

## I-SITE SURVEY EFFICIENCY

**BHP Billiton Spence mine in the Atacama Desert of Chile uses the Maptek™ I-Site 8800 to record material volumes.**

The Spence project, in the Antofagasta province in the north of Chile commenced operation in 2006. Spence is an open pit, heap leach, solvent extraction and electro-winning project, with a capacity of 200,000 tonnes of copper cathodes a year. The Metallurgy department acquired a Maptek I-Site 8800 laser scanner in late 2010 for various applications.

One of the critical tasks is to manage reclamation of the leaching pads. The control method is by Roto shovel or estimated truck volumes. The I-Site 8800 system allows the operation to accurately measure height and volume of reclaimed material weekly, in a fast and safe manner.

**Since introducing the I-Site technology, a deviation of 5% in reconciliation tonnage has been identified.**

The I-Site system has also been used for measuring the gravel overburden, the advancing mine face, and for geotechnical and geological slope analysis.

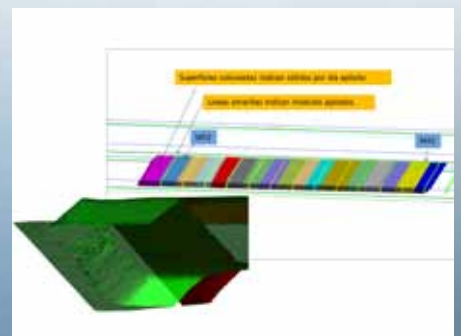
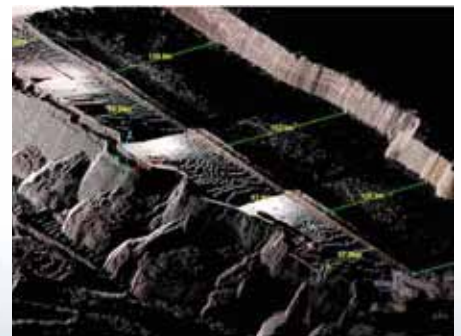
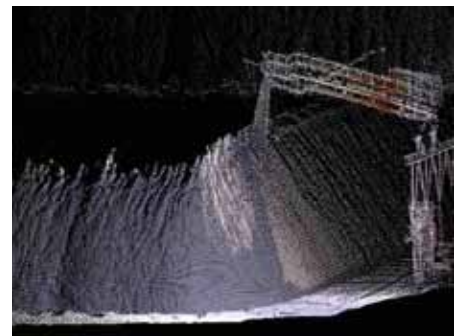
Dentro de las Operaciones de BHP Billiton en Chile, se encuentra el proyecto Spence, ubicado en la segunda región, provincia de Antofagasta. El proyecto consiste en una mina a rajo abierto, lixiviación en pilas, extracción por solvente y electro-obtención, con capacidad de 200.000 toneladas de cátodos de cobre anual.

El departamento de Metalurgia adquirió durante el año 2010 un Sistema de escaneo I-Site 8800 para diversas labores. Una de las tareas críticas es el control de reclamo de las pilas de lixiviación, donde se necesita el volumen de ellas y su altura. La metodología de control es de Roto pala o a través de volumen estimado de camiones (servicio externo).

**El Sistema I-Site ha sido utilizado para mantener un control exacto de volumen y avance de la extracción de pilas con una frecuencia semanal de una manera más rápida y segura, detectando una desviación en el control de tonelaje cercano a 5%.**

