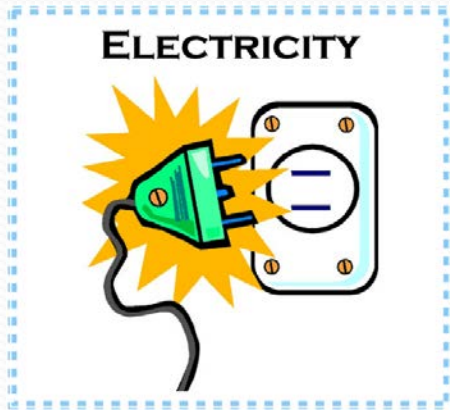


# Utility Detection: an Overview and a UK perspective

Erica Carrick Utsi  
Utsi Electronics Ltd



# The Problem: Common to all Countries



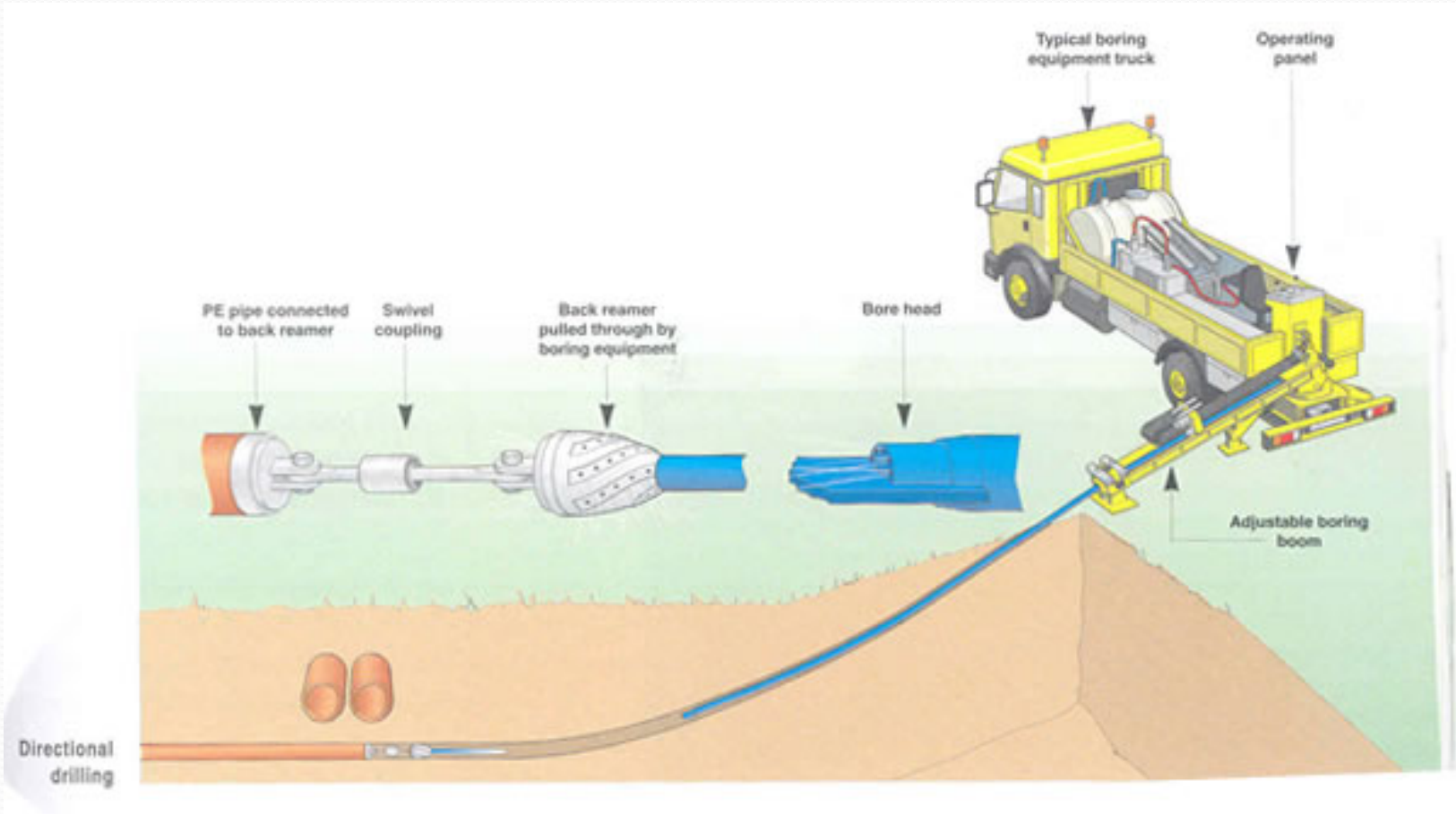
**Different Depths  
Different Sizes**





**The Problem Common to all Countries –  
An Overcrowded Underworld**

# Extending the Problem?



# The Risks

**Water & Gas mains are under pressure.**

**High Voltage Electricity can kill**

**Gas can ignite.**

**Night Working?**



# The Risks



# The Risks





# The Risks



# The Risks



# The Risks



# Associated Costs

**BBC Report (22<sup>nd</sup> August 2011):  
Road work charge for digging up roads  
proposed.**



Lost Working Time  
Pollution  
Additional Wear and Tear on  
the adjacent roads  
Fuel

# Traffic congestion on roads costs UK economy £4.3bn a year

12 December 2012



Traffic congestion is costing the UK economy nearly £4.3bn a year, according to new report from traffic information provider INRIX and the Centre for Economics and Business Research (Cebr).

INRIX, an international provider of traffic information and intelligent driver services, together with Cebr, has revealed that congestion on roads costs around £491 per car-commuting household.

The costs originate from the direct impact of traffic on drivers in terms of fuel and time wastage, and also through indirect impact on households as a result of businesses passing costs to consumers in the form of higher prices.

Close to £426m is being wasted on fuel alone, which means each of the 8.2 million commuting drivers in the country have to bear a fuel cost of £52.

Other direct cost is wastage of time, with the average cost of time wasted in gridlock per traveller £331, which results in a total national time cost of £2.7bn.

In London, the cost of idle time spent in traffic is £15.19, compared to the UK's national average of £12.51.

The report highlighted that gridlock in the country indirectly leads to a rise in the cost of goods and services; business or freight vehicles comprise 19% of every day traffic, which in turn results in passing more than £1.1bn of indirect costs to households every year.

