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EMERGENCY COMMUNICATION AND TRACKING SYSTEMS

MSHA Technology Evaluation



MSHA ACTIVITIES TO ADDRESS COMM AND TRACKING ISSUES

- Investigate Mine Site Technologies PED and TRACKER systems
- Evaluate available new technology
 - Received more than 70 proposals
 - Requested proposals through www.msha.gov
 - Reviewing proposals to determine which to pursue further

MINE SITE PED AND TRACKER INVESTIGATION

- 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)
- Travel 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)
- 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

SYSTEM EVALUATION CRITERIA

- System capability – precise tracking and 2-way voice and text preferred
- Survivability in a fire or explosion
 - Focusing on completely wireless communication
- Current availability
 - Available or near term available hardware vs. conceptual
- Capability of complying with MSHA requirements

EVALUATION GOALS

- Determine how well signals propagate (maximum distance between nodes)
- Determine how much overburden systems can penetrate if capable of Through The Earth communication
- Determine mine coverage area (i.e. are there blind spots and why?)
- Explore interference issues
- Determine accuracy of tracking features

CURRENT SYSTEMS UNDER EVALUATION

- Rajant Breadcrumb System (representative of 802.11 systems)
- Time Domain Ultra-Wide Band Communications and Tracking (representative of UWB systems)
- Kutta Consulting Subterranean Wireless Electronic Communications System (SWECS)
- Vital Alert Canary 2 Mine Messenger
- Transtek Partnership
- Geosteering Mining Services, LLC MinerTracker System

RAJANT BREADCRUMB SYSTEM

- The system is a fully wireless LAN network based on WiFi technology (802.11b at 2.4 GHz). It is a self-configuring and self-healing node-based system.
- The system is intended for rapid deployment of a wireless network.
- VoIP phones (or PDAs) can be used for personnel tracking.



RAJANT BREADCRUMB SYSTEM

- The system is currently available and is marketed to police, military, hazmat, and other emergency response agencies. The durability of the system is proven by the current markets.
- The system has both communication and tracking capabilities.

TIME DOMAIN Ultra-Wide Band Communications and Tracking

- Utilizes pulsed ultra-wide band RF energy spanning 3.1 – 5.5 GHz instead of narrowband signals
- Self configuring, self healing wireless node based system
- Hand-helds will act as tags or specific RFID tags can be used



TIME DOMAIN UWB

- Provides both communications and precision tracking (~1 ft accuracy) capabilities.
- UWB technology is well-suited for high multipath environments.
- Ability to penetrate walls, i.e concrete stoppings.
- Operates below the noise floor thereby reducing interference issues.

KUTTA CONSULTING Subterranean Wireless Electronic Communications (SWECC)

- Under development through an SBIR contract with the U.S. Army CERDEC.
- Self configuring, self healing wireless node based system.
- The system is fully portable and can be used without a network for through the earth communication.
- Tested so far to over 800 ft. through the earth.



KUTTA CONSULTING (SWEC)

- Relative location of a specific SWEC radio to a node can be determined.
- Radio location of a SWEC radio underground from the surface is possible.
- Node to node communication can be low frequency, allowing a network link to be established through geological barriers i.e. roof falls.
- Can be used with existing mine communications infrastructure, i.e. leaky feeder systems.

