

Communicating from the coalface

As US mine safety requirements are intensified, RFS's RADIAFLEX radiating cable passes the test to deliver a unique wireless in-tunnel solution that is finding widespread application in US coal mines.

Coal mining is essential to modern living. A vital element of some of today's most valuable building blocks, coal is used to produce approximately 40 percent of the world's electricity, and is crucial in the production of steel and cement. Like all mining applications, underground coal mining can be hazardous. Continuous improvements in mining techniques, hazardous gas monitoring, and ventilation methods are minimizing potential risks, and providing modern coal miners with a safe working environment. The recent significant change in mine safety legislation in the US underlines the mining industry's ongoing commitment to safety.

In June 2006, US President George W. Bush

RADIAFLEX—line in the mine

The Pillar Innovations/Becker Electronics-designed underground wireless communications system is based on a combination of passive and active RF technology. Typical networks comprise radiating cable, distributed point-source antennas, and numerous bi-directional amplifiers (BDA) to boost the signal along the length of the radiating cable system. The fully engineered turnkey system offers outstanding wireless coverage throughout the mine, and is founded on Radio Frequency Systems' popular RADIAFLEX foam-dielectric coaxial radiating cable.

RADIAFLEX radiating cables function as distributed antennas to provide wireless coverage in confined areas, such as tunnels,



products to obtain the MSHA certification, cementing RFS at the forefront of wireless communications technology development.

In addition to obtaining MSHA approval, the RFS radiating cable was the focus of a number of end-user practical tests. In conjunction with Becker Electronics, Pillar Innovations deployed the RFS cable in numerous 'pillar and room' coal mines with differing geometries, and assessed its lateral coverage, and signal attenuation and propagation performance.

According to Pillar Innovations Project Manager, Adam Brenneman, RFS's RADIAFLEX cable presents the US mining industry with an attractive alternative to conventional hardwired telephony and legacy VHF cable. "We were extremely impressed with the performance of the RFS cable," says Brenneman. "Unlike 'yellow-stranded' VHF cable, the RADIAFLEX cable boasts high signal propagation, retaining signal strength down the line."

Cables that support UHF, such as RADIAFLEX, present many advantages over VHF systems. "The broadband nature of UHF communications enables the transmission of voice, data and video," says Brenneman. "UHF systems are much quieter and less susceptible to underground noise than VHF systems. UHF systems also allow users to seamlessly upgrade to wireless LAN (WLAN) services, which are becoming increasingly prevalent in mining applications."

12 WIRELESS INDOOR SOLUTIONS

signed the *Mine Improvement and New Emergency Response (MINER) Act*—the most significant US mine safety legislation in nearly 30 years. The new legislation further develops safety guidelines, set in place by the Mine Safety and Health Administration (MSHA), to improve mine safety nationwide. More particularly, it calls for the modernization of safety practices and the development of enhanced communications technology, requiring all mines to install wireless two-way communications and electronic tracking systems within three years.

One company that has been developing and implementing innovative mining solutions, long before the introduction of the latest US mine safety legislation, is leading US mining solutions group, Beitzel Corporation. A subsidiary of Beitzel Corporation, Pillar Innovations, has recently paired with leading mining automation and communication system provider, Becker Electronics (partner company of Becker Mining Systems), to develop turnkey wireless communications systems for some of the largest coal mines in the US.

buildings and mines. Thousands of slots along the cable's length permit the tailored distribution of the RF signal into the surrounding space. Supporting multi-level UHF-based voice and data communications, the RADIAFLEX RCF12-50JFN half-inch diameter radiating cable represents a key component of the Pillar Innovations/Becker Electronics underground communications system, and is, therefore, an integral element of modern mine safety.

Underground approval

According to RFS US Business Development Manager, Suzanne Kasai, new mining communications systems and their components have to be certified 'MSHA approved', in order to comply with the new US mine safety requirements. The RADIAFLEX RCF12-50JFN half-inch diameter radiating cable achieved this approval. "The cable was subjected to a month-long qualification process to certify that it possesses advanced fire-retardant characteristics, crucial for mining applications," says Kasai. "It passed with flying colors." RADIAFLEX was one of the first radiating cable



Many on-site mine installation and maintenance crews prefer RADIAFLEX, as it is extremely robust, maneuverable and easy to install.

It is this performance characteristic that further sets RADIAFLEX apart from other radiating cables on the market. "Due to the presence of methane gas, all electrical equipment in coal mining installations, such as leaky feeder communication systems, must be certified as incapable of igniting the gas or 'intrinsically safe'. Therefore, such systems must use relatively low voltage and current," says Brenneman. "This limits the amount of power we can pump through the radiating cable. Overcoming this design limitation requires a highly engineered cable that can perform under these demanding conditions. RADIAFLEX does just that. It retains signal-strength in cable runs of up to 400 meters (1,312 feet), allowing us to minimize the number of in-line amplifiers. This provides a real cost saving to the end user."

Robust in the rock

The rugged and rocky nature of the mine environment—as opposed to road or rail tunnels—often presents a challenge to radiating cable installation. This is further complicated by the changing coverage area of a typical coal mine. As coal is removed, the mine changes shape and eventually the underground wireless communication infrastructure must be realigned to suit the new mine geometry.

"We've found that the on-site mine installation and maintenance crews prefer RADIAFLEX, as it is extremely robust, maneuverable and easy to

work with," says Brenneman. "This is very important, as the radiating cable is continuously moved and reinstalled as the mine's layout changes and develops."

With cable runs in underground mine shafts often having to negotiate tight corners and unconventional distribution paths, RADIAFLEX is easily installed. Its low bending radii enables it to be fashioned around most underground structures," says Kasai. "Its inherent flexibility and high strength allow it to be deployed in the most complex cable network layouts."

In addition, the ambient temperature and humidity experienced in US coal mines can fluctuate dramatically, depending on the time of year. "RADIAFLEX cable is engineered to resist dust, moisture and humidity, making it the ideal choice for demanding conditions, such as those experienced in rugged coal mining environments," says Kasai.

A bright future in the dark

Pillar Innovations has deployed RFS's RADIAFLEX cable in a number of coal mining installations, including America's second largest long-wall coal mine, located in Pennsylvania. Many of the Pillar Innovations installations incorporate up to 27 kilometers (16.8 miles) of RADIAFLEX cable, providing the crucial link between mine site personnel, most of which are located several hundred meters underground.

"These wireless networks are future-proofed to

some degree," says Brenneman. "While RADIAFLEX provides the required multiple voice and data channels, its broadband capabilities allow for sufficient expansion up to 6GHz."

With the US on the brink of establishing an industry based around converting its coal to transportation fuel—the so-called coal liquefaction initiative—the future of coal mining in America looks bright. "The growing momentum behind this initiative, coupled with America's enormous coal reserves (the largest in the world), indicate that underground communications systems are to become increasingly implemented in new and upgraded coal mines throughout the US in the coming years," says Kasai. "RFS is mining-ready, with approved technology and know-how to strongly support the US's mining communications development."



ClearFill—indoor/in-tunnel innovation

RADIAFLEX is an important element of RFS's innovative ClearFill suite of end-to-end wireless indoor solutions (WINS). The ClearFill suite is scalable, flexible and modular, encompassing solutions from 'plug-and-play' to the fully engineered. The advantages of the ClearFill solution are its flexibility, high reliability and inherently broadband nature, which facilitate the addition of new services to the WINS system.