

# Lights on for the Paganini Electric Corp. and San Francisco City Hall

**O**n Apr. 18, 1906, an 8.3 earthquake shook San Francisco, caused fires and destroyed much of the city. All that remained of San Francisco City Hall was the dome. Instead of rebuilding the structure, the city's Board of Supervisors voted to fabricate a new building. Its construction became a symbol of the city's rebirth. Doors opened on Dec. 28, 1915, and it is now a National Historic Landmark.

Since 2015 marks the 100-year anniversary of the iconic building, San Francisco city administrators decided to upgrade the City Hall's existing exterior facade lighting system by replacing metal-halide fixtures with high-efficiency light-emitting diode (LED) luminaires and installing state-of-the-art controls to operate the system and enable more dramatic light shows.

San Franciscans have seen lighting displays—heralding holidays, citywide events and sports team victories—on the facade of their Beaux-Arts style City Hall for years. Creating those shows called for placing individual gel caps on each fixture, which required considerable time and excessive labor.

Implementing the upgrade project required close collaboration between the project team, which included Paganini Electric Corp.;

Arup Engineering, an independent firm of designers, planners, engineers, consultants and technical specialists; Philips Lighting (Color Kinetics); and staffers at San Francisco City Hall.

“Being a native San Franciscan, I was very proud to be involved in such a high profile project that the city will showcase for years to come,” said Michael Paganini, president, Paganini Electric Corp., and grandson of company founder Albert E. Paganini.

Toby Lewis, lighting designer, Arup, began by reviewing available LED facade lighting equipment. She selected Philips Color Kinetics because of the existing power system's 277V requirements and for the color range. This will result in consistent color matching on all building levels using the same LED chips. She also selected a DMX control interface called Pharos, which was installed on a computer at City Hall. (DMX is a nonproprietary control signal that facilitates the creation of dynamic light shows.)

“Every time the city wants to change the colors or create a new color scene for the building, they will be able to program it from the computer,” she said.



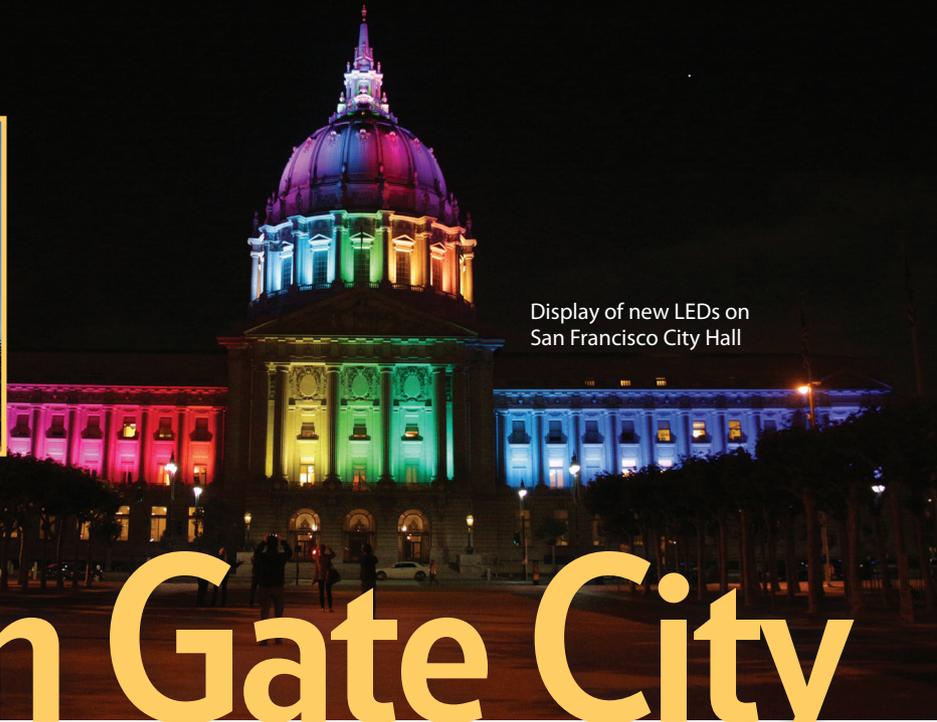
Highest lantern level



Fixtures installed at highest lantern level



On the roof level, the high-powered LED fixture shown in the top left corner at a diagonal illuminates the upper dome with a beam that shoots up approximately 200 feet.



Display of new LEDs on San Francisco City Hall

# Golden Gate City

PHOTOS COURTESY OF ARUP ENGINEERING

In designing the infrastructure for the new lighting system, Jonathan Gervais, electrical engineer, Arup, worked with the existing electrical distribution system.

“An iconic building creates challenges, but we were able to reuse some existing provisions, and that allowed us to simplify the installation, control costs and meet the project deadline,” Gervais said.

Due to historical society restrictions, the Paganini Electric crew had to preserve the building’s appearance.

“We had to route the conduits in very specific routes so they would be virtually unseen from every angle of the building,” said Mike Provence, lead foreman, Paganini Electric. “That required using crawl spaces and existing conduit paths so that we could get our infrastructure in place without any long-term visual impact to the building. The new fixtures and controls required additional wiring, which meant that the existing wiring had to be abandoned. New wiring was pulled to all fixture locations. It was challenging, but on-site electrician Bill Carlile provided valuable input on how we could run our new conduit systems throughout the building with very little impact to the existing finishes.”

“A key component of the design was the fact that we modified standard products to get the color range desired,” Lewis

said. “It was important for the city to have a static white scene available with a similar color temperature on the building that had been provided by the metal-halide sources.”

