

## Mining Iron Ore in Australia

Network supports critical mining applications improving operational effectiveness and worker safety



Photo credit: Tor Lindstrand

### Customer Highlights

#### Challenges

- Mobile network nodes in mining vehicles must be capable of withstanding heavy vibration
- Reliable network operation 24/7 in dusty, hot environment (to +40°C)
- Flexibility to easily relocate network nodes around active excavation site
- Capacity to support multiple IP applications concurrently including fleet management, fuel polling system, video cameras, lightning alert system, surface mine telematics, and mobile client Wi-Fi access

#### Solution

- Mobile network nodes installed in vehicles withstand dust and high vibration, delivering reliable connectivity and facilitating mining operations
- Field proven high capacity wireless mesh network provides high reliability 24/7 in environment with extreme temperatures
- Routers are easily relocated and automatically associate with the network as they are moved to different locations around the mine

#### Results

- Proven reliable, high-performance wireless communications infrastructure supports multiple mission critical applications under challenging environmental conditions
- A flexible network infrastructure that is easily relocated and quickly self-configures, minimizing service disruption

- Different models and generations of Tropos mesh routers seamlessly interoperate on the same network
- Operational efficiency and productivity achieved with mining control and management applications
- Highly accurate GPS enables excavation accuracy (within 200 mm) and real-time feedback
- Remote monitoring and diagnostics of mining vehicles maximizes uptime and facilitates scheduling of preventative maintenance
- Fuel polling system provides accurate tracking of tax credits

#### Systems and Services

- ABB Tropos Mesh Network
  - Tropos outdoor mesh routers (Tropos 7320, Tropos 5210)
  - Tropos mobile mesh routers
  - Tropos Control wireless network management system
- Caterpillar (CAT®)
  - CAT MineStar™ System

**ABB Tropos wireless mesh networks are installed in field mining operations around the world. Tropos' wireless broadband communications foundation enables a wide range of applications that improve operations and safety.**

#### Background

One of the world's largest iron ore mines spans over 25 hectares in Australia. This open pit mine operates 24/7 with 1,500-2,000 workers on site each day. The ore lies 20-70 meters

below the surface and is extracted using heavy machinery including face shovels, excavators, and surface miners. Careful planning and orchestration of the mining equipment is important and real-time telematics is essential for achieving accurate and safe extraction and removal, while optimizing profits.

Once extracted, the ore is transported via trucks and conveyors to the on-site processing facility where it is screened, crushed, blended and separated from sand and clay. The processed ore is then transported via a rail line from the processing facility to a port where it awaits shipment.

## Challenges

In setting up the iron ore mine, operations selected a mine management system to optimize productivity and safety with its ability to monitor, manage, report, and control all aspects of mining operations.

Operations invited IT to the project to help in outlining the network communication requirements for operating the pervasive mine management system. IT identified key attributes for the communications network, which included:

- Private wireless network
- High reliability network capable of 24/7 operation with self-configuring, self-healing nodes and no single point of failure
- Easy to setup and move non-gateway nodes frequently to active mining area (typically relocated every 30-60 days), with minimal disruption to service
- Capable of withstanding harsh environment with high heat (to +40°C) and dust
- Mobile nodes mountable in mining vehicles that extend network coverage and reliably operate under high vibration conditions
- High capacity network with the ability to aggregate communications and implement QoS for multiple IP applications including fleet management, fuel polling management, lightning alert, and IP video cameras.
- Flexibility to easily and seamless scale the network as additional nodes and coverage area is added, connecting hundreds of devices.
- Centralized network visibility, management, and troubleshooting.
- Cost effective to deploy and operate.

## Solution

After evaluating and testing several wireless solutions, an ABB Tropos wireless mesh network was selected. It was the only solution that met all the requirements which included reliable high capacity communications with the ability to operate in extreme heat and dust, plus mobile nodes capable of withstanding high vibration typical in mining vehicles. The first step

before deploying the networks was a site survey and analysis to identify the best locations for the fixed Tropos router around the mine. Tropos routers were mounted on fixed poles, some with solar panels, providing power when it was not otherwise accessible.

