



# COST

European Network on New Sensing Technologies for Air Pollution Control  
and Environmental Sustainability - *EuNetAir*

COST Action TD1105

**WGs and MC Meeting at Cambridge, 18-20 December 2013**

Action Start date: 01/07/2012 - Action End date: 30/06/2016

Year 2: 1 July 2013 - 30 June 2014 (*Ongoing Action*)

**Imperial College  
London**

**Centre for  
Transport  
Studies**

**Dr Robin North**

**SIG2, WG3 Member**

**Imperial College London / UK**

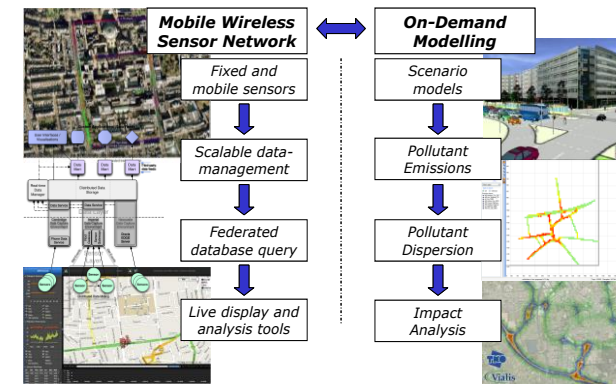
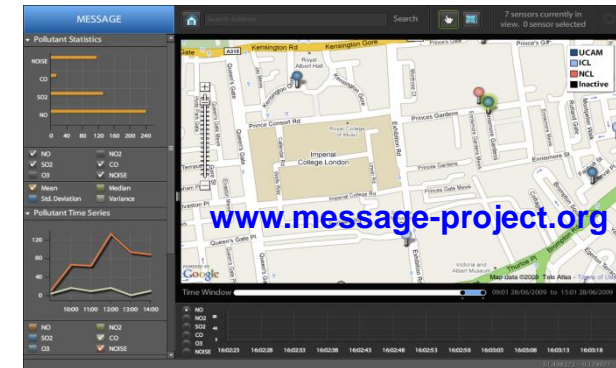
**[www.imperial.ac.uk/transportandenvironment](http://www.imperial.ac.uk/transportandenvironment)**

 **cost**  
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY



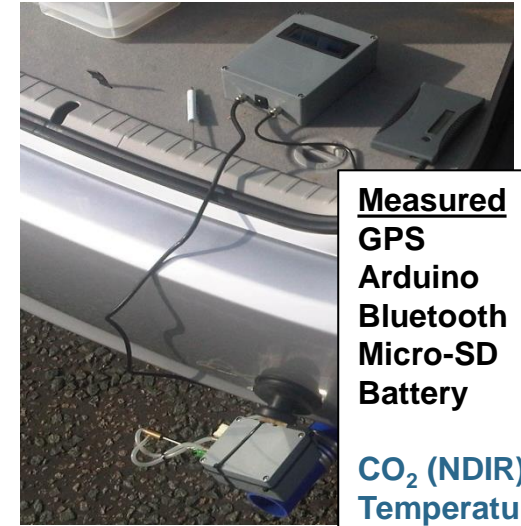
# Understanding pollutant sources and exposure

- ~~Problem~~ **Opportunity**: Advances in sensing air pollutants allow us to **measure** (at far higher spatial and temporal resolutions than previously possible), but we need to **deploy** intelligently, **interpret** this new information, and to **manage** sources and exposures.
- **Work to date**: Focus on transport emission sources (Road, Aviation, Shipping...), changes in technology and operations.
- **Link to TD1105 objectives**: WG3, SIG2 (and interested in the outputs of others!)



