



Location and Timing Programme

Safety overview

Bob Cockshott

Location and Timing Programme
in the Digital Systems KTN

- >1,000 members
- >680 organisations
- managed by National Physical Laboratory

Location and Timing Programme

Space assets

- Earth observation
- Communication
- GNSS for position, navigation and timing
- Risk identification
- Prediction / prevention
- Warning / evacuation
- Mitigation



Location and Timing Programme

Meteorology

- Space weather – solar flares

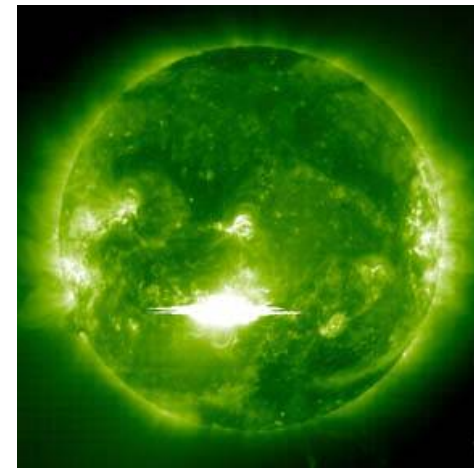
Radiation upsets to spacecraft

Interference to GNSS: L-band emissions, ionospheric scintillation

Disruption to electricity transmission

- Solar constant

Vital to distinguish to distinguish between anthropogenic and natural climate effects



Oct 28th 2007 flare



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Meteorology

- Weather imaging
- Sea surface temperature measurement
- Atmospheric temperature
- Wind speed
- GPS water vapour measurements
- Ocean wave height
- Aerosol monitoring
- Ozone layer and CO₂ measurement
- Ocean roughness from GNSS glint



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Data products

- Input to climate models
- Storm prediction
- Storm tracking
- Mash-ups combining weather and asset location – e.g. oil industry
- Specific local predictions – “Nowcasting”

Location and Timing Programme

Safety in remote areas

- Location
- Navigation
- Communication
- Tele-health

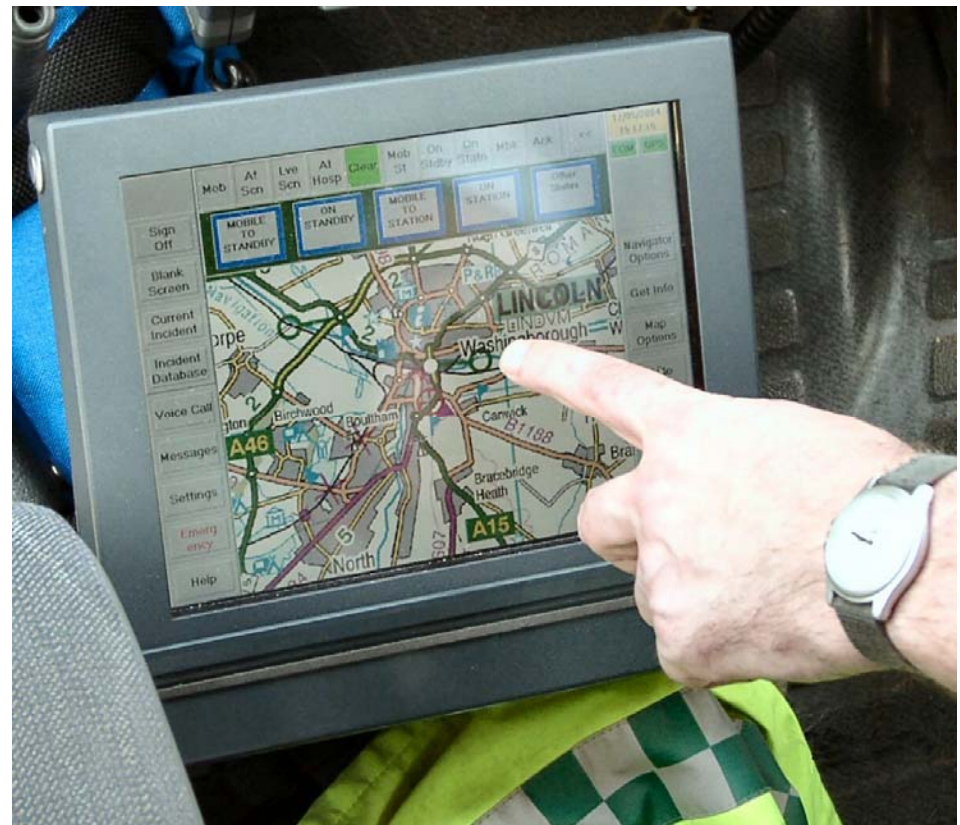
- Lone worker protection
- Tourism
- Disaster relief



