

Queensland Mining Industry Health and Safety Conference

Safety Innovation Award Application

Company: Peabody Energy

Site: North Goonyella Mine

Innovation: Infra-Red Thermal Camera on Underground Mobile Equipment

Presenters: Wayne Smith (Development Electrical Engineer) & Martin Kime (Group Long Wall Projects and Automation Engineer)

The Problem

Across all underground mining operations visibility while operating machinery is challenging due to operator line of site and the need for personnel to work in close proximity to the operating equipment. The core safety focus is to eliminate vehicle to personnel incidents and providing a working environment provide a working environment where risk is as low as is reasonably achievable.

The issue confronting operations is the environmental limitations that come with being underground in confined areas including darkness, dust, water spray mist and machine line of site. Cap lamps and or machine lights provide some visibility in direct line of site situations however blind spots remain.

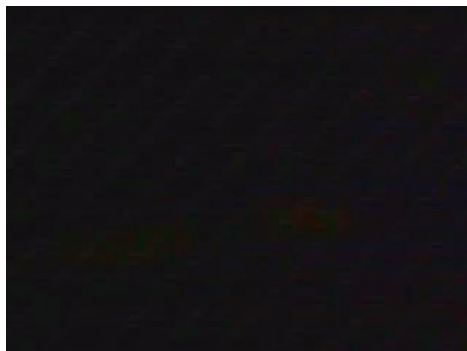
Continuing to operate large machinery in limited areas exposes employees to risks of crushing, pinning or being run over causing serious injury or death. Peabody Energy continually focuses on lowering the risk to its employees and sees the introduction of this technology as an additional layer of protection.

Peabody Energy experienced two high potential incidents where people were struck by underground mining equipment. As part of their broader strategy, Peabody Energy approached Nautitech Mining Systems (Nautitech) to utilise their Infra-Red Thermal Cameras on mobile machinery initially on shuttle cars to provide additional visibility in blind spots without being impacted by the environmental conditions. The cameras were installed on a shuttle car as a trial which produced significant improvements in visibility and driver confidence while navigating face production road ways, the Infra-Red Thermal image of personnel provides immediate clarity without the need to continually focus on the displays. In other words, the Infra-Red Thermal image of a pedestrian in a blind spot can be witnessed in the operators peripheral vision.

The use of this technology as an underground safety initiative won the Peabody Energy Global Safety Innovation Award, and has gained wide spread support from the operations team.

The Solution

Peabody's application of Nautitech's Infra-Red Thermal camera technology reduces the risk associated with large underground machinery operating in confined spaces with low visibility in close proximity to people. The Infra-Red Thermal camera technology was aimed at providing the operator with the ability to detect people in traditional blind spots. It requires equipment that meets regulatory and legislative requirements as well as being adaptable for multiple applications. An investigation into available technologies was completed identifying high and low tech solutions all with their own limitations and issues. The best solution currently available was the Nautitech Infra-Red Thermal camera and when the company was approached by Peabody it was the first time they had been approached to use the camera in a personnel detection application.



Screen without Infra-Red Thermal Camera



Infra-Red Thermal Camera

The trial has been well received in the underground environment with operator's adopting the technology well, they have requested inclusion onto other machines they find with similar visual limitations.

Safety is of primary concern, however use of the Infra-Red Thermal camera has a secondary benefit minimising the damage caused to infrastructure and operating machine. There is a safety, commercial and community advantage to our initiative.

Nautitech's Infra-Red Thermal camera detects heat instead of light, the advantage of this is a clearer display of people, machines, cables and other warm objects in areas that are in darkness, or shrouded by dust, heat or steam. A driver's range of vision using just his headlights is limited to approximately 20 meters. Whereas the Infra-Red Thermal camera can detect the heat signature of a person 500 meters away, giving the driver ample warning of the persons presence and so making the interaction between men and machinery safer. The camera can also record for up to 72 hours, meaning if there is an incident or near incident it can be investigated fully using the film from the data logger to assist the investigators identify the root cause. As any asset that is giving off heat will be illuminated by the cameras, damage caused by vehicles cutting trailing cables or hitting other infrastructure can be avoided. These incidents often lead to downtime at the coal face and the actual root cause is often not established.