# Current research - activities and topics

- **Current focus:** Discrepancy between measurements and models, especially for short-times and local scales => Examining the contribution of transport emission sources under varying operating conditions, at high temporal (seconds) and spatial (5m) resolution.
- **Research topics:**
  - On-road emissions performance of (new) vehicle technologies (NO/NO<sub>2</sub> ratios, DPF regeneration events, BC emission rates) => enhanced models.
  - Variability of in-service emissions from aircraft (fuel-specific emission rates, activity and validity of models)
  - Simulating the implications of alternative (i.e. un-measurable) “traffic management” strategies (roads, ports, airports)



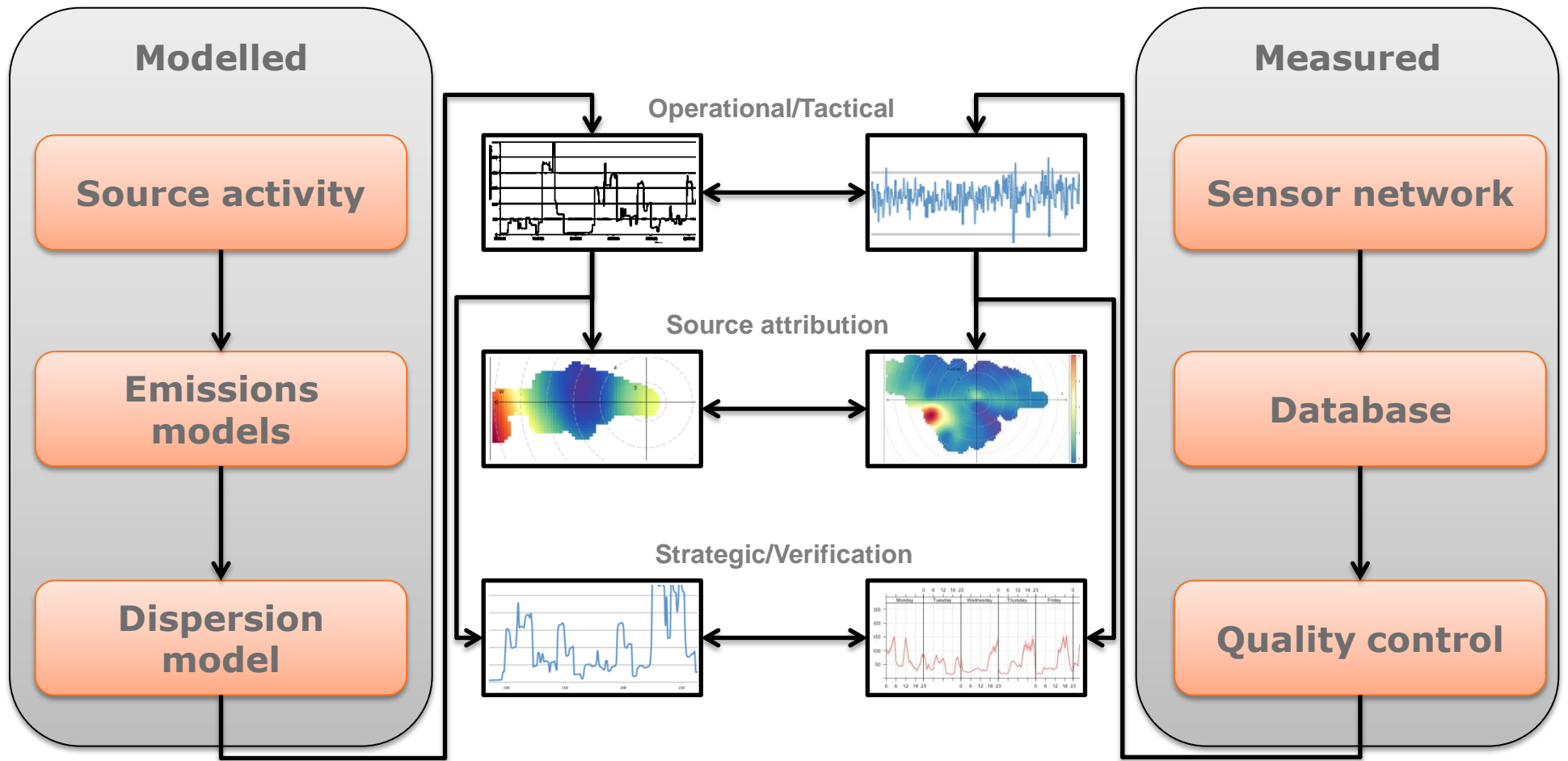
Measured  
GPS  
Arduino  
Bluetooth  
Micro-SD  
Battery

