FLUKE®

Advanced electronics make the catch less deadly

Application Note

Case Study

Tools: ScopeMeter® Portable Oscilloscope, Fluke 87V Digital Multimeter

Applications: Installing, updating, and servicing sophisticated electronic detection, communication, sensor, and control systems in fishing vessels

Customer: Harris Electric, Inc.

The boats pound bow-deep into cold black swells, while deck crews swing one-ton steel pots aboard, filled with crab. When it gets even colder, crewmen hammer ice from the rails and superstructure to keep its gathering weight from capsizing the boat.

It's with good reason that TV's Discovery Channel calls its hit show *Deadliest Catch*: king crab fishermen working winters in the icy Bering Sea north of Alaska's Aleutian Islands have a fatality rate about 90 times higher than the average worker. Harris Electric's shops in Seattle and Alaska are helping to improve those odds by installing and maintaining twenty-first-century electronic systems on the boats.

Fisherman's Terminal in Seattle is home to more than 700 commercial fishing vessels (including several that have appeared on *Deadliest Catch*). That's where you'll find Harris Electric, Inc., which has served the North Pacific marine industry for more than 80 years. Some 90 percent of the company's work is done on vessels: fishing boats, tugs and other commercial craft, private mega-yachts, and Washington State Ferries.

The fishing industry is both steeped in tradition (many Northwest fishermen trace their roots to ancestors who fished in Scandinavia) and changing fast. Pressures on wild-caught fish and crab stocks have led to new regulations, smaller quotas, and shorter seasons. Short seasons, in turn, have forced fishermen to work long hours in perilous conditions to bring in their catch.

Fortunately, shipboard electronics are changing too—and

High above the harbor, field electronics technician Jeff McMahon tests power supplied to a radar antenna.

Field electronics technician Jeff McMahon checks components on a radar amplifier located inside the helm's control cabinet.

for the better—helping to make fishing safer, easier, and more productive. Harris Electric has been installing, maintaining, and upgrading shipboard electronics since the beginning of this technological revolution. In the 1960s, Harris owner Victor Sundholm helped pioneer systems that enabled the first unmanned engine rooms in tugboats. Crews were leery at first, according to company chairman (and Victor's son) Dick Sundholm, but the concept proved its worth and Harris converted 52 tugs to the new system.

Here are the fish!

Today, the people of Harris Electric spend half their time installing, updating, and servicing the sophisticated electronic detection, communication, sensor, and control systems that fill today's vessels. Skippers use radar, plotters, autopilots, global positioning, and vessel tracking systems to guide their vessels and avoid collisions. The same echo-location technology that the Navy uses to find submarines is used by fishermen to measure water depth and, using direction-adjustable transducers, as an underwater sonic searchlight to find reefs and hunt fish. Catch-monitoring systems help them to place and control their nets for maximum productivity.

In the past, each of these systems had its own display in the pilot house, but today the data from multiple systems can be integrated and displayed on a single screen, so it's easier for crew members to interpret what they're seeing.

All this technology makes it hard for the catch to wriggle away, and it also helps fishermen limit their catch of unwanted species and to maintain sustainable fisheries.

Electronics play an equally vital role inside the vessels. Many functions once controlled by mechanical, air, or hydraulic systems now rely on sensors networked through Ethernet or 24-volt control networks to programmable logic controllers (PLCs). Marine-grade computers are costly, so most vessels do their data processing with off-the-shelf computers designed for use in living rooms or offices, not the high seas.

A boat, a city...a highway

Damp, salty, and subject to vibration, the shipboard environment is "the worst situation you could put electronics in," said Keith Ostby, electronics shop foreman for Harris. "Everything has to be sealed." To avoid corrosion, technicians don't crimp wire joints—they solder them. When they bolt a radar array in place, they coat the threads with anti-corrosion compound.

