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Detailed Data of Coverage by Sutro's New Antennas

A standard home television antenna on a plastic mount rose 30 feet in 30 seconds through the roof of a tricked-out van in the Home Depot parking lot in San Carlos, to capture exact measurements of broadcast signals from Sutro Tower precisely 20.6 miles away.

David Kelly, project manager for the wireless consulting engineers Hammett and Edison of Sonoma, took these measurements in early March at 45 locations around the Bay Area from Santa Rosa to Gilroy to Stockton. The goal was making sure the new TV antennas installed on Sutro Tower last year are broadcasting as expected – a final step in the nationwide repack project that transferred 30% of television's broadcast frequency spectrum to wireless companies.

At field test sites in Pacifica (top) and San Carlos (right), David Kelly recorded coverage data before lowering the mast and removing the antenna.

"This is proof of compliance that each antenna is performing as designed," said Kelly, as he adjusted the compass on the antenna mount from the van below. "Normally the strongest signal should be with the antenna pointed directly at Sutro Tower, but occasionally that's not the case, due to a hill or something. I can manually tune it to get the best signal."

Inside the van, a 22-foot-long Freightliner Sprinter, there's a demodulator, a spectrum analyzer, azimuth control

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for the antenna, a laptop receiving the information from the antenna, a plain television to see what reception looks like, an air compressor to raise and lower the antenna's 30-foot mast, a battery pack and an inverter to change the power from direct current to alternating current. On the antenna mast is a basic but finely calibrated directional antenna, a GPS antenna, and a sensitive compass.

At each stop, Kelly raised the antenna, zeroed in on Sutro Tower, flipped the compass off "to eliminate any interference from the compass itself," then captured multiple statistics of each station's signal for 25 seconds.

Kelly explained that broadcasters and the Federal Communications Commission use "predictive analysis" to foretell "where a broadcast signal will go, based on the antenna itself, its power, how high it is, where it's pointed, those kinds of things." In the early years of television, this analysis was used in granting a broadcast license so stations' signals wouldn't overlap, and then field tests were used to confirm the predictions. But the analyses were so accurate, and the broadcast antennas so consistent, that 20 years ago the FCC stopped requiring regular field tests, though they're useful when new antennas are installed. Before this year, the last field tests of broadcast coverage of Sutro Tower's antennas were in 2009 after the conversion to digital TV.

Kelly recorded each location's data on the van's laptop, then marked on a map whether measured coverage aligned with predictive analyses for the site. "When we've been to all the sites, after crunching the data, if something looks wrong compared to the predictive analysis we'll measure again," Kelly said. "Like a shadow from Coit Tower may affect coverage on the Embarcadero. Does a station want to re-aim its antenna a bit because of that, or would that affect coverage someplace else?" It's about as complicated as rocket science, which Kelly has in his blood: his father, rocket scientist Bob Kelly, was director of space transportation for Boeing, in charge of the Space Shuttle in the 1970s. "When I was a kid we spent summers in Cocoa Beach having barbecues with astronauts' families," Kelly said.

All in the Family for Sutro Maintenance

Two brothers have joined the Sutro Tower maintenance team, bringing new meaning to coworkers being "family". Emmanuel (Manny) and Julio Perez began working together 17 years ago and have jointly made the transitions from satellite installations to cellular to broadcast towers, and, now, to the Sutro Tower staff.

"This is the opportunity," said Julio. "We were honored to be offered this job — everyone in the tower industry respects Sutro."

The Perezes join Dave Gaddy to make up the team in charge of overall tower and building maintenance. The Perez brothers started working at Sutro two years ago as employees of Shane Best and Best Endeavours Inc. Shane was previously Sutro Tower's head of safety and maintenance.

Raul Velez, vice president and chief operating officer of Sutro Tower, Inc., said of hiring them, "These two very intelligent men are stellar examples of how to do things right. They do their work, look out for others, and fit right in."

Manny and Julio Perez, and the new puppy Yoda who will greet Manny's family when they move here from New York.

Going from contractors to staff is a big change for both men. "It's different," said Julio. "Normally tower workers are at a job site for two or three months and then move on, but now this is a 'never-ending project.' It's

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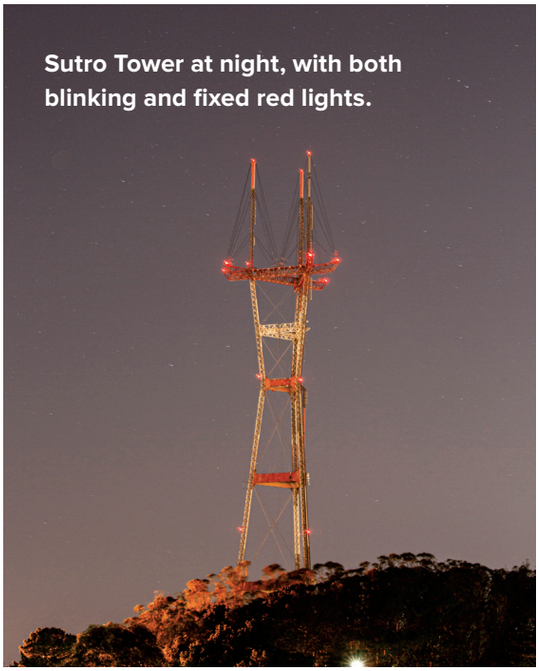

Sutro Tower at night, with both blinking and fixed red lights.