Integral to that process, Arup developed custom fixtures that are half red-green-blue (RGB) and half white light. The half that is white is two-thirds 2,700 Kelvin color temperature and one-third 4,000K.

“We knew we wanted a color temperature around 3,000K, which is what the metal-halide sources produced,” Lewis said. “The intent was to visibly dial in the right color temperature of white light that would complement the building materials and also add dynamic color-changing abilities.”

To envision the result, Arup, Color Kinetics and City Hall staffers conducted a series of mockups at various locations on the building’s exterior. They used high-output, narrow-beam RGB projectors with exchangeable lenses in most cases to determine the right output and the correct beam angles.

Accessing the areas where the fixtures were to be placed presented logistical and physical challenges for Paganini electricians. To install fixtures on the second floor—where the offices of the mayor, the board of supervisors and other VIPs are located—Paganini’s crew had to schedule their installation so that the City Hall staff could continue to work.

PHOTOS COURTESY PAGANINI ELECTRIC CORP.



**Left:** Conduits tie together lighting controls and fixture runs at the upper lantern level; DuraBlock mounts support the structure and the lights.

**Center:** Due to space restrictions, Paganini built triangulated strut assemblies 9 feet off of the dome-level platform to mount 32 fixtures that circle the drum level and illuminate the larger drum level of the dome.

**Right:** 108 LED fixtures of this type were installed on the balcony level.



**Left:** The box on the column base contains data controllers for the lighting control system. New and existing conduit systems tie all the lighting controls together. **Right:** Note the two fixtures, the front for RGB, the back for white light. Since it was a nesting area for the city's many pigeons, the city had to clean the area prior to the electrical work.

Paganini Electric used large JLG lifts to reach existing conduit runs and boxes not accessible from balcony locations. Each articulating lift could extend 140 feet. The basket carried two crew members, their tools and materials and moved slowly.

"The only thing we could do from the sidewalk was to cantilever all the way out to the building," Provence said. "Just from the sidewalk to the building is 80 feet, not to mention we were going diagonally. We were tied off, had to climb over and carry heavy materials. We had to tie off in all locations where we had any kind of a fall potential."

"The most challenging part was to place the lights around the dome because the geometry of the dome is circular and the roof of the building is not," Lewis said. "To get uniform coverage on it, we placed fixtures on the roof as far away from the dome as we could and used a very narrow beam, so we were able to control the light and keep much of it on the dome rather than sending a lot into the atmosphere."

On the balcony, the drum level (effectively the columns supporting the dome), and both lantern levels, designers used geometry and figured that the fixtures should be positioned within 8 feet of the building.

"The effect provided a grazing light within the architectural cavity between columns," Lewis said. "We minimized the length of the shadows by placing the fixtures as far away as possible from the facade within each balcony, while still providing necessary circulation for maintenance."

Atop the dome is a lantern with two levels that a person can stand on. The drum level and above can be accessed by a narrow spiral staircase.

"The area is 10 feet up from the floor, but it was hard to even get ladders in the area to work," Provence said. "A little archway that is about 2 feet tall was basically our access around the entire perimeter of the building."

Paganini built a triangular strut system assembly to support each drum fixture installed on the dome.

"It took two electricians to mount each fixture on the strut assemblies because the strut assemblies mount 9 feet above the ground and each fixture weighs 70 pounds," Provence said.

The most physically challenging aspect of the project for the Paganini crew was on the lantern level. All of the materials and tools had to be transported by elevator on a flat cart to the fourth floor. Once there, Paganini's crew—including Pat Burke, Lucas Wenger, and Mike Speris—had to push the cart through a makeshift doorway that led to the bottom of a 250-step spiral staircase. Then the crew carried the tools, fixtures and other material up the staircase and climbed a 15-foot ship ladder with a 30-inch-by-30-inch opening. Crew members followed that route more than a hundred times during the project.

"It was a physically demanding job," Provence said.

Paganini also installed the lighting control components (driver and data enablers) so the head-end system could communicate with the new fixtures. Conduits tied all the lighting controls together where there are fixture runs.

"Existing buildings offer unique challenges and Paganini did a great job on the installation and the team was careful with the historic building," Arup's Lewis said.

And what happened once all the fixtures were installed?

"We worked with Paganini electricians and showed them exactly how to focus each light in each location," she said. "And they helped carry that same technique around the building."

At the centennial celebration on June 19, San Francisco Mayor Ed Lee gave a speech, a facade lighting show, an Obscura Digital projection presentation, and a Project Bandalop dance performance including dancers repelling down the building. (The projection can be seen at [www.sfcityhall100.com/projects.html](http://www.sfcityhall100.com/projects.html)). Arup also presented a five-minute lighting display that exemplified the system's capabilities and encapsulated the history of San Francisco in images depicting the Gold Rush, the Spanish mission period, fog, a railroad, earthquakes and more.

Another aspect of the project is cause for further celebration. The LED fixtures will reduce the daily wattage use by more than 50 percent, from 31,600 to 14,120W, and will last for 50,000 hours of operation compared to 4,000 hours with the previous installation. The wattage reduction along with the use of lighting controls in lieu of hands-on placement of gels results in a 70 percent reduction in exterior lighting cost.

"It was a very rewarding project to be involved in, since City Hall is such a historic focal point here in San Francisco," said Ron Baxter, project manager, Paganini Electric. "We take great pride in having the opportunity to partner up with the City of San Francisco and all associated team members to improve the exterior lighting of a true San Francisco treasure." ■

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