From: Steven Hitch [SteveHitch@OmahaThinkTank.com]
Sent: Saturday, March 11, 2006 2:04 AM
To: zzMSHA-Standards - Comments to Fed Reg Group
Subject: RIN 1219-AB44 and robotics

Ladies and Gentlemen,

I am responding to this RFI to address a significant aspect of part "F", robotics in mine emergency use. and to a lesser degree, part "A", rapid deploy systems. I have performed a great deal of research on a robotics technology that promises to provide benefits in many rescue scenarios, certainly to include mining accidents. The system is called "Dexter".

This system is a telerobotic system, meaning it is not programmed, rather it responds in realtime to a human operator's control. It is distinguished from other systems by virtue of allowing natural use of the operator's hands, eyes, and ears at the hazard site from a safe remote distance. In other words, the robotic system has a head, arms, and human-like hands. Whatever the operator does, the robot does. This can allow the use of whatever tools are deemed important at any moment. It could operate hand-held sensors and other equipment within the mine, and assist in searching for miners when the air is still unbreathable.

To answer your direct questions:

1. "Besides providing video, gas readings and temperature readings, what other uses can be made of robotics in mine emergencies?"

Before the mine is safe for rescuers to enter, the system could be deployed to do almost anything a rescuer would do with hands, eyes, and ears, but it is operated by wire from a safe distance from the hazard. We expect virtually any hand tools could be used with this system.

2. "What could be the role of a robot in mine rescue operations?"

The robot could be the first to enter the mine, may be configured to convey oxygen and other rescue materials, give the first visual information on conditions, and use hand-held sensors for air quality. It may also be used to attempt locating survivors and convey information between them and the surface rescue personnel.

3. "What information could the robot supply to the Command Center?"

This system is intended to act as a surrogate for a human operator, and as such, the operator can see, hear and provide hands-on work on the operator's behalf. Any sensory equipment that is portable in nature could likely be used in conjunction with this system, and no special interface would be necessary. If the sensory equipment is made to be hand-held, it would likely be possible to use it with the Dexter system.

4. "What tasks could robots be built and programmed to perform?

The system is only programmed to reproduce its human operator's movement in realtime, and convey video and audio from its point of view. This generic approach is intended to provide much greater flexibility than any pre-programmed system in response to an unusual event.

5. "Should individual mines use robots for emergency situations?"

I'm not the best person to take that question on. It's my vague understanding that many mines are within close proximities, which may indicate local official benefits, but wider distances between the mines may make it more adventageous for specific mines to have their own equipment.

Section A of your RFI (Rapid Deploy Systems) also contains questions quite applicable to

this system. Short answers for these follow:

1. "What kinds of rapidly deployable systems could be used to locate miners who are trapped by a mine emergency?"

Hands, eyes, and ears deployed early after the accident may be a significant part of the overall answer. For example, the system could fairly easily be equipped with binaural audio. This would give its human operator spacial distinction capability, a directional sense of hearing - if a voice is heard to the left, he can turn to the left, etc.

2. How would such a system work?

The operator wears a pair of sensory gloves and a display visor. With these alone, he can control the robot's human-like hands and head movements. The operator sees and hears from the robot's perspective, providing an immersion in the hazard site while staying at a safe remote distance personally. Most of the dexterity of the average human is reproduced by the robot, in real-time. The robot is also expected to have at least average human strength. The system would need to be married to a rugged terrain transport, but such robotic bases are already commercially available.

3. "Is the system currently available? If no, what obstacles are there to the development and implementation of this type of system? How long would it take to develop the system?"

The system is not currently available, but is very far along in its design. Prototyping of the technically risky aspects have already been performed, and proven quite feasible. For example, the hand design is complete and fully functional over a standard network in realtime. The remaining obstacles are much simpler, standard engineering tasks, legal, and design of manufacturing processes. We anticipate less than two years from the project's current state to manufacturing if funding was available to afford it. An overview of the system, and video of the hand's proof-of-concept prototype can be seen at the company link below. I am the principal on the project.

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Creators of the Dexter telerobotics system
See it in motion: http://www.OmahaThinkTank.com/Dexter.htm