Grid Smart. Grid Tough.

Storm-Hardened Switchgear Weathers the Elements to Help Power NOAA's new Pacific Fleet Headquarters

Central Lincoln People's Utility District installed a Trayer 3805 6-way SCADA VFI with high-speed automatic transfer to provide reliable 15kV power distribution in a corrosive salt air coastal environment of high moisture and humidity.

The National Oceanic and Atmospheric Administration's new Marine Operations Center-Pacific (NOAA MOC-P) provides nearly 41,000 square feet of state-of-the-art LEED-certified offices and warehouses supporting the agency's Pacific Fleet operations. Situated adjacent to Oregon State University's Hatfield Marine Science Center at the head of Yaquina Bay, the new MOC-P facility in Newport, Oregon (Figure 1), is home port to four NOAA research/survey ships as well as supporting five other vessels operating out of Alaska and Hawaii.

Mission-critical operations demand high power availability

Since 2011, the Marine Operations Center has not only provided administration, engineering and maintenance for NOAA's Pacific fleet. It has also provided a host of other mission-critical operations underscoring the importance of this facility to the maritime operations of the entire Pacific Rim. These include:

- Producing nautical charts
- Deploying and maintaining buoys for gathering oceanographic information, weather data and generating tsunami warnings
- Managing commercial marine fish stock
- Collecting data relative to climate and the protection of marine life, coral reefs and historic shipwrecks

The NOAA center's need for global communications and high-performance computing underscores the demand for reliable power from the local utility to the facility on a 24/7/365 basis.

Case Study

Figure 1. The NOAA MOC-P facility in Newport, Oregon provides global communications and high-performance computing operations on a 24/7 basis. Designed for extended service life under harsh environmental conditions, Trayer's 3805 series of storm-hardened switchgear ensures power availability for this mission-critical facility.

The environment in which the facility operates complicated matters. As if an average annual rainfall of almost 70 inches is not enough, Newport is no stranger to dense coastal fog, temperature variations and other coastal weather phenomena. Corrosive salt air operating conditions often exceed manufacturers' specifications and pose special complications in keeping equipment running at peak performance. This was part of the challenge faced by Central Lincoln People's Utility District (PUD) during the construction of the new NOAA facility in the area known locally as South Beach.

Central Lincoln PUD connects the Marine Center to the grid

Founded in 1943 in Lincoln County, Oregon, Central Lincoln PUD is sourced primarily by hydroelectric power from the Bonneville Power Administration dams on the Columbia River and its tributaries. Now serving over 34,000 residential and 4,000 commercial customers over a 700 square mile service territory, Central Lincoln PUD was faced with extending its power distribution line from an existing substation to the new NOAA facility.

"Shortly after the Port of Newport was selected to be the new home port for the NOAA Pacific fleet, we contacted Trayer Engineering about the new facility's need for highly reliable, underground electric service," said Bruce J. Lovelin, Cental Lincoln PUD's Chief Engineer/ Systems Engineering Manager.

The utility's existing switch (three 200A three-phase ways) was not sufficient to supply adequate power to both existing customers and the new facility from the same substation. To find a solution, Central Lincoln PUD called on Trayer Engineering's Western Regional Manager, Tom Trayer, who had partnered with them on several previous projects of this type. The job: Find a solution that could not only handle the increased power load but could also provide ruggedized, longer-life operation suitable to Newport's harsh environmental conditions.

"Trayer Engineering worked directly with Central Lincoln engineers and built the switch exactly as we specified," recalls Central Lincoln PUD's Bruce Lovelin. "They use nonferrous materials in manufacturing switchgear, which is a requirement for our corrosive coastal environment."

Rugged climates demand rugged switchgear

Trayer engineers analyzed the requirments and made a recommendation to Central Lincoln PUD consisting of a six-way, three-phase SCADA-ready vacuum fault interrupter (VFI) that would protect their distribution system from a failed transformer or other system fault/overcurrent condition. Brad VanPelt, Senior Sales Engineer with T-Line Electric, Trayer's Pacific Northwest factory rep, coordinated the purchase and delivery of a 15kV-rated 3805 series pad-mount medium-voltage unit.

"Tom had already been working with Central Lincoln, so this project came out of that relationship," VanPelt said. "He coordinated with Central Lincoln and the Trayer engineering team to define the customer's goals and find the ideal solution. Without engineering's confirmation that the project was doable, the overall solution would not have moved forward."

