Mine surveying technology

Mine surveyors are responsible for maintaining an accurate plan of a mine as a whole and will update maps of the surface layout to account for new buildings and other structures.

By Torah Onyango
vComp Pty Ltd

vComp Pty Ltd is an Australian based company that specializes in software development, consulting and training for Tcl scripting under the Surpac software environment. vComp is a leader in the development of both Surpac extensions and other third party software products that complement any major mining software package. Through its Mine Solutions web site it has software present on mines in over 20 countries including the DRC, Egypt, Ghana, Mali, Namibia, RSA, and Tanzania.

Their products include the MSO application that is used to process and create raw data files from the Leica Geosystems range of survey equipment. The application will read/write data from TPS1000, TPS1100, TPS1200, GPS1200, and the new TS15 instruments.

MSO creates data files for those instruments from a Surpac string file or stations database in either the on board DBX or GSI format. The application uses an FLD (Field) file to process data making it easy to view edit and interpret observations. MSO also maintains an instrument collimation log and a processed job log for auditing purposes. Another of their survey products is the FlexiSurv which is a suite of programs. The FlexiSurv functions streamline many of the daily survey tasks putting them into a simple process making what is normally a time consuming and error prone set of manual tasks into a logical single process.

The FlexiSurv suite includes functions to manage survey lasers including producing laser offsets easily. It has a customizable survey memo system eliminating hours of plot editing. The level solids function takes survey pickup strings and drive outlines to effortlessly create a wireframe model. It includes a unique process for calculating and reporting over-break/under-break.

A number of other functions are also available in the application. New developments include CMS filtering and stitching. The unique feature about these products is that the features have universal appeal but features can be customized for each mine. David van de Veen, Managing Director, says that these products are proven time and money savers as they automate manual tasks a surveyor would otherwise have to perform.

Langley Technical Services Pty Ltd.

Langley Technical Services was established in 2006 and is managed by Troy Langley a Registered Mine Surveyor.

LTS aims to give all mine surveyors the ability to model and understand the accuracy of their survey control networks and to produce objective evidence of the accuracy of these survey networks. With the power of modern software, detailed survey networks can be modeled and compliance test run to prove networks accuracy or to find problem areas in the network. With increased regulation requiring accuracy statement for survey networks, the need for surveyors to have complete confidence in their survey control has never been greater.

LTS offers customized training for all surveyors, who at the end of this training will be able to take daily electronic fieldwork and produce detailed survey control network models with one button compliance tests.

LTS offers the following Services: General mine setouts and pickups, volume calculations, end of month mining pay calculations, short term to long term surveyor coverage, registered mine surveying, check surveying, ICSM SP1 statements for survey networks, for old and new fieldwork, submission of mine plans to the new work safe Australia’s survey and drafting directions, submission of plans for QLD Standard 10 directives. Submission of plans for WA Class 1 standard. Auditing of department internal systems and compliance to design reports.

Troy Langley from Langley Technical Services Pty Ltd says that the emerging trend in the mine survey industry is that there will be more regulation and the need to produce “objective evidence” to the quality of survey control networks.

DAT/EIM Systems International

Based in Anchorage, Alaska, DAT/EIM Systems International® is a company that has been developing digital mapping and photogrammetric hardware and software since 1987.

Summit Evolution™ is a full-featured digital photogrammetric system designed to be powerful, flexible and customizable to your needs. It makes mapping easier and provides precise data collection with fast, vivid 3D stereo viewing along with other DAT/EIM software including: Landscape™, Capture™, Contour Creator™, MapEditor™, Airfield 3D™ and Ortho+Mosaic™.

DAT/EIM Summit Evolution is DAT/EIM's flagship product and the primary tool for vector information collection from stereo images. Using the proprietary DAT/EIM Capture interface, vectors are collected directly into one or more companion CAD or GIS programs. Capture works in the background to send 3D (X, Y, Z) ground coordinates to the companion application. Simultaneously, 2D or 3D features from the CAD or GIS program are rendered back in true relative 3D position in the stereo display using DAT/EIM Superlapse™ for immediate feedback and feature verification. The user’s experience and productivity are enhanced from precise and instantaneous validation of their work.

Currently supported companions are AutoCAD®, MicroStation®, and EasyGIS®; the Capture API (Application Program Interface) is also available to enable development for other CAD and GIS programs. The stereo capture capability is a real boon to people trying to interpret imagery: urban planners, foresters, wetlands biologists, ecologists. Enter the powerful world of 3D digitizing and drawing the editing with DAT/EIM Summit Evolution.

