GPR technology
Vol 3, No. 12
October 2007

Subsurface Views

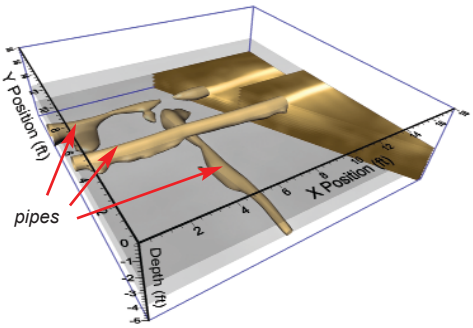
Sensors & Software Inc.

GPR data views
GFP files and Voxler

3D Visualization

Sensors & Software have introduced two major advancements for visualizing GPR data in two and three-dimensions.

- Now, when data are collected on a grid with any of our GPR systems (Noggin, Conquest or pulseEKKO), a GFP (Grid File Parameters) file is created. GFP files simplify the process of opening grid survey data in visualization software like EKKO_Mapper and ConquestView. With these software packages, 3D volumes are presented as a series of horizontal depth slices and vertical cross-sections.
- EKKO_Mapper and ConquestView now export the 3D volume data in HDF and CSV file formats for use in third-party programs including Voxler, a 3D volume visualization



Application: *Utility-locating*
System: *Noggin 250 SmartCart*
Grid: *18 x 18 feet, 2 ft line spacing*
Display: *Isosurface*

program developed by Golden Software and now available from Sensors & Software.

(continued on page 2)

From our customer files:

"Dig First" outcomes...

Residents of Burnaby, a city near Vancouver B.C., recently experienced the consequences of not calling before you dig. A geyser of black crude oil erupted into the air when a backhoe dug into a pressurized pipeline.

Figure 1: *A geyser of black crude oil erupted into the air when a backhoe dug into a pressurized pipe.*

Thousands of litres of oil covered the street, many nearby houses and polluted a nearby inlet (Figure 1). Once the situation was safely under control, the inevitable question of how this disaster could have been prevented was asked.

TERRAprobe, a utility-locating company specializing in GPR, demonstrated to the local newspaper how a Noggin 250 SmartCart system (Figure 2 - pg.2) could have been used to determine the location of the pipeline. The lateral position and depth of the pipeline (Figure 3 - pg.2), as well as several other utilities, were located in just a few minutes.

This story confirms the importance of following proper procedures and

(continued on page 2)

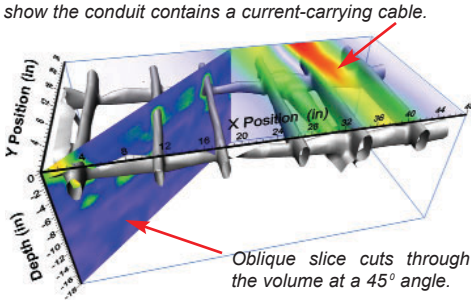
In This Issue

3D Visualization

(continued from page 1)

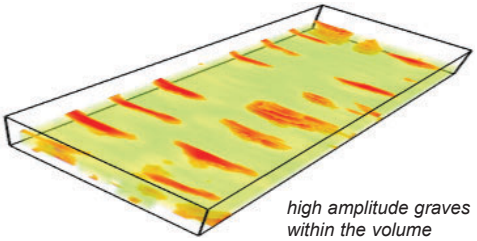
Voxler provides many display options including volumes, variable-opacity views, isosurfaces and orthogonal or oblique slices; these can be combined together to create powerful visual presentations.

PCD (Power Cable Detector) image superimposed to show the conduit contains a current-carrying cable.



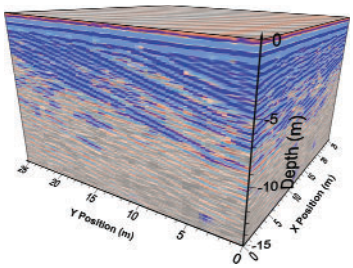
Oblique slice cuts through the volume at a 45° angle.

Application: *Concrete scanning*
System: *Conquest (1000 MHz)*
Grid: *2 x 4 feet, 4 inch line spacing*
Display: *Isosurface*



high amplitude graves within the volume

Application: *Cemetery mapping*
System: *Noggin 250 SmartCart*
Grid: *20 x 40 feet, 2 ft line spacing*
Display: *Variable opacity volume view*



fanset foreset beds from a prograding delta

Application: Geological mapping
System: pulseEKKO 100 MHz
Grid: 25 x 25 meters, 0.5m line spacing
Display: Volume view

Data courtesy of Dr. Harry Jol, University of Wisconsin.