Traffic congestion costs every urban household £107 per annum.

Individual annual costs per commuting household are the maximum in London with gridlock costing households £1,003.58 annually.

The study indicated that efficient movement of people and commerce across the UK road networks is required for a healthy economy.

**"Traffic congestion costs every urban household £107 per annum."**



# Other Costs

- Emergency Repairs typically cost 7 times the Cost of Routine Maintenance.
- Compensation, Lost Equipment, Collapsed Buildings.....etc

It makes Economic and Social Sense to locate utilities as accurately as possible **before any work in their vicinity begins.**

# Why Don't We know Where the Utilities are already?

- Schematic Information
- Changes in measurement systems
- Non-permanent reference points
- Incorrect Installation
- Close Spacing = 1 utility can “hide” another
- Can we identify which utility is which?
- How many in total – does anyone know?

# Primary Methods of Detection



But it takes more than just reading a handbook



# For Example.....

How do you construct a viable sampling strategy?

Could you justify the strategy if something went wrong & you were called to account?

What difference does transect spacing make to the results of the survey?

Why does a pipe or service suddenly disappear?

What are you going to do about it?

GPR does not work in the rain.....or is this just a lack of knowledge on the part  
Of the operator?

Does ground coupling matter? Why?

How do you make sure your results are in the right place?

# Knowledge & Understanding are Key

1. Many service providers did not have relevant training.
2. Many service providers wanted the technology to be “easy” and not to have to understand the theory/principles/science.
3. GPR Manufacturers want to sell. They want to provide a product that their clients will buy. If it isn't perfect or if the clients don't fully understand either the potential or the limitations of their equipment, is that their problem?
4. Equipment training is often – not always – limited to “button pushing “ instructions.
5. Service users don't want excuses or to have to understand the science. They just want an accurate plan.

