SFO’S TOWERING ACHIEVEMENT

News / Airlines

An iconic and towering structure rises along the San Francisco Bay area skyline --and it’s safe to say it’s unlike any other.

The 231-foot air traffic control tower features a graceful flaring base with an offset cab of glass at the top, giving it a distinct look resembling that of a wine glass or Olympic torch. A ribbon of glass stretches up the base, reflecting the sparkling waters of the bay during the day and illuminating the darkness with ribbons of color at night.

And yet, though the new construction at San Francisco International Airport provides a distinctive and unique silhouette, it also strikes a harmonious chord with the airport’s surroundings.

Construction crews recently completed the impressive $126 million tower--paid for with a mix of $70 million in FAA funds, City of San Francisco bond issues and airport revenue--to replace the existing control tower atop Terminal 2. The goal for the project—besides for constructing a functional air traffic control tower that meets today’s seismic codes—was fashioning an aesthetically pleasing structure that blends in with the airport’s existing buildings.

“We were very sensitive to building a tower that not only fit well within our passenger terminals, but

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we also wanted to it be an iconic landmark at SFO," says Doug Yakel, the airport's public information officer. "Our goal all along was to end up with something that wasn't just utilitarian and functional in nature, but also meshed well with our developing terminal design aesthetic."

The airport also needed the tower to be green. San Francisco International Airport, known for opening the first LEED Gold terminal in the world in 2011, mandates that all new airport structures achieve LEED Gold certification. It is anticipated that this new building—with its extensive water and energy saving features--will be no exception.

"With this airport traffic control tower, SFO is again leading the way with innovative, sustainable design," says Airport Director John Martin. "This facility will provide both a functional space for our partners at the FAA and an iconic landmark, which will be recognizable to travelers round the world."

Not a Lollipop on a Stick

The new air traffic control tower replaces a tower that has been operating since 1954. The airport plans to demolish the old tower down to Level 3 of the Terminal 2 building after the FAA is confident the new tower is functioning properly and removes its electronics from the facility.

An FAA siting study determined the best location for the new tower was between Terminals 1 and 2, giving air traffic controllers optimal airfield views from the tower cab. To allow for central elevators and stairwells, architects offset the tower's glass cab, positioning it closer to the airfield to improve sightlines and accommodate state-of-the-art electronics. The offset position also gives the structure a uniquely graceful appearance and provides air traffic controllers—at least six on duty at a time--with a sweeping view of the airfield.

From their perch in the new tower, slated to open for business in July 2016, air traffic controllers will have unobstructed views of planes as they take off from an almost parallel vantage point and head toward the San Bruno Mountains then veer off to the East or the West.

"The original tower was not as tall as this one, and the runways had been extended since it was built, so air traffic control officials didn't have as good a view of the airfield as they once had," explains Curtis Fentress, principal in charge of design for Fentress Architects.

Airport officials also sought a unique appearance for the tower. Some people describe most towers as a lollipop on a stick.

"If you look at some FAA towers, they're pretty standard and very symmetric," says Mark Costanzo, project manager for the airport. "We didn't want that—they are not very pretty," he adds. "We wanted something more iconic that gave more of a view of the airfield. By pushing the cab off center on the concrete core, you gain more access of the gates and positions down below the tower."

Shake, Rattle and Roll

The old tower also no longer addressed seismic design requirements, states Fentress. The government has significantly upgraded seismic standards for new construction since the Prieta Loma earthquake in 1989, when a magnitude 6.9 earthquake severely shook the San Francisco and Monterey Bay regions. The new tower will withstand and continue to operate in a magnitude 8.0 earthquake, according to Yakel.

Designers met seismic requirements by making sure the tower, which rises up through the middle

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of the airport's Integrated Facility Building, is completely separate from this 44,000-square-foot structure. "If the tower stands independent of this building, it will not damage it if it moves," says Constanza. "This was challenging from a design perspective. We did models of the structure to make sure everything worked, and they put special buckling resistant beams on the building."

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The resulting air traffic control tower uses a vertical post tension concrete structure design, making it the tallest vertical, self-centering post tension concrete structure in the United States. Typically this type of design is used in parking garages where the parking decks are post tensioned. This design employs tension cables in the walls of the cylinder cab which allow it to bend and move during a seismic event "then swing right back to where it was at the end of the seismic event," says Fentress.