CO<sub>2</sub> (NDIR)  
Temperature  
Flow rate

Estimated  
CO<sub>2</sub>, NO<sub>x</sub>,  
BC and  
PM10 on a  
5m, 1s  
resolution



# Modelled-measured comparisons



Ref: G. Koudis 2013

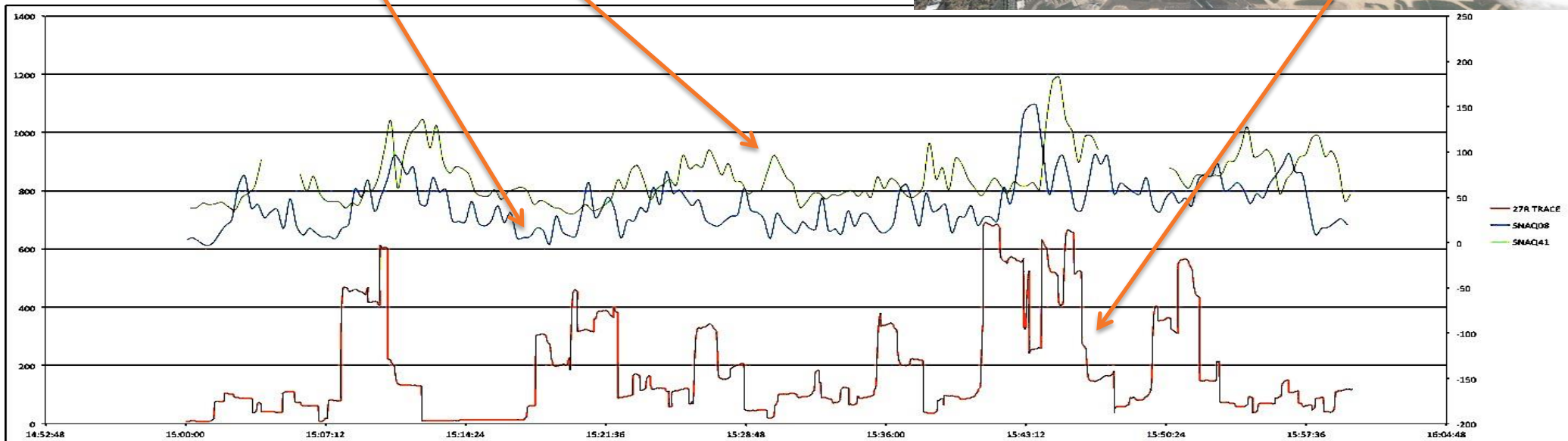
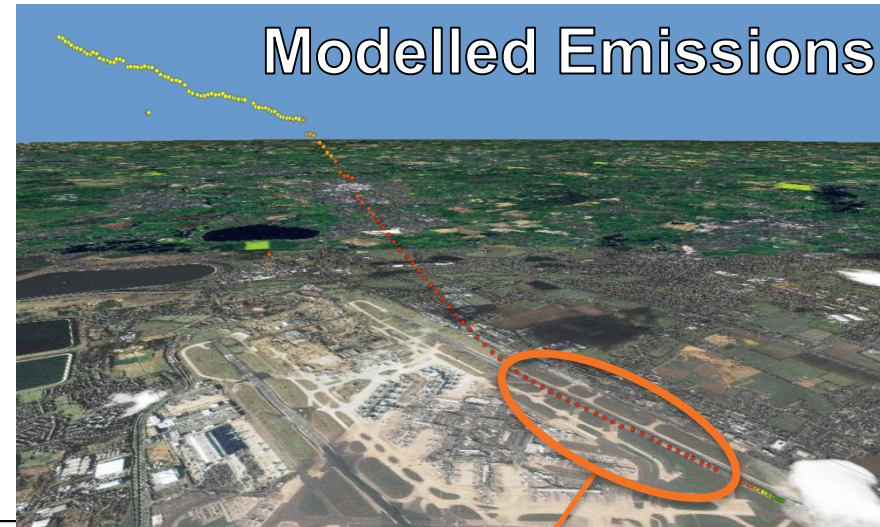
Use validated model system to identify and test model improvements and examine operational alternatives => **What can we DO about it?**

