

Collision Avoidance & Proximity Detection

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Abstract

Collision and struck-by incidents involving mining machines and other vehicles, objects, or persons result in fatalities, serious injuries, equipment replacement/repair expense, and lost production. It is generally understood that with the increasing size of mining machines, large areas are outside the normal view of the operator. This has been especially evident at surface mines with incidents involving large haul trucks and at underground mines with incidents involving remote control continuous miners. This paper will discuss some of the technologies that can greatly reduce these incidents and refer to a number of published and on-going studies.

Discussion

Surface Mines

On average 40 incidents with 5 to 6 fatalities involving powered haulage equipment occur each year at surface mining operations. Fatalities related to equipment blind areas comprise approximately 7% of all fatal accidents (2000-2005), which points to a significant problem. [Ruff 2007] These accidents typically result in collisions with other equipment and vehicles, pedestrian workers, or stationary objects.

Several technologies have been studied and are commercially available. Those related to collision avoidance include the following:

- Radar Systems
- Radio Frequency Identification (RFID)
- Global Positioning Satellite (GPS) Based Collision Warning Systems
- Video Cameras
- Ultrasonic Systems

The Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) have conducted a number of studies and field tests at various surface mining operations and continue to support development of these new technologies. The results have shown that the technologies listed above offer various advantages and costs. Some experimentation has also taken place combining technologies with some apparent success at reducing false or nuisance alarms.

Underground Mines

Many fatal and nonfatal accidents have occurred at underground mines involving mobile mining machinery. This is particularly true with remote control continuous mining machines which have been involved in 31 fatal accidents since 1984. MSHA believes that proximity detection systems could have prevented a large number of these accidents. A proximity detection system provides automatic proximity detection and can initiate machine shutdown to protect personnel from being run over, crushed or pinned when they are positioned in a hazardous area in close proximity to the machine. The system can also be designed to give the operator an audible or visual warning before initiating machine shut down.

MSHA recently undertook a special project to identify and investigate existing technologies that can provide proximity detection. For the limited MSHA project, the radio frequency identification (RFID) technology, mentioned above, was identified as the best technology for the remote control continuous mining machine application.

MSHA is currently working with the West Virginia Mine Safety Technology Task Force and NIOSH to make proximity detection technology mine-worthy. Initial developmental trials have shown great promise.

References

The following are internet links for MSHA and NIOSH information on collision avoidance and proximity detection efforts:

NIOSH

- [Advances In Proximity Detection Technologies For Surface Mining Equipment](#)
- [Test Results of Collision Warning Systems for Surface Mining Dump Trucks](#)
- [Recommendations for Testing Radar-Based Collision Warning Systems on Heavy Equipment](#)
- [Proximity Alert for Monster Trucks](#)
- [Development and Testing of a Vehicle Collision Avoidance System Based on GPS and Wireless Networks for Open-Pit Mines](#)
- [An Active Proximity Warning System For Surface And Underground Mining](#)
- [Recommendations for Evaluating & Implementing Proximity Warning Systems on Surface Mining Equipment](#)

- [Engineering Considerations and Selection Criteria for Proximity Warning Systems for Mining Operations](#)

MSHA

- [MSHA's Proximity Detection / Collision Avoidance Website](#)
- [MSHA Proximity Detection](#)

The following is a partial list of available collision avoidance and proximity detection technologies and manufacturers:

Global Positioning Systems (GPS)

- [Safe Mine](#)

Radar Systems

- [Preview radar system by Preco, Inc.](#)
- [Sense Technologies, Inc.](#)

Radio Frequency Identification Systems (RFID)

- [Becker Mining](#)
- [Booyco](#)
- [Frederick Mining Controls](#)
- [HighService Industrial Support Company, LTDA](#)
- [Matrix Design Group](#)
- [Nautilus International](#)

Ultrasonic Systems

- [Lookout](#)

Video Cameras

- [Vision Techniques](#)
- [Safety Vision](#)
- [ECCO](#)
- [Intec](#)

Integrated Systems

- [Acumine Pty](#)
- [Advanced Mining Technology](#)