



U.S. Coast Guard Hangar

Opa-Locka, Florida



The United States Coast Guard, reflecting increased responsibilities in Florida and the Caribbean basin, selected Air Station Miami to become a Mega Base for USCG Aviation activities. These activities run 24 hours per day 365 days a year and include Search and Rescue operations, Law Enforcement, Drug Interdiction, and National Emergencies.

A program was devised to support this unique mission. The program included new and retrofitted Aviation Maintenance and Operations, new Fuel Farm, new and expanded Airfield Facilities and new Administration Facilities. The planning and design contract was awarded to O'Kon and Company. The most spectacular part of the program is the 165,000 sq. ft. Aviation Maintenance and Flight Operations Center located adjacent to the airfield. This facility is the center of an efficient emergency operation that results in successful missions for the U.S. Coast Guard.

HANGAR DESIGN CHALLENGES

The salient aspect of the new facility is a 26,000 sq. ft. nine position hangar for the HH-65 Dolphin helicopter. The facility, which boasts a 260' clear span, is adjacent to the flight line and at

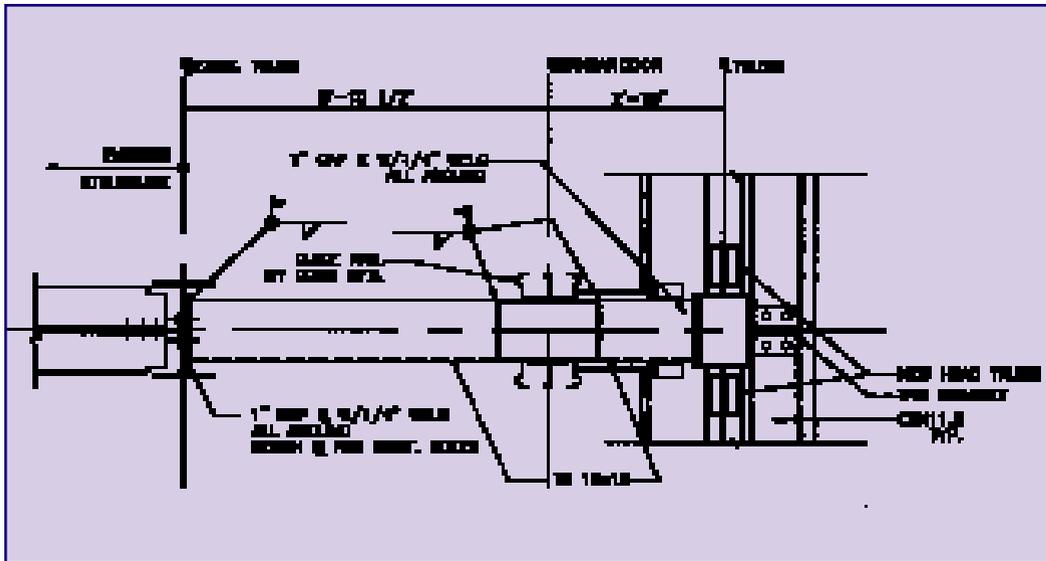
an intersection of two active taxiways. The design challenge of this long span facility was not only to develop a hangar with proper vertical clearances for the helicopter and full coverage overhead crane, but also to create a structure that would develop a low profile roofline. The hangar is located directly in the sight line of the control tower, and the FAA decreed that the hangar envelope must be below the sight line.

Creating a hangar envelope that was lower than the control tower sight lines while also providing proper clearances for interior functions resulted in a solution that permitted only a total of 10' of depth for the structure. Also required was the articulation of the structure to permit clear sight lines. This thin structure must withstand 150-mph hurricane winds and 30 psf live loads.

Jurors' Comments:

This 260' span hangar had to meet very demanding requirements for wind loads imposed by the FAA. It also had to satisfy the owner's need for a minimum door height. The use of a pair of articulated, triangular vertical bents and 65 ksi steel limited the structure depth to 10'. The idea of creating an exoskeleton around the hangar envelope eliminated any interior obstructions.





The O'Kon Engineering team used three dimensional computer models to develop a low profile but highly resistant structure. The resulting solution was a pair of articulated, triangular, vertical bents/wind resistant frames featuring circular tube members for the lower chord. This unique solution created a structural exoskeleton around the hangar envelope.

The compactness of the structure required the use of 65-ksi structural steel to reduce the member sizes by making use of the triaxial stiffness of the long span, triangular, truss/bent system. Creativity was used in the selection of upward-acting structural fabric hangar doors to reduce space; however, these doors required special structural details to ensure proper installation. Creativity was further utilized to achieve the owner's requirement of eliminating situations that could damage the delicate rotor blades of the helicopters (i.e. avoiding interior structural bracing). The solution was to create an exoskeleton, place the bents and horizontal lateral force resisting structures on the exterior of the hangar, and place the smooth surface of concrete block walls on the interior.

This exoskeleton required unique detailing for design continuity, shipping and erection.

Details were developed that were contractor-friendly. The exoskeleton was designed to be primarily shop-fabricated with a minimum of field fabrication.

UNIQUE FEATURES AND TECHNICAL VALUE

The U.S. Coast Guard commissioned O'Kon and Company to design a state-of-the-art maintenance and operations Mega Base for emergency and life saving operations for third millennium aircraft. The O'Kon team responded with design innovations which included unique structural systems to resist 150 mph winds and 120 psf uplift; complex, government-specified environmental systems; and a low profile structural exoskeleton, which produced significant cost savings while achieving maximum structural resistance as well as satisfying FAA and Coast Guard requirements.

The techniques developed on this unique project have been disseminated to the engineering profession via conferences with the Coast Guard, the U. S. Air Force, and the U.S. Navy, as well as engi-

neering seminars presented by O'Kon and Company in the U.S. and abroad.

The use of three dimensional models to resist unique loadings, the use of high strength steel, and the flexibility of long span steel structures enhanced this creative structural design.

COMPLEXITY OF DESIGN

The design, construction, and operation of a low profile, articulated exoskeleton aviation maintenance facility is one of the most complex of all engineered facilities. The maintenance of strategic aircraft that are on 24 hour per day standby presents a set of unique criteria that is complicated by the threat of hurricanes.

The helicopters must be serviced quickly and efficiently while maintaining the life safety of USCG personnel. Therefore, the hangar has a full coverage crane and full protection devices to protect personnel.

The hangar is protected by a sophisticated foam fire protection system featuring specialized fire detection systems and toxic effluent collection system. All equipment must be explosion resistant, and hydrocarbon exhaust systems



are located through the facility. To enhance flexibility and reduce space, upward acting fabric hangar doors were used requiring special structural details.

SATISFYING THE OWNER'S PROGRAM

The project exceeds the U.S. Coast Guard needs and requirements. The facility is the pride of Air Station Miami, and has gained attention nationally due to its functional capabilities, aesthetic appeal, and creative structure.

The unique exoskeleton structure and its color present a signature structure for the Coast Guard Mega Base. The all-white interior paint of the structure and white floor coating have produced what the U.S. Coast Guard terms "its prototype hangar for the third millennium."

U.S. Coast Guard Hangar, Opa-Locka, FL

Owner: United States Coast Guard

Architect & Structural Engineer: O'Kon & Company, Inc., Atlanta

Steel Fabricator: Industrial Steel, Inc., Mims, FL (*AISC member*)

Erector: Industrial Steel, Inc., Mims, FL (*AISC member*)

Detailer: Structural Technics, Inc., Miami (*AISC & NISD members*)

General Contractor: MCM Engineering and Contractors, Inc., Miami