Location and Timing Programme

Emergency response – “the golden hour”

- Emergency call location
- Automatic emergency calls
- Emergency response routing
- Emergency response tracking
- Report ETA at destination
- Tele-medicine to monitor patient
- Pre-position assets
- Command and control
- Tetra radio depends on GPS



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Health care: Ambulance tracking

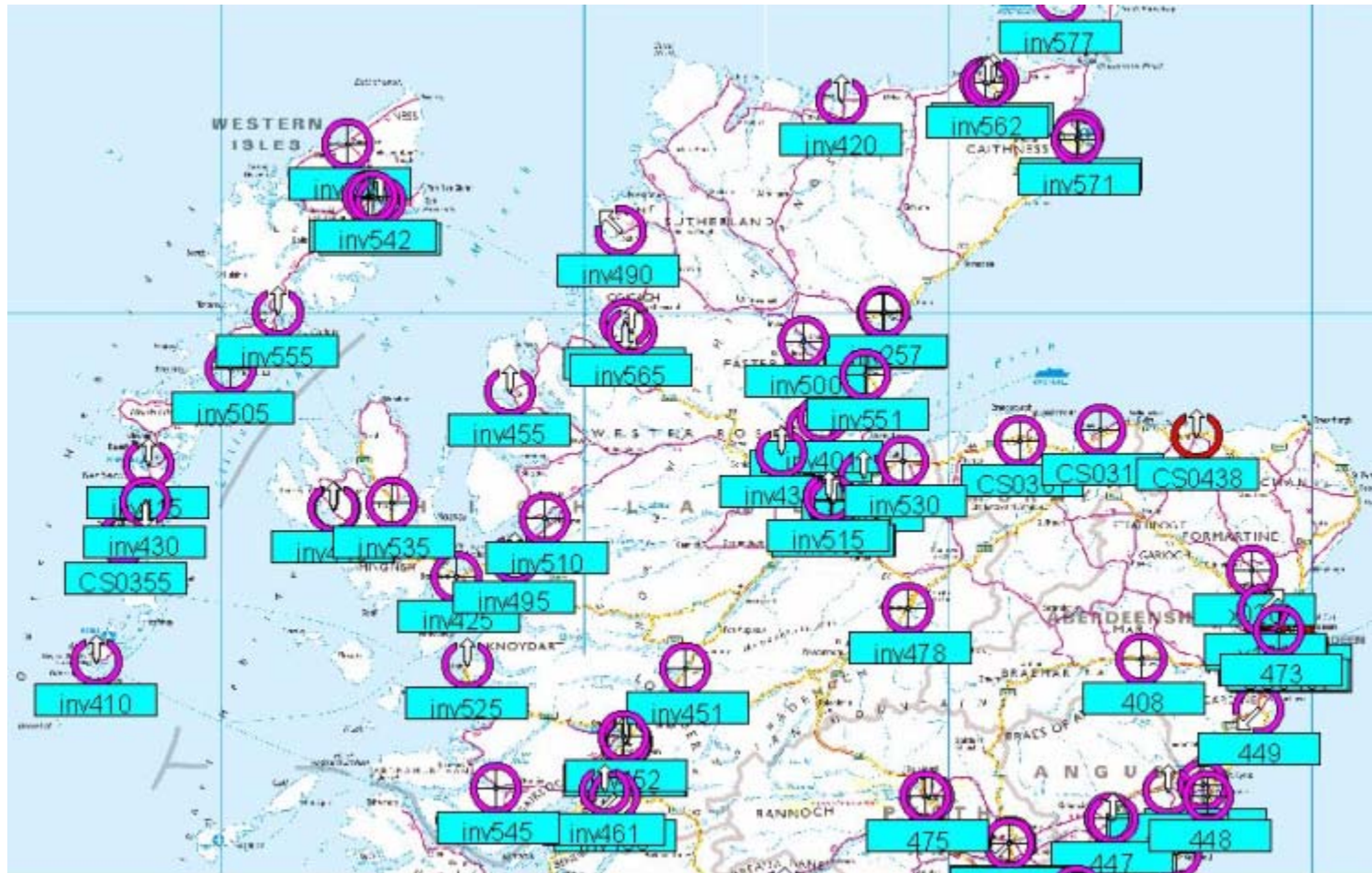


Image credit: Terrafix Ltd

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Aging population

- Geofencing
- Locating vulnerable people
- Remote health monitoring
- Navigation assistance
- Social networking



