Saving the World's Last Strato

A major setback fails to stop the restoration of a historic airplane.

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Having overcome a potentially project-ending event earlier this year, employees and retirees of The Boeing Co. (Chicago, Illinois) and other aircraft enthusiasts are forging ahead with the refurbishment of a rare airliner.

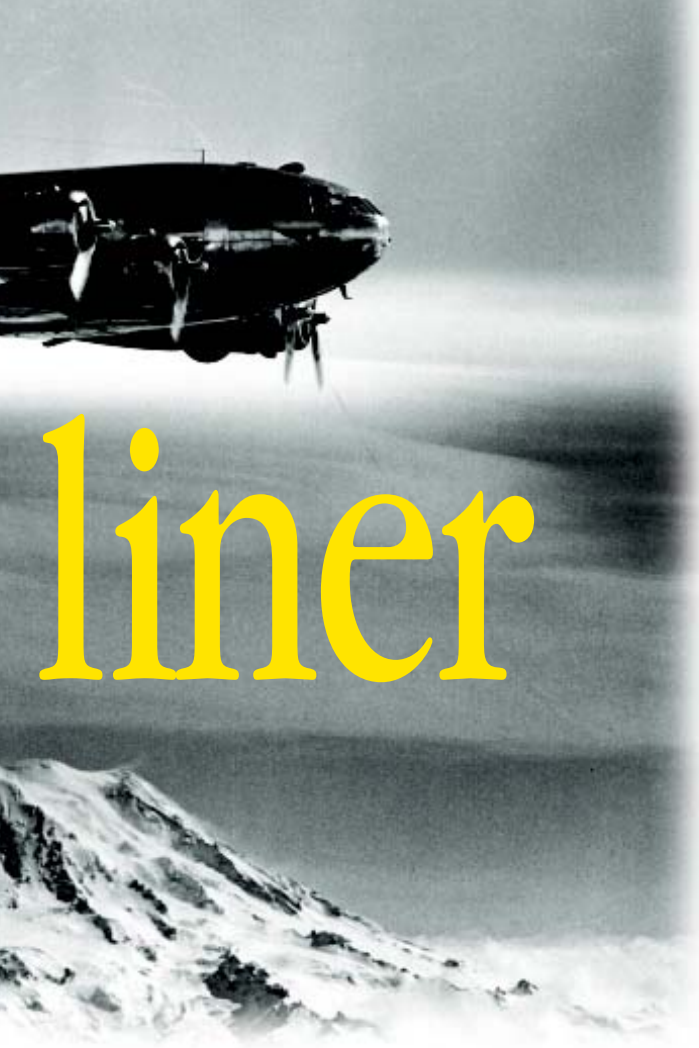
In the final stages of a 7-year restoration, the only surviving Boeing 307 Stratoliner—the Clipper Flying Cloud B-307—was undergoing practice takeoffs and landings from Boeing Field (BFI) (Everett, Washington) on March 28, 2002. A series of engine malfunctions occurred during one of the test flights. Determining that the plane could not safely return to BFI, the pilot ditched the plane in Elliott Bay, an inlet of Puget Sound near downtown Seattle. The pilot and three-person crew safely exited the aircraft and were rescued shortly thereafter.

A Pioneering Aircraft

Owned by the Smithsonian Institution (Washington, D.C.), the Clipper Flying Cloud is the only remaining B-307 of the 10 that Boeing built during the years preceding U.S. involvement in World War II. The Stratoliner was the first four-engine airliner in scheduled domestic service as well as the world's first pressurized commercial airliner. It was designed to fly above rough weather at an altitude of 20,000 ft (6,096 m)—higher than any other transport of its time.

In 1940, the now-defunct Pan American World Airways took delivery of the B-307 and designated the plane Pan American 903. The luxurious Stratoliner was flown in Caribbean service for 2 years. The plane would soon become a part of the U.S. war effort, however, and was used by the Army Air Transport Command to fly South American routes from 1942 until 1946. It had multiple owners during the postwar period, and for a time it was even used as the personal airplane of former Haitian President François "Papa Doc" Duvalier.

The Smithsonian acquired the plane in 1972 after it had most recently been used as a crop duster. In the early 1990s, several Boeing employees found the Clipper Flying Cloud at the Pima Air and Space Museum (Tucson, Arizona) during a visit to recover the famous Model 367-80 "Dash



An early 1940s photo of Pan American 903 flying near Mt. Rainier, Washington. Photo copyright © 2002, The Boeing Co.

80" jetliner—the prototype for the Boeing 707. Seeing the need to preserve the last-remaining Stratoliner, the employees offered to restore it with all of its original parts. The Smithsonian agreed, with the understanding that the plane would become part of its National Air and Space Museum collection.

