

# Industrial Technologies Program

## Through-the-Earth Communications for the Mining Industry

### Enhanced Underground Communication Will Increase Productivity and Safety

The use of electronics specialized to very low frequencies in communication equipment will increase the range and data rate of through-the-earth communications and make underground wireless networks commonplace in underground mining operations. The through-the-earth radio system will increase underground mining safety and productivity, by allowing better communications and position information. This system can benefit an individual miner or a mining machine.

The best approach to underground communications systems is to use low frequency electromagnetic waves that can deeply penetrate into the earth. These low frequency waves will typically penetrate several hundred meters into solid rock in a mine environment. Digital Signal Processors (DSF's) are used to compress voice audio signals into narrow bandwidths that are compatible with these low frequency carriers. The overall system uses low cost components that are easily reconfigured for changing mine conditions. The low cost of the radios allow for large number of such stations to relay the data throughout the mine.



### Benefits for Our Industry and Our Nation

- Increases miner productivity
- Increases underground mine safety
- Increases productivity of autonomous mining equipment

### Applications in Our Nation's Industry

This new technology can be used in any underground mining operation and can benefit the individual miner or mining equipment.

Figure 1. Current configuration of the underground radio during testing.

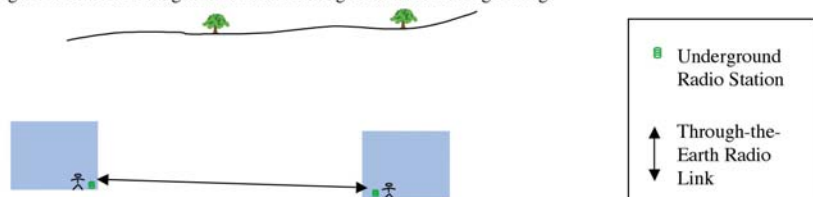
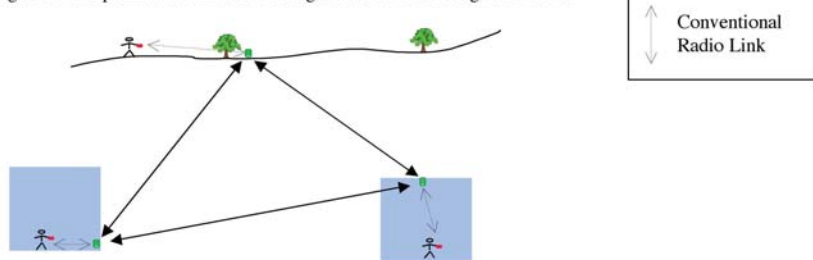


Figure 2. The planned commercial configuration of the underground radio.



## Through-the-Earth Communication Radio Configuration

## Project Description

Objective: To develop and apply through-the-earth communications to improve safety, productivity, and energy efficiency in the mining industry.

## Milestones

- Conduct field tests to examine noise backgrounds and signal propagation
- Develop long range audio
- Evaluate industry needs for portable communications
- Identify MSHA requirements effect on in-mine systems
- Demonstrate high quality long range audio to mining companies
- Perform system analysis of underground radio networks and potential benefits
- Design and build portable transmitters
- Field demonstrate two-way radio based on portable electronics
- License technology to communications vendor.

## Results

The demonstrated wireless range of communication is well over 100 meters through the earth. This range for the wireless communication technology allows one to transmit low frequency radio waves from base station to base station throughout the mine.

## Commercialization

Los Alamos National Laboratory has exclusively licensed this technology to Vital Alert, a Canadian-based company, now with an office in the United States. Vital Alert wants to retrofit this technology with their existing communications technology to develop a more robust product. They are currently evaluating the technology to apply for Mine Safety and Health Administration (MSHA) approval for coal mining.

## Project Partners

Los Alamos National Laboratory  
Los Alamos, NM

Helca Mining Company  
Coeur d'Alene, ID

CONSOL Inc.  
Library, PA

ASARCO Incorporated  
Sahuarita, AZ

Phelps Dodge Mining Company  
Morenci, AZ

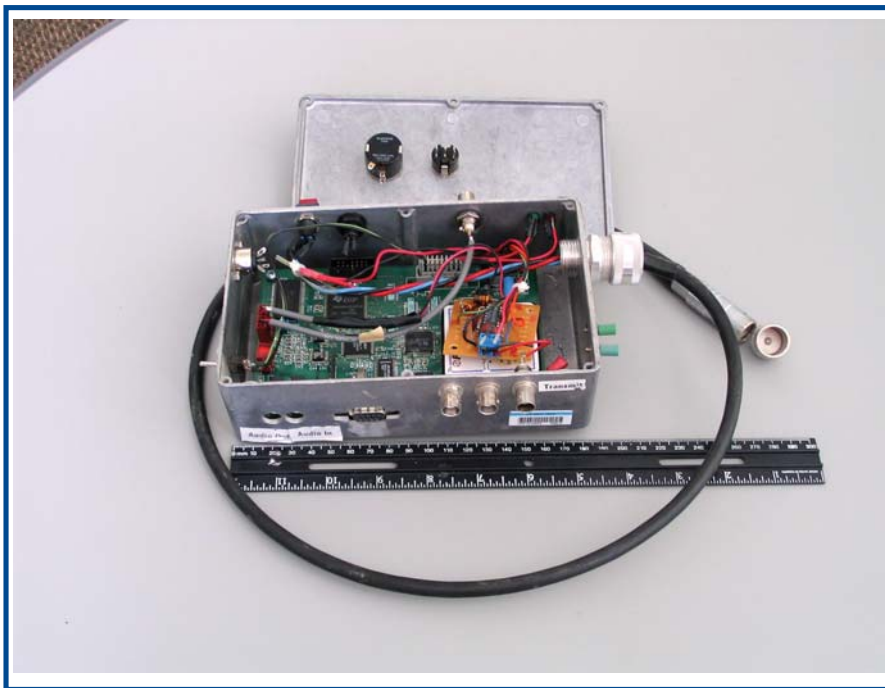
Raton Technology Research  
Raton, NM

Harris Communications  
Rochester, NY

Waste Isolation Pilot Plant  
Carlsbad, NM

## A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.



**Through-the-Earth Radio Transmitter**

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