Photo by John Curley

FAA Gives Final Signoff for New Sutro Lights

The Federal Aviation Administration has granted final formal approval for new safety lighting on Sutro Tower, ending a lengthy process to upgrade the tower's 18 aviation safety lights.

There is a medium-intensity LED beacon atop each of Sutro Tower's three antenna stacks, 977 feet above ground level, which blinks white during the day and red at night. There are six low-intensity LED lights on the extended "outrigger" portions on level 6, 750 feet above ground level, which are red at night and off during the day. And there are nine high-intensity strobes — three on each of the tower's three legs — blinking white during the day and red at night. They are located 262 feet above ground level between levels 2 and 3, 569 feet up at level 4, and 769 feet up at level 6.

The new lights were ordered in 2018 from Dialight, Inc., of London, and installed in 2019. The final step came in October 2020 when the FAA notified Sutro Tower that its modified "antenna structural registration", which includes the lights, was officially approved.

Making Sure Broadcasts Aren't Interrupted

Television broadcasting is a split-second endeavor, and Sutro Tower, Inc. has installed the most complex and modern antenna monitoring system in the country to keep its 10 TV and 3 radio stations on the air continuously.

Developed and installed by DAC System SA of Switzerland, the new Sutro system has 105 sensor sites and 16 junction boxes in three separate locations collecting data for each station's main and auxiliary antennas, as well as from the transmission lines running up the tower from control rooms to the antennas. With this information, any anomaly in power output anywhere in an antenna system (known to engineers as forward and reflected power) can be instantly detected – and corrected.

Maurizio Santovito in one of the antenna monitoring control rooms

"We're the only company to design specialty monitoring systems for broadcasting," said Maurizio Santovito, DACS's sales engineer, who took his first transatlantic trip in nine months to set up the system in San Francisco in November. "This is the biggest system in the U.S."

With nine new antennas installed on Sutro Tower last year as part of the Federal Communications Commission's nationwide broadcast spectrum repack project, new equipment was needed to monitor the antennas' output. Peter Eckmann and Marty Acuff, Sutro Tower's chief technical consultants, began designing a new system more than three years ago to replace the aging monitors previously in place; DACS signed on as vendor in 2018. "With DACS, we now have monitoring that finds defects, and also finds trends in usage of power for preventive maintenance," said Eckmann.

Like the antennas themselves, the DACS controls rely on PG&E's electricity delivery system or backup generators that Sutro Tower and the stations have for emergencies. DACS is tied into monitors from WorldCast Systems, which keep track of the amount of power output from transmitters in stations' control rooms. "It all fits together to keep each station broadcasting non-stop," said Acuff.

"This is a very complicated system because of the huge amount of power involved," said Santovito, who has worked in mobile and broadcast engineering for 20 years since graduating from Milan Polytechnic University. "It is very exciting to install our system here."

New Cable For Sutro's Elevator

Elevator experts have replaced the 10,000-pound cable that lifts Sutro Tower's little elevator inside the west leg 750 feet. The new cable, consisting of ⅝" drawn galvanized steel wire rope, took three days to install.

Marco Genato, project manager for Bleyle Elevator Inc. of Pacifica, said Sutro's 20x33-inch elevator "is one of a kind... It's outside in the ocean breeze and fog, it goes over numerous sheaves with multiple turns, tighter turns. So the rope life is less than for elevators indoors. Sutro's elevator cable is replaced more often."

Because of the 11-degree tilt and space limitations inside the tower's leg, its special use elevator goes 100 feet per minute, compared to 300 or 400 or more feet per minute for elevators in buildings of similar height.

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definitely more challenging."

"We have to take a step back and look at the big picture," said Manny. "We're embracing the responsibilities. The biggest surprise so far is that the people are always so positive."

The brothers share an understanding that tower work can be dangerous. "Everything is calculated for safety," said Manny. "Shortcuts get you killed and get everyone around you killed." Julio added, "If you don't embrace the danger, you get careless. Respect keeps you sharp — and safe."

After years of traveling from tower to tower around the country in their RVs, the brothers are getting used to permanent residence with their new positions at Sutro. "I'm getting the mindset of not being on the road," said Manny. "It's a good feeling not traveling, but this is an expensive state to bring a family."

Manny, the older brother by 3 years, and Julio grew up in the Bronx, a few blocks from Yankee Stadium (though both are fans of the New York Mets instead of the Yankees). Manny's wife and two children will move here from upper Manhattan after the school year, while Julio, who is single, is relocating from Florida, where their parents and sister now live.

"I got my kids a puppy to lure them out here," Manny joked.