The next step was installation of Tropos 4210 mobile mesh routers in select mining vehicles. The customer selected the CAT MineStar system as its critical mine management system which used the Tropos network for communications to mining vehicles and around the mine.

Since its initial deployment in 2007, the Tropos network has grown along with mining operations – the coverage area has expanded, and it supports more nodes and IP end point devices. Network coverage includes the mine pit and other areas within the mine. Newer Tropos mesh routers (Tropos 7320 and Tropos 6320 mesh routers) have been integrated into the network seamlessly alongside the older generation Tropos 5210 and Tropos 4210 routers. Tropos tests its mesh routers to ensure customer can build reliable networks that incorporate different models and generations of its routers. Today, there are over 60 fixed Tropos routers around the mine. Some are located to support connectivity near lunch rooms and other buildings on site. Because the operation is constantly on the move, some routers are mounted on pump-up masts mounted on trailers. As the excavation site moves to different locations, the trailers are easily relocated. The trailer-mounted routers are powered by solar. Where required, a point-to-point unit is collocated for backhaul.

Over 300 mobile Tropos nodes are mounted within various mining vehicles (graders, surface miners, haul trucks, light vehicles, and more) that move in and around the mine pit, supporting the CAT MineStar system and other applications that facilitate operations and communications. Tropos Control is installed in the server farm located on site and provides centralized visibility, monitoring, and control of the Tropos entire mesh network.

Key applications that utilize the Tropos network today are:

- [CAT MineStar](#) – The software system has multiple modules for various functions. The modules utilized at the mine are:
  - MineStar Terrain – Iron ore mining requires precision operation of mining equipment for precision excavation. Vehicles used in excavation (diggers, excavators, loaders, etc.) each have GPS that communicates location and helps in guiding excavation accuracy (within 200 mm is needed) to increase productivity and provide real-time feedback for improving efficiency.
  - MineStar FleetCommander – Creates scheduling assignments for vehicles, white line assignments (creates map for where to drive), minimizing wait time and optimizing utilization.
  - MineStar Production – Gathers productivity information from trucks, loading tools and other equipment, increasing mine operation efficiencies.

- MineStar Health – Centrally collects information related to fleet health in real time (tire pressure and heat; fuel usage; repairs and maintenance) and recommends preventative maintenance schedule to help avoid vehicle downtime.
- IP cameras – installed in the mine pit, the cameras are mounted to Tropos routers and provide real-time viewing of pit activities to operations (located in pit trailer). This also provides visibility for ensuring site and personnel safety in the pit.
- Survey equipment – collects and records information on ore samples which is sent to operations for analysis.
- Lightning alert system – an early warning system with sensors that monitor for lightning strikes in the area and can alert should conditions become risky for workers.
- Mobile device connectivity – geology, mining, and IT personnel use laptops and other mobile devices to connect to the Tropos network for email, access to information, and recording information in the field.
- Geology, mining, IT personnel use laptops in the field and connect to Tropos network.

## Results

The Tropos mesh network has become an integral part of mission critical mining operations. It serves as the core communications foundation supporting a wide range of applications that improve operational efficiencies and safety for the workers on site each day. For example:

- Highly accurate GPS enables excavation accuracy (within 200 mm) and real-time feedback, improving productivity
- Operations now has real-time access to excavation data and analysis
- Vehicles are scheduled, their drive route mapped, and their time is optimized improving productivity
- Vehicle health is monitored and preventative maintenance scheduled, helping avoid downtime
- Mobile workers around the mine have access to the network using their mobile devices
- Fuel polling system provides accurate recording of tax credits

## Additional applications under consideration

- [CAT integrated object detection system](#) – This system integrates with CAT large mining trucks to aid an operator as they start to move a vehicle, helping them to avoid accidents. It utilizes a combination of radar, four video cameras, and a monitor in the cab to provide the operator with enhanced visibility and audible warnings.
- [Fatigue monitoring system](#) – CAT has signed a strategic agreement with Seeing Machines for incorporation of their DSS in-cab fatigue monitoring system with CAT's MineStar to help improve mine safety and productivity.

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