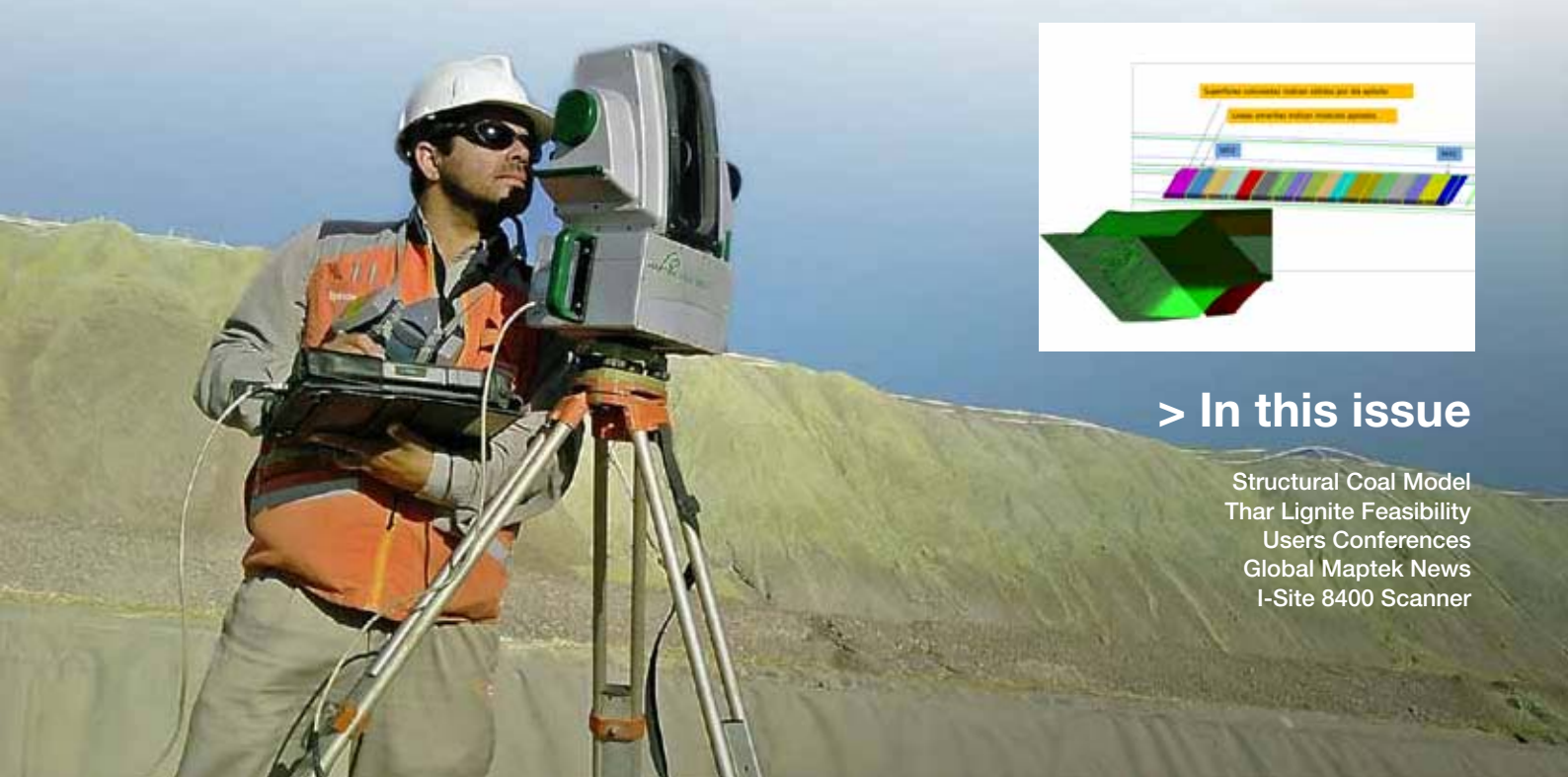
También el equipo ha sido utilizado en otras aplicaciones tales como control de avance de rípios, control de avance de mina, análisis de deslizamientos para Geotecnia y Geología. *dh*

*Thanks to Eduardo Hidalgo  
Hydrogeologist Leader  
Pampa Norte  
BHP Billiton*



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# STRUCTURAL COAL MODEL

**Drillholes are not the only source of data for interpreting the structure of a deposit and making decisions about mining.**

Many engineers prefer drillholes as the most reliable source since they are tangible points on a map and can be statistically reproduced. However, a lot more data can be profitably used by geologists making good interpretations and trusting their judgement. All sources, including seismic, mine workings, croplines and geological interpretations should be considered, but only trustworthy ones should be used in the final plan.

An underground coal mine in Routt County, Colorado has complex structures with asymmetrical folding affecting mine planning. Variations in slope from near zero to greater than 20 degrees across a short distance had led to the logical assumption of a thrust fault between the open pit and underground mine which might affect the extent of underground mining.

A road-cut showed evidence of near-vertical beds, which suggested a different interpretation than faulting. More evidence needed to be gathered. Drilling, which provides invaluable information for quality, coal thickness, and roof and floor properties, is not a very cost effective way of ascertaining structure, especially in terrains such as this.

Seismic, while better for structure, can still have interpretation issues. The vertical scale is time, not depth, plus scaling, vertical exaggeration, and curves/bends in the shot line from access and permit problems make it difficult to truly visualise the simple 2D representation.

In 2008, the Maptek Vulcan™ 3D environment was used in a 'medium-tech' but innovative way to provide a simple representation of the seismic data in 3D space. The images were 'registered'



Despite the steep beds behind, the drillhole showed flat lying strata from the core samples

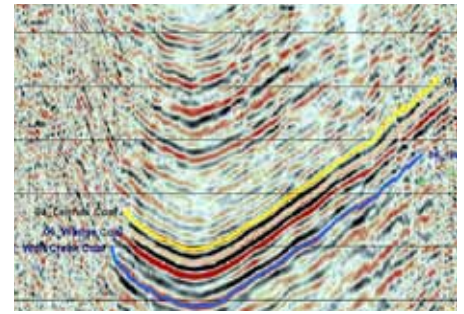
across a vertical triangulation to transform time to depth. Although not exact, it was enough to visualise the character of the structure. A major sandstone marker bed provided subsurface and surface control. A grid model was produced honouring the drilling, seismic and cropline data.