# Knowledge & Understanding are Key

6. Service users do not want to pay any more than they have to for that plan.
7. Service users cannot tell Careful Company Ltd from Kamikaze Inc although they would like some form of certification.
8. Service users do not have sufficient knowledge to judge the viability of the detection plan and will probably accept the conclusion that the technology “just does not work”!!!!
9. Worst of all, no one overall responsible authority.

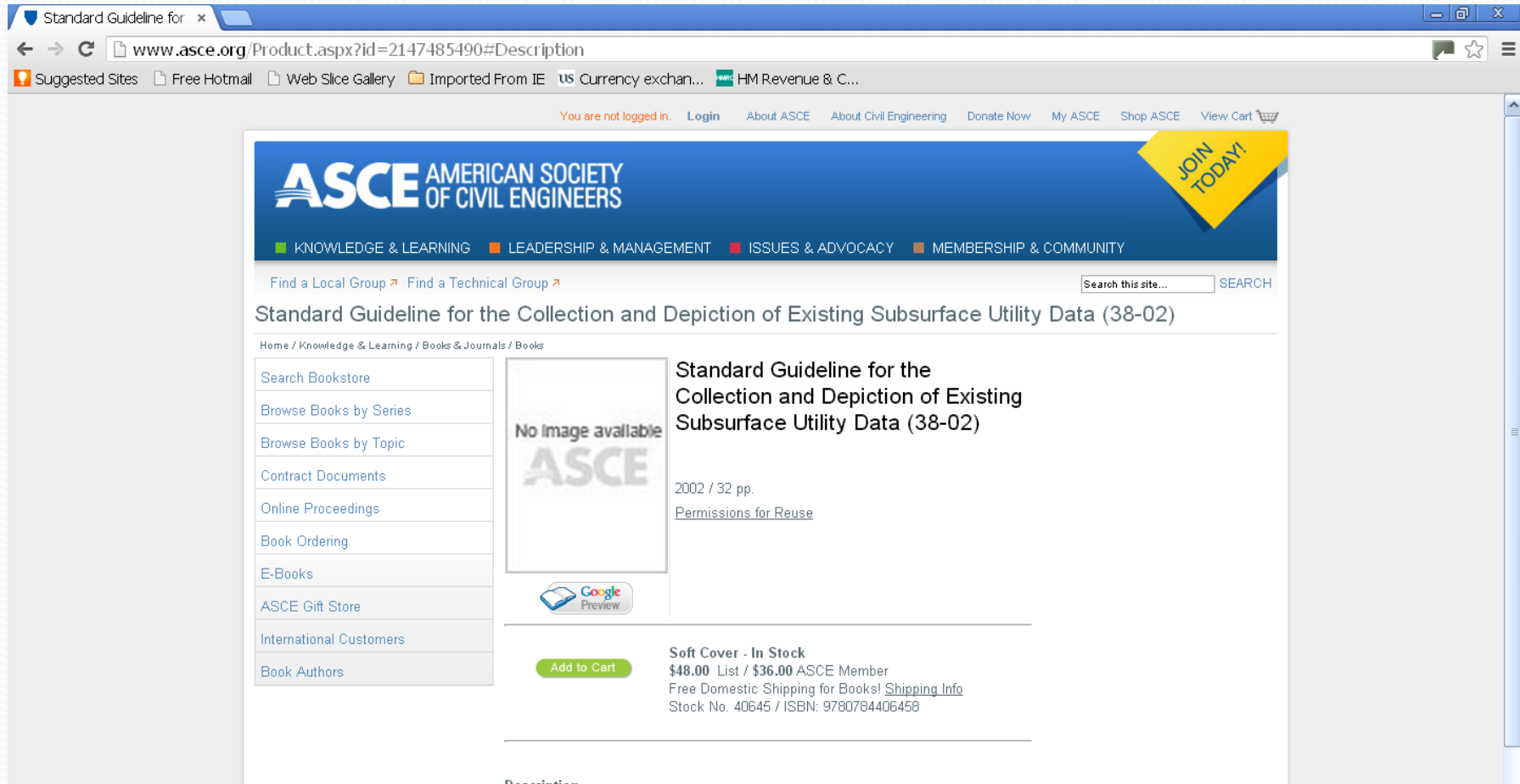
**THIS IS A RECIPE FOR DISASTER**

# The Results

1. Tenders accepted on the basis of lowest price  
BUT  
Lowest price = Least amount of work  
OR  
Lowest level of technical expertise.  
Where is the Incentive to carry out the job thoroughly?  
(cf PEJUTA practical exams)
2. Until something goes badly wrong .....& it does.  
THEN  
The technology gets the blame.  
One operator gets banned.  
This does not solve the problem.

**But we still need that utility map. What Next?**

# Accreditation, Standards & Affiliation



The screenshot shows a web browser window with the URL [www.asce.org/Product.aspx?id=2147485490#Description](http://www.asce.org/Product.aspx?id=2147485490#Description). The page header features the ASCE logo and navigation links. A yellow banner on the right says "JOIN TODAY!". The main content area displays the title "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data (38-02)" and a "No image available" placeholder. Below the title, it lists "2002 / 32 pp." and "Permissions for Reuse". A green "Add to Cart" button is visible. The left sidebar contains a "Search Bookstore" section with various navigation options.

Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data (38-02)

2002 / 32 pp.  
[Permissions for Reuse](#)

**Add to Cart**

**Soft Cover - In Stock**  
\$48.00 List / \$36.00 ASCE Member  
Free Domestic Shipping for Books! [Shipping Info](#)  
Stock No. 40645 / ISBN: 9780784406458



2002.

# ASCE – 4 Basic Categories of Survey

Quality Level D	Information derived from existing records or oral recollections.
Quality Level C	QL D + Surveying and plotting visible above-ground utility features.
Quality Level B	QL C + Appropriate geophysical methods to determine existence and approximate horizontal position of subsurface utilities. Surveyed to applicable tolerances defined by the project.
