

Earth moving made easy task by intelligent dozer



Moving earth is a fact of life in mining and construction – a painstaking and time-consuming task. Leica Geosystems, in partnership with Tritronics (Australia) Pty Ltd and assisted by their Australian Distributor, C.R. Kennedy & Company Pty Ltd, however, have developed just the solution – the Leica DOZER 2000T. Without even stepping out of the office, the mining engineer and surveyor have direct radio contact with the machine operator who is working with the bulldozer. Digital Terrain Models (DTM) are relayed directly to the machine, guiding and verifying earth grading by real time GPS and completing this task more efficiently, in less time, and with considerable savings across the entire project.

The success of a recent trial by mining giant BMA (BHP Billiton Mitsubishi Alliance) at their Blackwater coal mine in Queensland, Australia, has led to an order of 15 Leica Dozer 2000T integrated systems for the Blackwater Mine. A further 19 units have been ordered for three other mines within the BMA operation – a significant sign of the considerable potential that this revolutionary technology has for the industry.



The Leica Dozer 2000T guides and verifies earth-grading by real time GPS.

For some time, BMA have wanted to improve the process of relaying instructions from the office to the various machine operators on site. After an assessment of all dozer systems on the market, BMA approached Leica Geosystems at the end of 1999 to further investigate the Leica Dozer 2000 machine guidance package.

It was decided to trial the Leica Dozer 2000 package at BMA's Blackwater Mine. Using Global Positioning System (GPS) technology, the Leica Dozer 2000 is able to clearly indicate the position of the earth moving machine relative to the desired "design" surface, enabling the operator to move left or right, and to cut and/or fill accordingly.

Better data transfer and integration

Although the Leica Dozer 2000 worked well during the trial, there was still a requirement for better data transfer. "In particular we were looking for productivity improvement because at that stage there was no way to bring data back to the office automatically," said Ian Rogers, Technology and Communications Manager for BMA. The normal Leica Dozer 2000 setup meant that data had to be transferred via a PCMCIA card from the office computer to the on-site machine.

"BMA wanted to simplify the radio networks and obtain the production data in real time," David Williams from Leica's Australian Distributor, C. R. Kennedy & Company Pty Ltd said. "The Leica Dozer 2000 is a stand alone system as the memory card needs to be returned back to mine office for transfer of data. On a mine that

stretches 64km, this can be very time consuming."

Integrated Mining System

In February 2001, BMA introduced Leica Sales Representatives to Queensland Company Tritronics (Australia) Pty Ltd, world leaders in the design, development and installation of mine machine monitoring and information systems.

For the past six years, the Blackwater Mine has been using Tritronics' Fleet Management System – a communications network that allows mine production to monitor machinery throughout the whole mine by use of GPS receivers. BMA has invested significantly into this system with the upgrade of 75-80 pieces of equipment with new high-speed radios in order to incorporate them into the new system software Integrated Mining System (IMS). The IMS combines powerful reporting and analysis software with reliable radio telemetry to deliver accurate monitoring and reporting. "Tritronics were well established and well trusted," Anders Mangen, C. R. Kennedy's National Survey Division Manager, said. "They had proven to BMA that they could deliver a good system – particularly for a complicated big mine like the one at Blackwater."

"With the IMS system we can locate drills, water trucks and other vehicles over the entire 64km mine strip on a computer back in the office," BMA surveyor Brad Payne said. "Information such as the job description, production statistics and current machine operator can also be provided."

Following discussions with Tritronics, it was decided to incorporate the Leica Dozer 2000 package into the Tritronics Integrated Mining System.

"We were asked to do the integration between the GPS systems and the data telemetry system and also to connect the dozer into the reporting system," said Geoff Baldwin, Manager of Tritronics. "It wasn't overly

complicated. The biggest problem was the file transfer system – ensuring that large files can be transmitted over the radio system. This is especially difficult when there are often breaks in transmission such as when the dozer is turned off during a download."

Productivity, security and savings

Consequently, over the last six months BMA Blackwater has been trialling the Leica Dozer 2000T integrated system – which has opened up a radio link, providing the engineer with direct contact by radio to the machine operator and allowing complete computer designs in the office to be sent directly out to the dozer.

The integration of the IMS and Leica Dozer 2000 has demonstrated a considerable increase in productivity. According to Ian Rogers, the company envisages considerable savings. "We believe the trial showed some productivity gains and though it's hard to say how much at this stage, we are looking for pay back from the system within three years."

Most of these savings are generated by eliminating the need for survey staking and reducing the re-handling of spoil.

For Operators such as Les "Pfeffy" Pfeff, the Leica Dozer 2000T has made the job easier. "It's a lot easier to do the job now because you follow a plan," he said. As



The GPS Base station transmits data to the Rover.



The cab holds a ruggedised touch-screen computer.



The bulldozer operator is in direct contact with the office.



Mine design software is used to provide details of cut and fill.