GFP and Voxler are making visualization of GPR data quick and easy. ■

"Dig First" outcomes

(continued from page 1)

performing your "due diligence" before digging. Disruption of valuable services is serious. It puts people in danger, destroys costly construction equipment and causes substantial property damage. Incidents can result in fines on top of the costs of the repair of the utility. GPR surveys are recognized as a valuable part of the locating process and many jurisdictions have mandated its use before excavating.

Dr. Nemy Banthia from the Civil Engineering Department at the University of British Columbia confirmed to the "Vancouver Sun" that:

"It's important that contractors get the most exact information they can before they dig. Ground penetrating radar is a very good way of doing this. So anybody who is excavating should do GPR mapping of the place before anything happens, especially if there is a sensitive pipeline here."

THE VANCOUVER SUN

FINAL EDITION SERIOUSLY WESTCOAST SINCE 1912 THURSDAY, AUGUST 2, 2007

Ground penetrating radar

Terraprobe, a Burnaby-based firm specializing in ground-penetrating radar, has mapped the Kinder Morgan pipeline with scientific precision.

Top of the asphalt
1.4 m
Top of the pipeline

The top of the Kinder Morgan oil pipeline shows as bright curved shapes (above) on the readout from ground-penetrating radar. The device quickly mapped underground pipes — oil, gas and water — for The Sun.

PETER BATTISTON/VANCOUVER SUN

Caxba Ekse, President of Terraprobe Geoscience Corp., on site of Burnaby oil spill.

Technician Terry Wong with radar at the site of the damaged pipeline.

Radar quickly pinpoints pipeline

BY JONATHAN WOODWARD
VANCOUVER SUN

While there has been much discussion about where the Kinder Morgan pipeline actually runs under Inlet Drive in Burnaby, *The Vancouver Sun* can now say exactly where it is.

A Sun reporter and photographer donned hard hats and safety vests, slipped past flag people Tuesday evening and joined a crew from Terraprobe, a Burnaby-based firm specializing in ground-penetrating radar, to map the pipeline with scientific precision.

Using a lawn mower-sized device, the whole procedure took less than 30 minutes, and enabled *The Sun* to know within centimetres not only where the 61-centimetre (24-inch) pipeline was along the suburban highway stretch, but also every water main, electrical line and major underground structure.

"The pipeline is a very large, obvious target," said Caxba Ekse, president of Terraprobe, whose firm offered to do the probe. "If we had been able to do this last week, we would have accurately mapped the pipeline's location then, too."

The results from one cross-section of the readings show the pipeline at about 1.4 metres below the asphalt, in a line roughly following the pipeline map provided to The Sun by its previous owner, Terasen Inc.

Whether the pipeline's location corresponds exactly to the maps handed to the contractor and meets the standards required for an excavation is a more complicated question, better left to Transportation Safety Board investigators.

It's important contractors get the most exact information they can before they dig, said University of B.C. civil engineering Prof. Nemy Banthia. "Ground-penetrating radar is a very good way of doing this. So anybody who is excavating should do GPR mapping of the place before anything happens, especially if there is a sensitive pipeline here."

Figure 2: *TERRAprobe, demonstrated to the local newspaper how a Noggin 250 SmartCart system could have been used to determine the location of the pipeline.*

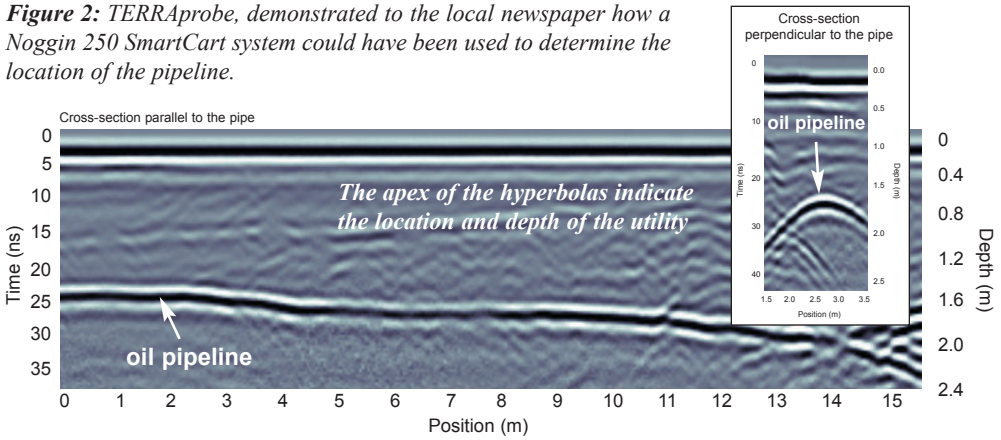


Figure 3: *GPR cross-sections showing the lateral position and depth of oil pipeline.*

Data and photos courtesy of Terraprobe Geoscience Corp. ■

A new transducer for the pulseEKKO® PRO

TR1000

The TR1000 transducer is the newest member of the pulseEKKO PRO family. Based on customer interest, the light weight compact sensor head of the Conquest systems has been adapted to run with the pulseEKKO PRO Control module.