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Assisted living example

Mobility for a boy with Asperger's

- Low cost Blackberry app
- Tells his parents where he is

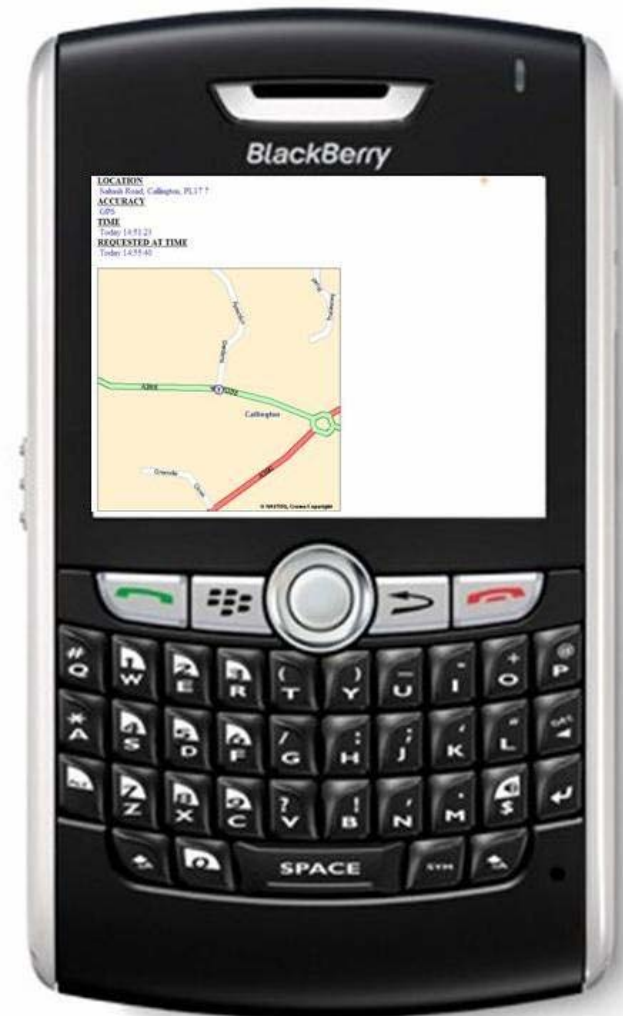


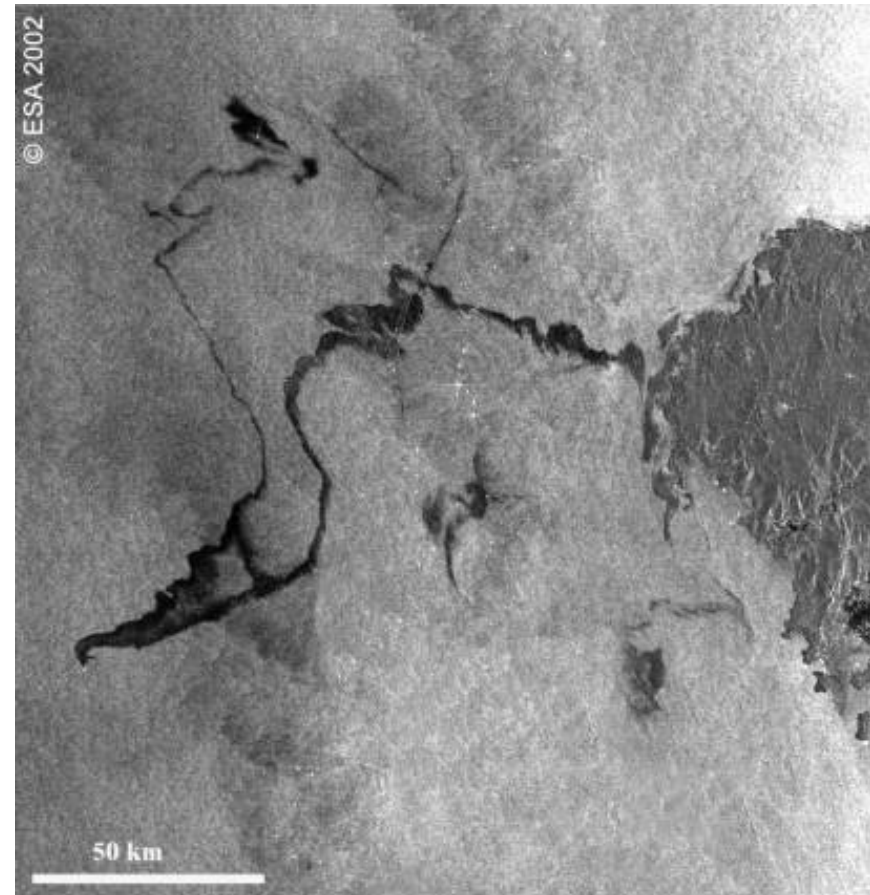
Image credit: Trackaphone

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Pollution monitoring

- Global ozone layer measurement
- Aerosol measurement
- Pollution plume mapping
- Tracking algae blooms and oil slicks
- Locating low cost mobile sensors