Harris electronics technicians must be qualified for marine work. They receive training and certification from equipment manufacturers, and all are licensed by the FCC; most hold the GMDSS (Global Maritime Distress Safety System) radio maintainer's license.

Power quality is another issue. "A boat isn't like a building," Ostby said, "it's like a city, because you're generating your own power. The generators are delta or Y configuration, and we have to deal with that because uninterruptible power supplies don't like the delta configuration." A Y system has 120 volts on each leg, he explained, while the delta configuration presents what looks to the equipment like 60 volts on each side of zero. Installing an isolator fixes the problem.

Vessels can be highways, too. The 24 ferryboats that crisscross Puget Sound are officially part of the Washington state highway system, and safety is a key concern. Working under state contract, Harris maintains the radar systems—two radars and a multitude of peripheral electronics at each end—on those busy boats.

Electronics technician Trevor Comstock checks the power supply on a satellite antenna.

"Too valuable not to have with you"

A corner of the Harris electronics shop is set aside for state ferry work, including a test bed for checking radar motherboards and electronics. Harris technicians check both radars and their peripheral equipment once a year, and calibrate each radar to manufacturer's specifications every three months.

They use the Fluke ScopeMeter® portable oscilloscope to capture waveforms the radar equipment is generating, and then compare those with model waveforms provided by the radar manufacturer. The ScopeMeter tool serves in the same way to check echo locators. "The only difference is that, because of the frequency, we can actually see the transmit pulse, whereas on radar you can't," Ostby said. "You can see the timing of it and the amplitude of it. We can check and see if the transducer is bad, if it's knocking the amplitude down or whatever is happening with it." Ostby also uses the Fluke ScopeMeter to detect electrical noise that could interfere with the useful signals traveling through cables. He and others at Harris have their own Fluke ScopeMeters. "The Fluke 'scope—it's too valuable not to have with you," he said.

They use Fluke digital multimeters (most carry the legendary Fluke 87) for other important tests. "All of the guys, I think, in the shop have Fluke voltmeters," Ostby said. "On some of the equipment we work on, we use the frequency setting on our voltmeters. On an autopilot system, for example, we have to set a frequency for the feedback that's tied to the rudder, to indicate to the autopilot the angle of the rudder, to make it steer straight.

"We're always checking input voltage," he added, "because it's so ragged on boats. It's just a fact of life. Batteries are stuck away, maybe they're checked, maybe they're not. That's the first thing that we need to know—that we have good voltage or we don't."

Techs use the Fluke meter's Min/Max recording capability to check for voltage sags and swells. "Sometimes we even leave our Flukes set to peak reading and leave them on for 24 hours to see what has happened. Are they turning on a winch and is it spiking? What's affecting our equipment? That comes in really handy."

Proper grounding is also essential. "Sometimes you'll use an ohmmeter to see how good your ground is, because the Fluke will give you such a good indication of resistance," Ostby added. "You know if your ground is bad, even to a minute amount, because you don't want any resistance in your ground system."

A less predictable challenge is those hammer-swinging *Deadliest Catch* guys. In the dark and cold, deckhands beating ice off a boat's superstructure sometimes confuse radar cables with deck rails. "That's where some of our work comes from," said Ostby.

Hammered cables are just part of the job. Its reputation for service has kept Harris busy for more than 80 years. The company maintains a year-round satellite shop at Dutch Harbor, in the Aleutians, and opens in summer at Naknek to serve the Bristol Bay salmon fishery. Whatever it takes.

Ostby recalls flying to Dutch Harbor once as a technician, when a boat there burned at the dock three weeks before the start of crab season. The choice was stark: forgo the season and lose a year's income. . . or fix the boat. "We gutted the whole wheelhouse of electronics," he said. "I put in 110 hours one week and 120 hours the next, but in two and a half weeks, we got 'em ready.

"That was the big thing—they were able to fish the season."

Trevor Comstock checks the magnetron current on a radar antenna unit.

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