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.

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.”
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 GPS Base station transmits data to the Rover.

The cab holds a ruggedised touch-screen computer.

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

"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 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."