Quality Level A	QL B + precise horizontal and vertical location of utilities obtained by actual exposure at a specific point which is shown on plan documents. Accuracy typically set to 15mm vertical and appropriate horizontal tolerances as defined by the project.

1. Introduces clarity between the service user and the service provider.
2. Only applicable to the States but serves as a starting point for discussions elsewhere. Note difference in density of utilities between USA & UK.

# End User Education

The Survey Association (TSA)

The European GPR Association (EuroGPR)

Professional Institutes e.g. Institute of Civil Engineers; ICES etc.

Utility companies.

Local Government

Highways Agency (Areas)

Action needed to distinguish acceptable & unacceptable practices.

Contracts begin to specify competence & look for affiliation.

Co-operation begins, helped by members who cross affiliations.

# TSA Guidelines

Wide Discussion & Consultation  
with other bodies  
Including  
EuroGPR

Issued 3<sup>rd</sup> March 2011





# TSA Guidelines

The screenshot shows a web browser window with the URL [www.tsa-uk.org.uk/for-clients/guidance-notes/](http://www.tsa-uk.org.uk/for-clients/guidance-notes/). The page title is "Guidance Notes".

## Guidance Notes

### The Essential Guides

TSA's Technical Committee is working on updating and creating Client Guides and Guidance Notes on various areas of surveying. These are available opposite as pdf files.

These documents belong to TSA and must not be made available for download anywhere else.

TSA's **Client Guides** are primarily aimed at other professionals such as engineers, architects, planners and clients in general. They are not intended to go 'in depth' into practical issues but to act as a basic guide on a particular topic and, in particular, on procedures and regulations which may govern how a particular aspect of the survey is carried out.

**Guidance Notes** are generally aimed at survey companies and clients who require detailed information on a subject. Where procedures are recommended for specific professional tasks, these are intended to embody 'best practice', ie procedures which in the opinion of TSA meet a high standard of professional competence.

