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JETBLUE TECHNICAL OPERATIONS CAMPUS HANGAR

Unique Steel Truss System Supports an Expansive Roof

In planning the JetBlue technical operations hangar completed at JFK in May 2005, design architects Hellmuth, Obata + Kassabaum (HOK) were faced with a problem of dimensions: while the hangar opening had to be tall enough to accommodate the maximum tail height of a jet airliner, the roof height couldn't exceed the sight-line clearances of the airport control tower. With the help of Butler Manufacturing Company (Butler), a new steel truss system was designed that would simultaneously fit within this narrow margin of space and be strong enough to support the expansive roof.

The rather ordinary shape of the hangar—a large rectangle with a smaller rectangle attached to one side—masks the complex planning that went into achieving the large spans between columns required for the storage of multiple aircraft of varying size. Approximately 140,000 square feet in area, the hangar is both a storage space and technical operations facility with workshops served by a technologically advanced system for storing and retrieving parts. The smaller adjacent structure houses the parts sorting facility, administrative offices, and employee training facilities.

As with the specific height limitations, much of the hangar was designed around spatial requirements that could only be resolved through customizing the steel components. According to HOK project architect Darryl McDonald, Butler—usually known for its pre-engineered solutions—provided a unique structural system that could satisfy the minimum clearance for the main bay of the hangar and still span the 282 feet found at the widest point.

"Everything was specific to the project," said Mark Cogley of Butler. Speaking about the hangar entrance, for example, Cogley noted, "Whereas a pre-engineered metal building would have a column much wider at the top than at the base, we were able to provide a cleaner look with straight shaft mill w-shape standard columns." The straight shaft (wide-flange) columns allowed for a shallower truss and wider span, which was necessary for the planes to pass, without sacrificing structural integrity. The system relied completely on steel, which, in Cogley's words, was "the only reasonable material" for the project.

ALL The unique truss system allowed for maximum spans with a relatively shallow truss.

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JetBlue Technical Operations Campus Hangar

RIGHT Windy conditions complicated the truss erection.

BOTTOM LEFT The unique Megadoor™ is both space and energy efficient.

BOTTOM RIGHT Long ceiling spans accommodate jet aircraft.

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Due to the hangar's long spans, the roof system required careful selection and planning so that, as Cogley explained, the roof could be supported with minimal bracing and column support from below. This required transferring the weight away from the center of the roof where the bending moment would be greatest. To accomplish this, Butler turned away from the more traditional pre-engineered rigid frame approach in favor of a system of frame braces that would transfer lateral loads to an end bay and then to the foundation.

The 100,000-square-foot roof comprises a single-skin steel panel with laminated insulation on the interior and a standing seam Butler MR-24® roof as its exterior. The exterior system is free-floating. Twenty-four-inch, 24 gauge steel panels are interlocked and seamed together with a 360-degree Pittsburgh double-lock seam, the same seam used to fabricate a coke can, and then attached to the hangar.

HOK and Butler met other spatial considerations, such as increasing efficiency throughout the building, with creative solutions that took advantage of the long span capability of structural steel. Noting that wide spans are only necessary to accommodate the wingspread of the plane, the designers realized that much of the back portion of the hangar, especially along the sidewalls, is not used. To maximize the use of space, HOK placed small, multi-story buildings within the hangar in both rear corners of the main rectangle to serve primarily as offices and training spaces for JetBlue employees.

These smaller buildings within the hangar itself serve an important structural purpose as well. At the inner corner of each building rises a w-shape ASTM A572 Grade 50 steel column that projects above the building to serve as a mast providing support for the roof, thus allowing the full span of the hangar to occur at the front and middle of the building. "We took advantage of where we could drop columns," said Cogley. The solution is one in which space and structure alike benefit from a system that solves the basic inefficiencies of a hangar layout.

The JetBlue hangar serves as a reminder that the recent trend of high-profile design in architecture and construction often detracts from structural achievements that arise from facing challenges such as this one. While the use of steel as the structural material was, according to both McDonald and Cogley, a given for the type of project, it was through creative and practical applications of the material that the structure eventually worked in its environment. The designers' solutions demonstrate that while the hangar may appear relatively simple, it has an underlying complexity that is enabled only through careful consideration of the structure and of the flexibility, weight, and strength of the medium it relies on—steel. ■

JETBLUE TECHNICAL OPERATIONS CAMPUS HANGAR

Owner **JetBlue Airways**
Architect **Hellmuth, Obata + Kassabaum** *New York, NY*
Engineer **Butler Heavy Structures** *Kansas City, MO*
General Contractor **Turner Construction Company** *New York, NY*
Structural Steel Fabricator **Butler Heavy Structures** *Kansas City, MO*
Structural Steel Erector **Midlantic Erectors, Inc** *Roselle, NJ*
Metal Deck Erector **A.C. Associates** *Lyndhurst, NJ*