DAT/EIM Capture also interfaces to DAT/EIM’s other flagship products, the Landscape point cloud editing toolkit, and hence to the companion CAD or GIS applications. Landscape, Summit...
and Capture all work seamlessly together in the stereo environment to present a unique means of overlaying and working with vastly different types of terrain data. When melded with the out-of-the-box terrain, data validation, and vector construction tools, DAT/EM software provides unprecedented insights into one's environment.

Asked on her advice to mine surveyors, Tara Tate Marketing Coordinator, says “Look for quality and support. Reliability is key to productivity. The power, stability, and ease of use of DAT/EM software are reasons for its widespread and growing adoption, which are powerful indicators of the confidence thousands of users have placed with us.

We would advise our users to pay attention to the proliferation of new sensors from satellite-, airborne-, and ground-based platforms. These new forms and types of data will grow in availability and variety, and become increasingly cost-effective alternatives to traditional data gathering methods. Leveraging these tools increases the efficiency of people on the ground.

Lidar is becoming increasingly important and data-rich, and its availability mirrors that from image-based solutions. New platforms, including Unmanned Aerial Systems (UAS) are at an exciting stage of development and are worth watching. New orthophotometric systems for offshore (fresh and marine) environments are also a developing technology.

MCE Lasers
Australian laser manufacturer MCE Lasers design lasers used for alignment and leveling used in a wide array of applications. In its mining division they are typically used for tunnel construction and alignment of tunnels driven by tunnel boring machines, drill and blast, pipe jack or conventional hand techniques.

The full range is rugged and entirely made from materials such as stainless steel, anodized aluminium and brass. The lasers incorporate diode technology and can be powered by a variety of battery supplies, from 9 V cell batteries to LR44 cell batteries, suited to the customer’s ideal operating time and physical size requirements.

MCE Lasers is a 30 year old Australian company that specializes in the manufacture and design of lasers for alignment and leveling. After years of review and consultation with some of the biggest mining laser clients, such as Rio Tinto, Newcrest, Xstrata Coal and BHP, the mining industry can be confident that the complete range not only meets but exceeds expectations.

The range offers a unique array of features such as user defined focussable green or red beam for extra long-range, single and dual beam lasers, fine generator optics, beam splitter optics, intrinsically safe lasers for use in explosive areas, MCE Lasers aims to provide the mining industry with state-of-the-art Geographic Information Systems (GIS) software. GIS is a valuable tool to visualize spatial data or to build decision support systems for use in your organization. A GIS stores data on geographical features and their characteristics. The features are typically classified as points, lines, or areas, or as raster images.

On a map, mining data could be stored as points, road data could be stored as lines, and boundaries such as natural resource fields could be stored as areas, while aerial photos or scanned maps could be stored as raster images. GIS stores information using spatial indices that make it possible to identify the features located in any arbitrary region of a map.

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are also possibilities for rapid resource estimation and quick setting of borehole coordinates. All their systems are designed to be simple and effective to use in the field with minimal training, to minimize operator errors, dramatically increase productivity, sensitivity and accuracy, and to reduce end-user’s field survey costs.

Carlson Software
Carlson Geology, Carlson Underground Mining, and Carlson Surface Mining modules from Carlson Mining are easy to learn, affordable, and feature fast-paced technological development driven by clients’ needs. This explains why Carlson Software is the largest provider of software for mines in the United States and has expanded and is also in use in Russia, India, South America, Europe, Africa, Australia and more.

Whether the application is permitting, geologic mapping, underground mining, surface mining, reserves studies, reclamation or machine control, Carlson provides uniquely powerful automation combined with its trademark ease-of-use.

Over its 25 years of development, Carlson Mining has progressed to now providing a comprehensive set of mine mapping tools, including projections, symbol placement and mine quantity calculations.

Recent improvements to the feature rich software include Parent/Child Strata Splits – Improved reporting in Surface Mine Reserves to automatically report quantities as parent strata for areas without children strata, Surface Mine Reserves – Improved speed to run more than three times faster with an option added to process with low precision on grid cell subdivision for running another two times faster for quick, rough calculations and Underground Splits – New set of commands for underground cavities to model, draw, label and get quantities. Other recent enhancements to the software have included expanding 3D abilities within bench pit design, added methods to assign block sequence by rules with added real-time display of selected quantities and qualities in scheduling selection, augmentation of the haul truck cycle analysis routines, enhanced visual feedback in the underground timing sequencing, and increased ability to produce customized, more professional reports.