**The new subsurface model allowed the underground planners to develop their panels farther to the west than previously projected because the milder slopes extended farther than the previous modelling had indicated.**

Maptek's in-development 'high-tech' exploration product, Eureka, has much to contribute for seismic work. Raw SEG Y files can be read directly and displayed in the real XY plane with a Z-axis in time units. Once the seismic data is converted to depth via sonic logs or another process, you can use the 'smart line' options which are familiar to I-Site users who track geologic lineations.

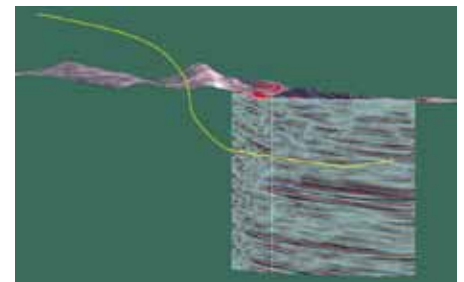
Cropline interpretations, made from an orthophoto image draped onto topography, were combined with the geophysical data to make a template curve of the folding. In parallel cross-sections, this curve, drillholes and the croplines were used to make modelling points for the seam structures, especially where erosion complicated the true structure.

The horizon information was augmented by data from the Colorado State Survey which had wells with a complete stratigraphic column.



Seismic data proved very useful, establishing a tight L-shaped fold rather than a thrust fault

With the effects of erosion removed, the character of the folding took shape, and the cropline interpretations could be refined.

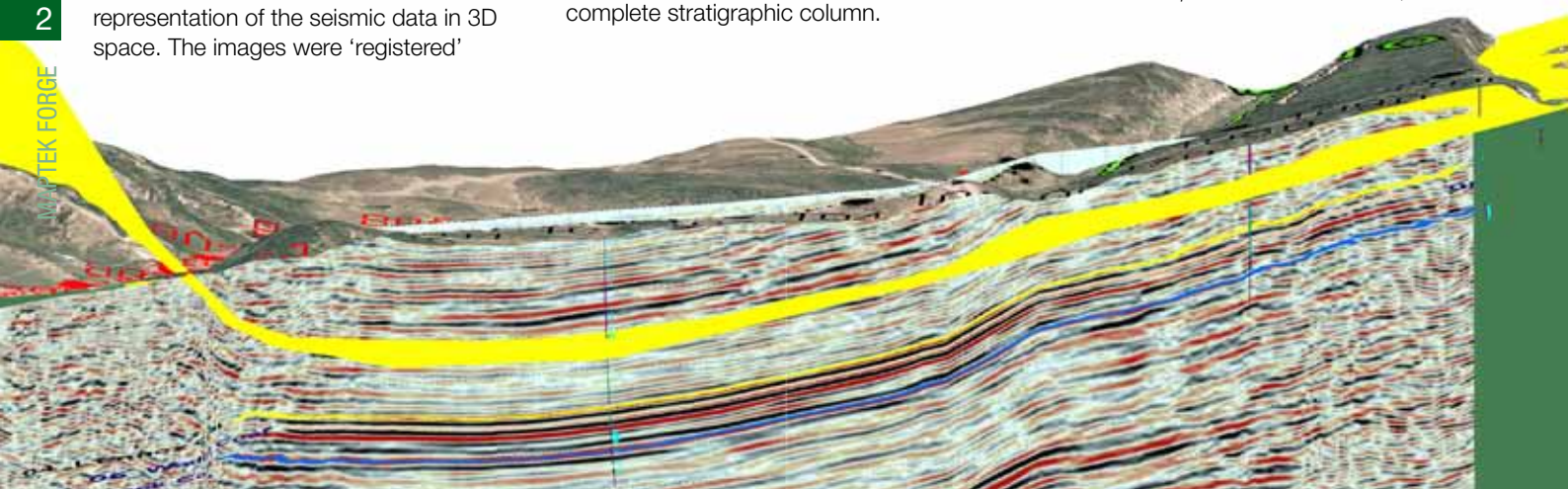


In section view, and using the geophysical points as a guide, it is now possible to make a template curve to accurately reflect the folding

Drillholes, spad elevations from mine surveys, seismic lines, croplines, and interpreted points were all used to produce a realistic structural model, which showed the coal continuing much farther than previously thought. Subsequent mining confirmed the model's accuracy.