E.g. Message project



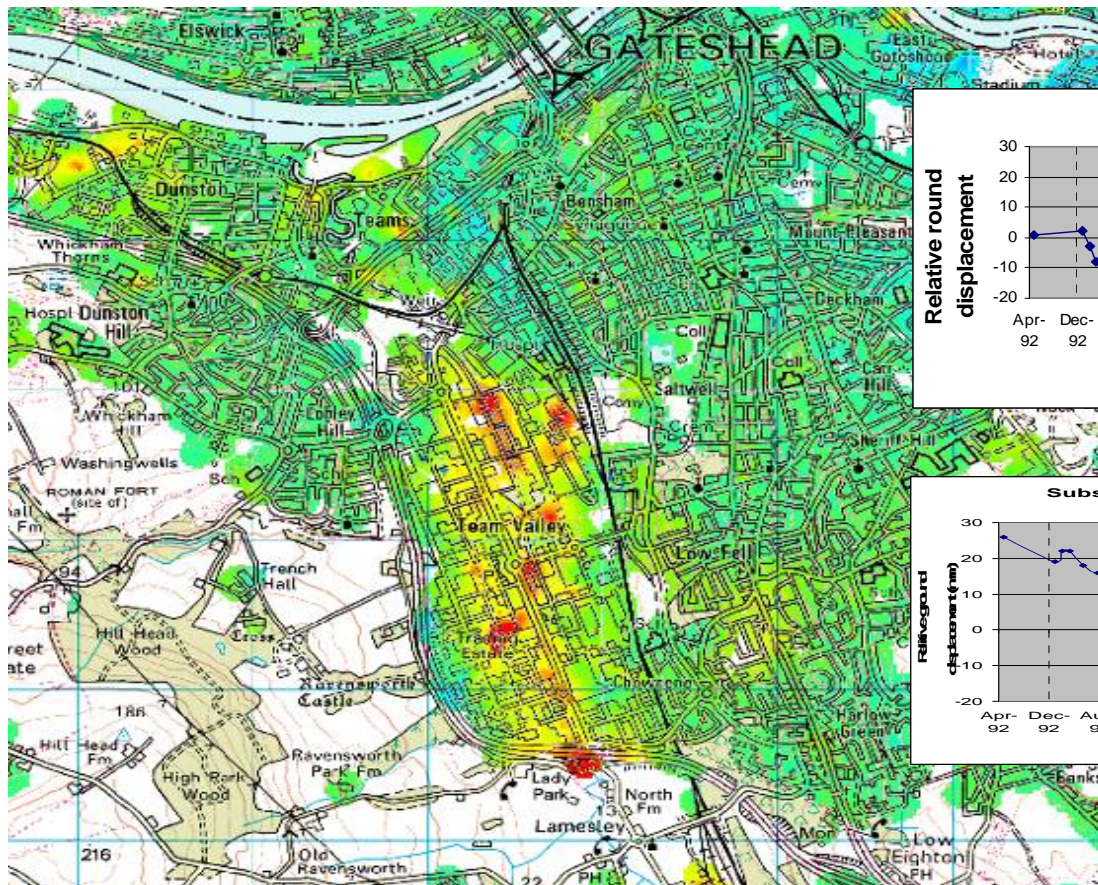
Prestige tanker spill, Spain Nov 2002

Image credit: ESA

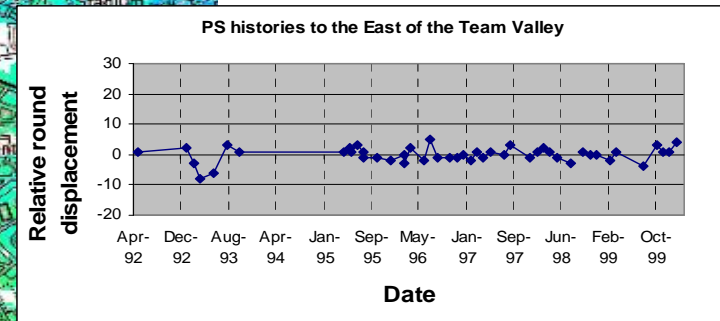
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Monitoring subsidence from space using radar

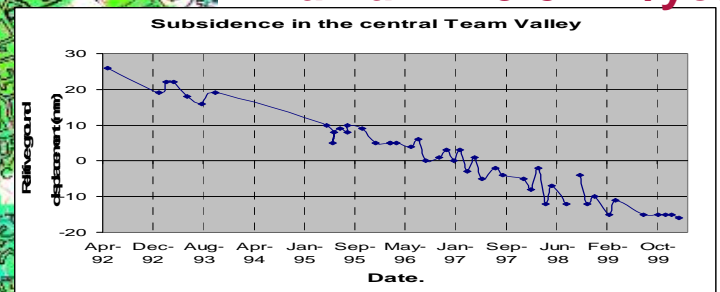
