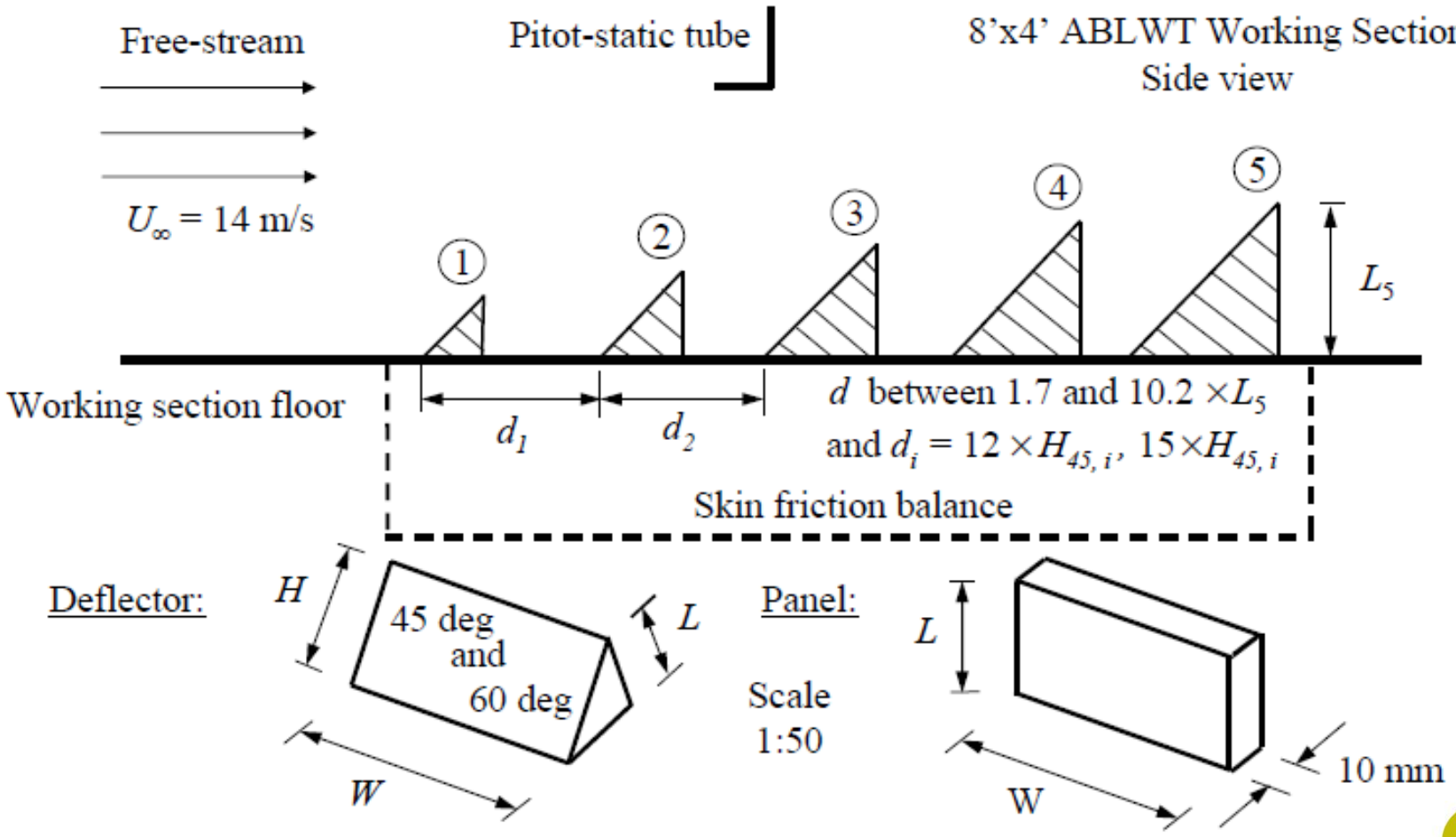
Summary of previous SFB tests

Cranfield UNIVERSITY
S. Velikov



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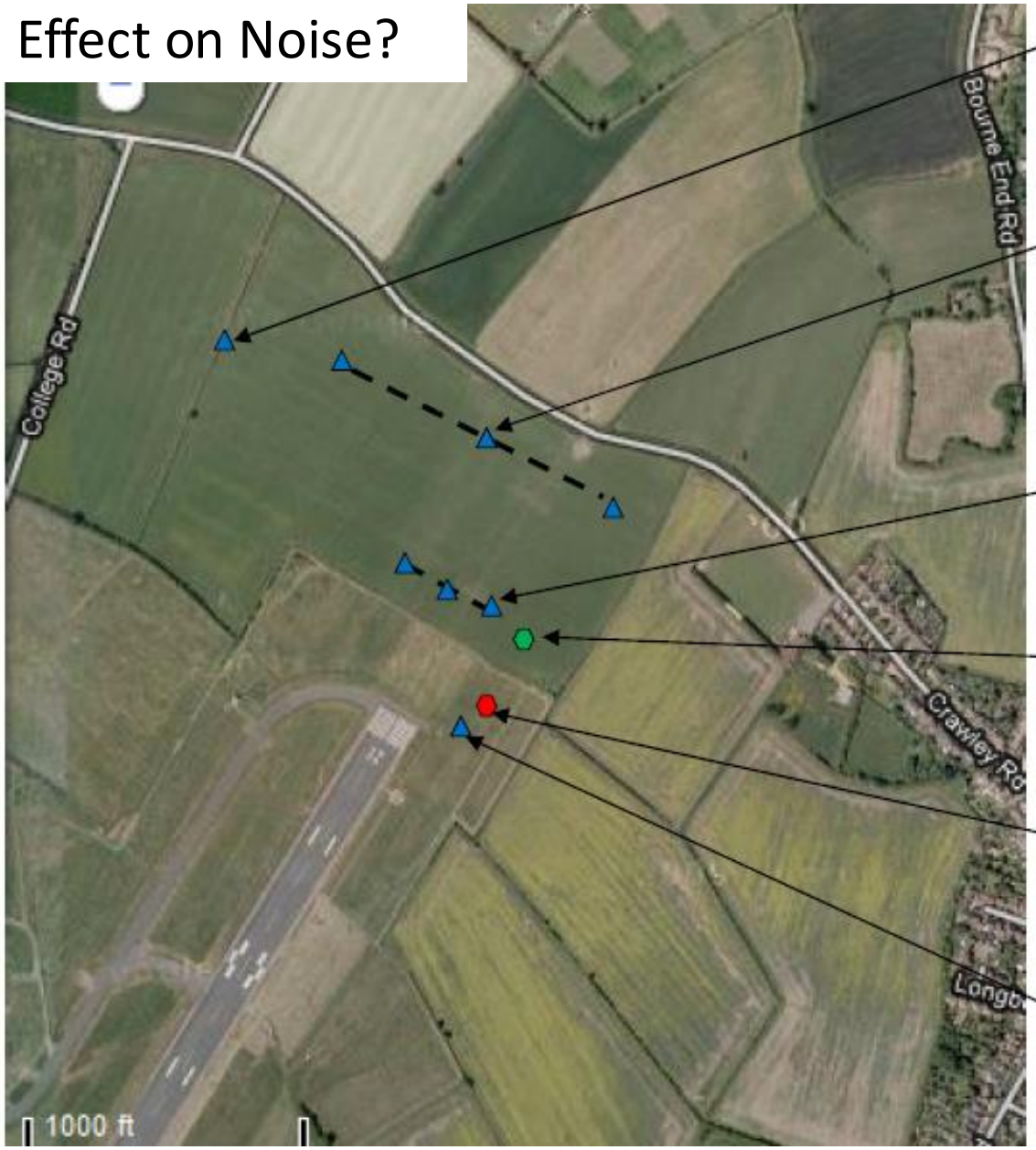
FAAM aircraft preparing for take-off

MGS

Effect on Noise?