Until mining is finished, you will never have all the data. Models must be continually refined – low, medium or high-tech ways can all contribute. Geologists estimate the extent and amount of coal before mining and engineers determine the best way to mine. Simulations are only as good as the models – geologists and engineers must work together for the best outcomes. *rw*

Thanks to Michael Wilkins  
Geologist  
Peabody Energy  
Presented at Europe-Africa Users Conference, 2011

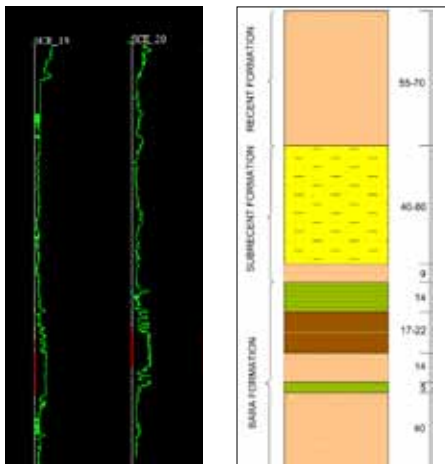


# THAR LIGNITE FEASIBILITY PROJECT

**This case study describes how an SRK geologist used Maptek Vulcan™ for resource estimation and integrated technical studies of layered deposits.**

The Thar lignite deposit in Pakistan is a sequence of thin and thick coal seams in a 40 metre envelope within a greater sequence of silts and sands. The horizons are sub-horizontal with a maximum slope of 3°.

While modelling the seams is important, the aquifers and overburden are the critical geology that affect the design and feasibility of the operation. Pit slopes are at a very shallow angle; assigning the correct densities and geotechnical parameters is critical to mine design and Net Present Value (NPV) of the project.



Downhole geophysical traces aided correlation of coal horizons and seam splits, as well as highlighting changes in overburden

Previous work had been done in 2D, so 3D provided a new and different approach. The historical datasets, geophysical logs, hydrological data and recent drilling were all assessed and validated. Reconciliation between the drillhole collars and topographic surface had an impact on the model so the grids were modelled iteratively until a robust geological interpretation was produced.

**Downhole geophysical logs were displayed in 3D and used to correlate the coal and overburden horizons.**

Vulcan's interactive tools allowed interval codes to be changed, validated and written back into the database. Critical waste zones were also identified and coded, and the FixDHD process was used to interpolate missing horizons and control further interpolation.

Grids were contoured to facilitate visual checking of correlations. Obvious errors were corrected and the models were rerun iteratively until the geologist was satisfied. The process was streamlined using specification files which record each step so that it can be easily repeated.

Coal quality composites were statistically validated. Reconciliation between historical and analytical data revealed that the historical coal quality was over-reported and was not used in the high confidence areas of the geological model.

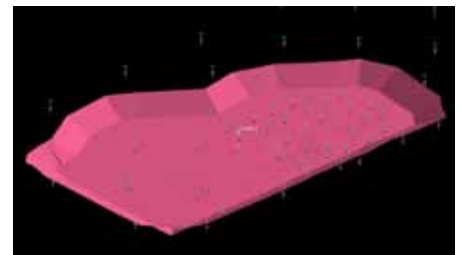
The final structural surfaces for the coal and overburden horizons and quality grids were used to create the stratigraphic model. The block size is chosen to reflect the X and Y resolution and selectivity for mining. The Z value for each block is variable.

The HARP block model holds the data in an easily accessible format. Creating multiple variables gives a lot of flexibility. HARP models can also be regularised for export into pit optimisation software. The advanced block reserving is very good, and the models handle faults and different mesh sizes for different surfaces.

Block model tools increase the flexibility of reporting and scheduling, and fed through into all parts of the feasibility study including geotech, pit design, scheduling and hydrogeological modelling.

Geotechnical design and simulation from dip and slope maps for different horizons was important to predict the angle of failure in the unconsolidated strata overlying the lignite. The thicknesses and strengths of the different waste horizons were investigated for implications on slope angles.

