Space enabled services for transport solutions

Prof. Paul Monks
University of Leicester
Air pollution causes annual health costs of roughly £15 billion to UK citizens. (Defra 2012)
New Innovations for Air Quality

User Needs

Causes

Solutions

Opportunities

EMBRACE
East Midlands Business and Research
satellite Applications Centre of Excellence

CATAPULT
Satellite Applications
New Innovations for Air Quality

- User Needs
- Causes
- Solutions
- Opportunities
Identifying the problem

Hot Spot Mapper
Hot Spot Mapper

Local Authority need for Air Quality Management in Urban Areas

- Ground based air quality monitoring network
- Bus and Lorry GNSS
- Dynamic traffic flow and speed data
- SCOOT – traffic lights
- Traffic Camera Data
- Strategic Planning

Inputs
- Open source data
- Web services
- Open source
- Data processing
- Air Quality Monitoring
- Statistical models

Outputs
- Management
- Air quality
- Management
- Air quality
- Air quality

Led by the UK Space Agency
Delivered in collaboration with the Satellite Applications Catapult

Disclaimer: University of Leicester and Geospatial Insight Ltd is responsible for the information contained in the presentation. Views expressed do not necessarily reflect those of the SSGP and UKSA.
Hot Spot Mapper – A Satellite Enabled Solution

8 million datapoints every 24 hours
Incorporating a range of satellite data including (when available) Sentinel data.

Copernicus Atmospheres Service (Formerly MACC)

Historical, nowcast and forecast background field of air quality for HSM region of interest. Input into AQ GeoDataBase.
“Satellites” over Cities
NO, NO$_2$, CO, O$_3$,(SO$_2$), Temp, RH

Small Sensor – high measurement density
Overview of Prototype

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Intelligent use of urban infrastructure

SATURN – HGV Router

uTRAQ – Urban Traffic Management and Air Quality
Heavy Good Vehicle Route Planner Demonstrator

Satellite and GNSS data

Local Authority Data

ROUTE SERVICES

Parking facilities
Appropriate routes for HGVs
Weight, Height and Width
Safety margins
Near fuel stations

Estimated Time of Arrival
Distance to destination
Real-time Weather
Real-time traffic information

Mobile Device

Digital Map

09/12/2014

Heavy Good Vehicle Route Application Demonstrator
In action
uTRAQ – Urban Traffic Management and Air Quality
What it does

A dynamic traffic management system that optimises the use of the road network whilst sustaining high standards of air quality in the urban environment.
The Approach

A modular system architecture
Which is scalable
Abillity to interface with other UTC systems
Interfaces with CDBs
Modular = customisable

and we start with SCOOT...
Demonstration Area (1 off 3)

Neighbouring district to Leicester. Demonstration site includes up to 66 road junctions in the town of Northampton, most of which are SCOOT provisioned.
Supporting Innovation

EMBRACE

IMPETUS

Harwell
Competition to host regional Centres of Excellence (CoE) was launched in December 2013, with the first three Centres operating from April 2014.

**The North East**
- **Lead:** Business Durham
- **Focus:** Maritime and Transport

**The East Midlands**
- **Lead:** University of Leicester
- **Partners:** University of Nottingham, British Geological Survey
- **Focus:** Transport and Sustainable Living

**Scotland**
- **Lead:** University of Strathclyde
- **Partners:** University of Edinburgh
- **Focus:** Offshore Energies & Maritime

Over 70% funding from regional sources
The Role of the Regional Centres of Excellence

To reflect the aim and vision of the Catapult, each Centre will:

• Support industry and academia across the UK to accelerate the growth of satellite applications

• Create a focal point of activity linking the science base, industry and academia across the UK

• Enable the development of applications and solutions through engagement with the wider end user markets

• Act as a representative and ambassador for the Catapult in their local regions.
INTELLIGENT INFRASTRUCTURE
Using sensing and tracking technologies to model and improve multimodal network performance

Signal strength and network performance of wireless access in vehicular environments

Intelligent traffic control systems model enhanced with earth observation 3D mapping

Using braking data to predict junctions with high accident risk
Summary

• Space can be an embedded part of the “big data” solutions

• Air quality and transport is critical issue (UK and globally)

• Solutions can be centred around optimisation of infrastructure usage

• New technologies coming on-line (e.g. small sensors and airborne imagery)

• Ability to collaborate through “centres of excellence”
Bus Retrofit project

125 and 126

5 and 5a

9 sensors at Melton road/ Loughborough road (bus retrofitting)