

# Hypalon® Provides Proven Protection for PRECIOUS CARGO



Photo Credit: Carolyn Russo, Smithsonian Institution

While most building owners like to think of their building contents as “precious cargo,” this description is particularly apt for the Smithsonian Institution National Air and Space Museum’s Steven F. Udvar-Hazy Center. When this new facility at Washington Dulles International Airport opens in December 2003, it will display not only noteworthy cargo, but also noteworthy cargo-carriers, such as the Spacelab Module, the B-29 Superfortress “Enola Gay,” and the Boeing B-17 Swoose Flying Fortress. In fact, the museum will eventually be home to the world’s premiere collection of historic aircraft and spacecraft, showcasing 200 aircraft, 135 spacecraft, and housing hundreds more.



Storage at the National Air and Space Museum's Paul E. Gerber Facility in Suitland, Maryland. These artifacts will eventually be on display at the Steven F. Udvar-Hazy Center at Washington Dulles International Airport. Photo Credit: Smithsonian Image by Eric Long.

## Topping it Off

Since many of these historic artifacts are one-of-a-kind and irreplaceable, it was crucial to make sure the building materials were strong enough to not only withstand Washington D.C.'s hot summers and chilly winters, but also bear up under threatening elements unique to an airport environment, such as jet fuel. Features such as strength and durability were especially important when it came to selecting the materials for the 800,000 square-foot roof, which makes up a major portion of the building.

“The Udvar-Hazy Center was designed to incorporate an aviation theme,” said Jeff Smith, vice president of Pioneer Roofing



Photo Credit: Mark Avino/Smithsonian Institution

Various stages of construction on the 10-story aviation hangar of the Steven F. Udvar-Hazy Center and the adjoining James S. McDonnell Space Hangar. The Udvar-Hazy Center hangar is the length of two and one-half American football fields.



Photo Credit: Smithsonian Institution/Sisson Studios, Inc.

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A view of the Steven F. Udvar-Hazy Center aviation hangar. Several historic airplanes receive final preparations before being suspended from the hangar's trusses. Photo Credit: Eric Long, Smithsonian Institution.

Systems of Lorton, Virginia, the project's roofing contractor. "The front portion was designed to look like an airport terminal, whereas the rear half has a main aviation hangar and a space hangar."

The main aviation hangar, a barrel vault design that rises 10 stories tall and runs the length of two and one-half football fields, is by far the largest part of the facility, and due to its unique curved truss design, "is all roof, from grass to the top and down again," according to Smith. The roof also covers a space hangar, an archival resource center, a large format theater, as well as restaurants and museum shops.

### Hypalon® Flies High

Although the criteria for a roof was strict – strong chemical resistance, a light color that would be aesthetically pleasing and not too harsh on pilots' eyes, the flexibility to be installed on curved and sloped surfaces, and of course, durability – there was little question as to what the roofing material would be: Stevens Hypalon® chlorosulfonated polyethylene from DuPont Dow Elastomers. Hypalon is a scrim-reinforced, heat weldable single-ply membrane that can be made in light, energy-saving colors such as white, or in

this case, light gray. After it is installed and exposed to natural elements, the material cures into a cross-linked rubber, giving it outstanding strength and durability. It also offers superb resistance to chemicals, particularly those found around airports such as jet fuel, which is why the Metropolitan Washington Airport Authority has been specifying Stevens Hypalon for more than 20 years.

### An "Uphill" Challenge

As might be expected, installing such a large roof over such unusual buildings like the aviation hangar was a challenge. "This is the largest installation we have ever done, so scheduling the work crew was a logistical nightmare, especially when the schedule kept getting pushed back," Smith stated. "Plus, while we have installed barrel roofs before, we had never installed a roof that was vertical all the way to the ground."

Fortunately, Pioneer Roofing has many years of experience installing Stevens Hypalon on many different types of buildings, which is why they were selected to be the roof installers.

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Authority many times before, so they were confident we had the mettle and know-how to handle the job," Smith explained.

To install the Stevens Hypalon roofing system on the Aviation Hangar, Pioneer Roofing worked closely with ADF International, Inc., the structural steel subcontractor for the project. While the trusses were still on the ground Pioneer Roofing laid down acoustical decking, covered it with two, 2.6-inch thick layers of Stevens Polyisocyanurate Insulation (manufactured by Atlas Roofing Corporation), and then fully adhered the Stevens Hypalon membrane on top.

