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AN INTEGRATED APPROACH TO IMPROVING SAFETY AND EFFICIENCY THROUGH COMMUNICATIONS, TAGGING AND COLLISION AVOIDANCE SYSTEMS

Brian Nicholls[1] and Tony Napier[2]

ABSTRACT: The use of tracking and collision avoidance devices coupled with better communication facilities for personnel are shown to be important not only for reducing accidents but also for managing emergencies.

INTRODUCTION

Recent vehicle to operator and vehicle to vehicle accidents (some resulting in serious injuries or fatalities) have highlighted the need to introduce better communication systems into the mining industry.

Systems currently available include methods of collision avoidance, tracking devices and facilities for personnel communication.

UNDERGROUND PERSONAL COMMUNICATIONS

The availability of adequate communications is of benefit in the effective deployment of machines and personnel but is of particular importance in dealing with emergencies that may involve evacuation from the mine.

Some aspects of such Communication systems as shown in Figure 1 are:

Figure 1 - Becker communication cystem components

- Operator to operator communications are now available through the two way radio systems. This equipment enables mine wide communications to be achieved via a base station, amplifiers and leaky feeder cable run throughout the main transport roads in the underground mine complex. Other vital areas of the mine (main conveyor drives / underground workshops) can be accessed via branches off the main leaky feeder line.
- Hand held Intrinsically Safe (IS) two way radios can be installed with up to 16 independent channels. These units are suitable for segregated voice communications for various mine operations longwall/development/maintenance or can be used for mine wide emergency messaging.

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- Where required, using specifically located antennae, two way communication can be achieved in roadways without the installation of the leaky feeder cable.
- Information can also be relayed from the leaky feeder system via access points through the mine fibre optics cables installed for high speed data transmission shown in Figure 2.
- Radios can also be used as independent units without the necessity of installing the leaky feeder cables in specific areas of the mine such as during longwall relocation tasks.

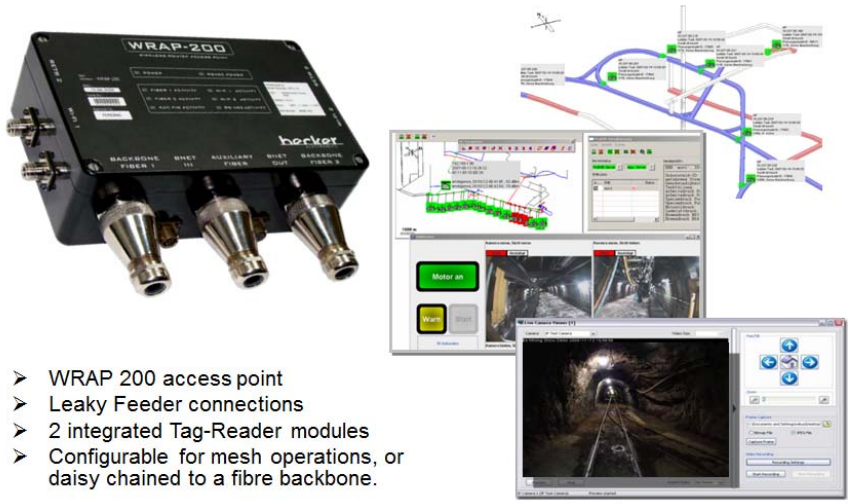

Figure 2 - Intrinsically safe "hotspots" to provide access on to the Network, for VoIP, high speed data and video monitoring

TRACKING AND TAGGING

When tracking and tagging components are used the following advantages can be assured:

- The location of all personnel and mobile machines (including equipment ancillaries) can be available in real time on a constant 24/7 basis in the mine operations control room, as shown in Figure 3.

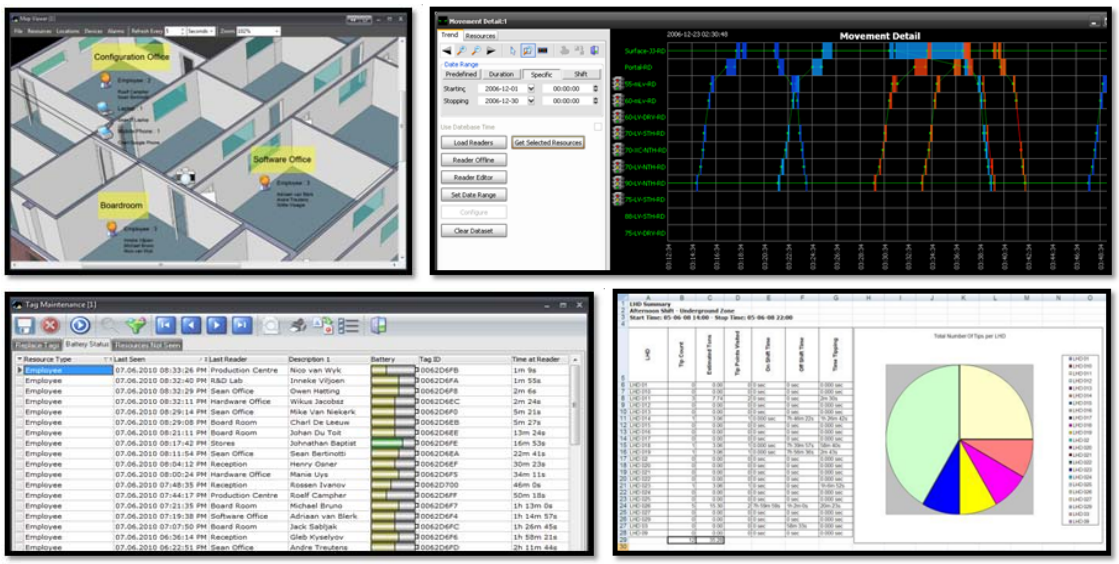

Figure 3 - Pantha screenshots allow unlimited options for displaying tracking information and system maintenance/performance data

- Increased operational efficiencies and particularly in the event of accidents or an emergency. The importance of knowing the location of individuals within the mine workings in case of a major

emergency requiring evacuation cannot be overstated. Combining this with reliable two-way personal radio communication will make dealing with any emergency much more effective.

- When mine control officers know the location of all personnel and machines in the mine, (including within the various operating panels much more effective deployment of people and machines can be achieved, thereby improving overall utilisation of these resources.

COLLISION AVOIDANCE

Collision avoidance devices are an important aspect of accident prevention not only from the point of view of personal injury but also the costs involved.

The following comments apply to the application of such devices:

- The multi-technology collision avoidance system is designed to facilitate bi-directional notification and alert warnings against potential collisions.
- It is recognised that no single detection technology is currently capable of providing all of the required information needed to predict a dangerous proximity in a reliable and optimal manner. It follows then that the use of multiple detection technologies concurrently will provide the maximum protection envelope required within the confined underground mine environment. Figure 4 shows the multiple warning zones provided by multiple detection technologies.
- The systems used have to be reliable, repeatable and must ensure that the information conveyed to the vehicle /machine operator and the miner is in such a format as to minimise the annoyance factor. If this is not achieved, it may result in the operator ignoring the warning or possibly turning off the information source.
- While seeming complex, the use of various technologies does result in an effective zoning of alarm or information levels between the machines and adjacent personnel.
- It is believed that collision avoidance and proximity detection technology will be mandated by the mining inspectorates in the major mining states of N.S.W, Queensland and W. A. within the next two years.

Figure 4 - Multiple warning zones provided by multiple detection technologies

CONCLUSIONS

Improvements in the use of control equipment for mining machinery and the availability of better communication facilities are considered to be essential for efficient management and maintenance of safe working conditions.