

**Project Title:** Operational Sensitivity of Through-The-Earth Communication  
**Organization:** Virginia Polytechnic Institute and State University (Virginia Tech)  
**Partnerships:** Virginia Center for Coal and Energy Research (Lead)  
Lhoist North America  
James River Coal Company  
Prairie State Generating Company  
Carroll Technologies  
Lockheed-Martin

**Investigator(s):** Steven Schafrik, PI  
Chester Weiss, Co-PI  
Ellen Gilliland, Co-PI

**Focus Area:** Safety

## SYNOPSIS

***Problem Statement and Justification:*** Through-the-Earth (TTE) communication systems will play an important role for maximizing worker safety and facilitating rescue operations in emergency situations. However, at this time TTE is a burgeoning technology with only one system commercially available and one not yet commercially available. How to effectively deploy TTE technologies in the complex geologic setting of an active underground mine, and more importantly, under the logistical constraints imposed during a mining emergency, has not yet been examined. Limited worker mobility during a mine collapse, restricted topside access, and the presence of mining infrastructure each affect the effectiveness of TTE communications, as does the inherent geologic complexities of the subsurface through which the TTE signal must propagate.

***Impact of the Research:*** This research will answer the critical question, "What is the effect of these complicating factors and how must the TTE operational team deal with these effects in order to save lives?" Those deploying the communication unit above ground will have a better understanding and methodology for deployment when guided by the experience developed during this project. Implementation of the guidelines and tools developed will ensure that the operational envelope of the communications system is well defined, allowing the system to be optimally deployed during an emergency, to support successful rescue operations.

***Objective(s) and Research Approach:*** The objective of this project is to develop guidelines for using TTE technology, taking an experimental approach assisted by theoretical work. This project addresses the problem of quantifying the effect of geologic and logistical complexity on TTE communications. The specific aims of the project are 1) to identify performance factors; 2) test and evaluate performance related to those factors; and 3) develop operational and planning recommendations for effective deployment of TTE communications systems. This will be accomplished through a hybrid approach of field testing supported by state of the art TTE simulations for 3D geologies.