Smith explained that some parts of the building received a fully tapered sheathing system, using precut material. The areas in front of the hangars housing the restaurants and tower received tapered polyisocyanurate, while the hangars themselves utilized flat insulation boards. Commenting on the use of the insulation, Smith explained that "by using polyisocyanurate in lieu of what was specified on the project, the Smithsonian was able to obtain the same R-Values, and also receive tremendous value-engineering benefits." According to Jeff Pepper, sales manager at Mid-Atlantic Foam, of Fredricksburg, VA, the supplier of the tapered and flat insulation package, the project used 100 truckloads of Stevens Polyiso roofing insulation.

Once the trusses were completed, the 58-foot wide sections, each weighing 35 tons, were raised by crane and put in place on thrust blocks, which are steel and concrete bases built to support the weight of the trusses.

As it turned out, not all roof sections could be put together on the ground, so Pioneer Roofing rigged together a special spider scaffold that crawled up and down the sides of the hangar like a window-washing scaffold. Even then it wasn't possible to reach all of the roof sections, so in some instances members of the roofing crew literally had to rappel down the sides of the hangar to install the roofing system.

Despite these obstacles, the majority of the roof installation was completed in nine months with an average crew of 30 workers. (Portions of the roof are still being completed.)

"This was a difficult installation, but we were able to overcome the numerous complications that are inevitable with a job of this size and scope," Smith said. "The crew did a great job and I'm very proud of their work."

### A Safe and Secure Shelter for Special Treasures

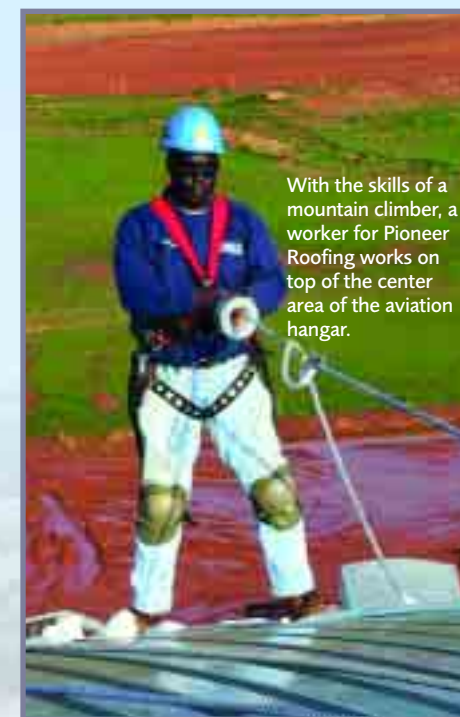
Notable air and space craft such as the Cessna 180 Spirit of Columbus, the McDonnell F-4S Phantom II, and the Space Shuttle Orbiter Enterprise are national artifacts that should be preserved for the enjoyment of this and future generations. Fortunately, with the proven durability, weatherability and chemical resistance of Stevens Hypalon, paired with the skilled workmanship of Pioneer Roofing, those and the other special contents of the Udvar-Hazy Center are sure to be protected for light years ahead.▲

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# Vital Statistics

- The vaulted roof of the aviation hangar is **103.37** feet high, **10** stories, in the center. The hangar is **248** feet side-to-side with no center supports.
- The building is situated on **176.5** acres.
- Each of the arching trusses of the Aviation Hangar roof can support up to **20,000** pounds of hanging aircraft.
- Pioneer Roofing Systems installed some **17** miles of **6** foot-wide Stevens Hypalon®-based roofing membrane from DuPont Dow Elastomers.



With the skills of a mountain climber, a worker for Pioneer Roofing works on top of the center area of the aviation hangar.

- Pioneer Roofing crews installed **1,800** squares of membrane on a near vertical surface.
- Workers hot-air welded **28** miles of roofing seams.
- They also used **170,000** roofing fasteners, **1,300** pails of bonding adhesive, **8** miles of wood nailers, and **4** miles of coping.

- The roof has **39,000** pieces of Stevens ISO insulation.
- The entire roofing installation required more than **60,000** man hours and over **100** truckloads of material deliveries.

Sources: Pioneer Roofing Systems, Smithsonian Air and Space Museum