

## Housing WWII History

LYON AIR MUSEUM

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# HOUSING HISTORY

*The Lyon Air Museum shelters irreplaceable WWII aircraft in a unique contemporary structure*

**T**he stunning new Lyon Air Museum at John Wayne International Airport in Santa Ana, California, houses a lovingly restored private collection of WWII historic aircraft—including a Boeing B-17G Flying Fortress, a B-25 Mitchell bomber, a C-47 Dakota troop carrier and an A-26 attack bomber.

Owned by General William Lyon (USAF-Ret.), who also funded its construction, the museum's impressive collection includes vintage military vehicles and motorcycles as well. [See "More About the Museum," p. 6.]

The sleek new building is a hybrid of metal building systems and conventional construction, and shares its location with Martin Aviation—an Air/Lyon, Inc. company also owned by the general. It incorporates three Martin Aviation hangars previously at the site, which provide maintenance for corporate aircraft and general aviation at the airport.

"General Lyon wanted to maximize the size of the museum based on the land configuration and code requirements, and to integrate metal building systems into the new design," explains Eric Donnelly, the general's construction manager for the project.

A hybrid solution would benefit everyone. The older metal hangars needed refurbishing, and the new museum would need plenty of column-free space for the exhibits, which is most economically achieved with systems construction.

"After looking at different options, using metal building systems made the most sense—financially and operationally," says Mark Foster, the museum's president.

Three architectural firms were interviewed for the job. Donnelly and General Lyon selected J. R. Miller & Associates, Inc., Architects & Engineers (JRMA), in Brea, California, for their experience in designing hybrid aviation structures. In turn JRMA, the designer of many outstanding aviation buildings in California, worked with their long-standing building partner for these projects—Butler



Builder® T. Violé Construction Co, Inc., of nearby Tarzana.

"T. Violé has a very hands-on approach to design and construction," notes Dan Bianco, AIA, LEED AP, a principal architect with JRMA. "We go back and forth with ideas from the very beginning of the project development. Their knowledge of systems construction in regards to aviation buildings is unparalleled."

## **A unique structure**

The team's solution is a building with a more-or-less wedge-shaped footprint—with the 29,925-square-foot museum at the wide end, tapering to envelop the 29,200 square feet of pre-existing hangars (see plans page 9). Seen in elevation, the buildings, which are different heights, are tied into an attractive and cohesive whole with a parapet wall of architectural horizontal metal wall panels that echo the finish of the vintage aircraft in the museum.

On the street side, the museum's two-story offices and main entrance—built with conventional steel framing—jut out from the parapet wall at a lower elevation, and the exterior is finished in light-brown-colored stucco. The remainder of the museum's street-side wall features an



*The Lyon Air Museum is a hybrid of conventional and systems construction. Its custom Widespan™ structural system provides a 31-foot eave height and 240-foot clearspan, providing ample space to house its impressive collection of WWII aircraft and vintage military vehicles. The historic planes are all operational, and the museum's massive 28-foot high hangar door (right) is comprised of 12 full-floating glazed leaves filling a 220-foot-wide opening.*

expanse of full-height solar bronze insulated glazing, affording an excellent view of the museum's interior. Inside the windows, an elevated walkway—also conventionally framed—overlooks the historic aircraft below.

The museum proper is constructed with a custom Butler® framing system and is essentially a giant hangar with a 31-foot eave height and 240-foot clearspan. The historic planes are all operational and taken out for demonstration flights, so the side facing the runways includes a massive 28-foot-high hangar door comprised of 12 full-floating glazed leaves that fill a 220-foot-wide opening.

### Early engineering challenges

"The project was a truly hybrid construction," Bianco says. As such, it presented unusual challenges, and JRMA and T. Violé consulted Butler.

The museum's conventionally framed, 2,738-square-foot

## LYON AIR MUSEUM

### Butler Builder®:

T. Violé Construction Co. Inc., Tarzana, California

**Architect:** Dan Bianco AIA, J.R. Miller & Associates (JRMA), Brea, California

### Size:

29,925 square feet (new museum proper)

1,778 square feet (museum storage and theater)

2,738 square feet (conventional museum offices)

29,200 square feet (re-roofed hangars)

### Butler® Systems:

Custom Widespan™ structural system

MR-24® standing seam roof system [museum]

Butler Lite\*Panl® skylight system

Butlerib® II roof system (existing hangars)

two-story office sits partially inside and partially outside the Butler structure—much like an opened drawer. This required custom framing, similar to the opening for the hangar door.

Butler worked out the detailing and provided engineering drawings for the opening that accommodated the office. The builder, architect and Butler worked closely together on the design—each giving valuable input. "It was helpful to go back and forth to get it exactly right," Bianco says.

The observation walkway required custom engineering as well. It extends from the office's second floor on one side, but it hangs from the museum structure above and attaches to Butler-designed hollow steel shapes within the adjacent glass wall.