#### STEP 1 - Your Details

Please fill out the form below.  
*All fields are required*

**Name**  
Your Name

**Company**  
Your Company

**Email**  
Your Email

Your details are solely for TSA's statistical monitoring of downloads. This information is kept confidential and will not be passed onto any

#### STEP 2 - choose your downloads

Please check guidance notes you would like to download

- Guidance Note - Utility Survey method of measurement Issue 2
- Guidance Note - The Essential Guide to Utility Surveys (Low Res)
- Guidance Note - The Essential Guide to Utility Surveys (High Res)
- Guidance Note - Network RTK GNSS Report 2012 (Low Res)
- Guidance Note - Network RTK GNSS Report 2012 (High Res)
- Guidance Note - Network RTK GNSS Best Practice 2012 (Low Res)
- Guidance Note - Network RTK GNSS Best Practice 2012 (High Res)
- Guidance Note - Network RTK Full Report (2008)
- Client Guide - Working on Railways

#### Utility Surveys - The Essential Guide

#### Twitter

about 2 days ago we were checking out RT @classofyourown The COYO Weekly is out! [paper.li/classofyourown](http://paper.li/classofyourown) ▶  
Top stories today via @gwpl @RIBA @GeneratingG

#### Linked-in

Discuss all aspects of surveying on our updated Linked-In Profile

The Windows taskbar at the bottom shows the Start button, several open applications (Outlook Express, AE.19.AUG.KG, Erica's CatchUp, Windows Explorer, EPSON Scan, The Survey Ass..., PhotoMagic), and the system clock showing 11:06.



Available on-line.

# TSA Guidelines



## TSA guidelines

Level 1	Desk top
Level 2	Level 1+ Real time RFL (and GPR if specified) tracing
Level 3	Level 2 + Surveying of features and CAD drawing
Level 4	Level 3 + Manhole ID of services
Level 5	Level 4 + % of area with GPR with post processing
Level 6	Level 5 + 100% of area with GPR with post processing

Similar categories.  
Differences in wording & context.

Quality Level D	Information derived from existing records or oral recollections.
Quality Level C	QL D + Surveying and plotting visible above-ground utility features.
Quality Level B	QL C + Appropriate geophysical methods to determine existence and approximate horizontal position of subsurface utilities. Surveyed to applicable tolerances defined by the project.
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# TSA Guidelines

14 Sections:

- Introduction
- Equipment & Techniques
- Levels of Survey
- Inputs from the client
- Outputs from the contractor (Deliverables)
- Timescales
- Excavation/Ground Truthing
- Accuracy/Confidence Ratings/Limit of Liability
- Traffic Management
- Health & Safety
- Manhole/Node Survey Issues
- Environment Issues
- Glossary of Words, Terms & Acronyms
- Bibliography & Websites for Further Reading
- And a number of Appendices, including  
The EuroGPR guidance on the use of GPR for utility detection.

# EuroGPR Guidance

**EUROPEAN GPR ASSOCIATION**

PROMOTING THE USE OF GROUND PENETRATING RADAR

Home About us News & Events Introduction to GPR Rules & regulations Media Forum Scientific literature Contact us

Basic information  
Code of practice  
Guidelines  
Glossary

Members login

Username  
Password  
 Remember me  
Login

Members only

» Meetings diary  
» EuroGPR licensing activities  
» Licensing regimes  
» Forum

Members

A selection of our members:

» 3d-Radar AS

Welcome to EuroGPR

Welcome to the Web page of EuroGPR, an association made up of users and manufacturers of GPR equipment, intent on raising standards within the GPR industry and looking out for the rights of our members, giving them voice at a pan-european level on matters such as licensing, health and safety and market access.

GPR stands for Ground Penetrating (or Probing) Radar. The technology is very similar to traditional radar but uses a shorter wavelength, to:

- Locate buried pipes & services underground;
- Find evidence for other buried potential hazards e.g. mine shafts; voids;
- Investigate concrete structures to determine the position of reinforcement &/or the quality of the concrete & whether it contains voids;
- Check on the integrity of road subsurfaces;
- Investigate environmental conditions both natural (geology) & man-made (e.g. pollutant spread);
- Learn about glaciers, their formation & structure;
- Uncover forensic evidence including buried human remains & weapons; and
- Locate, Identify & Investigate Archaeological Sites.

