BUILDING INTRODUCTION

Occupant: Smithsonian Institution
Function: National Air and Space Museum
Size: 470,000 square foot
Number of Stories: Main Exhibit Hangar – 10 Stories
Observation Tower – 16 Stories
Public Amenities – 2 Floors
IMAX Theater – 5 Floors

Primary Project Team:

- **Architect** – Hellmuth, Obata + Kassabaum (HOK)
- **Construction Manager** – Parson Brinckerhoff Construction Services
- **General Contractor** – Hensel Phelps Construction Company
  [http://www.henselphelps.com](http://www.henselphelps.com)
- **Mechanical Contractor** – MC Dean
- **Electrical Contractor** – John J. Kirlin, Inc.
- **Steel Contractor** – ADF International, Inc.

Cost Information: Overall Project – $309 million
Building incl. Construction - $125 million
Project Delivery Method: Design – Bid – Build
Architecture

The design of the Air and Space museum contains four major components:

- The Main Exhibit Hanger consists of an arched Tri-truss design, hanging mezzanine walkways, counter-weighted Exhibit doors, and a rubber membrane roof.
- The Space Hanger, which will contain the Space Shuttle Enterprise, consists of a “space frame” truss design, sliding exhibit doors, rubber membrane roof, and metal panel exterior.
- The Observation Tower is an egg shaped design that is fastened above a twelve-story shaft. The egg exterior is made up of angled glazing and metal panels. The shaft is also wrapped in metal panels.
- Public Amenities including: classrooms, a retail shop, a restaurant, and an IMAX theater. The exterior consists of metal panels, curved glazing, and metallic ceramic tile.

The building envelope is made up of a combination of glazing, custom metal panels, and ceramic tile.

Zoning Requirements: Must abide by Dulles International Airport Zoning
**Owner Profile**

The Smithsonian Institution is the world's largest museum complex and research organization. Composed of 14 museums and the National Zoo in Washington, D.C., and 2 museums in New York City, the Smithsonian's exhibitions offer visitors a glimpse into its vast collection numbering over 142 million objects.

Since the opening of the original Air and Space Museum, the Institute has been planning on building a facility like the Steven F. Udvar-Hazy Center. Less than 10 percent of the National Collection of artifacts that reflect the history of flight are on display at any one time at the Museum in Washington, DC. Also, very large machines, like the Space Shuttle *Enterprise*, can never be trucked into the city.

On this project, Smithsonian is looking for a state of the art; high quality building that is able to preserve their remaining artifacts. This is shown in the amount of time, and money that was spent in design and planning of the new Air and Space Museum. Another issue that is important to SI is safety. This was a big criteria in selecting a general contractor for the job. The contractor that was chosen, Hensel Phelps Construction Company, has one of the best safety ratings in the industry.

Keys to completing this project to the owner's satisfaction integrate quality of work, and deadlines for completion. Superior quality is of course important for a museum that will hold a huge part of aviation history. Also, deadlines must be met to open the building on the 100th year anniversary of man's first flight. This means that the building must not only be complete, but the artifacts must be in place for the grand opening in honor of the Wright brothers’ first flight at Kitty Hawk, North Carolina. The doors are set to open on December 17, 2003.
**Systems Analysis**

**Electrical:** The system consists of a 13,200V supply stepped down to 277/480 and 120/208 for distribution. The supply is carried under the slab in the Main Hangar through Walker Ducts. This allows for artifacts to be set up anywhere throughout the Hanger by coring through the slab and into the duct.

**Lighting:** The Main Hangar is equipped with a 39-watt ceramic metal-halide system along with 90 percent reflective ceilings to conserve light. The Public Amenities areas contain a typical 32-watt florescent lighting system.

**Mechanical:** All areas in the museum use a reheat air system. In the Public Amenities, variable air volume (VAV) boxes are situated in the plenum and control the air volume to each room. The mixed air in the Main Hangar is generated by four massive air-handling units (AHU). Heated air is produced by three 200 - 400hp gas-fired steam boilers, and chilled air is produced by four 500 – 760 ton centrifugal chillers along with 27 ice storage tanks.

**Structural:** The Main Hangar consists of an arched tri-truss steel system that ties into cast-in-place thrust blocks. The foundation for each trust blocks is a set of three 42” diameter drilled caissons. The Public Amenities' system is a steel skeleton, with slab on metal deck, which is supported by spread footings. The Observation Tower is made up of a steel skeleton encased in concrete. The foundation is a 32” mat slab.
Fire Protection: The Hazy Center is protected 100% by a sprinkler system. Also, the steel in the public amenities is fireproofed using spray on fireproofing to a two-hour rating. Due to the large amount open space in the Main Hangar, the steel does not have to be fireproofed.

Transportation: There are a total of ten elevators and eighteen sets of stairs in the new Air and Space Museum. This includes an elevator to the top floor of the Observation Tower, and mezzanine walkway throughout the Main Exhibit Hangar.