Spotlight: Virginia Tech researchers find that rail and roof mesh can significantly extend transmission range of Magnetic Communication Systems (MCS).

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Contact Information: Virginia Tech, Dr. Steven J. Schafrik PI, Steven.Schafrik@uky.edu

Several well-known factors impact and limit Through-The-Earth (TTE) communication technologies, among these being coal and "consolidated" overburden geology. Permissibility requirements play a major role in restricting underground to surface transmission capabilities by limiting transmission power. There is less understanding of anthropogenic influences. One interesting discovery from this project was how influential rail and roof mesh can be in magnetic communication technologies (MCS) designed for TTE communication in underground mines.

Along the rail, the MCS achieved a maximum underground-to-underground communication distance of 3,000 m (10,000 ft). One interesting example was a case where transmission was received from the TTE device in the seam below the portal located 550 m (1,800 ft) away from the transmission source. It was concluded that the communications received at portal of the overlying mine were the result of TTE signal propagation between parallel sections of rail. However, while the rail enhanced underground-to-underground communication, the impact of rail on other aspects of Through-The-Earth communication was extremely limited. In fact, communications could only be received in a proximal area around the rail when the native MCS range was exceeded.

In entries supported with steel wire mesh, the MCS achieved underground-to-surface communication distances up to 2,300 m (7,500 ft) and underground-to-underground communication distances up to 4,600 m (15,000 ft). Locations that clearly exceeded the native transmission range of the MCS could receive surface to underground messages if the surveyed site overlaid a meshed area of the mine. Thus, the mesh allowed MCS transmission to propagate through approximately 150 m (500 ft) of overburden in these locations, which contrasts the performance of the rail described earlier in similar situations.

Map of surface to underground testing locations for transmission locations SAS 1 and 2 along non-rail travelways.