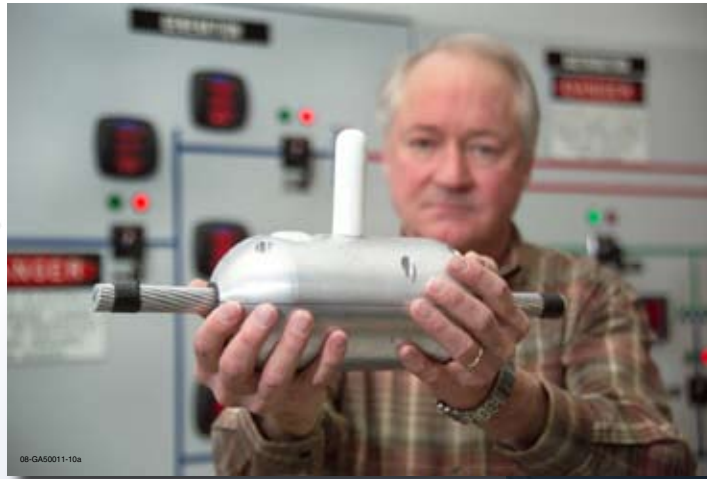


The INL-developed Transmission Line Security Monitor can remotely detect abnormal vibrations and faults on high-voltage transmission lines.



08-GA50011-10a



08-GA50011-10b

Transmission Line Security Monitor

High-voltage transmission lines strung from support towers sprawl for thousands of miles across the United States and form the backbone of the nation's electric power grid. The grid carries power from generating sources to industrial complexes, urban areas and rural communities across America. On its march from power generators to consumers much of the high-voltage transmission corridor passes through remote areas where security is scant or not available. Authorities recognize that our power grid is vulnerable to terrorist attacks, van-

dalism and extreme natural conditions including weather, fire and seismic activity. These conditions can bring lines and towers down and disrupt service to wide areas of the country. Until recently, there was no cost-effective way to comprehensively monitor the grid, optimize performance and protect it from catastrophic failures.

Engineers at Idaho National Laboratory are working on an advanced transmission monitoring systems that is providing an effective and inexpensive way to monitor the physical security of towers

and transmission lines. The Transmission Line Security monitor senses and identifies threats, then alerts power system operators to protect these valuable assets and take action to prevent damage. The TLS monitors mount directly on high-voltage lines ranging from 230 kV to 500 kV near each support tower. Using wireless communications to monitor and relay real-time threat information from tower to tower, these advanced sensors can detect tampering from sources such as unbolting tower support structures,

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For more information

Technical Contacts

John Svoboda
 (208) 526-0857
 John.Svoboda@inl.gov

Robert Polk
 (208) 526-0850
 Robert.Polk@inl.gov

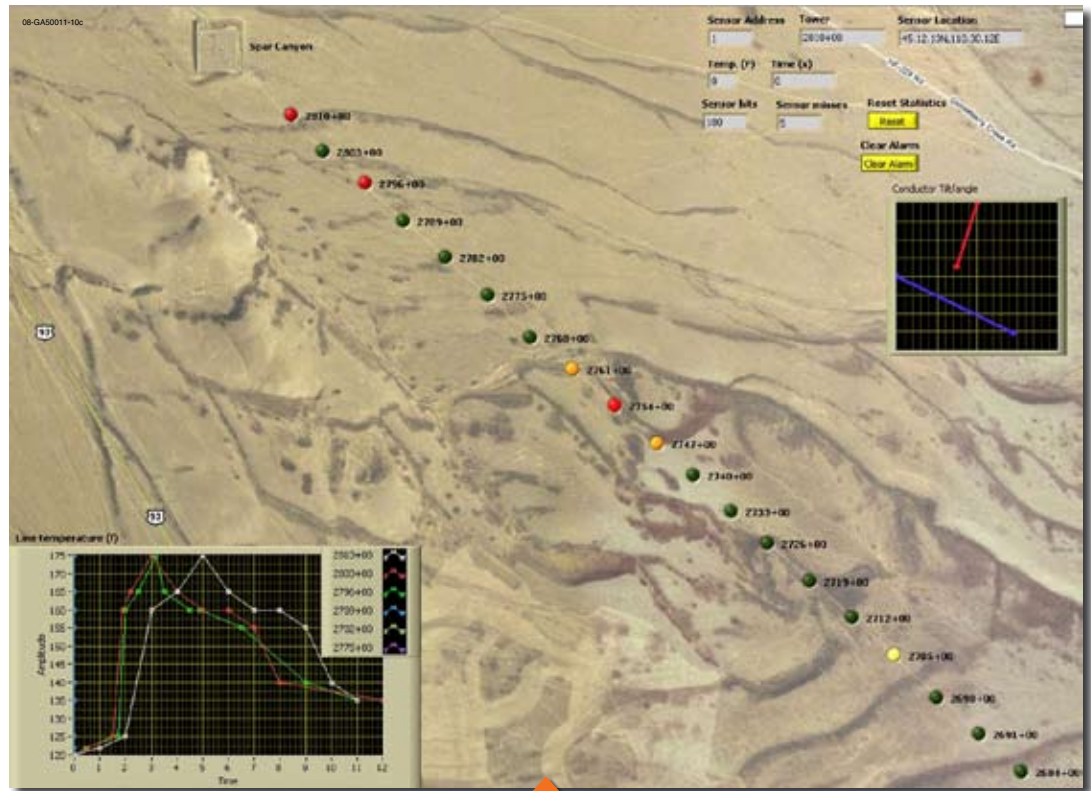
Licensee Contact

Phil Spillane
 Lindsey Manufacturing Co.
 (626) 969-3471, Ext 148
 pspillane@lindsey-usa.com

Technology Transfer Contact

Lisa Nate
 (208) 526-2426
 Lisa.Nate@inl.gov

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The Transmission Line Security Monitor uses wireless communication to relay the status of high-voltage transmission lines to command and control centers.

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the use of cutting torches and saws, shooting of conductors and insulators and explosive blast events. The sensors also monitor for operational problems such as excessive sagging of the conductor and galloping conductors.

The TLS monitor is housed in a small, weatherproof and corona-resistant enclosure that clamps on to the transmission line conductor. Placement on energized high-voltage lines can be accomplished by using a specially designed tool. The TLS monitor requires no batteries – it derives power from the magnetic field generated by the flow of current through the conductor. If there is a loss of transmission line power,

the TLS monitor will continue to operate for several minutes to provide post-interruption information.

The principal innovations that make the TLS monitor possible are the development of custom software signal processing algorithms and secure packaging to integrate an array of advanced sensors and communications technologies. On-board processing and analysis identify sensor inputs as threats which require immediate attention, or as natural non-threats which receive a lower response priority. These advances give the TLS monitor the ability to detect and characterize transmission tower vibrations, detect infrared heat at the base of the tower, conductor

conditions and pinpoint the location and nature of potential problems. This type of on-scene, real-time information has the potential to thwart costly and disruptive terrorist, vandalism or weather events, and help utilities maximize power transmission efficiency and performance.

The TLS monitor was conceptualized and developed in 2005, and licensed to California-based Lindsey Engineering the following year. Current enhancements to the technology are being funded from the Department of Defense’s Technical Support Working Group. Additional power line testing is scheduled to occur this year.