**Applied to SNAQ Heathrow data & roadside cases**

# Example – 1hr of 30s resolution data



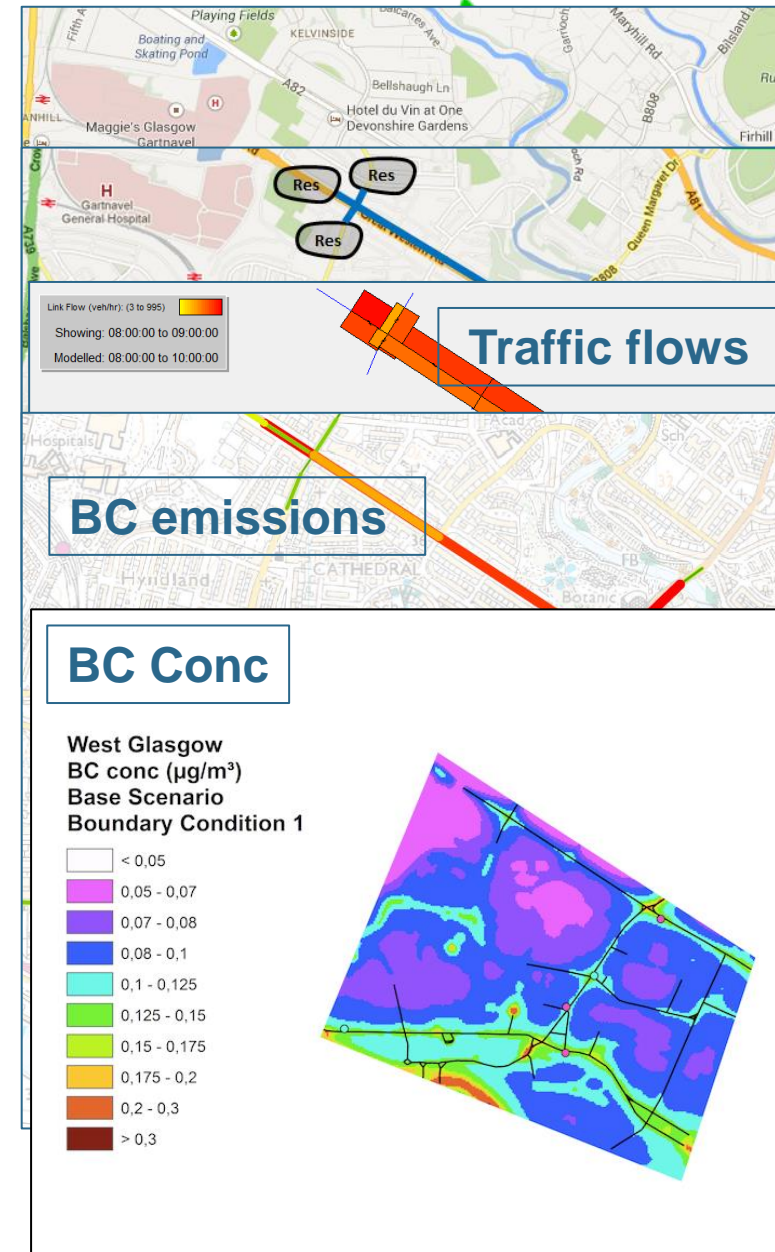
Dispersion  
model  
(next step)



