Isolated Area Reliability

Georgia Power brings next-generation system protection to St. Simon's Island to pilot.

By **Jason T. Payne**, *Georgia Power Co.*

EVEN IN THE AGE OF INTELLIGENT, FAULT-DISTANCE-SENSITIVE RELAYING, ISLANDS and other isolated areas still present a major restoration hurdle because of radial taps on radial lines. Islands can be fed through several different conventions, but the fact remains that it is extremely expensive to build redundancy. And in the event of an outage, restoration efforts are usually both difficult and time consuming. To reduce the time it takes to restore power on a prominent resort island, Georgia Power Co. (Atlanta, Georgia, U.S.), a Southern Company subsidiary, has implemented new technology to assist in load restoration.

GOLDEN COAST OF GEORGIA

Heavily protected, century-old oak trees decorated with Spanish moss line the streets and yards of every lot on St. Simon's Island, Georgia, and the transmission right-of-way is no exception. Local ordinances prohibit the removal of any oak tree on the island without approval, and trimming is heavily discouraged. Most outages on the high-profile line are caused by tree contacts in medium to high winds. The beautiful moss-covered oaks, which live and grow within the transmission right-of-way, wrap their branches around the distribution and transmission circuits.

Fortunately for Georgia Power, the hurricane activity has been very forgiving to the Golden Coast of Georgia over the past few decades. The coast has had several brushes with violent hurricanes, direct hits from tropical storms and the occasional tornado. Hurricane season in Georgia is generally mild compared to that of neighboring states, but in anticipation of a large-scale storm, Georgia Power has installed the LineTracker technology from GridSense (West Sacramento, California) on a 115-kV line on St. Simon's Island. The Smart Grid device is recording and transmitting information from the longest and most-exposed line tap on the island.

LineTracker is a simple-to-install device that clamps onto bare transmission or distribution conductors up to 1.33 inches (34 mm) in diameter at voltages up to 138 kV. Installation does not require the line to be de-energized, and these devices can be installed and removed using hot-stick or live-line methods in a short amount of time. Three spring-loaded fingers hold the LineTracker securely to the conductor, and facilitate the voltage and conductor temperature measurements. The spring-loaded fingers automatically close, and the Rogowski coil circuit connection is completed when the LineTracker presses against the conductor and a safety mechanism is manually engaged.

The devices are unobtrusive, versatile and self-powered by a solar panel. They can be used in practically any location on

the system, such as substations, reclosers, switches, underground risers and taps. In the St. Simon's Island pilot installation, the device is mounted in the close vicinity of a remote-controlled, motor-operated switch, primarily to transmit fault data back to Georgia Power's control center in Atlanta.

DATA IS GOLDEN, TOO

The LineTracker device transmits real-time information through a license-free radio frequency to a receiver referred to as a DataPAC (pole-attached collator). In turn, the DataPAC can communicate through a RS-232 serial port, Ethernet, modem (cellular, landline or satellite) or utility radio. For the St. Simon's Island installation, the external serial port is connected to an existing remote terminal unit (RTU) associated with the motor-operated switch. Programming and reporting are dependent on the type of RTU used. This particular motor operator is outfitted with a Telvent (Madrid, Spain) SAGE 1330, and all available information is broadcasted to the control center. In the future, only application-specific information may be transmitted, but for this pilot project, it is beneficial to see all the data.

