TECHNICAL PROGRESS REPORT

Quarterly Report

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DISCLAIMER

ABSTRACT

Work has progressed on both subsystems: the through-the-earth (TTE) system and the In-Mine Power Line (IMPL) system. After the Lab prototype of the IMPL system was perfected to function satisfactorily, the thrust of the work focused on building a first production prototype that can be installed and tested inside a mine. To obtain multi-channel voice communication through the TTE system, effort has proceeded to compress voice messages and make the format compatible with the power-line interface protocol.

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RESEARCH, DEVELOPMENT, AND EXPERIMENTAL

Work has continued on both subsystems: the through-the-earth (TTE) system and the In-Mine Power-Line (IMPL) system. The TTE laboratory prototype has served to develop and examine concepts and design the initial circuits. In addition to providing test means in the laboratory, the prototype also served to test the system on short term fleld trips into mines. For thorough, extended evaluation inside a mine, a rugged prototype must be built. The electronic circuits and software of the lab prototype were reexamined and fine-tuned to perfect the system to a satisfactory condition allowing clear, flawless, real-time communication.

After the designs had been finalized, the thrust of the effort turned to designing, fabricating and building a first production prototype. This effort is still in progress. The prototype requires mechanical structures designs as well as electronic circuit board fabrication and electronic assembly. This system will be waterproof, mechanically and electrically rugged and reliable. The prototype will be used for extended field tests and will be left inside a mine over weeks and months.

Our effort relative to the IMPL system focused on making it possible to transmit multi-channel voice. Since a power-line is a relatively narrow-band transmission line, it is necessary to compress the voice bandwidth to accommodate more than a single channel. Since industrial (including mining) power lines constitute a harsh signal transmission environment (electric noise, multi-path, multi-voltage, bridged lines for communication, yet disconnected for power distribution), much logic overhead must be included in the transmission to guarantee error-free communication. This requires automatic error correction and tightly controlled transmission protocols arranged in packages.

This is even a challenge for data communication even though data can be transmitted in packages or “spurts” without effecting the information. Successful digitized voice transmission under these circumstances is even more of a challenge because the information must not be received in “spurts” lest it be corrupted and unintelligible.

So the information must be transmitted in packages and at reception “smoothened out” before it is applied to the voice transducer (telephone hand-set, speaker, etc.). We have a handle on an approach and believe to have a solution at hand.

RESULTS AND DISCUSSION

We expect to have an industrial prototype of the through-the-earth (TTE) communications system ready for demonstration available within weeks. We shall install and evaluate it at the NIOSH Lake Lynn Laboratory mine. We shall then build additional prototypes for demonstration and testing at other mines.

We have met the voice transmission challenges of the In-Mine Power-Line (IMPL) communications system and expect to have a laboratory prototype in three to four weeks.

CONCLUSIONS

The program is proceeding on schedule. Anticipated challenges were met successfully and demonstration prototypes are expected to be ready within weeks.