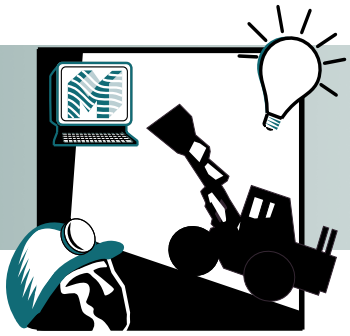
MINING

Project Fact Sheet



24-Channel Geophone Array for Horizontal or Vertical Boreholes

Benefits

- Saves energy by minimizing mining interruptions
- Decreases the amount of waste that is mined
- Improves mining productivity

Application

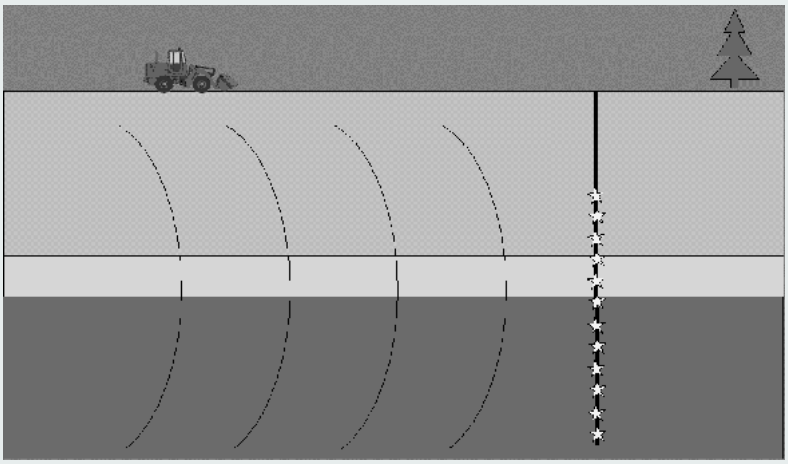
Development of a 24-channel geophone array will benefit surface and underground metal, industrial, and coal mines by increasing the accuracy of tomographic imaging through source and receiver locations that completely surround the area of interest.

24-Channel Geophone Array Eliminates Problem of Sensor Placement

This project will develop an array of 24 seismic sensors capable of being mounted in either a vertical or horizontal borehole. Seismic tomography has been used successfully to monitor and evaluate geologic conditions ahead of a mining face. A primary limitation of existing seismic tomography, however, is the placement of sensors. This 24-channel geophone array may eliminate this problem of sensor placement. It will significantly increase the accuracy of tomographic imaging of conditions ahead of mining by allowing source and receiver locations to completely surround the area of interest. This technology will save energy in excavation, transportation, ventilation, and processing phases of mining operations. It will also reduce the amount of waste mined and mining cycle interruptions.

Three primary components are critical to the design. First, conventional measuring devices are lowered into vertical holes, a reliable placement method is required for horizontal boreholes. Second a unit which houses the geophone and allows clamping to the borehole wall must be designed. Finally, the geophone must be electronically connected to the data acquisition system with appropriate cable and connectors. The development of this array will minimize mining interruptions and improve productivity.

Seismic Sensors



Above illustration shows seismic sensors in dry a vertical borehole for surface mining/quarrying.

Project Description

Goal: To develop an array of 24 seismic sensors capable of being mounted in either vertical or horizontal boreholes to improve ground-imaging techniques. This will reduce energy usage in mining operations because anomalous conditions ahead of mining will be more clearly imaged, allowing fewer interruptions and less waste material mined.

The primary research tasks will focus on sensor placement method, sensor housing and clamping, and cabling and connector selection. Following assembly, a prototype will be tested in the laboratory as well as in both an underground coal mine and a surface stone quarry. Data analysis and tool performance will then be used for subsequent design modifications. A final design will have several components available for patent application.

Progress and Milestones

This project includes the following activities:

- Finalize design and assemble arrays including sensors, housing and clamping units as well as cabling and connect issues.
- Laboratory testing will focus on the clamping and placement components.
- Apply for Mining Safety and Health Administration (MSHA) Experimental Permit to allow it to be used in a methane drainage borehole of an underground mine.
- Field tests at surface quarry and underground coal mine.
- Data analysis of the clamping repeatability, placement ease, and sensor response will be evaluated during laboratory and field testing.
- Alter array design based on test results.
- Prepare final report.

Commercialization Plan

Project support from companies which are actively involved in borehole equipment and ground imaging will assure that the developed technology is transferred to industry. Further, two publications will describe the ability, usage, and advantages of the technology. These publications will be in highly visible forums so that numerous additional representatives of the mining industry will be aware of the development of the technology.

Project Partners

Virginia Polytechnic Institute and State University
Blacksburg, VA

CONSOL Inc.
Library, PA

Global Stone James River
Buchanan, VA

NSA Engineering, Inc.
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