

**Grant AFC719-57:** Investigation of Improved Communication from Portable Refuge Alternatives to Facilitate Mine Escape and Rescue

**Organization and Principal Investigator:** Rebuilding Their Future Foundation (Steven Cotten)

**Focus Area:** Health and Safety Interventions

**Priority Area:** Using Refuge Alternatives as a Base of Operations

**Problem Statement and Research Approach:** Currently, miners taking shelter in a portable underground refuge chamber may not have a means to communicate their location and other potentially vital information to coordinate with others outside of the mine or approaching underground and thus contribute to their own rescue.

The objective of the proposed research is to develop and demonstrate the feasibility of improved means for reliable emergency communication between occupants of an underground refuge alternative (chamber) with mine personnel on the surface and/or approaching rescue teams or occupants of other nearby refuge alternatives located underground. Modest modifications to both refuge alternative construction and commercial communication systems would significantly improve the ability of occupants of the refuge alternative to share critical information such as their location, number, individual physical condition, refuge alternative status, and surrounding in-mine conditions to assist in coordinating their rescue or escape.

The primary intent of this proposal is to evaluate and demonstrate the feasibility of modifying both a commercially available TTE system and refuge chamber construction to enable less expensive, more easily deployed TTE communication from inside refuge chambers with the surface of the mine to establish a new emergency communication link. The proposed effort will also evaluate the feasibility of sheltered miners to use the same TTE system to communicate with an underground rescue team using an emergency communication system maintained by the Mine Safety and Health Administration (MSHA) and employed by rescue teams to enhance their in-mine exploration efficiency. The proposed work will demonstrate and evaluate the interoperability of these two systems.

**Specific Aims:**

- Determine the possibility of integrating the TTE system antenna into the actual construction of the refuge alternative, thus eliminating the need for the antenna deployment.
- Determine the means to integrate the operation of wireless system components with the capabilities of the TTE system to possibly enhance effective in-mine communication, including that used by MSHA rescue teams.
- Conduct proof-of-concept evaluations initially on the surface and finally in a working underground coal mine.
- Prepare a concept of operations (CONOP) for the enhanced mine rescue communication equipment.