Almost all of this work has a strong Health & Safety aspect. It is also important to local & national Government as the ultimate End Users of the information generated.

Why be a member of EuroGPR?

Technology you can trust in

» 3d-Radar AS

...reasons why you should consider EuroGPR can only recommend the equipment and

# EuroGPR Guidance

Date  
needed

Guidelines for the use of GPR equipment

EuroGPR is committed to the adoption of best practices for the use of GPR technology in all applications. At present there are no recognized International Standards but a number of guidances and recommendations are used in different countries and across different GPR applications. EuroGPR provides some facts sheets for guidance in GPR surveys on different applications. For completeness, this page includes also references originated by other entities. EuroGPR takes no responsibility for their content nor endorses them but simply acknowledge their existence.

Members EuroGPR and visitors of this website are encouraged to report to the [Association Secretary](#) should they feel a relevant document should be added to the following list.

### Guidelines for utilities

Utilities detection is certainly the biggest commercial application for GPR. EuroGPR statement below is the official recommendation of the association. Guidelines to the use of GPR, usually embedded into more general guidelines from utilities mapping, are listed below in an attempt to give members the widest possible picture; however, EuroGPR does not endorse such guidelines.

- [EuroGPR policy statement on utilities detection and mapping.](#)
- Association pour la qualité en Géophysique Appliquée non Pétrolière (AGAP), Guide d'adéquation des méthodes et techniques géophysiques aux applications concernant le sol et le sous-sol (guideline for the update of geophysical methods and techniques for soil and sub-soil applications), 1992.
- American Society of Testing and Materials (ASTM), Standard Guide for Using the Surface Ground Penetrating Radar Method for Subsurface Investigation, ASTM D 6432-99, 1999
- American Society of Civil Engineers (ASCE) Standard Guideline for the Collection and Depiction of Subsurface Utility Data, CI/ASCE 38-02, 2002
- Comitato Elettrotecnico Italiano (CEI) Norma per l'impiego del radar per introspezione del suolo per prospezioni preliminari ad opere di posa di servizi ed infrastrutture sotterranee (Regulations for performing preliminary surveys with ground probing radar before laying underground utilities and infrastructures), CEI 306-08, 2004
- Fondazione Politecnico di Milano, Sistemi geognostici per la mappatura dei sottoservizi (Mapping subsurface utility networks using geognostic investigations)
- The Survey Association Guidance Note, "Utilities Surveys, detailed guidance notes for specifying a utility survey", Issue 1, November 2009. Available in low and high resolution from TSA website at <http://www.tsa-uk.org.uk/guidance.php>

### Guidelines for archaeology

As a rapidly growing sector, the archaeological industry has come to consider GPR as a standard extension of the more established geophysical techniques, rather than a novel addition. The wide range of targets, and thus scope of responses which may need to be identified, means that survey strategies will vary greatly from one project design to another. However, for any given situation, the basic considerations and controlling physical limitations that are key to defining the "best" approach will typically remain the same. In a similar way to utility mapping, the current guidelines tend to be part of documents with a far wider scope, the primary examples of which have been listed below. Again, inclusion on this list does not necessarily imply EuroGPR endorsement of the document.

- [Euro GPR "Archaeological Applications"](#)

# The Legal Aspects



# The Legal Aspects



## Membership Certificate

*This is to certify that*

### **European GPR Association**

*was admitted as a Full Member of the*

### **European Telecommunications Standards Institute**

*by the ETSI General Assembly*

*ETSI Full Members commit themselves to comply with the Statutes and Rules of Procedure of ETSI and other decisions taken by the General Assembly, to contribute to the work, to make use of the standards produced to the extent practicable and to support those standards for use as the basis for world standards and recommendations..*

*Sophia Antipolis, France*

*28 March 2007*

A handwritten signature in blue ink that reads "John A. Phillips".