Figure 2. Trayer 3805 series medium-voltage electric switchgear provides high-speed automatic transfer and double-sided access. The unit's corrosion-resistant 304 stainless steel enclosure requires no maintenance and prevents rusting in harsh marine and inland storm environments. Note placement of boulders as a landscape barrier to protect the pad from vehicular traffic. (Trayer Engineering photo)

Delivered to the job site from Trayer's manufacturing facility in San Francisco, Central Lincoln PUD's line crew and meter-relay shop personnel installed and energized the switchgear, "which only took our crews two to three days, however, the distribution lines to the switchgear took about two months." Lovelin notes that the installation of the equipment went very smoothly but that vehicular traffic in close proximity to the pad-mounted switchgear was of concern. So, as a safety precaution, landscape barriers were installed to protect the unit (Figure 2).

Operational characteristics

Also shown in Figure 2, the switchgear takes advantage of the corrosion resistance provided by its Type 304 stainless steel enclosure which prevents rusting and requires no maintenance, even in harsh, salt air coastal environments like Newport.

Operationally, the unit's primary feeders consist of two switchable 600A ways—one closed and one open during normal operation. A major advantage of having both power feeds coming from the same utility substation, as opposed to separate substations, is the seamless transfer that results from the phasing being identical on both feeds.

The switchgear's fully automated supervisory control and data acquisition (SCADA) switch performs high-speed automatic transfer of the primary power feed circuits to the secondary source in just under 10 cycles—well within the normal ride-through of typical distribution equipment today. In addition to open mode, closed transfer mode is also selectable by the user. This allows transfer back to the primary source after power is restored. Other performance characteristics of the 15kV liquid-insulated switch include:

- Two switched ways; three 200A VFIs and one 600A VFI;
- 10,000 load break switch operations at full load, including 8,000 for the VFI;
- 600A continuous current and load switching;
- One-minute withstand capability at 34kV (60Hz) for both load switch and VFI;
- Standard 95kV BIL (impulse insulation) for 15kV-rated switchgear.

Fine-tuning the transformer protection relay

Of note in this application is how Trayer switchgear's SEL-487E control unit, Central Lincoln PUD's preferred relay, has been implemented. Manufactured by Schweitzer Engineering Laboratories of Pullman, Washington, the industry-leading SEL-487E was originally designed for classic, high-reliability transformer protection applications in utility substations. However, due to the highly adaptable, I/O-intensive capability of the device, the NOAA facility application represents the first known use of the SEL-487E for new, highly specialized distribution automation functions that were neither considered by the manufacturer, nor previously implemented in the industry.

As T-Line's VanPelt points out, padmounted switchgear is a very commonly used piece of equipment. "To make a very simple analogy, it'd be like two different wires coming into your house," he says. "Your typical switchgear is smart enough that, if one of those wires goes down, it automatically transfers to the other one. But instead of it just being your house, there are four other houses where your house is and it does it all on a dynamic basis." VanPelt says that, until now, there has been no technology capable of doing that—even by the relay manufacturer used in this application. "It was really Trayer's ability to fine-tune the relay, under Central Lincoln's guidance, that made this such a unique, one-of-a-kind solution."

What VanPelt is referring to is Trayer engineering's customization of the SEL-487E's firmware to take advantage of the control unit's ability to simultaneously protect four different three-phase circuits. In operation, this allows the same control platform to provide high-speed transfer functions, fiber or radio communications, an optional GPS clock and true synchrophasing to ensure that closed transitions for both feeds are completed in exact synchronicity relative to the phasor.

"The unit has been in operation for about a year and a half, and Central Lincoln engineering staff and operations personnel are all very satisfied with the performance of the switch," Chief Engineer Lovelin says. "Electrically it allows us the flexibility to serve the critical area loads from two sources." He further notes that, based on the high-speed transfer capability and the ease of integrating the NOAA switch into SCADA, Central Lincoln PUD has recently upgraded an existing Trayer switch serving the local hospital.

Looking forward

"We've been satisfied with both their product and their excellent support during all phases of this project," Lovelin says. "For future projects, Trayer along with other switchgear manufacturers will again be requested to bid on Central Lincoln projects. As experience is gained on how Distribution Automation benefits our system reliability, Central Lincoln will consider additional projects."

"As with all engineering projects, we strive to find the perfect solution to meet the need of our customers," T-Line's VanPelt adds. "However, the complicated nature of these projects requires us to maintain flexibility

as we confirm our initial assumptions. Ongoing support and coordination maximizes the customer's return on investment (ROI) for these types of projects."

"This project speaks to the capability of Trayer's engineering resources, something the company's always been known for. But beyond that, how they work one-on-one with their customers is what really sets them apart from the other guys. That's the rest of the story in my eyes."

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