



Centers for Disease Control  
and Prevention (CDC)  
National Institute for Occupational  
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Dear MSHRAC Committee Members:

I want to provide an update to you on a recent accomplishment related to developing a mine communication system. We are studying, through both contract and in-house research, a number of different technologies and systems that have the potential to be used for a mine-wide communication and tracking system during routine operations as well as following a major mine failure such as an explosion, fire, inundation or ground collapse. We have recently conducted an in-mine test of a system that has met a critical developmental goal and I wanted to share the information with you.

As you are aware, mine tragedies over the past few years have underscored the unmet need for two-way communications between underground miners and rescuers located on the surface. We are conducting research to develop and deploy systems as quickly as possible to meet this need. Last week engineers demonstrated a crucial step in an underground coal mine in West Virginia using a system being developed by NIOSH, the U.S. Army, and Kutta Consulting; in which two-way wireless voice communications were achieved over a two mile distance.

The tests found that transmissions from a two-way wireless voice communication system were successfully received over a two-mile distance in two underground coal mines, despite twists and turns in the mine tunnel and other physical barriers. To date, in underground mines, such barriers have limited two-way wireless communications to systems that provide slightly beyond line-of-sight communication – typically, much less than 2,000 feet.

We are working with partners including MSHA, labor, and industry to build on the success of these tests, and to proceed with the next steps of research that will be needed to get a better communications system into mines in the short-term, while providing a bridge toward further, longer-term improvements. While these tests do not yield a final product, their success tells us that it is technologically feasible to devise a system that communicates over much longer distances inside an underground mine than existing systems.

The ability to do this without depending upon an established communications network was a fundamental challenge that needed to be met in developing the technology for a mine-wide communications system. Being able to communicate throughout a mine, and not only in limited areas of a mine, is essential for a system that would be needed for two-way communications from the surface with miners trapped underground after a mine explosion or collapse.

We have made multiple contract awards intended for the development of communications and tracking systems that can survive mining disasters. The medium frequency mesh radio system which is being

developed by Kutta Consulting for the U.S. Army Communications Electronics Research and Development Engineering Center (CERDEC) is being modified for use in underground coal mines under the NIOSH contract and is called the Digital Radio for Underground Miners (DRUM) system.

The hybrid MF/UHF is being designed to take advantage of the ability of the medium frequency radio signals to travel long distances in the coal mine using “parasitic propagation” characteristics. The medium frequency radio signal couples to whatever metallic structures are available and travels along a mine entry by placing the antenna within a few feet of a metallic structure.

By riding on available conductors, the signal can skirt physical barriers that otherwise would block and disrupt it. Potentially suitable conductors include mine rails, electrical lines, water lines, telephone and monitoring lines, belt structures, or any other metal including wire core lifelines. As a result of the MINER Act, lifelines are required along the escape paths from the working area to the outside of the mine or escape shafts. If the lifeline is wire core, it can provide a path for the radio signal as demonstrated during the test, and for the past year we have advocated the use of a wire-core lifeline in anticipation of this communications advantage

The research envisions that the medium-frequency transmissions would interoperate with limited-range communications systems that broadcast in the ultra-high-frequency (UHF) range. Such systems, called “leaky feeder systems” and “wireless mesh systems,” already are used in some mines for communications, and are being installed in others. By using a hybrid UHF/MF system mines could begin installing conventional UHF system today while building onto those existing infrastructures with medium frequency systems and other technologies to eventually provide a highly survivable mine wide radio system. In addition, UHF communication devices are smaller than ones that operate on medium frequencies, making them easier for miners to wear or carry. The NIOSH tests found that the medium frequency system could interoperate with a leaky feeder system.

We are proceeding toward the next steps of research with Kutta and the U.S. Army. In these next steps, we will:

- Explore the development of a digital version of the analog system that was tested. A digital system potentially could transmit over even longer distances inside a mine, expanding an emergency communications network.
- Validate the ability of the medium-frequency transmission system to interoperate with different types of UHF systems.
- Develop networks with infrastructures that will survive catastrophic explosions or collapses, or redundant systems using more than one network, in which at least one network is likely to survive a catastrophic event even if others are disrupted or destroyed.

The medium frequency solution is one of several technologies that NIOSH is working on, to provide operators with a range of solutions depending on the size and complexity of their operation. More details about our mine communications research roadmap, which defines NIOSH’s plans for collaborative development of survivable mine-wide communications systems, can be found at:

**[www.cdc.gov/niosh/mining/commtrack/commtrack.htm](http://www.cdc.gov/niosh/mining/commtrack/commtrack.htm)**. More information about our research under the MINER Act to improve mining disaster prevention and response can be found at

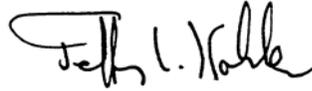
**[www.cdc.gov/niosh/mining/mineract/mineract.htm](http://www.cdc.gov/niosh/mining/mineract/mineract.htm)**. More information about Kutta Consulting can be

found at [www.kuttaconsulting.com](http://www.kuttaconsulting.com). The reference to Kutta does not constitute a commercial endorsement of the company by NIOSH. Information about our mining safety and health research in general is available at [www.cdc.gov/niosh/mining/](http://www.cdc.gov/niosh/mining/).

I wanted to share this important achievement with you and I would welcome any comments or suggestions on our program of research.

Thank you.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Jeffery L. Kohler". The signature is written in a cursive style with a large initial "J". To the right of the signature is a vertical red line.

Jeffery L. Kohler, Ph.D.  
Director  
Office of Mine Safety and Health