*Chairman of the General Assembly*



A handwritten signature in blue ink, appearing to be "F. Keller".

*ETSI Director General*

*Chairman of the Board*

*P.P. Alistair Urnie*



# Utility Mapping Association



Formed January 2012.

Utility Mapping only

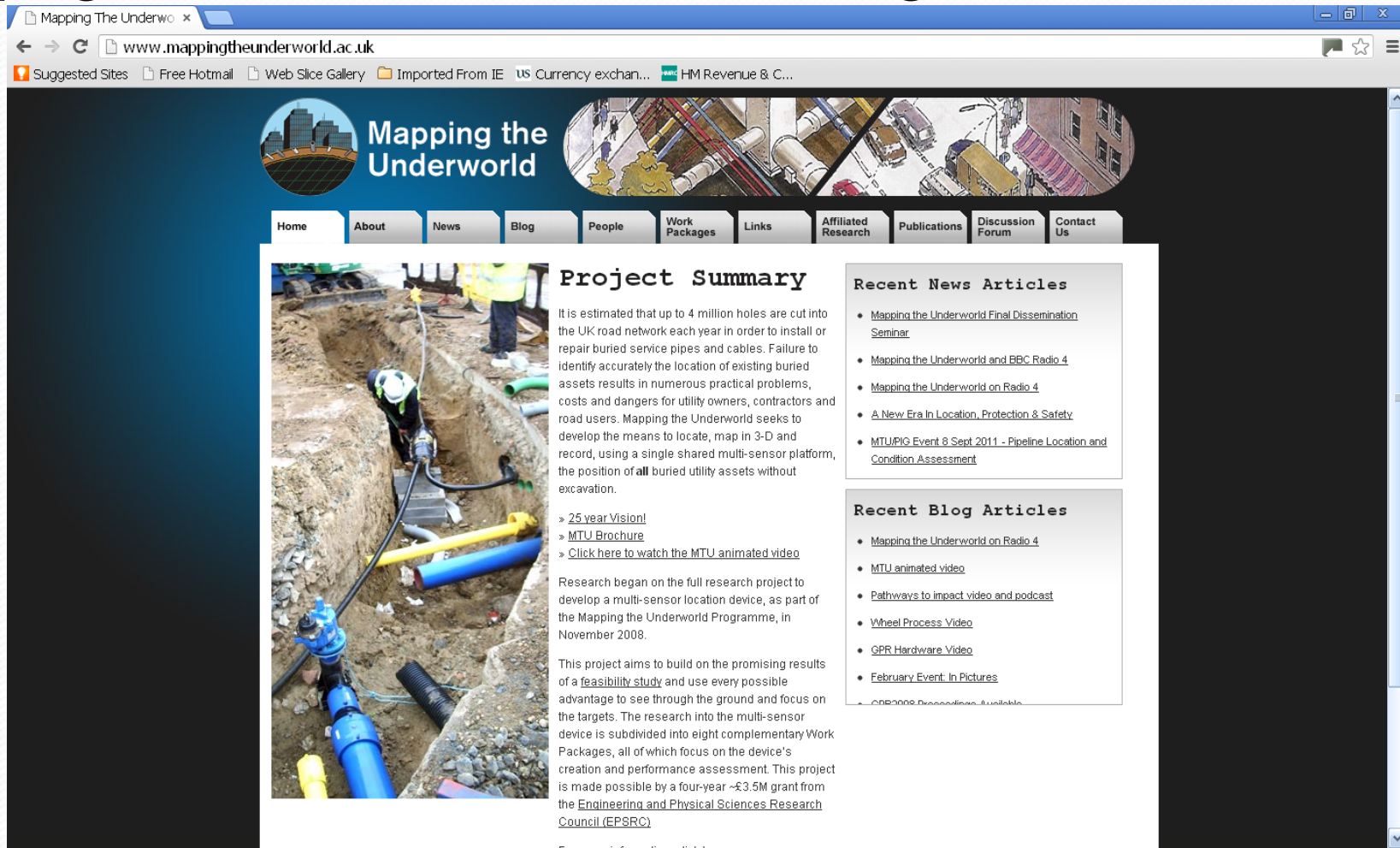
Co-operation with other Industry Professionals (incl. EuroGPR)