# Integration into Decision Support

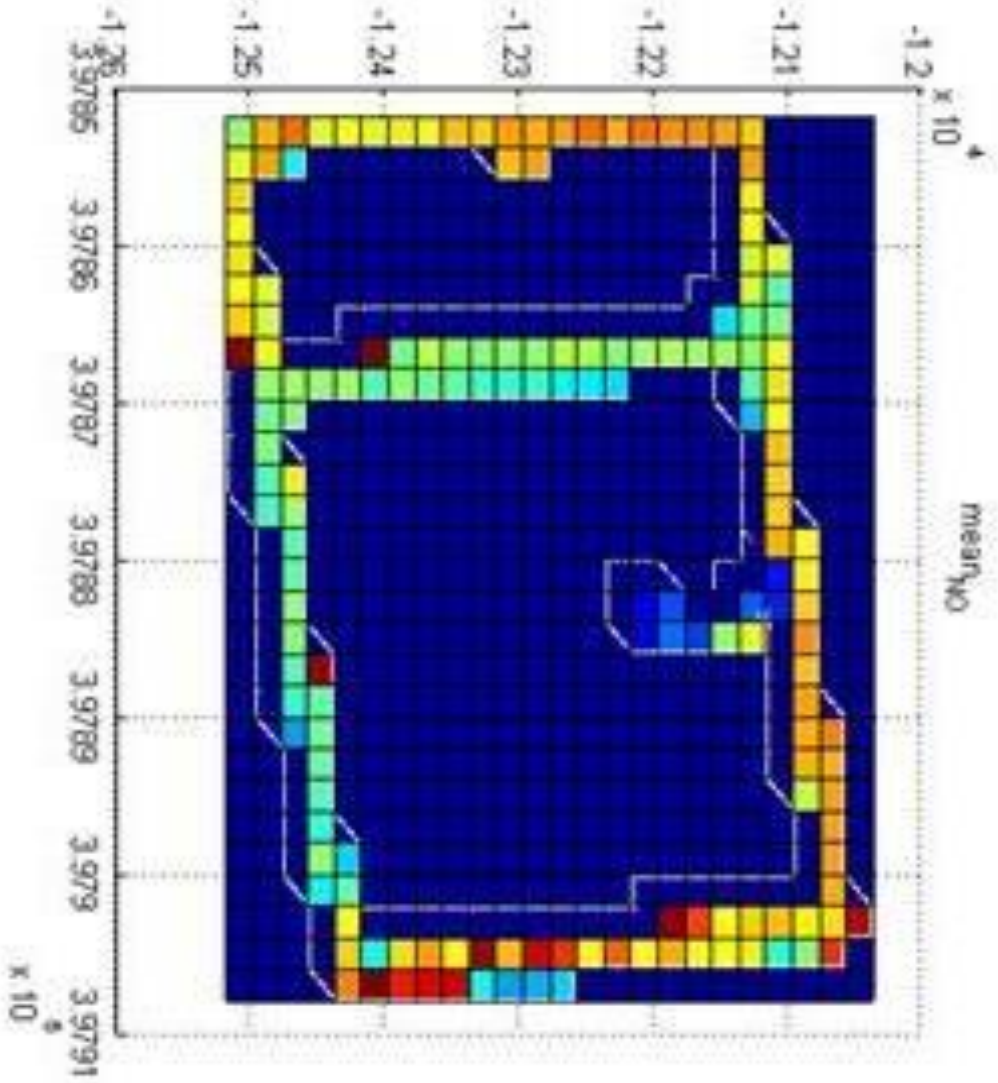