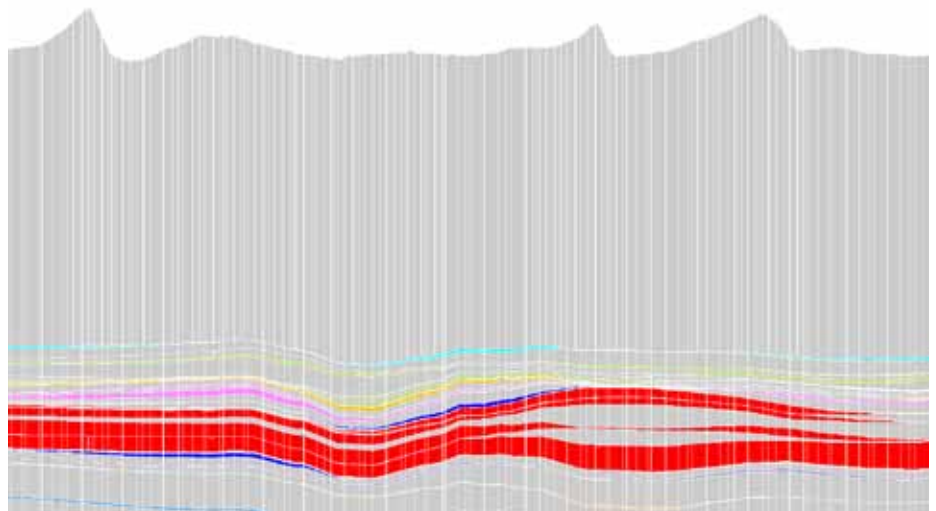
The aquifer core pressures were studied with respect to how the lithological thickness and porosity were going to impact mining. All of these factors were considered when developing pit designs and schedules.



Pit design tools are used for projection of strip ratio thresholds to the base of seam, creating a pit outline for reporting through the Vulcan advanced reserves editor

In summary, the geological interpretation tools in Vulcan are some of the most powerful for visualisation, cross-section generation and 3D interpretation.

Thanks to Anna Fardell  
Consultant Resource Geologist  
SRK Consulting  
Presented at Europe-Africa Users Conference, 2011



Stratigraphic model with waste horizons and resolution of 50m x 50m in the XY plane and a variable Z

# MAPTEK USERS CONFERENCES

## EUROPE-AFRICA

**A small but focused group exchanged stories at the Maptek clan gathering at Atholl Palace in the Scottish Highlands, in September.**

Customers from the UK, Africa, Europe, Australia and North America met with key Maptek staff from all regions.

'Clearly people gain value from attending conferences, and learn from the talks. The technical surgery sessions help users get extra training and information they need. Eureka and HARP stratigraphic modelling were extremely popular,' said Europe-Africa Regional Manager Duncan Lee.

Technical presentations on I-Site and Vulcan applications exposed attendees to new possibilities of using these products.

'By giving customers a snapshot of how Vulcan and I-Site are used at other operations, they see the solutions we can provide. Coal is an area of major focus and growth in our region, so it was great to hear local and international case studies on coal,' added Duncan.



Users conferences cement relationships with customers. They also promote skills transfer between Maptek staff. Product roadmaps, industry trends and developing technologies raised wide interest.

The Highland Clans dinner and quiz night, and tour of Edradour distillery were highlights of the social program.

**Professor Stuart Monro's keynote speech was thought-provoking.**

"When I was at university we did metamorphic geology, sedimentary geology, structural geology and never would any of these actually meet up. Now we've got to link it all in, with

computer science, visualisations and economics. So we need people trained to think across the disciplines, to think out of the box. I hope we are doing rather well with that in Scotland.

If we are actually going to engage with governments there are a number of challenges facing us. We need to know in a holistic sense what is going on from the core of the earth to the crust, the atmosphere and beyond!



To many of these challenges, we have no answer. When is the polar magnetic field going to reverse again? I don't know. And what is going to happen to us when it does? The earth's magnetic field protects us from solar radiation. What will be the effect when that diminishes? We don't know.

When is the next meteorite going to hit us? Well, it was probably yesterday, and there will be another one today. Fortunately they are quite small, but one of these days something bigger will fly in. What is going to happen with global warming? And what about methane hydrate? We have it in the tundra and in the deep oceans, what is going to happen when we warm up these oceans?

Or to look at it another way, is there a resource there that might be capable of being extracted? I don't know, you are the people that can answer some of these questions. I lay these challenges in front of you. But these are the things that we don't know. If we are going to understand how the Earth works and tackle the issues that confront modern Society, we have to understand the interaction between all of the Earth's facets.

No longer can we just be interested in one area, we must be interested in a whole range of other things as well and look at connections. Connections are perhaps the key to understanding many of the key issues facing the world right now."

*Excerpt from Keynote Speech presented at the Europe-Africa Users Conference, 2011*

## SOUTH AMERICA

**Maptek recently hosted one of the biggest users conferences in our company's history.**

Around 130 people registered for the event in Viña del Mar in early October. Customers from operations in Brazil, Peru, Chile, Argentina and Colombia joined Maptek staff from many regions.

Customer presentations ranged from conditional simulation for mine planning to I-Site applications, within geological modelling and open pit mine planning streams. Maptek showed the latest underground optimiser tools, new Vulcan modelling techniques, and the rapid pit design developments. Attendees previewed the new I-Site 8400 laser scanner.

