Thirty-seven fatalities in 30 years, involving a miner crushed by a continuous mining machine in underground coal mines, were just too many deaths.

“It seemed to us there should be a way of keeping the miners away from those machines and avoid those crushing accidents.” said David Chirdon, new technology program manager of the Mining Safety and Health Administration (MSHA) with the U.S. Department of Labor.

In the late ‘90s, Chirdon was given the task of facilitating the development of proximity detection systems for underground mining.

In 2002, MSHA partnered with Nautilus International in Burnaby B.C, and a mining company, and began development on a system for underground machinery. They found some technology called proximity detection systems being developed in other industries and began adapting it to underground mining.

“We had many failed underground field tests and repeatedly going back to the drawing board to redesign,” Chirdon said. “Our first field test was in 2003. Our first successful field test, where the system actually performed as we had intended and was designed to meet the explosion proof requirements, obtaining MSHA approval was in 2006.”

Mike Berube is the president and COO of Strata Worldwide, a safety company that offers safety solutions for its mining companies.

“We knew proximity detection was a topic that was coming up, not only in underground coal, but in hard rock and surface mining,” Berube said. “It was going to be an international initiative.”

Looking at proximity in relation to the injury and fatality statistics around heavy equipment, Berube realized that proximity detection and collision avoidance were technologies that could save lives. Proximity detection stops a machine from hitting a person. Collision avoidance stops machines from hitting each other.
“There’s a very large mining company in South Africa that saw the potential safety enhancement that proximity detection could provide,” Berube said. “On their own initiative they started looking at companies that could provide that technology.”

Over the past three years, the development and demand for proximity detection and collision avoidance systems has grown -- partly as a safety issue and partly as a pending legal requirement.

“It was pretty hard to get the mine operators to voluntarily adopt the new technology, because of the expense,” Chirdon said. “Some of companies felt that the hazard didn’t exist in their company.”

In 2010, MSHA put out a request for information that told the public they were looking at the possibility of rule making and asked a series of questions about proximity detection technology and what kind of machines should it be required on.

“We proposed a rule to require proximity detection on continuous mining machines in August of 2011,” Chirdon said. “That activity really got the attention of the mining industry and that’s when we started to see them actually making the effort to start installing these systems on these machines. The threat of the rule has really had a profound effect here.”

The publication of rule is imminent. The U.S is the only country requiring the use of proximity detection systems in underground coal mines; however, regulators in South Africa and Australia are also interested. These requirements will spread to hard rock and surface mining.

“Additionally, the (MSHA) regulatory agenda says that we are planning to publish a second proposed rule in November 2013 that would require proximity detection systems on other mobile machines in underground mines,” Chirdon said. “It does not say which machines or which underground mines.”

In early 2010, Strata began looking for proximity detection and collision avoidance technology and in November 2010, acquired Fredrick Mining Controls (FMC).

“We have taken the technology and we’ve refined it,” Berube said. “We’ve made it easier to install and made some advancements in the technology.”

Strata’s technology is focused on near-field, 30 metres or closer, or slow-speed, five mph and less.

“We put generators on a machine that create an electromagnetic field,” Berube said. “A person wears a personal alarm device (PAD) and the machine has a vehicle alarm device (VAD). PAD and/or VAD can
detect that electromagnetic field at a certain distance. The person or the vehicle will be warned they are close to another vehicle. The PAD or the VAD sends the signal back to the vehicle with the generators on it warn the operator.

“Our system is unique,” he added. “The operator of the vehicle is warned and the person in danger is warned. They are both warned simultaneously.”

The technology works and has saved at least one life. Two weeks ago, Strata’s system did its job.

“The local government and the mine have recognized that our HazardAlert system prevented that injury and potential fatality,” Berube said.

After three years in development, Hard-line Solutions has developed a proximity detention system called Prox, which is integrated with its Muckmaster Radio Remote Control System.

“We have several customers who are using our remote control systems and they wanted a system that would ensure that the operator didn’t get too close to the piece of equipment he was operating,” said Ryan Siggelkow, vice-president of Hard-line Solutions. “They are interested in systems that will increase safety.”

Hard-line’s product uses magnetic resonance that generates a magnetic field around the LHD. A unit is bolted on the machine. A receiver in the unit and the radio remote control interfaces with the magnetic field that generates two zones: a kill zone and a warning zone.

“If the operator gets into the warning zone, the machines lights will start flashing and horns will go off,” said Max Gray, director of sales North America and global marketing for Hard-line. “He is getting into an area he should probably think about getting out of. The red zone will either shut the machine down or it will cease to operate under his control.”

Prox will prevent the operator from running himself over by the slip of a hand.

“If you are six inches behind that machine and you make a random move, that’s a very heavy piece of equipment that could do a lot of damage very quickly,” Gray said.

Gray said accidents often occur because to complacency.
“What management is looking for is a way to deter their operators from accidentally becoming complacent,” he said.

Chirdon said low-frequency electromagnetic systems are preferred in the underground mining application, because the low-frequency nature of the signal can penetrate coal and eliminate blind spots around that machine.

“That technology is preferred at close ranges,” he said. “The problem is it’s limited to close ranges. When you get into faster moving machines it might not be as effective as some other technologies.”

However, other technologies for proximity detection and collision avoidance are available.

“Radar is used on the surface, but it’s an objective detection system that cannot distinguish between a rock and a person,” Chirdon said. “GPS systems work very well for surface mines, but they rely on a connection with satellites, so they are not going to work underground.”

Radio frequency identification (RFID) systems use higher frequency signals and may be more effective at greater speeds. Some companies in other countries use an RFID or UHF/VHF systems, the higher frequency signals, to detection the sensors that are on a miner or a vehicle.

“That’s something that can be used for the higher speeds and I think we will see that eventually in the U.S,” he said.

In the long term, Chiron believes a combination of technologies will be used.

“One of the systems I got to see when I was in South Africa uses three different technologies that electronically communicate with each other,” Chiron said. “It had the very low-frequency electromagnetic system for the slow moving machines for the close distances and the higher-frequency RFID systems for the larger distances and it also had radar system to detect objects. All of these technologies were communicating with each other.

“I think ultimately that’s where we could get the most effective system, but this is a technology that is still in its infancy.”