Scott Bills, project manaer at Hensel Phelps, explains it further in an article in San Francisco Business Times: "We built the tower with vertical post tensions, which means there are vertical strands running inside the concrete core of the tower that anchor it to the foundation, so in the

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case of seismic events, the building will center itself."

In addition, Paul Kim, architect for HNTB, the airport master architecture firm and project manager for the tower project, says the design includes two mass dampeners, of approximately 37,000 pounds each, at the upper levels of the control tower. The mass dampers help offset swaying motion in a seismic event or high winds, helping to "stabilize the tower at the top and avoid any kind of motion sickness for the air traffic controllers working inside the tower," according to Kim.

Make it Pretty

Airport officials request for a design that harmonized with existing architectural structures led to the selection of a unique, torch-shaped building that flares at the top. "We started looking at Olympic torches and narrowed it down to three options, which were vetted by SFO and the city's art commission. The result was the tapered silhouette that you see now," says Kim.

Kim says designers also spent a lot of time perfecting the facility's skin. They worked with a façade consultant and performed solar reflectivity studies to accentuate the tower's curve linear form. The resulting design rotates the individual panel joints to make them sort of spiral up the tower. These curved metal panels with a wide vertical ribbon of glass on the public "landside" face reflect the sky during the day and LED lighting within the glass glows softly at night.

"We used metal panels that wrap around the building," says Constanza. "If you look up close, they are not squared but rather trapezoidal shaped and curved."

Airport officials also sought to create a visible form that greeted the public upon arrival. This goal led designers to create an LED backlit glass waterfall that stretches 147 feet into the air on the tower's west side. The LED lighting system mimics the system used on the front of the international terminal, which is computer controlled and used to celebrate local events.

"The tower's LED panels can light up and we can change the colors based on whatever mood we are in," says Costanza. "We've celebrated the Warrior's victory with blue and gold. We celebrated Gay Pride week with rainbow colors. It's a really neat part of the tower and people love it."

The skin also features a lightening discharge system. Though lighting is fairly rare in the Bay Area, Yakel says it occasionally strikes the control tower. "The skin has a lightening discharge system woven into the seams of the panels," he says. "They are designed to be the receptors of any potential lightening strike so that the electricity runs down to the ground area and doesn't damage the facility itself."

Design-Build

With major construction complete, the airport now turns equipping the interior over to the FAA. The FAA is installing radar, servers, receivers, transmitters and other electronic equipment to ready the tower for operation by mid-2016.

This marks a new role in air traffic control construction for the FAA. Typically the FAA handles tower design and construction from A to Z but in this case the FAA turned over these roles to the airport itself. "This is actually the first time the FAA has allowed an airport to build a tower for them," says Yakel, who states the situation came about because it was being built near existing terminals and because airport officials sought an aesthetically pleasing, iconic structure that fit well with its surroundings.

The FAA's new role in this project has other airports looking to do the same, adds Costanzo. He

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notes an airport in South Florida is contracting with the FAA to construct its own tower to FAA specifications. “It’s a lot faster to get things done and a lot cheaper in the long run,” he says.

He explains typically the FAA prepares its own design then hires a builder. By doing the project on their own, airports can utilize a design-build construction method to speed the process. Design-build is a project delivery system used in construction in which the designer and the builder are part of the same team.

“This process gets the designer on board with the contractor,” Costanzo says. “It’s a lot more efficient than waiting until you’re in construction and issuing change orders. The designer and the builder work together upfront to understand the build-ability of the design.

“HNTB was contracted to develop the design and bring the contract documents up to 45 percent, at which point they were handed off to the design-build team,” says Kim.

HNTB, did the concept design for the airport’s new tower situated between Terminal 1 and 2. Besides the tower, they also did design work on a new three-story Integrated Facility building for the FAA and other personnel, two connector walkways, and improvements to the Terminal 1 Boarding Area C Entrance, all of which were also part of the project. Fentress Architects handled detailed design work once construction began with its design partner Hensel Phelps.

Constanzo says the benefit of the design-build process, which began to make its way into public and governmental construction projects about a decade ago, is that “you don’t need a complete structure design before you start construction so you can phase the construction process,” he says. “You can finish the structural part, which is the foundation of your building, while you’re still designing the mechanical and electrical for the facility.”

Overall the new airport air traffic control tower is one that has everyone talking, and has left those involved very pleased with the results. “We think it’s a dramatic new iconic element on the skyline at the airport,” says Fentress. “It’s been a lot of hours and a lot of hard work but it’s been a really great project for San Francisco.”

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