Environmental noise monitor

measurement array 2

measurement array 1

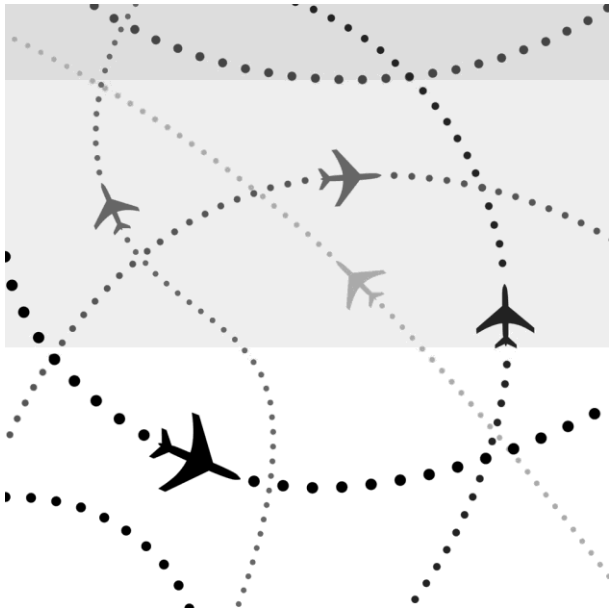
Parked vehicle

Sound source

Reference measurement station

M G Smith, Soton

Sustainable air travel, behaviour change and social media.