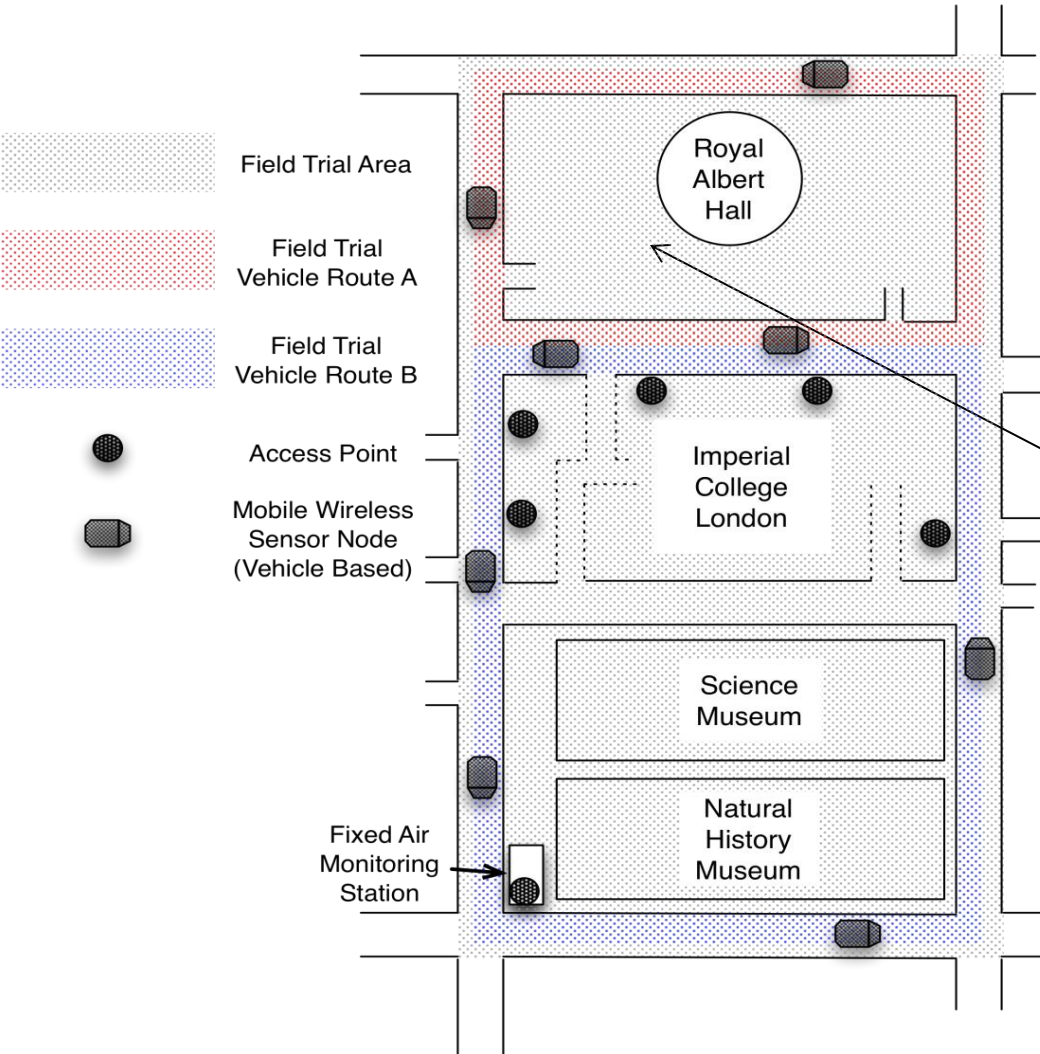
## EU FP7 CARBOTRAF Project

