Space Technologies For Urban Transport

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Global population growing at 75 million p/a

- ~7 billion (2012)
- >9 billion by 2043
- Significant pressure on systems, infrastructure and resources

Source: UNFPA 31.10.2011
Increasing levels of urbanisation. Everyone wants mobility

- 2010: > 1 billion vehicles in use worldwide
- >2 billion by 2020?

Source: UN report on world urbanisation prospects, 2014
More people, cars and urban migration result in a human and economic cost

“Nine days lost in traffic jams…”

“Traffic congestion costs UK economy £4.3bn a year”

Source: www.times.co.uk, www.telegraph.co.uk
CO2 increasing at record levels and our cities are choking

- 2014 breached the 400ppm milestone
- 2012: 7 million deaths worldwide
- UK: <8% of mortality in urban environment
Legislation has driven a decline in Automotive Emissions and fleet average CO2

[Graph showing emissions reduction from Euro 0 to Euro 6 for NOx, HC, CO, and Particules from 1990 to 2014.]

[Graph showing grams CO2 per kilometre normalized to NEVDC Test Cycle for various countries and regions from 2000 to 2025.]

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[Footnotes: (1) China’s target reflects gasoline vehicles only. The target may be higher after new energy vehicles are considered. (2) US, Canada, and Mexico light-duty vehicles include light-commercial vehicles. (3) Supporting data can be found at: http://www.theicct.org/info-tools/global-passenger-vehicle-standards]
Road fatalities have reduced but remain unacceptable
At the same time ubiquitous communications is changing behaviours

- More cell phones than people in 2014
- Generation Z – Digital Natives
- Everything is becoming increasingly connected

**Brontobtye** the new measurement for data

1,000,000,000,000,000,000,000,000,000

Source: [www.digitaltrends.com](http://www.digitaltrends.com), BBC
Increasing hardware complexity

- 70 – 100 ECUs in a modern car
- Connected by over 1000 wires
  - 1km long, and weighing 45kg
Increasing software complexity

Seismic shift in the level of software complexity

Lines of code

Space Shuttle: 400,000
Boeing 787: 14 million
F-35 Fighter: 24 million
Automotive: 100 million (2020)

Mercedes S-Class
Radio & Nav only: 20 million

1990: 1 million
1981 (GM): 50,000

Space Shuttle
Boeing 787
F-35 Fighter
Automotive

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Increasing electrification of vehicles

- Primarily HEV and PHEV
- But there is the emergence of FEV
  - City applications trend with FEV
  - Hugely compromised range dependent on use and environment
Our environment is increasingly intelligent
Roads will talk to cars,
Rails will talk to trains,
Buses will talk to cars
Cars will talk to trains
The transport network will inform mobility consumers
There is a demand for change..... And the ability to embrace it

- People are changing their modes of transport
- Car ownership models are changing
- Intelligent mobility is becoming a common topic
- And its impacting other beneficiaries of transport
Global Navigation Satellite Systems (GNSS)

- Road transport
  - Second most important segment of the GNSS market
  - Navigation devices to reach nearly 90% of the market by 2020.

- Key enabler for more efficient use of the road infrastructure
  - Reducing congestion and environmental effects

- Current applications
  - Navigation, e-call, pay-per-use insurance, road pricing
  - Tracking of goods, anti-theft systems, optimised parking solutions

- Enabling mobility services
Route Optimisation & Co-Operative Driving

- Delivering greater efficiency, safety, and convenience
- GNSS data has a major role to play but augmented by additional sensors and data sources
- Sensor fusion and communications is critical to achieve
  - Accuracy
    - Position
    - Maps
    - Dynamic mapping
  - Resilience
    - Urban canyons
    - Denial
  - Vulnerability
    - Jamming
    - Spoofing

Courtesy of Here Maps

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Earth Observation Data for Traffic Optimisation

- Use of earth observation data
  - Weather situation and weather patterns
  - Atmospheric pollutants

- Data can be used to help optimise traffic flows
  - Not just base on congestion but the environmental effects
  - Currently complimented by localised ‘ground’ based sensors

- Ever increasing accuracy, resolution, and low latency for real-time and predictive control
  - Potential to have huge societal benefits

Courtesy of ESA
Thank you