Demonstration of Crosswell Imaging Technology and Advanced Drillstring Radar Navigation for Horizontal Directional Drilling

Crosswell Imaging and Improved Horizontal Drilling Technologies Will Advance Exploration, Resource Characterization, and Extraction Technology

The mining industry envisions future mining in deeper, thinner ore deposits that are geologically more complex. There is a need to advance exploration, resource characterization, and extraction technologies, as well as enhance safety in all aspects of mining. Another need is to accomplish imaging during exploration with minimum land surface disturbance and fewer drillholes. In order to respond to these needs, the image and profile of the geology must be detected, the results need to be confirmed and mitigation practices need to be implemented when anomalies are found.

Imaging ahead of mining can be done from horizontal holes rather than the standard practice of using vertical drillholes. Underground horizontal drilling has become increasingly necessary with the growing need for accurate exploration methods. Also, the recognized inaccuracy of abandoned mine maps raises the concern that mining into abandoned mine voids is likely to occur in the future.

Researchers at Stolar Research Corporation, and their partners will demonstrate Crosswell Imaging in horizontal holes and will enhance the guidance and navigation of long-hole horizontal drilling. Through Crosswell Imaging, ore seam thinning can be located, indicating that the seam boundary rock is changing, the seam is rapidly thinning, and/or water has been injected into the void spaces.

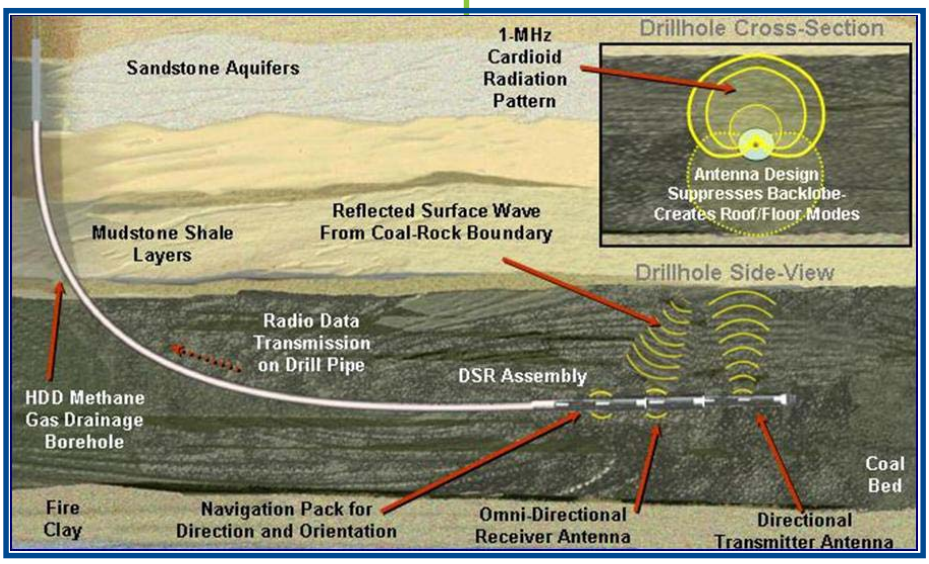
This advancement in mining technology will reduce the risk and cost of extraction. This technology can also be used to identify mine voids. The measurement-while-drilling (MWD) drill-string radar (DSR) technology detects the boundaries of the seam as a guide to drilling. The horizontal boreholes in the deposit can be used to image ahead of mining to identify geologic anomalies. The Data Transmission System (DTS) is another technology which will be developed to supplement the DSR technology. The DTS is a two-way radio frequency data communication system which is accomplished through modulated radio waves inductively coupled to the skin of the drill pipe using loop antennas which then transmits data in real-time to surface communications equipment. This system allows for a more complete picture of downhole conditions in real-time, and excludes the use of cables and wires unlike other commercial systems. The DSR and DTS will thereby improve run-of-mine ore quality, enhancing production efficiency, reducing operational risks, and reducing the production of wastewater.

Benefits for Our Industry and Our Nation

- *Reduces the risk of mining into a significant geologic anomaly.*
- *Eliminates unnecessary cutting of unwanted rock.*
- *Maintains production output to within a 10% margin of forecast.*
- *Reduces energy use by reducing the amount of unwanted material that must be handled and processed.*

Applications in Our Nation's Industry

This project will help to optimize underground mining operations by enabling imaging ahead of mining and assisting navigation while drilling. It will also help to improve safety by identifying mine voids.



DRILL-STRING RADAR (DSR) TECHNOLOGY

Project Description

Goal: To demonstrate two advanced technologies critically needed by the mining industry: (1) Crosswell Imaging of a deposit in advance of mining via horizontal boreholes and (2) real-time measurement-while-drilling (MWD) for guidance and navigation of drillstrings during horizontal drilling operations applicable to both short and long holes.

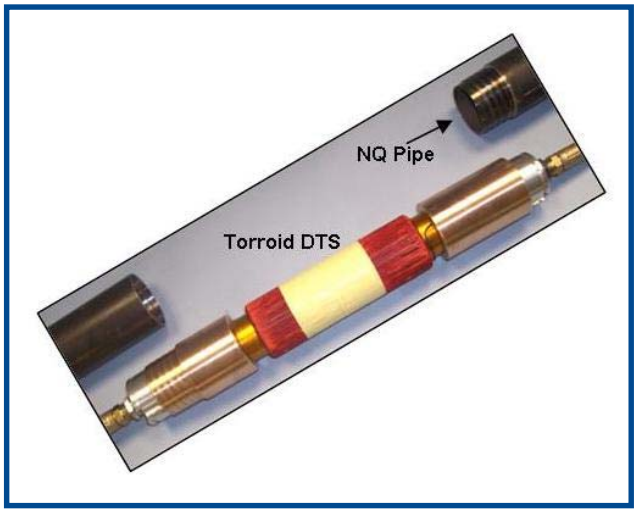
These technologies will be developed into commercial prototypes and field tested in actual mining conditions.

Milestones

- Complete the development of the RIM hardware for horizontal Crosswell Imaging. (2005)
- Development of the Drill-String Radar (DSR) Sensor Technology . Received R&D 100 Award in 2005.
- Development of the Data Transmission System (DTS). Received R&D 100 Award in 2006.
- Review the current portfolio of tomographic image models available and select two or three to use for creating images. (2006)
- Demonstrate the technology in the field. (2007)

Commercialization

- Demonstrate full capabilities of DSR-RIM to early adaptors such as Consol and SUFCO.
- Acquire commercial orders from early adopters so the value become evident to the industry.
- A non-MSHA approved RIM-IV downhole system was recently sold to a U.S. groundwater/bedrock mapping customer. Similar systems are being built for lease to metalifferous mining groups.
- The RIM-IV system is the core geophysical imaging tool of a new field service company with Stolar. The various configurations of RIM-IV (down-hole and in-mine) are being used commercially for subsurface imaging applications. Over twenty (20) commercial surveys have been completed with RIM-IV.
- Develop detailed commercialization plan including marketing strategy to establish price, product position.
- Support equipment manufacturing and field service groups as demand requires.



DATA TRANSMISSION SYSTEM™ (DTS) TECHNOLOGY

Project Partners

Stolar Research Corporation
Raton, NM

CONSOL Energy Inc.
Oakwood, VA

Canyon Fuel Company LLC
Salina, UT

West Virginia University
Morgantown, WV

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.

U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

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Ending in FY 2007