Uplift
↑
Stable
↓
Subsiding



Till = stable



Alluvium = 3-5mm/year



British Geological Survey

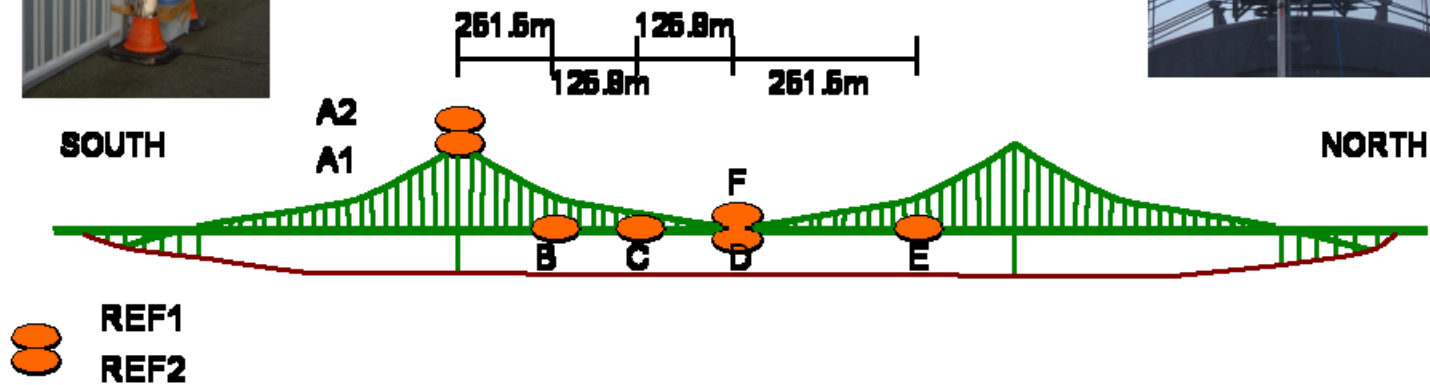
NATURAL ENVIRONMENT RESEARCH COUNCIL

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Structural integrity monitoring – Forth Road Bridge