'New products add another dimension to the proceedings and demonstrate that we are committed to bringing innovation to the market,' said Marcelo Arancibia, Senior VP South America.

With the conference being held one year after the rescue at San José, three of the miners were invited to tell the story. It was an emotional moment for the men, as well as Maptek staff who were involved in the events of 2010. The rescue operation was a strong case for how technology can help mines. 'Mind you, it was our best support case ever!' commented Marcelo.

'This conference delivered everything that Maptek believes is important - keep the thread of innovation running, deliver more products, and exchange experiences with our customers.'

'Maptek remains committed to an integrated approach which provides the best services to support our technology. This is highly valued by our customers,' Marcelo concluded.



Marcelo Arancibia (left) with San José miners and other attendees at the users conference



## NORTH AMERICA

24-26 October 2012  
Ritz Carlton, Denver

Plan ahead to take part in the Maptek Users Conference in Denver next year. Specialised training courses will be offered during the 2 days preceding the conference (22-23 October).

For information, email [info@maptek.com](mailto:info@maptek.com)



## AUSTRALIA

28-30 May 2012  
National Wine Centre, Adelaide

A wide-ranging technical program, tradeshow product booths and intimate forums will be supported by exciting social activities with an Olympic theme.

Visit [www.maptek.com/australia\\_2012](http://www.maptek.com/australia_2012) or email [register@maptek.com.au](mailto:register@maptek.com.au)



Join us for the 2012 Users Conference at the National Wine Centre Adelaide, South Australia from 28-30 May

Workshops  
Social Events  
Technical Papers

**Register now to realise your potential!**

Visit [www.maptek.com/australia\\_2012](http://www.maptek.com/australia_2012)

# GEOSTATS

## Maptek will host intensive courses in Applied Geostatistics in three offices in 2012.

Theoretical and practical sessions in the use of modern geostatistics in mining will be led by Professor Clayton Deutsch.

To register for the **Perth** course or to find out more, email [geostats@maptek.com.au](mailto:geostats@maptek.com.au)

Perth teaching sessions:

- > 30 January - 10 February
- > 7 May - 18 May

**Viña del Mar** will host the 11th Citation Course in South America.

To register or to find out more, email [cursos@maptek.cl](mailto:cursos@maptek.cl)

Viña del Mar teaching sessions:

- > 5 March - 30 March
- > 23 April - 27 April

**Denver** will host its 8th Citation Program. Register by 1 January 2012 to save 10%. Email [info@maptek.com](mailto:info@maptek.com)

Denver teaching sessions:

- > 28 May - 8 June
- > 20 August - 31 August



Richard Buckley, Maptek and Peter Ianella (right) at Adelaide University's scholarship ceremony in September. Emma Angeletti was also awarded a Maptek mining engineering scholarship for 2011.



Jason Richards and Athy Kalatzis with the new I-Site 8400 scanner at Intergeo in Germany in September

# CANADA OFFICE

## Maptek has opened a new office in Calgary, Canada.

Calgary is well-positioned to serve the mining industry in Canada. The new Maptek office will be managed by Carlito deSouza, who has experience in the oil and gas industry as well as various technical services roles.

As an I-Site Laser Scanner Sales and Technical Services Consultant, Carlito will initially concentrate on expanding the I-Site business in the region.

Maptek Canada Ltd

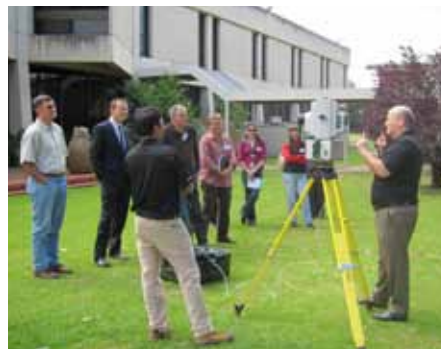
Suite 300, 160 Quarry Park Boulevard SE  
Calgary, Alberta, Canada T2C 3G3

Phone: +1 403 398 2469

Fax: +1 403 724 0091



Maptek hosted an industry tour of its Adelaide I-Site manufacturing facility in November



Maptek showcased its products at Expo in Melbourne in November

## VISIT MAPTEK AT THESE TRADESHOWS IN 2012

### January 23-24

Mineral Exploration Roundup (AME BC)  
Vancouver, BC, Canada - Booth C-15

### January 28-31

IME 2012 - Booth H2075  
Kolkata, West Bengal, India

### February 6-9

African Mining Indaba  
Capetown, South Africa

### February 19-23

SME - Booth 2315  
Seattle, Washington, USA

### March 4-7

PDAC  
Toronto, ON, Canada

### April 9-13

EXPOMIN  
Santiago, Chile

### April 25-27

IX Conferencia Internacional de Minería  
Chihuahua, Mexico - Booth 227-228

### May 6-9

CIM - Booth 506  
Edmonton, AB, Canada

### May 10-11

38th Symposium on the Geology of the Sydney Basin - Booth 10  
Hunter Valley, NSW, Australia

