

ENGAGING AUSTERITY THROUGH INNOVATION...

Extreme Endeavors Debuts its Communications System at Hellhole and Schoolhouse Cave

In January 2007 NSS Magazine published an article describing Extreme Endeavors state-of-the-art subterranean monitoring system designed for researching the environment of Hellhole and Schoolhouse Cave. Extreme Endeavors initial focus was on data quality and reliability of sensors to withstand the abuse and punishment of the cave environment. With considerable success in the precision of our data and years of operation without the need for maintenance, we turned our focus on upgrading the communications system. Our design results have yielded a 1 megabit per second wireless TCP/IP connection to the entrance of the caves. A specialized optical isolation system provides a bridge for accessing the RS485 network which provides communications with the sensors in the cave.

Why is this an impressive accomplishment from the viewpoint of electronics development? The high limestone content and a moist environment of a cave cause exposed circuitry and electronics to corrode. RF propagation through a cave is very problematic, and direct cabling is susceptible to static discharge and lightning strikes around the entrance. During the early years of this project, lightning storms would continuously destroy circuitry many thousands of feet back in the caves.

An embedded server is located at the entrance of each cave that supports multiple levels of encryption and has several security features. This server establishes a "tunnel" to the RS485 network that communicates inside of the cave. The server has a static IP and port address which is accessed through AvaLAN Wireless TCP/IP addressable 900 MHz Radios. Data is transmitted from each of the caves to a ridge top several miles away. The **portable relay station** transmits the received data down into the valley to Greer Lime's offices. There is a router using port forwarding connects the radio system to a DSL line allowing connection to the cave system over a secured internet connection from anywhere in the world.

Why are we doing this? Hellhole and Schoolhouse Cave is home to a significant population of endangered species of bats, the Indiana Bat (*Myotis sodalis*) and Virginia Big-eared Bat (*Corynorhinus townsendii virginianus*) hibernate and roost in these caves. Under the US Fish and Wildlife Endangered Species Act, Greer Lime is to provide monitoring of the caves to protect the environment. Greer Lime has greatly exceeded their requirements under the endangered species act as they have funded the largest known cave research project outside of the US Militaries operation. Extreme Endeavors is proud to support this operation to show how industry and nature can coexist in West Virginia.

In our next issue, Extreme Endeavors unveils a new concept of Intelligent Nodal SCADA, a SCADA system that expands and contracts with the user's needs and has tremendous potential in helping water districts in rural America find leaks.



Extreme Endeavors Relay Station



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