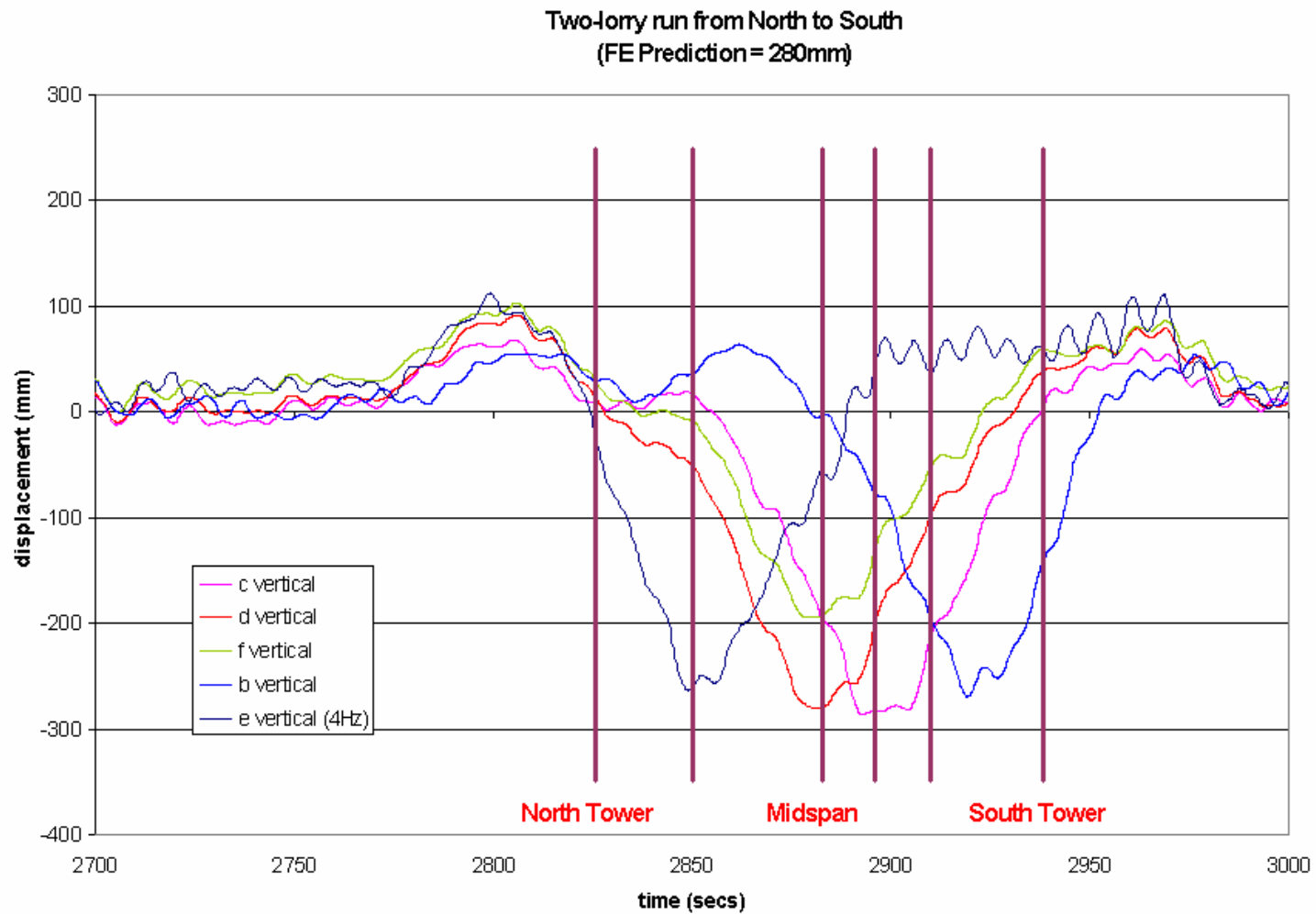
Instrument layout for the bridge test



Credit:
IESSG,
Nottingham

Location and Timing Programme

Structural integrity monitoring – Forth Road Bridge



Credit:
IESSG,
Nottingham

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Structural monitoring of ships