### May 14-16

9th International Gold Symposium  
Lima, Peru

### June 7-8

Elko Mining Expo - Booth 10  
Elko, Nevada, USA

### June 19-21

Hillhead 2012  
Buxton, UK

### July 24-26

Queensland Mining Expo  
Mackay, Queensland, Australia

### September 24-26

MINExpo International - Booth 6062  
Las Vegas, Nevada, USA



Katrina Cooper, Australian Ambassador in Mexico, with Maptek staff at Expomin in October

# INTRODUCING I-SITE 8400 SCANNER

**The Maptek™ I-Site™ 8400 laser scanner is built to get fast, accurate survey results.**

Launched at Intergeo following the international success of the long range I-Site 8800, the I-Site 8400 laser scanner is well suited to routine topographic and volumetric surveys.

A streamlined, lighter instrument, weighing only 12 kg, the I-Site 8400 has a range of 1000 metres and accuracy of 20 mm.

With robust engineering and industrial finishes to handle the rugged mining environment, it features internal digital compass, onboard controls, and USB memory storage. Optional connection to the handheld controller provides extra features and settings.

**The I-Site 8400 laser scanner operates in temperatures from below 0° to 50°C and is rated to IP65 for environmental protection.**

Data captured using the new laser scanner can be viewed using Maptek I-Site Topo, a subset of I-Site Studio™ software. I-Site Topo offers an abridged package suiting the common I-Site 8400 applications.

## FEATURES

- > Range up to 1000 metres
- > Rated to IP65 for environmental protection
- > Extendable memory - data captured and stored on removable memory
- > HHC option for extra scan resolutions
- > Operates in temperatures from below 0° to 50°C
- > Good battery life and ergonomics
- > Easy set up for mobile scanning
- > Onboard controls
- > Economic for routine survey
- > Suits topographic and indoor/outdoor stockpile survey
- > Applicable to underground survey with customisation
- > One step scan to volume analysis



### STOCKPILE VOLUMES

The I-Site 8400 laser scanner is the most economic system for conducting indoor stockpile surveys. Restricted access and space limitations present challenges for the surveyor tasked with obtaining accurate material volumes.

The I-Site 8400 laser scanner safely acquired 10.7 million fully surveyed (georeferenced) points on a 150 metre long indoor stockpile. The scanner was mounted on the crane-operated gantry 12 metres above the stockpile using Maptek's custom stair rail bracket, allowing an uninterrupted view.

Over 6,500 cubic metres of volume was calculated in just 30 minutes. Data was validated using I-Site Studio software and a volumetric model was generated to compare quarterly results.

The removable data storage and direct connection to the optional HHC mean the I-Site 8400 laser scanner is also ideally suited for mobile scanning of stockpiles.



### OPEN PIT SURVEY

The I-Site 8400 laser scanner is the survey workhorse for mid range scanning. An open pit measuring 1500 by 500 metres was scanned with 25 setups. In this example, the I-Site 8400 was mounted on a vehicle with supplementary tripod setups for some vantage points to complete survey coverage.

Raw data was loaded into I-Site Studio software to produce a detailed 3D pit model within hours. I-Site Studio functions include automatic toe and crest extraction, instant 3D modelling options, contours, sections and CAD extraction.

For more information, visit [www.maptek.com/products/i-site/i-site\\_8400.html](http://www.maptek.com/products/i-site/i-site_8400.html) or email [isite.sales@maptek.com.au](mailto:isite.sales@maptek.com.au)





# SEASONS GREETINGS

from Maptek

## VULCAN

**ADVANCED PROJECTS PTY LTD**, in Adelaide, South Australia will use Vulcan MineModeller for civil engineering consulting projects in SA mining operations.

**ALACER GOLD**, a gold producer and explorer, has purchased Vulcan for geological modelling and mine design. Headquartered in Englewood, Colorado, Alacer has operations in Australia & Turkey.

**BHP BILLITON PLC**, located in London, UK, has purchased Vulcan for mine planning.

**BLUE GOO ENTERPRISES**, located in Colorado Springs, Colorado, has purchased a GeostatModeller for consulting work. The company has also rented an I-Site scanning system for use in the field.

**BMP PARTICIPAÇÃO E EMPREENDIMENTOS LTDA**, a consulting company in Brazil, has acquired Vulcan for geology and mine design.

