

Communication and Tracking Technology

...What are the options?



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Outline

Communication, Tracking...

- Current Mine Communication Devices
- MINER Act requirements
- What's available now
- Technology Gaps
- Activities to help provide the technology

Current Mine Communication Devices

- Telephones
- Pager Phones (Loudspeaking Telephones)
- Handheld 2-way radios
- Leaky Feeder Systems



These systems rely on in-mine cables & components...



...that can be destroyed in a disaster

The MINER Act

...Communications and Tracking

✓ General Requirements



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Post-Accident Communications

MINER Act

At a minimum, provide for a redundant means of communication with the surface for persons underground, such as secondary telephone or equivalent two-way communication.

Program Policy Letter

When hardwired systems are used to meet the MINER Act requirement for redundant communication between surface and underground personnel, wires should be routed through separate entries or boreholes continuous to the surface.

Post-Accident Tracking

MINER Act

Provide for above ground personnel to determine the current, or immediately pre-accident, location of all underground personnel.

Any system so utilized shall be functional, reliable, and calculated to remain serviceable in a post-accident setting.

Program Policy Letter

Until post-accident tracking technology becomes commercially available and MSHA approved, MSHA will accept a dispatcher system, or equivalent system, that has as a function the tracking of persons underground.

A dispatcher system should track location of personnel in writing, on a map, or electronically, for the duration of the shift.

The MINER Act

...Communications and Tracking

- ✓ Specific Requirements for “within 3 years”

Post-Accident Communications

MINER Act

Within 3 years, Provide for post accident communication between underground and surface personnel via a wireless two-way medium.

Program Policy Letter

MSHA interprets the term “wireless”, as used in the MINER Act, to mean that no wired component of the system exists underground where it may be damaged by fire or explosion.

Post-accident communication technology would be considered acceptable if, based on its location in the mine and the history of mine explosions and fires in the mine, it is likely to withstand the event intact.

Post-Accident Tracking

MINER Act

Within 3 years, Provide for an electronic tracking system permitting surface personnel to determine the location of any persons trapped underground.

What's Available Now?

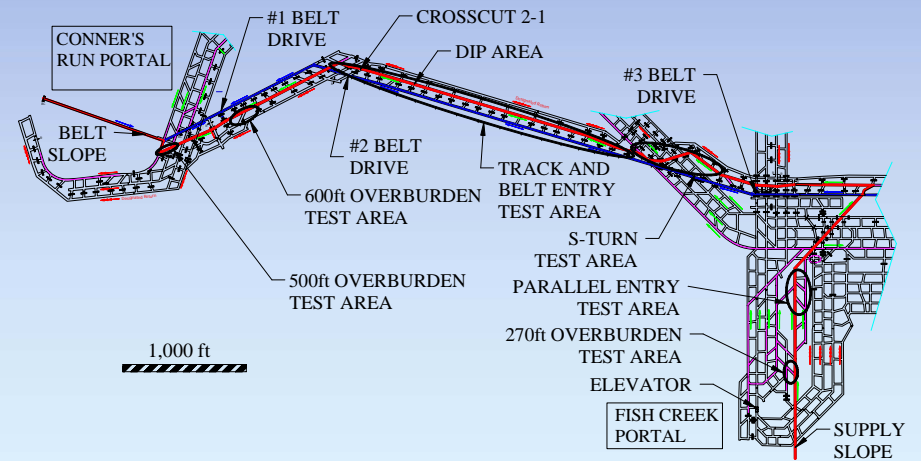


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Communication Systems Tests

Mine Emergency Communication Systems Partnership



Criteria for Selecting Systems for Testing

- **Systems that do not rely on a wire back-bone to operate**
- **Various types of technology are represented**
- **Evidence of sufficient development**

Systems Tested

- **Rajant**
- **Time Domain/Concurrent Technologies**
- **Geosteering**
- **Innovative Wireless Technologies**
- **Kutta Consulting**
- **Transtek**

Pre-Test Facts

- **All prototypes**
- **First coal mine test for most systems – the many challenges of a mine environment was not expected by the vendors**

Test Process- *evaluation criteria*

- **For in-mine communications**
 - Line-of-site
 - Non-line-of-site
 - Interference
- **For through-the-earth communications**
 - Depth of penetration
- **For in-mine tracking**
 - Ability to track

Preliminary Test Results

- **Most systems limited to 1000-2000 ft. Line-of-site communications**
- **Exception – MF system provided >5387 ft. non-line-of-site voice communication (>11,600 ft. in a 2nd test)**
- **One vendor achieved 270 ft. TTE voice communication**

Preliminary Test Results

	In-mine, Line-of-sight range (ft)	Through-the-earth range (ft)
Rajant	1500	N/A
Time Domain/Concurrent Technologies	2000	N/A
Geosteering	1000	270 (Beacon)
Innovative Wireless	1800	N/A
Kutta Consulting	>11600 (was non-line-of-site)	631 (Text)
Transtek	N/A	270 (Voice)

MINE SITE PED AND TRACKER INVESTIGATION (by MSHA)

- Investigate PED installations at:
 - Peabody Air Quality and Twentymile Mines
 - Consol Blacksville and Robinson Run Mines
 - BHP San Juan Mine (only surface-installed antenna in the US)
- Traveled to Australia to investigate TRACKER installation



PROS AND CONS OF PED

- Pros:
 - Can send evacuation instructions to miners in early stages of fire
 - Can be retrofit for Koehler, NLT and MSA cap lamps
 - System can be deployed in emergency by arranging surface loop antenna
- Cons:
 - Underground antenna could be compromised in fire or explosion
 - Reports of some areas where signals can't be received (shadow zones)
 - Can interfere with existing mine systems
 - Communications limited to one-way
 - No confirmation that message has been received

PROS AND CONS OF TRACKER

- Pro: Can provide last known location of miner before loss of power
- Cons:
 - Cannot provide precise location of personnel
 - System will become non-operational upon loss of power

Other System Tests have/are Being Conducted



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What are the Technology Gaps?

- Limited in-mine range requires significant in-mine components & infrastructure
- Through-the-earth communication has limitations
- Ability to be Intrinsically Safe
- Systems are prototypes

Activities to help provide the necessary technology

- Mine Emergency Communications Systems Partnership
- Emergency Supplemental Appropriations Bill
- Other Activities



Mine Emergency Communication Systems Partnership

Conduct in-mine tests on systems



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Emergency Supplemental Appropriations Bill

- \$10M to push promising technology to the mines
 - Funding to be administered by NIOSH through outside contracts
 - Divided between communications & tracking, SCSRs, refuge chambers



Funding Targets Areas...

- **Harden existing communications systems**
- **Hybrid communications technology**
- **New communications systems**
- **New tracking systems**



Harden existing communications systems

- Protect cables and components
 - Armor or conduit
 - Burying
- Enhance system
 - Loop-Around

Hybrid Systems

- During normal operations, function using existing communication systems
- In an emergency, use the same wireless components to function in another mode that has greater chance of survival
 - Example: Leaky feeder for normal operations and medium frequency in an emergency, using the same portable radio

Other Communication System Issues

- Interoperability
- Interference
- System safety

Actions...

- Award contracts for development & demonstration projects
- Continue to test promising technology
- Award contracts for research issues
- Share information through Partnership & NIOSH Web site



Mine Worker Health & Safety



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