Leica Dozer 2000

The Leica Dozer 2000 combines a Machine Guidance Global Positioning System (GPS) receiver with Computer Aided Design (CAD) software, to allow determination of the exact position of the vehicle in "real time". A screen display in the cab clearly indicates the position of the earth moving machine relative to the desired "design" surface, enabling the operator to move left or right, and to cut and fill accordingly.

For high accuracy, a GPS Base Station is established on site, consisting of a GPS receiver and radio transmitter to transmit differential GPS signals to any number of rovers within 10km range. The Rover is mounted on the Dozer, consisting of a GPS receiver (Leica MC500), a ruggedised touch-screen

computer loaded with the Leica Dozer 2000 software, and a radio receiver. The radio receives the GPS data transmitted from the Base Station where it is processed in the Rover GPS receiver, displaying the position of the machine on the Computer.

Once operating, the Rover GPS receiver measures the grade 10 times per second and the Leica Dozer 2000 software displays cut and fill amounts along with views of the dozer.

In the office, surveyors and engineers need to prepare data files to the Leica Dozer 2000. Mine design software (such as Vulcan) is used to create these files with text of final design plans detailing the cut and fill from a design surface. In addition, the location of equipment relative to existing features (buildings, existing roads, bridges etc),

calculation of the offset from a road centreline and the volume of earth that has been moved during each work period can be provided. The 'Leica Site Manager' then enables the conversion of these files to configure the Leica Dozer 2000. The information is then ready to be transferred from the office computer to the site computer and back again.

The Leica Dozer 2000 product can be purchased as a standard Leica Dozer 2000 stand-alone system with data transfer via a PCMCIA card, or it can be purchased as the Dozer 2000T system integrated into the Tritronics IMS system. The Leica Dozer 2000 system was introduced to the market by Leica Geosystems, in cooperation with Carlson Software.



The Rover GPS radio receiver is mounted on top of the Dozer.



The Leica Dozer 2000T communications components are mounted outside the cab.



Surveyor Brad Payne: "Now we get it right the first time – there is no cause for errors."

for training and operation, Pfeffy said that it really is just a matter of pushing the buttons on the touch screen. "You haven't got to be a whiz kid to understand this sort of thing."

Work is also safer, especially at night when visibility is poor. There is now less need for the operator to get down from the cab to check the equipment or stakes. The Leica Dozer 2000T also provides a warning alert when the design plan is not being followed correctly.

"Here on the mine its just lots of dirt and as quick as you can," Bevan Reibel, Senior Stripping Foreman said. "However, near enough is not good enough – by doing it accurately the first time, it is quicker because there is no re-handle and re-work. This system gives live information and therefore it is an aid in the machine to help the operator to do his job."

"Ultimately this allows the operators to feel more in control," Andy Davidson, Engineer for the Business Improvement Group said. "Information between shifts is shared, promoting more efficient work towards a common goal and eliminating time wasting. We are empowering operators to do their job better, and with million dollar equipment involved, involving the operators is a crucial part of adding value to the process."

Brad Payne was also keen to highlight the productivity saving during the re-grading of roads. "The slope of a grade is really important – and it is best for the machines to stay in second gear to get up the hill, otherwise the transmission is strained. In the past, to



Operator Les "Pfeffy" Pfeff: "The Dozer 2000T has made the job easier. It's just a matter of pushing the buttons on the touch-screen."

re-grade a road we used to have to work five to six hours on the weekend just to build up the ramp and get it right. Now we get it right the first time – there is no cause for errors."

Working smart will also save machinery from wear-and-tear as well as reduce maintenance and fuel costs.

There have also been discussions to install the

dozers and one dragline assist dozer and were implemented during July and August. Another eleven have been ordered for the Peak Downs mine, six for the Saraji mine, and two for the Goonyella mine.

"Ultimately, this is part of a larger program," said Andy Davidson. "The Leica Dozer package is a key element of our long-term success strategy. Demonstrating real

Blackwater coal mine

The BMA Blackwater coal mine produces up to 14 million tonnes of coking and thermal coal per year and has been operating for over 35 years. As an open-cut operation, draglines and truck/shovel fleets are used for overburden removal and coal seams are mined by front-end loaders or hydraulic excavators.

Website:
<http://bmacoal.com/bccom/export/operations/blackwater/index.html>

device in the supervisor's vehicle. "There is no reason why this won't work," Bevan Reibel said. "We could then just drive up and check the shovel for grade control. Inspection vehicles are becoming just as important as the dozer."

The future looks extremely bright for the Leica Dozer 2000T following the order of a total of 15 of the systems for the Blackwater mine, making it the largest single sale of the Leica Dozer 2000T to any single mine in the world. These will be fitted to six dragline dozers, four stripping dozers, two mining dozers, two pre-strip

benefits from machine guidance technology promotes acceptance, which ultimately starts to change the culture of the business. This is a classic example of working smarter – not harder. You have to do different things, to get different results."

And Tritronic's Geoff Baldwin considers the Leica Dozer 2000T project as the beginning of a long partnership with Leica Geosystems. "We are looking to forge a tighter alliance with Leica Geosystems and hope to promote the use of GPS-based guidance products in the mining industry long into the future." **Bt**