Multiple GPS receivers to

- Measure strain during loading
- Measure strain at sea
- Warn of over-stress

“slow down” light on bridge

- Detect long-term changes
- Monitor ship's attitude
- Accurate depth updates



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“Person overboard!”

- Activated by water contact
- GPS / EGNOS position
- UHF link to boat
- Integrated with nav display

- Sarsat
- MOB Guardian (RNLI)



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Marine safety

- Navigation & communications
- GPS assisted vessel-to-vessel docking
- GPS assisted berthing
- Ice berg mapping in shipping lanes
- Freak wave detection with radar altimetry



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Road safety

- GPS trackers to enforce speed limits
- Warning of excessive speed
- Intervention to prevent collisions
- Remote immobilisation
- Road trains, cooperative vehicles
- Safe driving rewards – e.g. Carats



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Safe driving - sticks



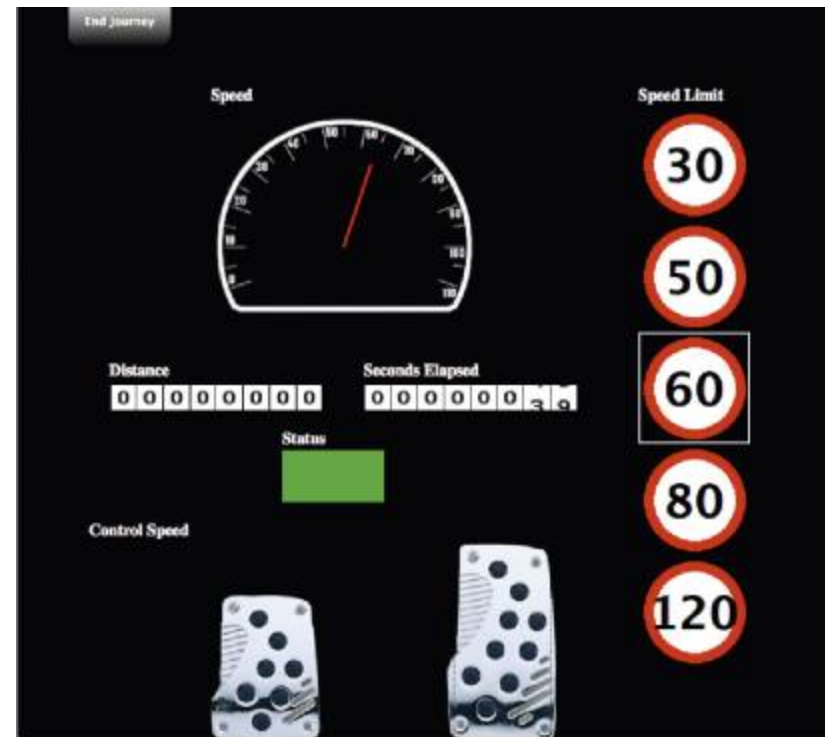
The screenshot shows the top of a BBC News website page. The header is red with the word "NEWS" in white. To the right of "NEWS" is a "LIVE BBC NEWS CHANNEL" button. Below the header, there is a navigation menu on the left with options: "News Front Page", "World", "UK", "England" (highlighted), "Northern Ireland", and "Scotland". The main content area shows the article title "Death crash police officer jailed" in large bold letters. Below the title is a sub-headline: "A former Metropolitan police officer who killed a woman". To the right of the sub-headline is a small image of a person's face. Above the article title, there is a timestamp: "Page last updated at 15:24 GMT, Monday, 26 October 2009" and two links: "E-mail this to a friend" and "Printable version".

The GPS tracker and an incident data recorder in the car showed it had been driven at speeds of more than 100mph, at times with flashing blue lights and sirens in use.