The plane was flown back to BFI in June 1994, and a number of the company's retirees and suppliers collaborated with the employees in the painstaking effort of returning the B-307 to its delivery condition. In June 2001, the newly restored plane was rolled out of the same Everett facility where it had been built more than 6 decades earlier. Restoration personnel soon began working on returning the aircraft to airworthiness in anticipation of its return to the Smithsonian in 2003.

Salt Removal

Approximately 30 hours after the incident earlier this year, the plane was hoisted from Elliott Bay by crane onto a barge. Although the plane's structure remained largely intact, its immersion in salt water did produce graying spots and streaks—signs of corrosion—on the aircraft's aluminum skin as well as pitting on its magnesium engine parts. In addition, Boeing determined that the plane's interior and structural skeleton were susceptible to attack. Under the supervision of Boeing personnel, contractor Foss Environmental Services Co. (Seattle, Washington) subsequently sprayed the aircraft's exterior with a 1% solution of soluble salt remover supplied by CHLOR*RID International, Inc. (Chandler, Arizona). The contractor added 15 gal (57 L) of the salt remover concentrate to a tank containing approximately 1,500 gal (5,678 L) of fresh water to feed the 3,000-psi (20.7-MPa) pressure washer during the 1 1/2-hour exterior wash, which was performed on the barge near BFI on the Duwamish River.

After the initial flushing and cleaning, contract personnel used the CHLOR* TEST† surface chloride quantitative analytical field test kits to measure the remaining levels of chlorides on the aircraft. The first of the two tests performed, taken under the belly of the plane toward the front, indicated 1.5 $\mu g/cm^2$ of chlorides. The second test detected a 3-$\mu g/cm^2$ level of chlorides under the wing at the engine cowling. According to the supplier of the salt remover and test kits, the surface prepara-

†Trade name

A photo of the restored Clipper Flying Cloud back in the hangar for repairs following the March 28, 2002, accident. The plane is scheduled to be returned to the Smithsonian Institution in delivery condition in 2003. Photo courtesy of Hap Peters, CHLOR*RID International, Inc.

A green and white Clipper Flying Cloud at the Pima Air and Space Museum in Tucson, Arizona, before its restoration. Photo copyright © 2002, The Boeing Co.

The restored Clipper Flying Cloud. Photo copyright © 2002, The Boeing Co.

tion industry generally considers such levels acceptable prior to applying protective coatings.

Once the plane had been moved into a hangar in Everett, the restoration workers began the process of repairing the aircraft. They removed the four engines, flushing and coating each with oil to prevent further corrosion. Rust had formed on the landing gear and other parts, all of which were removed from the plane and placed in large drums containing a 1% solution of the salt remover. In mid-April, two additional tests of the aluminum exterior were performed: one from the fuselage near the cockpit and another behind the starboard wing. Both tests showed a "nondetectable" level of chlorides, according to the test kit provider. Workers removed damaged parts of the aircraft as well as the entire aircraft interior. In addition to removing the wing tips, they had the entire interior and reachable exterior pressure washed—again at 3,000 psi with the 1% solution of the salt remover. Special attention was given to decontaminating the structural steel ribbing around the bottom of the fuselage in the cargo holds. Subsequent tests on washed and accessible structural parts detected "nondetectable" chloride levels.

In June 2001, the newly restored Pan American 903 was rolled out of the same hangar where it had been constructed 6 decades earlier. Photo copyright © 2002, The Boeing Co.

Down But Not Out

Following a favorable assessment by restoration personnel, Boeing announced in June that it will continue to devote resources to clean, repair, and reinstall parts on the B-307. The company anticipates completing the task by the summer of 2003, when it expects to deliver the plane to the Smithsonian by flying it to Washington Dulles International Airport in Northern Virginia. The Smithsonian plans to display the aircraft in its Steven F. Udvar-Hazy Center, a National Air and Space Museum facility under construction at the airport. The Udvar-Hazy Center is slated to open to the public in December 2003.

Stratoliner specifications

Span	107 ft 3 in. (32.7 m)
Length	74 ft 4 in. (22.7 m)
Gross weight	42,000 lb (19,051 kg)
Top speed	246 mph (396 km/h)
Cruising speed	220 mph (354 km/h)
Range	2,390 miles (3,846 km)
Ceiling	26,200 ft (7,986 m)
Power	Four 1,000-hp (745.7 kW) Wright Cyclone engines
Accommodation	5 crew, 33 passengers

—SOURCE: The Boeing Co.

*This article was prepared with materials from The Boeing Co. and CHLOR*RID International, Inc. The companies' Web sites are: www.boeing.com and www.chlor-rid.com. For additional information about the Clipper Flying Cloud restoration, contact Hap Peters, CHLOR*RID, via e-mail: hpeters@chlor-rid.com.* MP