- Adaptive decision support system for traffic managers to reduce emissions of CO<sub>2</sub> and BC.
- Detailed offline scenario models coupled to an online state estimator and DSS.
- Use of ambient Black Carbon measurements to evaluate the measured effects.
- Development of a BC calculation chain and alternative traffic management scenarios.



# MESSAGE - area mapping with repeated vehicle runs

February 2009 Data, NO mean, 20m bins



# Research Facilities

- **Transport and emissions modelling:**
  - S-Paramics and PTV VISSIM for traffic simulation
  - AIRE, EnViVer & PHEM for traffic emissions, Emissions Analytics Database
  - HIPER-TP and ICAO EDB for aircraft trajectory and emissions
  - Vessel power and emissions models for shipping and ports
- **Activity, emissions and air quality monitoring tools:**
  - Navigation and positioning calibration devices (IMUs, GPSs, DMEs)
  - Integrated GPS and accelerometry devices
  - Low cost Emissions Monitoring Units (EMUs) x 5
  - MicroAeth AE51 Black Carbon monitors x 2
  - Use of Arduino and LabView
- Additional facilities available through colleagues at Imperial IITS Lab...



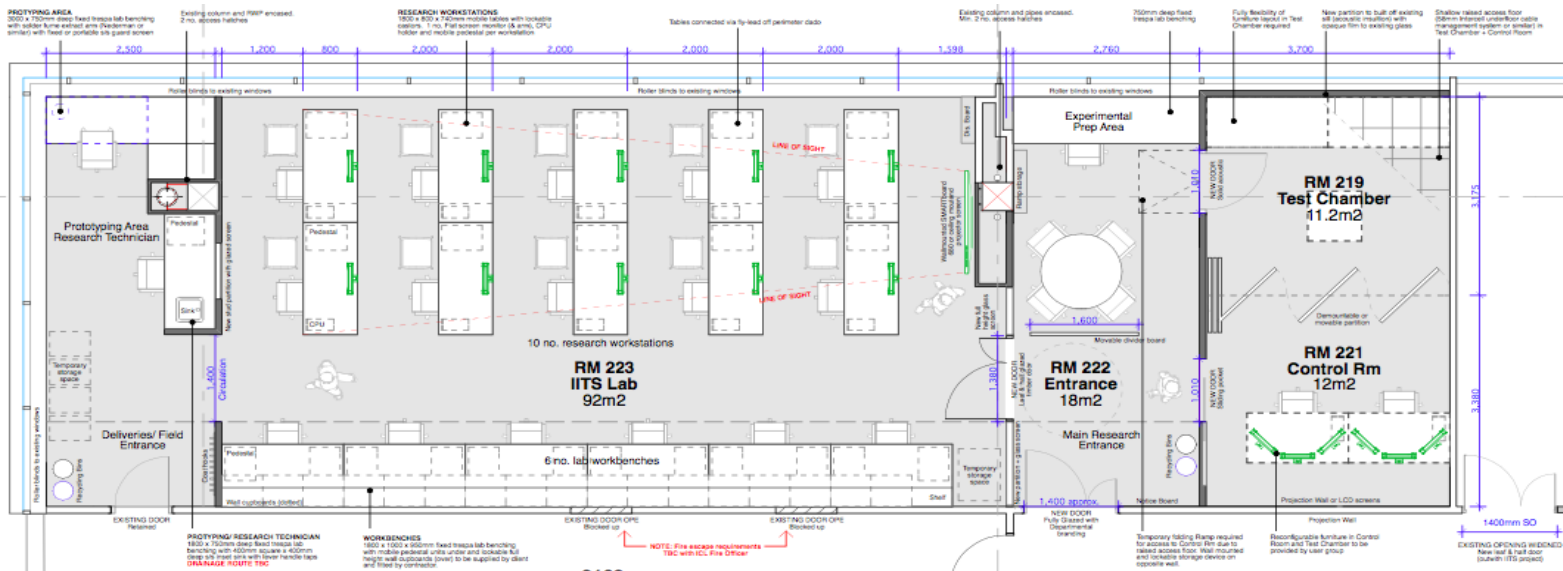
# Intelligent Infrastructure and Transport Systems Laboratory

## End-to-end test environments for sensors, field units, data aggregation, scenario modelling and decision support

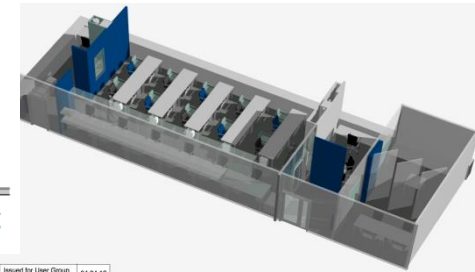
Device  
Prototyping

Modelling &  
Data Analysis

Experiment  
Test Chamber



Issued for User Group Jul 04 12



Issued for User Group Jul 04 12

Development,  
Calibration & test

Control Room for  
Decision Support



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# Suggested **R&I Needs** for future research

- **Research directions as R&I NEEDS:**
- Interpretation of distributed sensor network data requires information about source emission activities
- => propose the use of source emission monitors to identify and characterise systematic emission hotspots
- Similarly, interventions to reduce environmental impact of (transport?) sources can now be more fully evaluated
- => propose a closer integration of high-resolution traffic data streams and models with environmental monitoring approaches.