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Safe driving - carrots

- “Carats” project
- “Nectar” type points
- Rewards speed limit compliance



Carats display when driving in the “acceptable” range

Electricity transmission

- GPS timing to locate faults

Impulse propagates either side of a break

- GPS synchronisation of current measurements on transmission lines

Compare current in with current out

- Synchronising local generation with grid

Local generation must be in phase!

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Air and Rail

- GPS / EGNOS assisted approach / navigation
- Safer approaches to North Sea oil platforms
- Tracking bird migration

- Selective door opening
- Future potential for train control
- Track condition monitoring
- Location stamping CCTV

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Agri-food

- Crop health monitoring
- Yield prediction
- GPS equipped harvesting to monitor yields
- Automated farming



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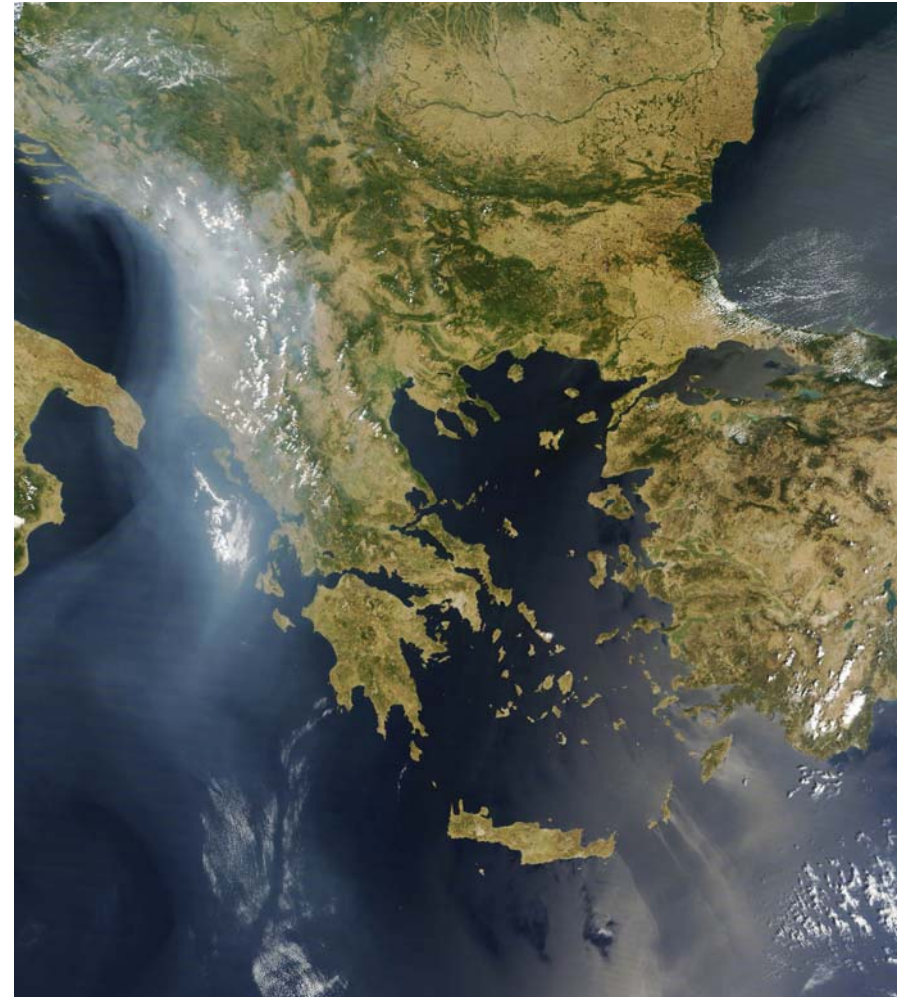
Disaster monitoring

- Flooding
- Detect and locate forest fires
- Volcanic eruptions
- Earthquake & tsunami damage

Customised maps

Compare before and after

Mash ups to show assets & victims



Forest fires from space

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Opportunities

- Ubiquitous personal location
- Increasing availability of EO mapping products
- Data aggregation
- Information accessibility
- Mobile processing power
- Many examples from UK SMEs