A one day workshop organised by the EPSRC Airport Energy Technologies Network.

18th May 2011, University of Lincoln.

Online social media sites, such as Facebook, give us hitherto unachievable insight in to what our friends collectively think and do – it is perhaps unsurprising that social media has been suggested as a powerful platform to deliver behaviour change interventions based on social norms and peer pressure. Emerging research has demonstrated this potential in applications such as domestic energy consumption, fitness and diet.

This workshop aims to summarise the state-of-the-art in using OSNs and social media to facilitate behaviour change and will explore the potential of using such technology to deliver sustainable behaviour change in the context of the air-travel industry. The seminar will reveal research already in progress aimed at using OSNs to deliver behaviour change interventions in both domestic and organisational settings and explore issues pertinent to the air-travel industry such as transport to and from airports, passenger attitudes to air travel, airlines and destinations, public attitudes to air freight and sustainable food consumption, energy usage in airports and international and multi-cultural agendas.

The seminar will be hosted by the School of Engineering at the University of Lincoln and co-organised by members of the Lincoln Social Computing (LiSC) Research Centre who are research leaders in the design of social media interventions for positive behaviour change. Speakers at the workshop will include those already engaged in delivering behaviour change interventions using ICT and social media across a number of societal issues. Confirmed speakers include Prof Mark Blythe, Professor of Interdisciplinary Design from Northumbria University, Dr Tim Ryley from Loughborough University and co-investigator on the Airport Energy Technologies Network, Dr Parisa Eslambolchilar from Swansea University and co-investigator on the EPSRC CHARM project, and Dr Charles Musselwhite from the Centre of Transport and Society at the University of the West of England.

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EPSRC

For further details please contact Denise Bateman dbateman@lincoln.ac.uk or Prof Shaun Lawson slawson@lincoln.ac.uk
This event is organised by the Airport Energy Technology Network (www.aeroenergytech.co.uk).

Spinout Activity

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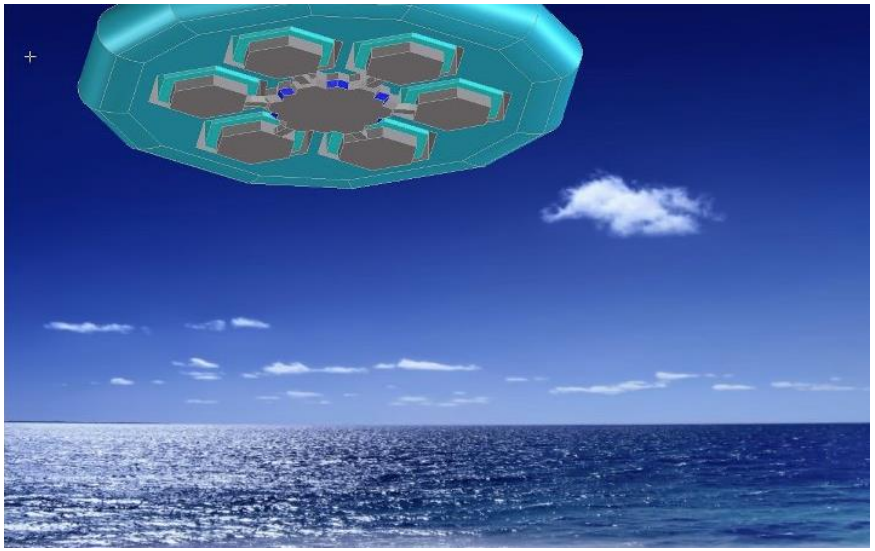
The MAAT Project

Multi-body Advanced Airship for Transport



Coordinator
Contact Person: DELL' AMICO, Mauro (Professor)
UNIVERSITA DEGLI STUDI DI MODENA E REGGIO EMILIA, VIA UNIVERSITA, ITALY

