Assessing The Underworld
An Integrated Performance Model of City Infrastructures

2014 Annual Meeting

Chris Rogers
University of Birmingham
11th December 2014
We need to be aware of the consequences of excavating trenches in the streets – *ideally before rather than after doing it*


Agenda for 11th December 2014

Theme – Informing Streetworks Asset Management

09:30 Registration and coffee

10:00 Introduction (Chris Rogers)

10:15 The Challenges Facing ATU – Andy Rhoades (HAA)

10:45 Introduction to the Case Study – Helen Reeves, Andy Rhoades on a problem to be solved, and discussed, within breakout groups

11:00 Tea and coffee; networking, demonstrations ... and ATU poster discussions

11:30 Electronic Voting Session 1

11:40 Breakout Session 1 – features to be included in the DSS

12:30 Lunch; networking, demonstrations and ATU poster discussions.
AGENDA

13:30  Training and Accreditation: Upskilling the Industry (Steve Walker)
13:45  Speakers highlighting the practical problems that ATU

... Steve Crossland providing a perspective from USAG

... Erica Utsi from the perspective of remote sensing, and

... Tony Rachwal the perspective of utility service provider

followed by Q&A

14:45  Practitioner Expectations – the ATU team will pose a set of

questions to be discussed within the breakout groups

14:50  Tea and coffee; networking, demonstrations

... and ATU poster discussions

15:20  Electronic Voting Session 2 – Emerging Issues on the DSS, and

Performance Expectations

15.40  Breakout Session 2 – Performance Expectations

16.10  Plenary Comments (chaired by Chris Rogers)

16:20  Wrap Up and Close
Mapping the Underworld Timeline

- **1996**: Water / Gas Industry Vision: Bodyscanner in the Street
- **2000**: Location of Underground Plant and Equipment Initiative ⇒ Minimising Streetworks Disruption
- **2004**: MTU Project: Location, Mapping, Data integration, Asset tags, Network
- **2008**: MTU Location Project: Multi-Sensor Device Generation, Assessment, Protocols
- **2012**: Streetworks become more sustainable
  - road occupation minimised
  - night surveys
  - trenchless installation / replacement / rehabilitation
  - congestion reduced
- **2016**:
- **2020**:

**TIMELINE EVENTS**

- **UKWIR - AWWARF - KIWA 3-Day Workshop**
- **1996**: UKWIR Commissions Location Trials
- **2004**: Ideas Factory: ‘Mapping The Underworld’ term coined
- **2008**: Project VISTA advances Mapping and Knowledge Management elements of MTU
- **2012**: Assessing the Underworld: Creating Multi-Sensor Device for Remote Assessment Monitoring of Asset Condition
- **2016**: ... and more sustainable forms of utility service provision researched
Mapping the Underworld Timeline

Assessing the Underworld – Creating a Multi-Sensor device for Remote Assessment Monitoring of Asset Condition
We contend that what is buried in, and on, the ground is to some degree controlled by the ground

... if the ground properties change, or the ground moves, the adjacent / overlying infrastructure responds accordingly

Considering buried utility services – we seek to create a system able to manage, coherently, what we do to the buried infrastructure (add new services, repair / renovate existing services, leave it alone for now). For this

... we need to be informed by the ground conditions and how the ground might react to any new activity or intervention

The same argument holds true for the transport infrastructure
ATU’s Core Proposition

ATU is using MTU’s multi-sensor platform, with amendments and additions, and robotic in-pipe pigs to assess the condition of buried pipelines and cables, and of the ground in which they are buried, and of the surface infrastructure that overlies it.

For example, a deteriorated water pipeline gives a different response than a pristine pipeline.
ATU’s Core Proposition

ATU is using MTU’s multi-sensor platform, with amendments and additions, and robotic in-pipe pigs to assess the condition of buried pipelines and cables, and of the ground and of the surface infrastructure.

For example, a deteriorated water pipeline gives a different response than a pristine pipeline while wetting of the adjacent soil or voids created by local erosion due to leakage will result in a different ground response to unaltered natural soil.

The influence of time is accounted for by a sequence of surveys analysed alongside variations in climate, local conditions and pipeline condition (via deterioration models).
ATU’s vision is to prove the concept of a single, integrated national ‘model’ for the UK’s infrastructure... and explore how remote assessment technologies can provide buried utility service infrastructure condition attributes alongside positional information... and the condition of the surrounding ground

Adding the same information for roads (and later rail and other transport infrastructure) into the ‘model’ – and incorporating deterioration models – any civil engineering intervention in this system can be undertaken intelligently... being informed by a level of integrated and coherent information heretofore unavailable
The only sensible base into which to add details of the utility service and transport infrastructures, and their condition, is the 3D geological ‘map’ (or ‘model’) held by the British Geological Survey

... which has solid geology, parent soils, surface soils and fill materials mapped to a fine scale in urban areas

... along with geotechnical attributes, groundwater levels, pore water chemistry measurements and suchlike

If the UK’s physical infrastructures and their condition were added to this 3D ‘map’, then we could explore the full implications

on adjacent services, the road structure and the surrounds of excavating a trench in a particular road at a particular location to carry out work on a particular pipeline or cable
ATU’s Project Structure

ATU is organised into eight work streams

WS1 – Impact Delivery (*Bham, Leeds*)
WS2 – Vibro-acoustics (*Southampton ISVR*)
WS3 – Broadband Electromagnetics (*Bath, Bham, Soton all Elec Eng*)
WS4a – Geotechnical Infrastructure (*Bham, Newcastle, BGS*)
WS4b – Road Infrastructure (*Bham, URS Scott Wilson*)
WS5 – Buried Utility Infrastructure (*Sheffield Civil Eng, Robotics*)
WS6 – Technology and Data Integration (*Bham, Leeds*)
WS7 – Intelligent Decision Support System (*Leeds, Bham, BGS*)
WS8 – Sustainability Costing Model (*Bham, Newcastle*)

The ATU team is working collaboratively on cross-cutting issues via a series of workshops:

*Data Management*          *Deterioration Modelling*
*Sensors*                  *Decision Support System*