The TR1000 transducer provides 1000 MHz bandwidth GPR data with integrated odometer and remote event marker. The new system configuration is ideal for complex and unusual infrastructure assessments. The embedded pulseEKKO PRO software provides both line profiling and grid scanning capability.

With post acquisition PC based software (EKKO_View, EKKO_Mapper and Voxler), a variety of sophisticated analyses and data visualizations in section, plan and 3D form are available.

The TR1000 facilitates work in hard to access areas. The light sensor head is ideal for overhead work. The compact self contained DVL acquisition and display means the system can be easily carried by one person.

TR1000 surveying over a structure and the 3D visualization of the data.

The TR1000 is available as an optional sensor to add to other pulseEKKO PRO systems or in the complete self-contained pulseEKKO PRO infrastructure inspection configuration.

For further details of the power and potential of the TR1000 contact our Applications Specialists. ■

Ask-the-Expert

Can GPR be used to detect oil from a pipeline leak at shallow depths?

As the oil pipeline spill story attests to, near-surface contamination by hydrocarbons is a problem all over the world. We wish that GPR was a magic-bullet solution but unfortunately the physics and our experience indicate that hydrocarbons do not change the electrical properties of the soil enough to be routinely detectable by GPR.

Under ideal laboratory conditions,experiments have shown subtle changes in the ground image before and after the introduction of oil; however, real-world problems are in the "after" situation where there is no "before" data to compare to. We have cautioned many people over the years about falling prey to silver-tongued sales pitches that GPR can easily map the extent of hydrocarbon contamination.

There is certainly experimental indication that bio degradation can create higher attenuation. In some instances of water saturated soils, the higher contrast between hydrocarbons and water may also provide GPR responses.

Some types of contamination are detectable with GPR; specifically those (like chloride-based liquids) that increase the electrical conductivity of the soil. ■

Recent Technical Papers

1. Effects of the transition zone above a water table on the reflection of GPR waves,
Geophysical Research Letters, Vol 33, L13309, doi: 10.1029/2006 GL0261, 2006.
By: Maksim Bano, 2006 ***ref 367***

2. Investigating multi-polarization GPR wave transmission through thin layers: Implications for vertical fracture characterization, Geophysical Research Letters. Vol 33, L20401. doi:10.1029/2006GL027788, 2006.
By: Georgios P. Tsoflias, Anthony Hoch, 2006 ***ref 368***

3. New Results on Comparison of Different GPR Systems and Antenna Configurations at the Roman Site Carnuntum
By: S. Seren , A. Eder-Hunterleitner , P.Melichar , W. Neubauer
2007 ***ref 373***

4. Agricultural Drainage Pipe Assessment Using Ground Penetrating Radar: Impact of Pipe condition, Shallow Hydrology and Antenna Characteristics
By: Barry J. Allred ,
2007 ***ref 374***

Upcoming GPR courses

One Day Noggin® Short Course
November 5, 2007
January 7, 2008

Our Noggin® short courses are offered throughout the year to anyone interested in learning more about GPR and subsurface imaging.

One Day Conquest™ Course
November 6, 2007
January 8, 2008

Our Conquest™ courses are offered to anyone interested in learning more about our concrete imaging instrument.

Information Request

Please check off information required below and fax or Email back:

- ☐ pulseEKKO® PRO
- ☐ Conquest™
- ☐ ConquestView
- ☐ Noggin® Systems
- ☐ OEM Noggin*plus*
- ☐ RoadMap™
- ☐ pulseEKKO® Borehole GPR
- ☐ EKKO_Mapper
- ☐ EKKO_View
- ☐ Rental Information
- ☐ 3 Day GPR Short Course
- ☐ 1 Day Noggin® Short Course
- ☐ Image Concrete with GPR
- ☐ Other (please specify)

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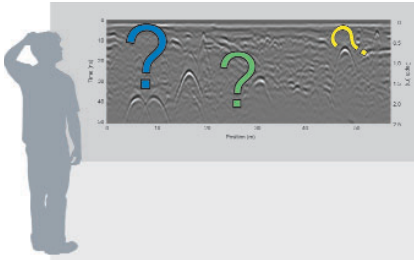

Need help with your GPR data?

Submit a data set and our Analyst will provide a report on your data.

www.sensoft.ca

Ask-the-Analyst

by Sensors & Software Inc.

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www.worldofconcrete.com

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