



High-Profile Customers Demand No-Outage System

S&C Featured Solution: Self-Healing Grids

Location: Orlando, Florida

Customer Challenge

A large southeastern utility was experiencing outages on their vintage distribution system that was serving 500 high-profile commercial customers at a popular vacation spot along International Drive. Accounting for a peak load of 45 MW, these highly competitive customers expected a much higher level of electrical service reliability than what they were currently experiencing.

At one point, they experienced as many as 16 outages within a one year period due to main-line cable faults. Many of the affected customers, at great risk economically, considered a reasonable level of service to be one outage every three to four years!

Significant improvement was needed, quickly, to improve the satisfaction levels of these customers and to prevent their defection to a nearby utility.

The utility's goal was to find and implement a solution that would yield significantly higher levels of reliability than most customers were experiencing—and to actually exceed their expectations. A fast-track schedule was developed, requiring that the system be in service within a year.

Multiple approaches were considered, and of those many were discarded since they would not produce significant reliability improvements. The remaining concepts formed the basis of a request for an engineering study to review intelligent switching and primary network alternatives.

S&C Solution

S&C Electric Company's proposal to provide not only engineering and design services, but also the equipment to implement the solution on a turnkey basis was chosen.



“The utility’s goal was to find and implement a solution that would exceed customer expectations by limiting interruptions to just six to eight cycles.”

S&C's Power System Solutions led a team of S&C engineers and designers along with a team of experts to develop a system which could meet the utility's very high expectations.

The first step was to complete an engineering study to ensure full understanding of the existing system and the details required to implement the new system.

Working with the utility, S&C developed the following design criteria:

- A single contingency failure of an underground cable must be automatically isolated, limiting customer interruptions to six to eight cycles.

S&C's Remote Supervisory Vista® Underground Distribution Switchgear provides high power reliability to popular vacation spot along International Drive.



- Automatic ties must be provided to adjoining feeders where available.
- SCADA control must be provided for the entire system.
- The use of prototype components must be avoided.

To meet these criteria S&C worked with the utility to develop a system consisting of four closed-loop underground feeders utilizing S&C Remote Supervisory Vista® Underground Distribution Switchgear. The main-line, 600-A loop switches in the Vista gear would be fitted with vacuum interrupters controlled by specially configured relays.

The key to the automation system would be its use of transmission relaying concepts. Two pilot-wire based schemes would be used—POTT (Permissive Overreaching Transfer Trip) and DCB (Directional Current Blocking). These two schemes would ensure that only the interrupters on either side of a faulted cable section open—all others would be blocked. Such an arrangement would minimize the number of customers experiencing an outage due to a cable fault. Backup systems would also utilize POTT and DCB schemes, which would race with the primary scheme.

Since the underground loops would have many Vista switchgear units in a series, simple time-current coordination would not be sufficient to provide coordinated operation of the system. Thus, both the primary and backup schemes would need to utilize high-speed fiber-optic communications.

In addition to the methods discussed above, schemes were devised to protect against bus faults in the switchgear, misoperation of load-tap interrupters, misoperation of cable elbows, and even outages at the utility source substations. Even a provision to transfer the critical customer's load to alternate sources on adjacent feeders would be provided should an entire loop lose power for some reason.

Besides the very critical underground loops in the system described above, there are two overhead radial circuits on the system that needed significant reliability improvement as well. But since overhead circuits typically have loads feeding from the lines between switching points, a “no-outage” solution would not be practical. The design criterion in this instance would be that a fault on an overhead section of the system must be automatically isolated, and service restored to customers served by the remainder of the system within one minute.

The overhead system would recognize this improvement in reliability through the installation of S&C Scada-Mate CX™ Switching Systems using S&C's automated controls and IntelliTeam® Automatic Restoration System.

In this arrangement, the upstream protective device isolates a fault in any section of the overhead line. The IntelliTeam then goes into action to open only the Scada-Mate Switches on either side of the faulted section. It then closes a tie to an alternate feeder. The result is restoration of service to all except the faulted feeder section. This unique peer-to-peer distributed intelligence system does not require intervention of a system dispatcher. It's the only way the one-minute restoration goal could have been achieved.

S&C Vista® Underground Distribution Switchgear units placed along International Drive.





S&C worked in concert with the utility to engineer and supply this unique solution. Major phases of the project included:

- Project management
- Engineering studies
- Design and development of the closed-loop automation system
- Equipment procurement
- Communications design
- System configuration and commissioning
- Programming
- Factory acceptance testing
- Site acceptance testing
- Documentation
- Training

In an effort to reduce field setup time and verify the fault-clearing time and SCADA scan rate, all electronic components were sent to S&C's testing facility in Chicago, IL. There, representatives from both S&C and the utility worked for a week to check timing and adjust settings. Loss of voltage tests were conducted to test the system's intelligent switching portion by bypassing each overhead switch to ensure they were closing and reclosing in the correct sequence and within the allowed-time criteria. These tests played an extremely important role in building confidence, and training and adapting the automated system.

Valued Outcome

The result of the entire team's effort was the delivery of a revolutionary distribution automation system that has and will provide reliability into the future.

The system was engineered, designed, procured, configured, delivered, installed, tested, and put in service in approximately one year to meet the utility's aggressive schedule.

Most importantly, the 45 MW load represented by the affected customers remains on the serving utility's system. Bottom line: Business was retained and the business development opportunities for this utility were enhanced because they can now offer a level of service unmatched in the industry.