Lead initiator **Martin Kime**, Group Long Wall Projects and Automation Engineer identified the Infra-Red Thermal camera as a tool for identifying personnel and identified an opportunity to install the cameras on mobile plant equipment. Martin developed a business proposal for the trial of the cameras on a shuttle car and presented to **Neville McAlary**, SVP of Safety, Training and Insurance and **Wayne Smith**, Development Engineer at North Goonyella mine.

Neville McAlary was extremely supportive of the initiative and without this support the initiative would not have moved forward. Neville sourced the initial funds to complete the trial at North Goonyella mine, ensuring the window of opportunity was not missed.

Peabody Energy Australia in consultation with the operations teams at North Goonyella identified opportunities to place two Infra-Red Thermal cameras and two displays on a shuttle car to give the driver additional visibility as a trial. As the shuttle cars have east west seating it was necessary to provide two displays one in each direction of travel to ensure the displayed information was in the peripheral vision of the driver at all times. Camera location was discussed and trialled with operators and engineering staff to identify the best location for providing additional visibility as well as ensuring the cameras were maintainable.

The cameras were installed onto a shuttle car in positions identified with operators to be the most suitable; and the drivers immediately saw the benefits and actively request additional units on other transport machines.

This initiative was communicated by conducting a risk assessment with a cross section of the workforce participating to ensure the application and risk profile was well understood by all stakeholders.

Benefits and Effects

The trial of the Infra-Red Thermal camera technology on a shuttle car in an underground coal mine has met the expectations of the project team. The Infra-Red Thermal camera technology provides a clear vision and profile of personnel in vulnerable positions, regardless of adverse environmental factors such as dust, water mist or distance. The driver is not overly reliant on using the display as focus is only required when the display lights up with the image of Infra-Red Thermal activity or personnel.

Success of this project would be no person impacted by a shuttle car that has this technology installed. As the low frequency of these high potential incidents across the industry and as the technology is proactive, detailed data will not be available for years to come and will not include the incidents where it saved a person from being impacted on. An indication that the use of Infra-Red Thermal camera meets and improves operator safety standards is the uptake of the initiative by other mining companies and positive feedback from other operations. Requests to install the cameras onto other mobile equipment also identifies that the cameras are cross functional to other equipment types including winders and equipment health monitoring, as well as being welcomed into the operators safety focus.

Transferability

Underground mobile equipment has had traditional colour and black and white cameras installed in the past however the usability of the units was poor due to environmental conditions and clarity. Peabody Energy initially trialled these cameras at two of its underground operations, North Goonyella in the Bowen Basin and Metropolitan Colliery in the Illawarra Region. Both trials have been successful and the organisation now intends to trial one at Peabody's third underground operation in Australia, Wambo Mine. This demonstrates that the innovation is proving to be transferable across any underground coal operation and is equally transferable into metaliferous operations.

The Infra-Red Thermal camera initiative has been communicated with other mining companies and advertised on Nautitech sites, increasing demand for this technology for application to both shuttle cars and rubber tyred vehicles across the industry.

Infra-Red Thermal cameras have the potential to be installed on any mobile plant, car, and truck (pedestrian identification in wet or foggy conditions) increasing visibility in harsh environments. Cameras can also be used for identification of failure of parts in mechanical and electrical installations. Peabody is considering trialling this technology on stockpile dozers to help minimise reversing risks.

Peabody plans to continue the fitment of the Infra-Red Thermal camera technology system to their Australian fleet of shuttle cars and chairing an industry workshop of all the major miners to determine what the industry wants and needs from this innovation and possible further opportunities with image recognition and proximity detection.

Innovation

Infra-Red Thermal Cameras have been used extensively in Industry for many years, but not to identify people. Generally Infra-Red Thermal cameras have been used to identify hot electrical components and bearings. All of the interaction and designing was done in-house and in consultation with Nautitech to adapt the technology for underground use on underground equipment.