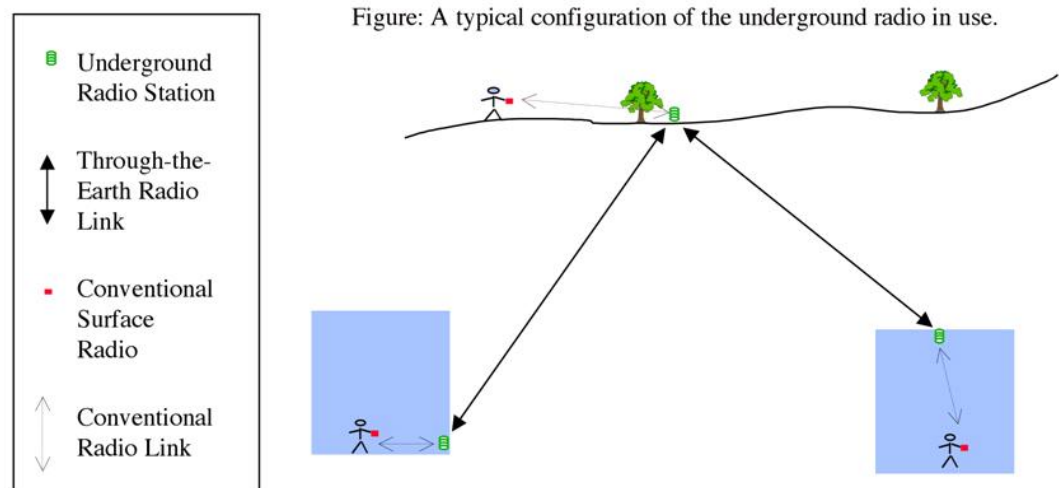
VITAL ALERT CANARY 2

- A real-time, two-way digital voice and data communication system (through-the-earth)
- Uses a wire-wound ferrite rod with a semiconductor amplifier as an antenna
- Uses handheld radios/phones to talk to surface through underground base units



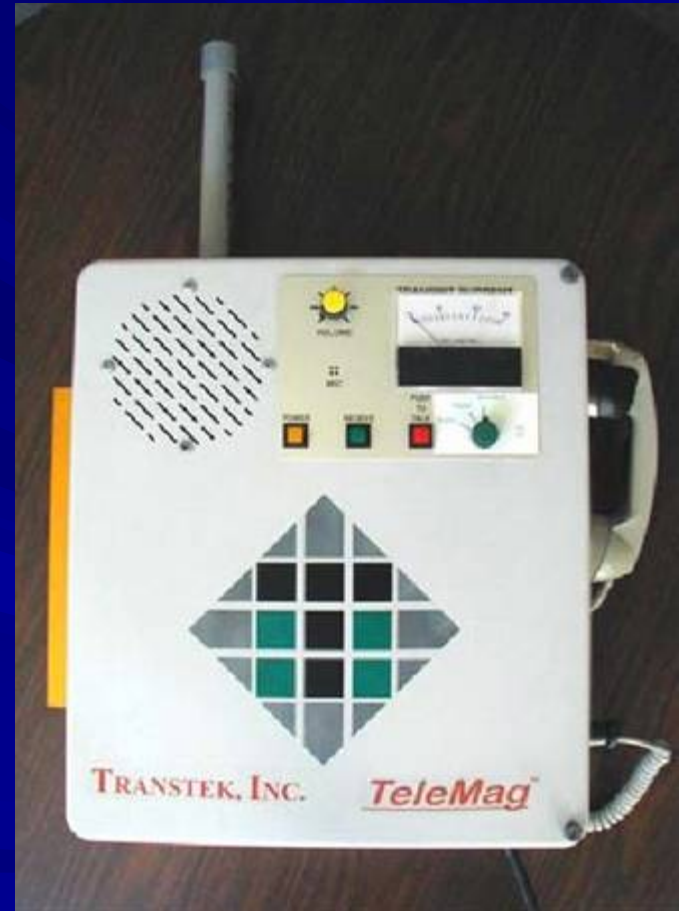
VITAL ALERT CANARY 2

- Preliminary tests suggest signal can penetrate depths around 400 feet
- One surface unit can communicate with several underground base units



TELEMAG PROTOTYPE COMMUNICATION SYSTEM

- A real-time, two-way digital voice communication system (through-the-earth)
- Uses a loop antenna and signal processing on surface & underground to communicate
- Calculations suggest signal can penetrate depths up to 1000 feet



TELEMAG PROTOTYPE COMMUNICATION SYSTEM

- Can be used with a handheld radio option within ~600 foot radius of Telemag underground unit
- Needs an identical unit on the surface to transmit and receive underground



GEOSTEERING MINING SERVICES

MinerTracker System

- Utilizes MinerTracker Unit consisting of a modified electromagnetic field generator designed for the TramGuard™ proximity protection system with a battery backup
- MinerTracker Units transmit the ID of any Personal Alarm Devices (PAD) within signal range to the surface via a cable
- During an emergency, each MinerTracker Unit operates as signal beacon that transmits a location pulse through-the-earth every 5 seconds



GEOSTEERING MINING SERVICES

MinerTracker System

- During an emergency, the MinerTracker Unit will transmit the ID of any PADs passing within its range during the previous 5 minutes
- Miners can enter different command modes for the MinerTracker Unit via PAD
- MinerTracker Unit can receive voice signals through-the-earth
- Miners can respond to voice signals with single digital data pulses using the PAD (ie. “Yes”, “No”)