LINE MONITOR ALARMS ☐ LOSS OF COMMUNICATIONS WITH THE MONITOR

BATTERY VOLTAGE (POLE MOUNTED MASTER) 13.60 VLT-DC

LINE MONITOR ALARMS	PHASE 1	PHASE 2	PHASE 3
EVENT TYPE - SHORT INTERRUPTION	☐	☐	☐
EVENT TYPE - LONG INTERRUPTION	☐	☐	☐
EVENT TYPE - ON THE FAULT PATH	☐	☐	☐
EVENT TYPE - POWER RETURN	☐	☐	☐
PRE TRIGGER POWER STATUS	☐	☐	☐
POST TRIGGER POWER STATUS	☐	☐	☐
BATTERY VOLTAGE	2.24 VLT-DC	2.08 VLT-DC	2.08 VLT-DC
VSENSOR STATIC	3200 V	164800 V	11200 V
EVENT TRIGGER CURRENT	174.4 A	252.8 A	422.4 A
PRE TRIGGER CURRENT	32.0 A	30.4 A	36.8 A
POST TRIGGER CURRENT	32.0 A	35.2 A	32.0 A
LOAD LOG CURRENT	38.4 A	43.2 A	40.0 A
LINE FREQUENCY	0.0 HZ	0.0 HZ	0.0 HZ
POWER FACTOR	0.000 PF	0.000 PF	0.000 PF
PHASE ANGLE	0.0 DEG	0.0 DEG	0.0 DEG
AMBIENT TEMP (DEG C)	7.36 DEG(C)	8.32 DEG(C)	8.80 DEG(C)
CONDUCTOR TEMP (DEG C)	10.88 DEG(C)	10.38 DEG(C)	7.04 DEG(C)

This screen shot of the control center screen in Atlanta shows the real-time information as reported from the Linetrackers in St. Simon's Island.

The receiver has an internal battery and can be powered by a 55-Vac to 600-Vac, or 13.8-Vdc, solar panel. A local ac power source was readily available at the subject switch mechanism,

A view from the switch structure down the right-of-way. The oaks are beautiful but can cause interruptions on the island to both residents and tourists alike.

Travis Watts prepares for hot line work on site. He is the crew leader at the local Brunswick Transmission Maintenance Center and performed the Linetracker installation on the conductors.

eliminating the need for a solar or battery source. In this installation, the DataPAC is attached to the switch pole, using stainless straps, just above the RTU cabinet for local power access. GridSense also has initiated discussions with a major switch manufacturer to integrate this receiver system into the manufacturer's motor operator enclosure to optimize and streamline both the installation and application.

In addition to communicating with GridSense's LineMan Remote and GServer software, the newly redesigned DataPAC includes DNP3 protocol for supervisory control and data acquisition (SCADA) integration. The DataPAC can be configured in a fully polled mode, a report-by-exception (unsolicited) mode or a combination of the two modes. This allows the information to be broadcasted back to generate real-time data on a screen and to record alarms such as a fault indication, which is the primary function in the pilot project.

Given this alarm, the control center has the knowledge needed to make the decision on which switch to open in order to restore service to the most customers within the shortest amount of time. This not only increases system average interruption duration index (SAIDI) numbers as a whole, but it assists in eliminating damage to breakers, switches and other hardware by preventing the accidental closure of a switch or breaker into an unisolated line fault.

In addition to the wireless data communication, the LineTracker devices also have red and amber LEDs on the bottom that provide a good visual indication for field personnel, as any standard fault indicator would. The amber LED advises when voltage and current are present through three flash sequences, and the red LED advises self-clearing short and long interruptions through three flash sequences.

FUTURE APPLICATIONS

Georgia Power is using this technology on St. Simon's Island in a pilot case, in preparation for a broader rollout. In addition to simply being a smart fault indicator, the LineTracker has the ability transmit other real-time data that may revo-

The complete installation with the inconspicuous Linetrackers hanging on the conductors to the left of the switch.

lutionize the power grid. Additional uses include transmission monitoring, line capacity ratings, troubleshooting, capacity planning and asset optimization. Currently, the LineTracker devices are configured to monitor and transmit:

- Event types (momentary, sustained, power restoration and fault current detected)
- Voltage presence
- Current (real-time current in addition to pre- and post-fault current)
- Temperature (ambient and conductor surface temperature)
- DataPAC and LineTracker battery voltage.

Twelve-cycle fault waveforms (current and relative voltage) and load profiles (current, power factor and phase angle) are also available through the DNP3 protocol. It is highly recommended the LineTracker devices be installed on the load (normally energized) side of the switch, so they not only indicate fault currently flowing through the switch, but also verify that voltage is present on the load side of the switch. This confirms the line leading to the switch is in service, even with the switch in the open position because of a downstream fault.

SMART SWITCHING AND RATINGS

Georgia Power also has been experimenting with the expansion of this technology in the area of real-time line capacity rating, or dynamic line capacity rating, which is the real-time rating of a conductor due to environmental conditions (i.e., wind, ambient temperature, rain, sun, etc.). This would allow

In this complete installation, the DataPAC is attached just above the RTU enclosure with 2½-inch stainless-steel straps.