**CENTURY MINING**, based in Lima, Perú has acquired Vulcan for exploration work.

**ENDEAVOUR SILVER CORP. - MINA BOLAÑITOS**, will use Vulcan for geological modelling and underground design in their Guanajuato mines project in Guanajuato State, Mexico.

**FORMATION METALS INC.** will be using Vulcan for mine design and geological modelling at its underground Idaho Cobalt project in Salmon, Idaho.

**HEMCO NICARAGUA** has acquired Vulcan for open pit mine design and geological modelling for their project in the Bonanza region, Nicaragua.

**KLONDEX MINES LTD** has purchased Vulcan for block modelling and mine design at its Fire Creek Mine underground gold operation in Elko, Nevada.

**MINING PLUS**, based in Adelaide, South Australia, has purchased a networked Vulcan GeoStatModeller with additional open cut mine design functionality for consulting work.

**PT GUNUNG BARA UTAMA**, Jakarta, Indonesia has acquired Vulcan GeoModeller and MineModeller for use in their new open cut coal mining operations in Kalimantan.

**SEAFIELD RESOURCES** has purchased Vulcan for geological modelling and resource estimation of properties in the Quinchia gold district of Colombia.

**Torex GOLD RESOURCES INC. - MINERA MEDIA LUNA**, a Canadian mining company engaged in exploration and development of precious metal resources, has acquired Vulcan for geological modelling. Torex owns the Morelos Gold Project, 180 km southwest of Mexico City.

**VALE SCM TRES VALLES** in Chile has acquired Vulcan for geological modelling, resource estimation and mine design as well as a Short Term Planner for sequencing.

**WALTER ENERGY WESTERN COAL** has acquired Vulcan for geological modelling and underground mine design at the operations near Neath in South Wales, UK.

**XSTRATA ZINC** has purchased Vulcan for use in underground mine planning, ring design and geological modelling for the Lady Loretta site, north of Mt Isa in Queensland.

## I-SITE

**AFRICAN RAINBOW MINERALS NKOMATI MINE**, an underground and open cut nickel operation in the Machadodorp area of the Mpumalanga province, 300 km east of Johannesburg, has bought an I-Site 8800 to speed up month end surveys and increase reporting accuracy.

**BHP BILLITON YANDI IRON ORE MINE**, an open pit operation 180 km northwest of Newman in Western Australia, will use an I-Site 8800 with vehicle mount for survey of active work areas, geological and geotechnical mapping.

**BHP BILLITON MITSUBISHI ALLIANCE (BMA)** operates 7 metallurgical coal mines in the Bowen Basin in Queensland, Australia. BMA has purchased 3 I-Site 8800 laser scanners for Goonyella and Blackwater mines, for end of month survey applications.

**CAMECO - CIGAR LAKE** uranium project in Saskatchewan, Canada has purchased I-Site Studio to process laser scanner data.

**FMG CHRISTMAS CREEK** iron ore mine in the Pilbara, Western Australia, has acquired an I-Site 8800 laser scanner for stockpile, end of month pit and general surveys.

**KINROSS PARACATU MINE**, a large scale open pit gold operation 230 km from Brasília, the capital of Brazil, has purchased an I-Site 8800 laser scanning system for accurate pit volume reconciliation and stockpile volumes.

**LEIGHTON CONTRACTORS** operates the Peak Downs open cut mining operation, and has purchased an I-Site 8800 laser scanner for daily workface pickups, general and end of month surveys.

**NEWMONT GHANA GOLD LTD**, operating the Ahafo operation and Akyem project, has purchased an I-Site 8800 laser scanner.

**RIO TINTO CLERMONT** thermal coal mine, 12 km northwest of Clermont in Queensland, will use an I-Site 8800 laser scanning system with vehicle mount for end of month survey.

**RIO TINTO HAIL CREEK MINE**, in Nebo, Queensland will use a vehicle mounted I-Site 8800 laser scanning system for end of month survey and stockpile volumes.

**TECK COAL LTD** of Vancouver, BC has ordered 7 I-Site 8800 scanners, to be deployed at each of the Teck metallurgical coal mines in British Columbia and Alberta. The systems will be used for end of month survey and for collecting and analysing geotechnical data.

**VALE TRES VALLES** copper complex in central-northern Chile consists of a copper processing plant and two mines. The I-Site 8800 system will be used for pit survey and volume control at the Don Gabriel open pit mine. The underground boom mounting will facilitate ring dilution control, excavation and cavity survey in the Papomono operation.

**XSTRATA COPPER LOMAS BAYAS** open cut copper sulphide operation, near Antofagasta in northern Chile, has purchased an I-Site 8800 laser scanning system for geology, general mine surveying and volume control on lixiviation stockpiles.

