



## Unwiring Coal

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Coal is an essential component in supplying the worlds increasing demand for energy. Mining coal is demanding work in extreme conditions, including severe heat, shock, and vibration.

#### Overview

Much of BMA - BHP Billiton Mitsubishi Alliance's coal is extracted from open cut mines where coal seams are exposed using huge dragline booms which scrape away rock and soil using sixty five cubic meter buckets.

This material, called overburden, is moved by truck and shovel fleets to previously mined areas which are filled in as part of the rehabilitation process. At the bottom of the pit, excavators, bulldozers, and many other pieces of heavy equipment remove the exposed coal from the seam where it is then loaded onto large haul trucks.

#### The Wireless Advantage

Mine operations operate around the clock and can cover hundreds of square kilometres. Maximizing productivity in operations and maintenance can yield substantial improvements in profitability, safety, and environmental impact. BMA understood these issues and recognized that a well-planned wireless communications infrastructure connecting equipment, systems, and people was vital to meeting its business, safety, and environmental goals.

#### The Solution

BMA established a project to design and install wireless networks at their many different mining operations. This challenging assignment had to provide infrastructure to sites as large as three hundred square kilometres where ICT infrastructure was at the time only available in administration areas usually at the head of the site. The results of the project delivered a wireless network infrastructure far in advance of any of its competitors consisting of two main components.

The first component, a high speed point to point backbone mounted on towers running up the centre of the mining operation, powered at some locations by environmentally friendly solar power produced by photovoltaic panels and batteries. This backbone



links the second component, wireless Mesh network clusters based on Tropos routers, with each other, and with wired gateways which form the bridge between networks.



## Tropos Metro Mesh routers, mounted on towers and mining equipment provide wireless connectivity for control & safety equipment, sensors, video cameras, and voice services

Tropos routers are installed at the top of dragline booms, fixed tower locations, mobile solar powered trailers, and moving vehicles of various types around the site. BMA engaged Acubis to install Tropos nodes at a number of sites. According to Ko Lane, Chief Technology Officer of the Acubis Group open cut mines offer unique challenges for wireless networks. *“The landscape is constantly changing in and around the site, and there are extreme changes in elevation”, “It is difficult to provide coverage down into the pits which can be in excess of 170 meters deep”,* said Lane. *“We are able to keep everything connected using Tropos MetroMesh routers which offer superior range, signal sensitivity and an advanced meshing algorithm. They automatically adapt to changing conditions, which are often severe in nature, Tropos routers perform extremely well, day in and day out.”*

The entire wireless system is designed around standards-based 802.11 wireless networking which is commonly used by equipment suppliers, this eliminates the need to install specialized subscriber equipment, dramatically reducing BMA’s support and commissioning issues while delivering truly high speed networking. Tropos routers automatically adapt and adjust to constantly changing conditions, providing optimal throughput without manual adjustment. The system also provides simplified centralised administration of over 170 routers that are deployed around BMA’s far flung operations. Updates, changes, and upgrades, are initiated from a single location and replicated to all devices.

The wireless network has been in place for two and a half years in total. *“We’re seeing a great number of business benefits”* said Ben Dennis, project manager for BMA. *“We’re improving safety and performance with improved communications, we can adjust operations more quickly and we are experiencing improvements in our maintenance cycles through less travel and more efficient servicing of equipment.”*

The wireless network enables other benefits. Video cameras mounted on equipment enable operators and engineers alike to see what is happening. Downtime is reduced with the ability to diagnose equipment from the office where reference manuals are located. Truck drivers and dispatch staff can gain situational awareness, back in the office supervisors have a better understanding of (the big picture) what is happening out in the field.

Tropos Network products are built to withstand harsh, outdoor environments. Outside temperatures can reach 45 degrees C in the shade, and in one instance a maintenance team found the temperature inside a protective enclosure was nearly 70 degrees C. The purpose-built hardware, self-healing mesh architecture, and efficient set-up and administration, provide maximum uptime - important when costly operations depend on the network.

Now that the system is in place, BMA is exploring new uses facilitated by the nomadic wireless network. One such application is field data upload, field geologists can upload drill data and pictures for analysis and evaluation, avoiding hours of overtime back at base. Other applications include live monitoring of large, expensive truck tires, real time environmental monitoring and field access to drill and blast application data which helps determine how much of an explosive charge to use.

Mesh wireless networks are quicker to deploy, less expensive to maintain, easier to expand, and cost less to purchase than other competing wireless technologies. Tropos technology has been deployed in over 30 countries worldwide and it is well suited to the harsh ever changing environment found within mining operations, which would defeat standard point to point or point to multi point networks.

“We are seeing a large number of business benefits”, “We are also improving safety and performance with improved communications”

-Ben Dennis, BMA Project Manager

“Open cut mines offer unique challenges for wireless networks, the landscape is constantly changing and there are extreme changes in elevation”

-Ko Lane, Acubis  
Chief Technology Officer

There are many applications that currently run on the site wide Mesh networks, including:

- Staff entry to site
- Surveillance of Explosive Storage and Mixing Sites
- Dragline Cameras are time reference logged to PLC alarms so footage of what was happening when the alarm was triggered can be seen remotely
- Staff at Shutdown Offices use the Mesh for all their data needs, no reconfiguring is required even though the shutdown offices move regularly.
- Radars scan High Wall for Stability and stream the data back to be analysed
- The SHECON (Shovel Conveyor System) uses the mesh for guidance, telemetry and alignment.
- Dragline Booms are monitored for stress and stream live across the network
- PEGASYS Mining systems providing production Data.
- Pit Pumps are monitored for running time and flow, servicing and remote start stop, and current locations.
- Lighting plants are monitored for Service Running, location and fuel levels
- Light Vehicles monitor speed rpm servicing location etc
- Man Down system (mercury switch to detect fall and distress button) utilizes the Mesh

The flexibility of a Mesh network provides the ability to deliver services to areas of the mine which otherwise would incur significant planning, delays, and additional costs.



#### Solar Trailers

Wireless Nodes mounted on trailers and powered by solar energy provide instant wireless coverage in a rapidly changing geographic landscape. When required trailers can provide the vital link for communications and video in the event of an unexpected incident. The trailers can be moved to location and operational within minutes of arrival.



#### Temporary coverage areas

The mobility of nodes makes it an easy task to provide coverage in temporary areas such as construction or maintenance areas providing communications and video monitoring for a safer working environment



#### Video Monitoring for a safer working environment

Cameras mounted on draglines provide vision around and under the vehicle giving the operator and central control instant alerts to potential situations.



#### Collision Avoidance

Collision avoidance systems and other onboard data systems relay data streams to the Mesh network from mobile assets improving safety and maintenance cycles and reducing costs.



#### Tropos

Tropos Networks™ technology adds intelligence to Wi-Fi to enable deployments that were previously difficult or impossible. The result: broader coverage, minimal installation and cabling costs, and rapid deployments.



Acubis is a technology company, specializing in the Design, Consultancy, and Supply, of wireless data networks and integration services to the mining and other industries. Acubis is also a provider of ISP services to the mining-accommodation and hospitality industries.

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