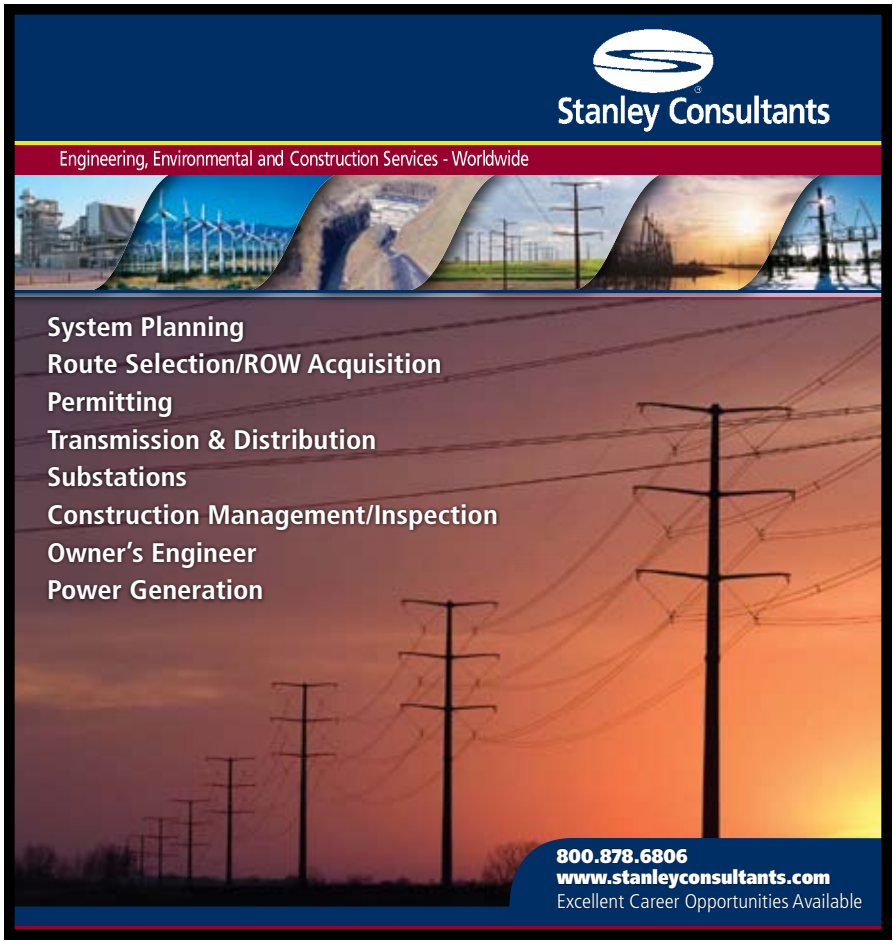
a conductor to possibly have an increased capacity at different times or under different climatic conditions. LineTracker devices have the potential to move the industry a step further in the direction of this theory by reporting the real-time current and temperature to the control desk.

Additional plans include the possible expansion of integrating a third-party system to create an automated line scheme on the radial line. This automated system would control the switches automatically to restore power by isolating the section of line with the fault on it between breaker operations, thus allowing the breaker to return to normal after a reclose. Other options would include the line to continue to lock out and then for the system to take over, isolate the fault and automatically close the breaker to restore power to the line.

Much of the automation has been pioneered in the distribution arena, and transmission has been limited because of the inherent characteristics of the system, such as the distances between switches and breakers on the line and the limitations of an automated system. Several different systems have been researched to perform this automation, and the application of the Linetracker devices in this system is still in analysis.

SMART INVESTMENT

One of the primary benefits of the GridSense system is the financial savings over other conventional potential and current transformers at transmission voltages, allowing for more units on the system for the same price as conventional methods. This investment in the grid will then allow for more cost savings in the future by increasing reliability to sensitive customers, reducing the number of customers involved in a long-term outage, and by providing accurate information needed to isolate a fault to prevent additional exposure to valuable equipment on the system. TDW



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