OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

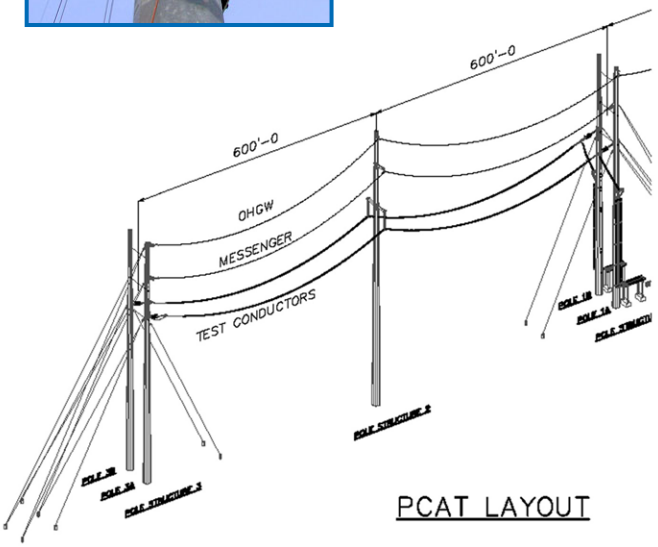
FACT SHEET

NTTRC
NATIONAL TRANSMISSION TECHNOLOGY RESEARCH CENTER

Outdoor Powerline Conductor Accelerated Testing (PCAT) Facility Now Operational

The outdoor Powerline Conductor Accelerated Testing (PCAT) facility at Oak Ridge National Laboratory (ORNL) is a unique testing center that supports the urgent need to address issues associated with electricity transmission reliability and security in the United States. It is the first operational facility of four that comprise the National Transmission Technology Research Center (NTTRC).

PCAT, sponsored by ORNL, the U.S. Department of Energy (DOE), and the Tennessee Valley Authority (TVA), is part of a DOE effort to address the growing demands for power at a time when the amount of electricity that can be carried currently over power lines is slipping. The PCAT facility will test and evaluate advanced power transmission technologies with the potential to increase the capacity and the reliability of the U.S. transmission and distribution network. The technologies to be characterized include new and conventional conductors, advanced sensors and controls, and power electronics.



PCAT LAYOUT

The first technology to be tested at the PCAT facility is aluminum conductor composite-reinforced (ACCR) wire, an advanced conductor developed by the 3M Corporation. Associated high-performance line hardware and accessories that attach the cables to the poles, manufactured by Alcoa Fujikora and Preformed Line Products, are being tested in conjunction with the 3M conductor. ACCR is a promising replacement for conventional conductors that addresses the issues of capacity and reliability. High current loads produce heat, which causes power lines to sag. ACCR uses 3M Nextel 650 ceramic fibers, embedded in an aluminum matrix, to make a composite wire that does not stretch as much when heated as do conventional conductors. The addition of zirconium to the material surrounding the composite wire makes the aluminum more resistant to deformation at higher temperatures.

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ACCR wire operates at temperatures of up to 210°C (410°F) with no degradation of its properties, while conventional aluminum-conductor steel-reinforced wires can operate only at 100°C (212°F) or below. The higher operating temperature allows ACCR to transmit two to three times more power than ACSR.

ACCR can easily replace traditional wires on existing transmission towers, avoiding the cost and environmental impact of building new towers and using new rights-of-way.

The PCAT facility, which began operation in late 2002, is located within a mile of the main ORNL campus. It consists of a closed loop of approximately 2400 feet of ACCR power cable mounted on fiberglass poles. The ACCR and the line accessories are being tested for thermocycling, or high-current situations. A 2-MW dc power supply fed by a transformer provides current for the site. TVA helped design the line structure at the PCAT site and install poles, hardware, and other accessories.

ORNL researchers will test 3M's small-, medium-, and large-diameter conductor cables successively. The tests will evaluate the overall performance of the conductor to verify predictions of computer models by looking at sag and tension data, such as stress/strain curve and breaking point. Each test will run from five to six months. The researchers hope to put each conductor through 500 cycles of simulated thermocycling, taking it to peak load and then returning it to normal load—the equivalent of 30 years of peak loads.

The highly instrumented PCAT will yield important data about the performance of ACCR and the other components under both high temperatures and high current and varying environmental conditions. If the tests show that the new conductor performs well, electric utilities will take greater interest in replacing their existing lines with new cables containing ACCR. Widespread usage of the composite conductor has the potential to increase the efficiency of energy transmission and provide one answer to the problems of growing energy demand and transmission bottlenecks.

Long-term plans for the PCAT facility include testing of other new conductor designs and performance testing of existing conductors.

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