

Proximity Detection in Underground Mining



Improving underground safety and production benefits

In underground mining environments, the risk of collision between machinery and personnel remains high where poor visibility and working in confined spaces can affect the ability of personnel to detect potential hazards before they occur.

Through normal day to day activities between underground vehicles and mining personnel, there exists a high chance of personnel injury and high financial cost of damaged vehicles and productivity loss from any downtime occurred.

In many cases, these collisions are a major cause of mine fatalities and the impact to the mines business operations can be phenomenal if steps to avoid collisions are not addressed.

Business Challenge

A Proximity Detection system operating above ground in most cases is reliant on GPS technology to position equipment and identify location zones. In an underground mine, the environment becomes more complex and impossible for GPS signals to penetrate. An additional level of control is needed to identify the risks associated with people to vehicle and vehicle to vehicle interactions underground. The system selected for underground environments requires the following features:

- Be proven in the underground mining environment
- Be easily installed and maintained by site personnel
- Be of modular design to allow for expansion to include vehicle to personnel protection

BUSINESS BENEFITS

- Equipment damage is negligent
- Data collected very useful to address operational and maintenance optimisation concerns
- Improved overall safety awareness dramatically
- Reduce risk of loss of assets
- Eliminates human fatality
- Improved productivity and morale

Green's Creek, a large silver mine in Alaska, owned by Hecla Mining Company identified that vehicle to vehicle collisions are a significant risk to their operation. The challenge they faced was that their existing surface solution would not work using GPS technology alone. Green's Creek required a highly reliable proximity detection system that was capable of providing additional benefits to avoid collisions in underground environments.

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Scope

The requirement started as a vehicle to vehicle proximity system. By using a modular based system, additional components were added to the original building blocks with site specific benefits realised in the areas of:

- Tracking of personnel and machinery
- Protection of personnel with feedback
- Voice communications underground
- Machinery data collection
- Blasting

Solution

Green's Creek initially selected the MST outer-zone WiFi-based Proximity Detection system as it fulfilled the mines requirements. Developed in conjunction with the mining industry, the Proximity Detection System provides superior technology that has been purpose built for everyday mining use.

The vehicle to vehicle protection requirement was achieved by installing the MST Proximity Detection solution using outer zone vehicle tags and systems on 15 heavy vehicles and 60 light vehicles.

The outer zone concept relies on active Radio Frequency Identification (RFID) Wi-Fi tags which emit "beacon" signals that are detected by a Wi-Fi Tag Reader mounted on the heavy vehicles.

The Wi-Fi Tag Reader was integrated into the MST Vehicle Intelligence Platform (VIP) module interfacing to a touch screen Display Unit, which allows the driver to easily be alerted if a person is encroaching within the vehicles vicinity.



Figure 1: MST's Proximity Detection Outer Zone

Using a 2.4GHz low frequency "beacon" signal, the outer zone Wi-Fi tag provides 60 to 120m of detection range from the tag to the vehicle. The display unit is especially useful as it provides the driver with the facility to easily interact with the Proximity Detection system and other drivers.

Greens Creek also saw the advantages in equipping the Koehler Cap Lamp fleet with 200 personnel tags. Installation of the MST tags in both vehicles and in cap lamps allowed proximity detection for both vehicles and personnel working underground and solved the mines desire to lower integration of equipment and raise awareness via an audible and visual alarm to the operator.



Figure 2: Driver using Vehicle Intelligence Platform display unit

To allow tracking a Minedash appliance was installed together with several Impact access points at strategic underground locations allowing tracking of tagged equipment.

MST Minephones were also added to the Minedash system enabling voice communications via integration to the Cisco call manager pbx allowing minephone users underground to contact individual desk phones or off site phone numbers.

The original installation of the proximity system on the underground vehicles allowed the VIP to integrate directly to the machines electronic command module allowing site to download engine and pay load data if required.

Solution Benefits

Greens Creek saw the benefits of implementing a proximity detection system to protect their vehicles and personnel underground.