Project Reference: 285602 **Contract Type:** Small or medium-scale focused research project
Project Cost: 5.09 million euro **Project Funding:** 3.77 million euro
Programme Acronym: FP7-TRANSPORT **Programme Type:**7th FWP (Seventh Framework Programme)
Subprogramme Area:
AAT.2011.6.2-1. Novel air transport vehicles, AAT.2011.6.3-1. The cruiser/feeder concept

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MAAT PROJECT

M.A.A.T. Open Source Project
Multibody Advanced Airship for Transport

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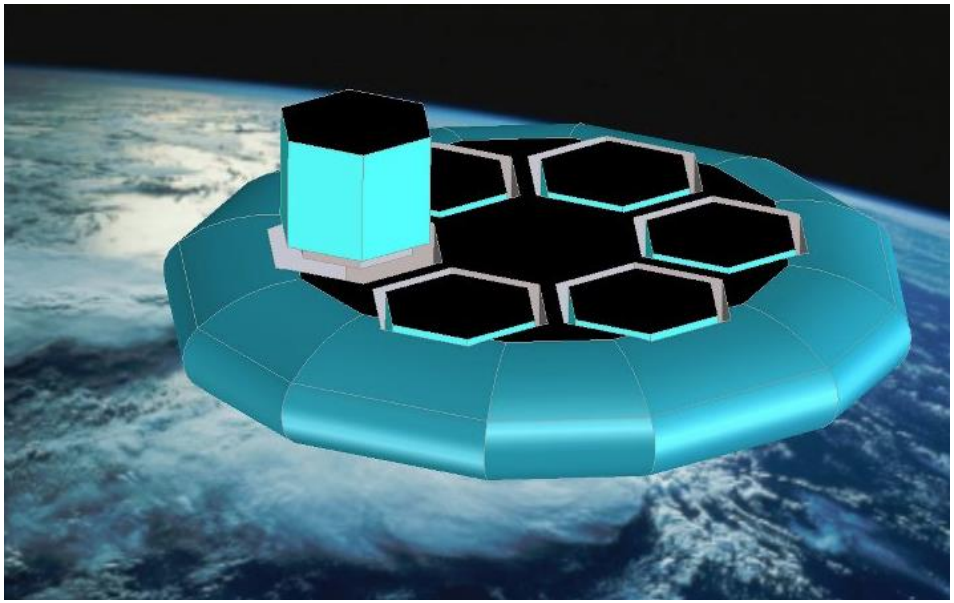

The MAAT project overcomes structural and physical limits of airplanes in cruiser/feeder operation. It aims to investigate an airship cruiser-feeder global transport system for medium and long range transports.

The MAAT system is composed by three modules.

- **PTAH** (Photovoltaic Transport Airship for High-altitudes) is a heavy payload cruiser which remains airborne on stable routes;
- **ATEN** (Air Transport Efficient Network feeder) is a VTOL feeder airship by gas buoyancy linking the cruiser to the ground;
- **AHA** (Airship Hub Airport) is a new concept of low cost vertical airport hub joinable by ATEN, easy to build both in towns and in logistic centres.

MAAT PROJECT

M.A.A.T. Open Source Project
Multibody Advanced Airship for Transport

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Objectives
•Safer
•Greener
•Smarter
transport systems for Europe that will
•benefit citizens
•respect the environment
•increase the competitiveness of European industries in the global market.

Mitigate the negative impacts and consequences of increased mobility in relation to the
•environment
•energy usage
•safety and security
•Public health

FP7-AERONAUTICS and AIR TRANSPORT (AAT)-2012-RTD-1
Budget: € 136 040 000

FP7- SUSTAINABLE SURFACE TRANSPORT (SST)-2012-RTD-1 including European Green Cars Initiative
Budget: € 114 040 000

2007 - 2013
SEVENTH FRAMEWORK PROGRAMME

Emphasis will be given to the following activities

Aeronautics and air transport
•reduction of emissions
•work on engines and alternative fuels
•air traffic management
•safety aspects of air transport
•environmentally efficient aviation

Sustainable surface transport
•rail, road and waterborne
•development of clean and efficient engines and power trains
•reducing the impact of transport on climate change
•inter-modal regional and national transport
•clean and safe vehicles
•infrastructure construction and maintenance
•integrative architectures

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Blog: energy-institute.eu/wordpress

Web: energy-institute.eu/AETN

-AETN academics are linked with Roger Gardner and the SIGMA proposal team working on an aviation environmental interdependencies network - this will add value to both communities to the benefit of the industry

pstewart@lincoln.ac.uk

Dissemination tools for the Network

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