"Because of Butler's involvement from the onset, we were able to implement these unique attributes early in the design process," notes Tim Violé, chairman of T. Violé. "This allowed time to address and

*“After looking at different options, using metal building systems made the most sense—financially and operationally”*

MARK FOSTER



## **MORE ABOUT THE MUSEUM**

During his distinguished military career, General Lyon held the position of Chief of the U.S. Air Force Reserve from 1975 to 1979, served in Europe, the Pacific Region and North Africa during World War II and later flew combat missions in Korea.

His superbly conditioned and operational private collection of historically significant aircraft includes a Boeing B-27, Cessna O-1E, Douglas DC-3, Douglas C-47, North American B-25, and a Douglas A-26. In addition, the museum displays military vehicles and motorcycles, vintage automobiles and related period memorabilia.

“The Lyon Air Museum is designed to capture the American spirit that thrived during World War II,” the general explains. “Each plane and each vehicle tells a story that deserves to live forever. It is my hope that visitors—young and old alike—will embrace these stories, experience an indelible and memorable time, and leave here with a clearer understanding of an era of tremendous victory and pride.”

The museum is open daily, available to the local community and visitors from around the world, and also hosts school groups and special events—such as special displays of rare classic cars. For more information about the museum, see [www.lyonairmuseum.org](http://www.lyonairmuseum.org).

*“The project was a truly hybrid construction . . . it was helpful to go back and forth to get it exactly right”*

DAN BIANCO, AIA



respond to the building's many other structural considerations.”

### **Further considerations**

The glazed hangar doors also presented somewhat of a challenge. “Considerations had to be made to accommodate the increased weight of the glass infill panels and the secondary framing that minimizes deflection of the glass panels to prevent breakage and other potential problems during use,” Violé explains.

The massive, custom-engineered trusses that support the roof and provide the museum's 240-foot clearspans were lifted into place in one piece. “It's an incredible sight when this length of structure is lifted off the ground,” says Tim Violé.

“The huge spans, which required no site welding on the structural framework, were very impressive,” adds Donnelly.

### **Roof solutions**

The project employed two different roof systems—each the best for the specific application. “The existing hangar buildings had very complex drainage issues and we could not add any increased load to the structures,” Violé recalls. “As a result, we removed and replaced the old screw-down roof systems with a Butlerib® II roof system to keep within loading capability and work with the existing drainage and transition issues.”

The new museum was given a weathertight MR-24® roof system to lower maintenance

***The new museum and three existing hangar buildings, all of different heights, were visually tied together with a parapet wall of architectural metal siding. One of the project's challenges was inserting the museum's conventionally framed two-story office—the brown stucco portion to the left—into the main museum structure, which was built using systems construction.***



*An elevated walkway (left in the photo above) runs along the museum's window wall and allows visitors to view the planes from above. The bright white interior is further enhanced by the glass hangar doors and Butler Lite\* Panl translucent panels inserted in the MR-24® standing seam roof system.*

costs and protect the priceless collection. Butler Lite\*Panl® translucent roof panels were seamed into it, allowing natural daylight to augment the high-efficiency fluorescent lighting.

### **Earthquake and fire protection**

John Wayne Airport is located in Seismic Zone Four, so construction there must meet the most stringent seismic code. The building's parapet walls therefore conceal an 18-inch seismic gap between the new museum and adjacent hangars, allowing the structures to move independently during an earthquake. A seismic gap also separates the conventional

steel-framed office from the museum proper. The gaps were field-tested when a quake shook the site after the buildings had been framed. "I was there that day," says Bianco. "There was absolutely no damage to the buildings."

The interior of the museum was fireproofed with a spray-applied coating concealed behind metal panel liners. These panels—which have a stark white finish—not only optimize the lighting of the building's interior, but also prevent any fireproofing material from potentially falling onto the aircraft.

### **Exceeding expectations**

To set off the exhibits and further enhance

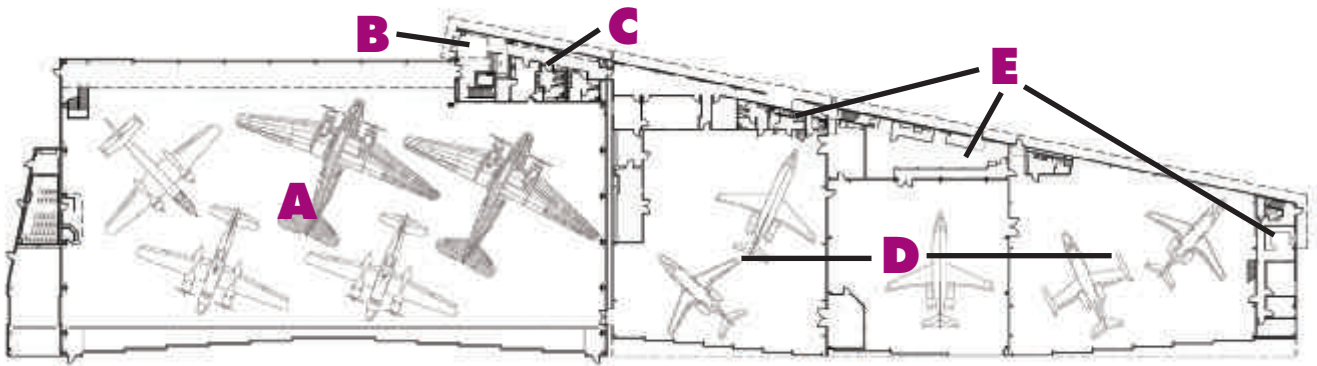
*“The huge spans, which required no site welding on the structural framework, were very impressive”*