Having MST tags fitted underground gave Greens Creek the opportunity to track underground personnel and assets in real time, offering a beneficial spin off from the safety system such as an increase in their productivity levels with the ability to easily locate equipment or service crews.

Most importantly, the system could detect personnel around corners and blind-spots, giving personnel an extra level of safety in the mine, and vehicle operators the confidence to perform mine operations within safe working boundaries.

Solution Components

- ICA running MineDash, Voice PBX and reporting tools
- Voice Headend for PTT Communications
- Caplamp Tags
- Vehicle Tags for light vehicle fleet
- Minephones
- NS50 and WAPS



Figure 3: MST's Proximity Touch Screen inside a vehicle cab

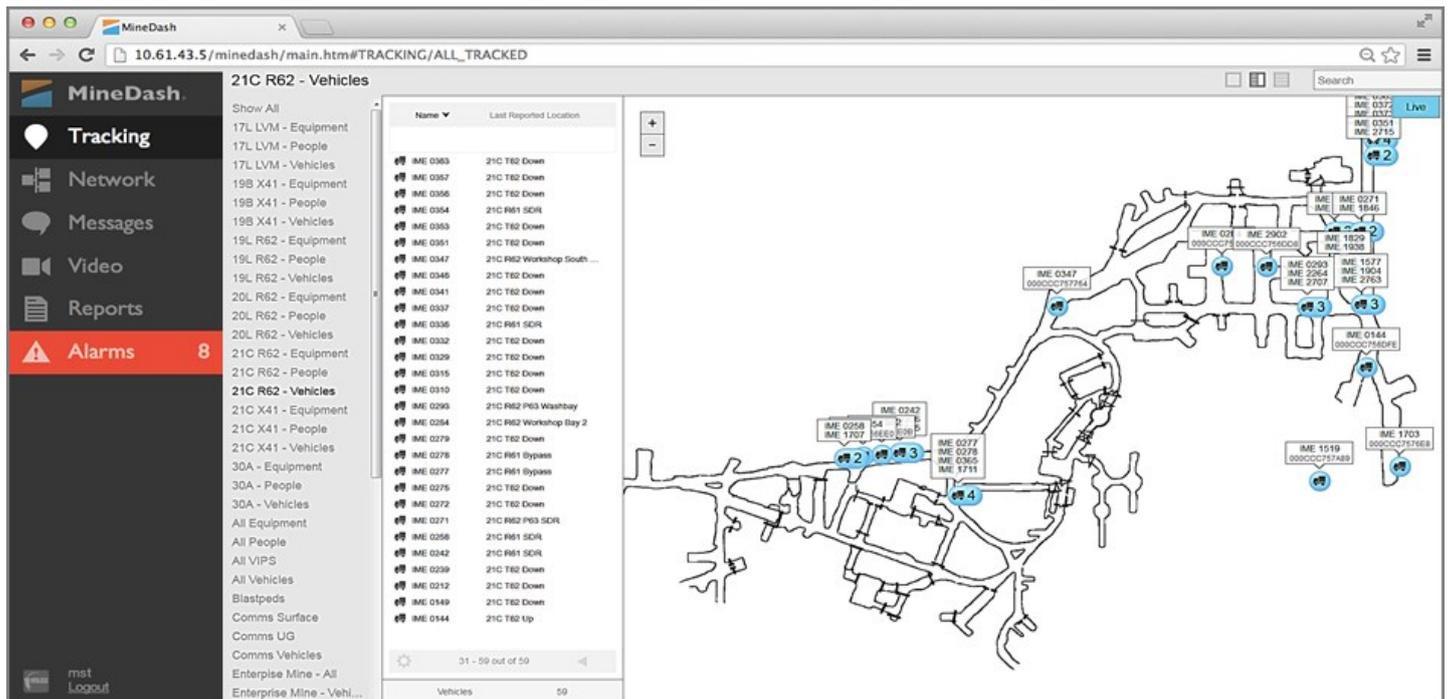


Figure 4: MST's MineDash example of vehicle location tracking points

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