Existing Mine Communications and Tracking Technology			Appendix B				
Technology	**Description**	**Communications Capability**	**Tracking Capability**	**Manufacturers**	**MSHA approval**	**Advantages**	**Disadvantages**
Ethernet (TCP/IP)	Ethernet communications system for tracking, paging, voice, video, and data transmission. Combination of wireless (WiFi) and wired (optical fiber or CAT5) networks usually used. Some systems can use a leaky feeder system for voice and data transmission.	Voice, data, and video	Yes - accuracy limited to zones defined by wireless access point placement.	Northern Light Technology, Hard-Line Solutions, iPackets, Ekahau	No, but some companies are pursuing MSHA approval for underground coal mining.	Open architecture. Mine monitoring from any remote location via internet. Two-way voice, data, video on one system.	System uses combination of wired and wireless ethernet. Damage to lines or equipment may disrupt service.
Leaky Feeder	Leaky feeder cable and amplifiers are strung through all areas of mine. Voice, data, video can be transmitted by RF coupling to leaky feeder cable.	Voice, data, and video	Yes - if optional RFID readers are coupled to leaky feeder. Accuracy limited to zones.	Minecom International, Mine Radio Systems/El-Equip, Varis Mine Technology, Tunnel Radio, FHF, Becker	Yes - some systems have MSHA approval for underground coal mining.	Two-way voice, data, video.	Damage to leaky feeder cable or amplifiers may disrupt service. No inherent tracking capability. Radios must be in line-of-sight of leaky feeder cable.
Through the Earth	Loop antennas on surface of mine transmit low frequency signal to receivers integrated into cap lamps. Text message or flashing cap lamp alerts miner to emergency.	Most systems are one way alarming and text messaging to underground.	Yes	Mine Site Technologies, Transtek, Mine Radio Systems/El-Equip, Vital Alert Communications, Faser (Poland)	The PED system by Mine Site Technologies has MSHA approval for underground coal mining.	Wireless. Systems with transmitting loops on surface are not disrupted by explosions, fires, or rock falls.	Large or deep mines may require tranmitting loop antennas underground which may be damaged by rock falls or explosions. No tracking. No voice communications for more popular systems.
Medium Frequency	Radio at 280 to 520 KHz using signal propagation on existing pipes, wiring, etc. Requires repeaters for full mine coverage.	Voice, and data	No	Conspec	Not known	Less dedicated wiring needed than leaky feeder.	Repeaters necessary to cover all areas of mine. Damage to repeaters, conductors, or metal structures that supply transmission paths could disrupt service.
Radio Frequency Identification (RFID)	Active (powered) RF tags are worn by workers or installed on mobile equipment. Tags are interogated by tag readers placed in zones throughout the mine.	limited to data exchange (one way paging may be possible). These systems are usually used in combination with a communications system like ethernet or leaky feeder.	Yes - accuracy limited to zones as defined by tag reader placement.	Mine Site Technologies, Mine Radio Systems/El-Equip, MineCom International, Varis Mine Technology, Becker, Saco, iPackets, Ekahau	No	Real-time tracking of miners and equipment. Other safety applications possible such as controlled access, proximity warning.	Systems require separate communications infrastructure such as leaky feeder, wire, or ethernet. Cannot pinpoint location of tag - only last known zone. Damage to communications lines or readers could disrupt service.
Distributed Antenna System	RF antennas are tapped into a coaxial cable backbone where coverage is needed.	Voice, data, video	No	Catron-Theimeg	No	Reconfigurable as mine layout changes. Antennas are placed only where needed, reducing cost. Relatively simple to install.	System requires coaxial cable backbone to all areas where communication is needed. Damage to cable or equipment may disrupt service.
Trolley Phone	High voltage trolley line used as signal path	Voice	No				
Pager Phone	Party line wired phone system	Voice	No				
Phone	Traditional wired phone system.	Voice	No	Austdac, GAI-tronics, Pyott-Boon Electronics, Comtrol	Yes - some systems have MSHA approval for underground coal mining.	Inexpensive and easy to maintain and use.	Damage to phone line will disrupt service. Little or no mobility at limited number of phone locations.
Seismic Monitoring	Portable system using seismic monitoring sensors on the surface that can detect sounds generated by trapped miners.	One-way communications from miners to surface, limited to simple codes generated by tapping.	Yes, if trapped miners signal as they move.	Not known - MSHA had only systems in existence which have now been transferred to FEMA.	NA	Trapped miner locating system that does not depend on integrity of mine communications. Portable.	Emergency system only. Limited to mines 1500 ft deep or less. Depends on trapped miners signaling the surface by tapping on mine structures.
TTE - Miner locator system	Miner carries GLON transmitter which is embedded in cap lamp; transmitter uses 8 channels (4100-5850 kHz); GLOP receiver used by rescuers to locate miner. *On Feb. 27 a Polish coal miner trapped more than a kilometre underground for 111 hours was brought to the surface alive and well after rescuers freed him from under tons of rubble in the Halemba mine in Ruda Slaska, southern Poland. Rescuers located the man thanks to a special transmitter (GLON) worn by miners.*	No communication capability - transmitter is only used for miner location purposes	Receiver GLOP enables location of the transmitters (1) by measuring of the distance from two measurement points or (2) by measuring distance and determining direction of the transmitters from one measurement point	Faser - Polish cap lamp manufacturer	Not yet MSHA approved, but does have European ATEX M1 certification	Lamp shuts down allowing 7 days of power to the locator transmitter, if voltage drops to certain level locatable through 25 - 50m of roof fall or solid rock. If "line of sight", it would enable location by rescue teams at greater distances. Also, LED cap lamp (including GLON transmitter) is lighter than standard cap lamp.	No communication capability - transmitter only used for miner location purposes; range is 50 m maximum; needs MSHA approval