In addition, Carlson machine control software, Carlson Grade, TruePit, and Fleet Manager Office, allows mine management to increase productivity, accurately track materials, and enhance safety on the site.

For reclamation needs, Carlson’s unique Natural Regrade program enables mining operations to not only meet, but also exceed environmental standards. Natural Regrade with GeoFluv creates a landscape that harmonizes with natural forces and does not require expensive long-term maintenance and repair. Grant Wenger, co-director of the Carlson Mining Division, says that when buying mine software, look for ease-of-use and options that allow you to receive data and send data to different branches of your project. Carlson provides all this at affordable prices.

Digital Globe
DigitalGlobe is a leading global provider of high-resolution earth imagery solutions. Sourced from the world’s leading satellite constellation, its imagery solutions deliver unmatched coverage and capacity to meet customers’ most demanding mission requirements. Each day customers in map making and analysis, mining, environmental monitoring, and oil and gas exploration depend on DigitalGlobe’s geospatial solutions to gain actionable insight. DigitalGlobe’s satellite imagery and analysis can be used for mining throughout Africa to plan exploration, perform daily operations, ensure environmental compliance and complete land reclamation.

Its imagery solutions help mining professionals identify, analyze, and act on geological data. Additionally, it reduces the time and resources required to find, mine, and recover the resource site. Existing vegetation, hydrology, population centers, soils and infrastructure are easily mapped using satellite and aerial imagery.

DigitalGlobe can also help evaluate before and after images to show progress, boundary compliance, and restoration needed to return the site to pre-mine health. Because satellite imagery eliminates much of the on-site field study previously required for day to day and follow up operations, the industry gains valuable insight and efficiencies on shield, land restoration, and operational impact, while enjoying significant cost savings. A DigitalGlobe base map of high-resolution imagery is valuable for feature extraction, analysis and classification through all stages of the mining lifecycle. Kumar Navulur, DigitalGlobe’s Director of Next Generation Products, says “DigitalGlobe’s satellite, WorldView-3, is scheduled to launch this summer. WorldView-3 is the first multi-spectral, high-resolution commercial satellite. Operating at an expected altitude of 617 km, WorldView-3 provides 31 cm panchromatic resolution, 1.24 m multispectral resolution, and 3.7 m multiresolution resolution.

WorldView-3 will offer the most spectral diversity available commercially and the first to offer multiple shortwave infrared (SWIR) bands that allow for accurate imaging through haze, fog, dust, smoke and other air-born particulates by determining what is outside of the human vision spectrum. The SWIR bands on WorldView-3 will enable new and unique applications for the mining industry, such as mineral identification.

WorldView-3 can identify different rock types, weathering regimes and surface materials, including their mineralogy and their alteration signatures.”

Fugro
Fugro is involved throughout the entire life cycle of mining projects. From initial desk studies, via reconnaissance and exploration through feasibility and construction into operation through to closure, they provide all supportive geological, hydrological, geotechnical, environmental and survey services and supply integrated mine data.

Fugro is experienced in slope stability analysis for open pits, tailing dams, dumps and stockpiles, in mineral reserve and resource estimation and classification as well as economic analysis, mine planning and feasibility studies and also assist with approval procedures in accordance with applicable standards, laws and special regulations.

With more than 20 aircraft equipped with a broad range of cameras and sensing technologies, Fugro have successfully completed photographic, mapping and LiDAR surveys of numerous mining sites around the world. LiDAR is a rapid, highly accurate and non-intrusive survey method used to capture and create a detailed model of the terrain, infrastructure or vegetation.

Fugro has worked on projects for mining companies in Cameroon, Congo, Cote d’Ivoire, Ethiopia, Guinea, Liberia, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Senegal, Sierra Leone, South Africa, Tanzania and Zambia. They have also carried out work for various governments and engineering firms and are currently working with a major mining company to provide a web-based service environment for their mine data. Naith O’Hagan, Marketing Manager, says “Mining developments are often multi-billion dollar investments.

Delivering complex projects on time and budget with world-class standards of health, safety, environment, and quality (HSEQ) is essential. On a mining development, technical risks associated with ground conditions are large, and collection and interpretation of quality data and development of cost effective technical solutions is imperative.

However, sound technical solutions in themselves are not sufficient in a project development environment. Owners and contractors need partners with the highest standards of project management.

In addition to solving the technical risks, delivering on-time and on-budget while delivering HSEQ and delivering local expectations are essential.”

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