ERIC DONNELLY

## LYON AIR MUSEUM

### FIRST FLOOR PLAN

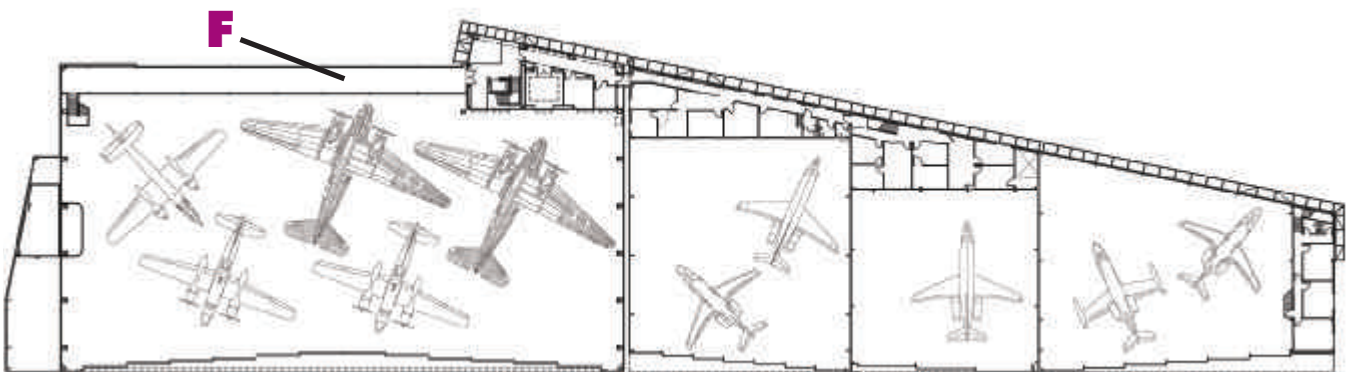
- A** New museum
- B** Entrance
- C** Museum offices
- D** Existing Hangars (Martin Aviation)
- E** Martin Aviation offices



*The museum's conventionally framed, 2,738-square-foot two-story office (C), sits partially inside and partially outside the Butler® structure (A)—much like an opened drawer. This required custom engineering, as did the 220-foot-wide opening for the hangar door.*

### SECOND FLOOR PLAN

- F** Elevated walkway



*“The project was finished with the high quality associated with all projects bearing a Lyon name”*  
ERIC DONNELLY



## OTHER SYSTEMS-BUILT AIR MUSEUMS

Metal building systems often are used for air museums because they provide cost-efficient large clearspans and are easily expandable. Some examples include:

- National Air & Space Museum satellite facility, Washington, D.C.
- Strategic Air & Space Museum, Ashland, Nebraska
- Commemorative Air Force Museum, Midland, Texas

the lighting, the museum’s ceiling and floor are also white. The concrete floor was leveled using a laser screed machine and has a gleaming epoxy finish.

The offices in the existing hangars were also refurbished during construction and the existing hangar doors and interior hangar finishes were refurbished to match the new museum.

Eric Donnelly and Mark Foster were very pleased with their architect and builder. “JRMA are creative problem-solvers and they brought neat ideas to the project that made it better than otherwise, like the observation deck and glass in the hangar doors,” says Foster.

“Violé was a strong building partner in the project. Their expertise in systems construction was a great asset in the development process,” Donnelly says. He adds that he was impressed with Butler’s ability to construct long spans with minimal beam depths.

“The project was finished with the high quality associated with all projects bearing a Lyon name. We were pleased with their finishes and final building presentations,” Donnelly says.

At the museum’s grand opening, General Lyon arrived in style as pilot of one of the museum’s bombers, and taxied his historic aircraft to within 20 feet of the open hangar doors before a selected audience of admiring onlookers. He is pleased with the project as well.

“General Lyon has expressed to me that the results exceeded his expectations,” Donnelly says. ▲

***The site’s Martin Aviation hangars (right in photo above) blend seamlessly with the museum, although an invisible 18-inch seismic gap separates the buildings to protect them. They were refurbished during the project and given new hangar doors, office makeovers, and a new Butlerib® II roof system.***