# Research Projects

## Mapping the Underworld (now Assessing the Underworld)



The screenshot shows a web browser window displaying the website [www.mappingtheunderworld.ac.uk](http://www.mappingtheunderworld.ac.uk). The page features a navigation menu with links for Home, About, News, Blog, People, Work Packages, Links, Affiliated Research, Publications, Discussion Forum, and Contact Us. The main content area is titled "Project Summary" and includes a photograph of a worker in a trench with various pipes and cables. The text describes the project's goal to map buried utility assets using a multi-sensor platform. A sidebar on the right lists "Recent News Articles" and "Recent Blog Articles".

### Mapping the Underworld

- Home
- About
- News
- Blog
- People
- Work Packages
- Links
- Affiliated Research
- Publications
- Discussion Forum
- Contact Us

### Project Summary

It is estimated that up to 4 million holes are cut into the UK road network each year in order to install or repair buried service pipes and cables. Failure to identify accurately the location of existing buried assets results in numerous practical problems, costs and dangers for utility owners, contractors and road users. Mapping the Underworld seeks to develop the means to locate, map in 3-D and record, using a single shared multi-sensor platform, the position of **all** buried utility assets without excavation.

- > [25 year Vision](#)
- > [MTU Brochure](#)
- > [Click here to watch the MTU animated video](#)

Research began on the full research project to develop a multi-sensor location device, as part of the Mapping the Underworld Programme, in November 2008.

This project aims to build on the promising results of a [feasibility study](#) and use every possible advantage to see through the ground and focus on the targets. The research into the multi-sensor device is subdivided into eight complementary Work Packages, all of which focus on the device's creation and performance assessment. This project is made possible by a four-year ~£3.5M grant from the [Engineering and Physical Sciences Research Council \(EPSRC\)](#)

### Recent News Articles

- [Mapping the Underworld Final Dissemination Seminar](#)
- [Mapping the Underworld and BBC Radio 4](#)
- [Mapping the Underworld on Radio 4](#)
- [A New Era In Location, Protection & Safety](#)
- [MTU/PIG Event 8 Sept 2011 - Pipeline Location and Condition Assessment](#)

### Recent Blog Articles

- [Mapping the Underworld on Radio 4](#)
- [MTU animated video](#)
- [Pathways to Impact video and podcast](#)
- [Wheel Process Video](#)
- [GPR Hardware Video](#)
- [February Event: In Pictures](#)
- [GPR Data Processing Available](#)

# Research Projects

Tie up with JK Guest test site which supplements test sites at Leicester

Bristol

Wokingham

& larger European test sites such as BAM, Gaz de France & Iffstar (Nantes).



The screenshot shows the homepage of the Mapping The Underworld Centre of Excellence. At the top left is a circular logo with the text "Mapping the Underworld CENTRE OF EXCELLENCE". To the right is a navigation menu with links: "MTUCE Homepage", "About MTUCE", "Mapping / Excavation Grades, Qualifications, Training", "Contact MTUCE", and "Academy Homepage". The main content area features a large banner with the same circular logo on the left and the text "The UK's Only Dedicated Facility for Utility Mapping and Avoidance Training" on the right. Below the banner is a welcome message: "Welcome to the Mapping The Underworld Centre of Excellence". At the bottom of the page, there is a small footer with the text "Welcome to the Mapping The Underworld Centre of Excellence".

# Setting the Standard (PAS)

- British Standards Institution
- Initial Meeting – Workshop 4<sup>th</sup> January 2012.
- Vote PAS V British Standard 26<sup>th</sup> January 2012.
- PAS 128 under the leadership of ICE
- Committee Membership incl. EuroGPR
- Sponsorship from various institutions, incl. EuroGPR
- Draft Guidelines distributed July 2013 for comment by July 26<sup>th</sup>.
- Due for finalisation within the next 12 months.



Training

Raising Standards

Disciplinaries??



Thank you for listening.  
Any Questions?