

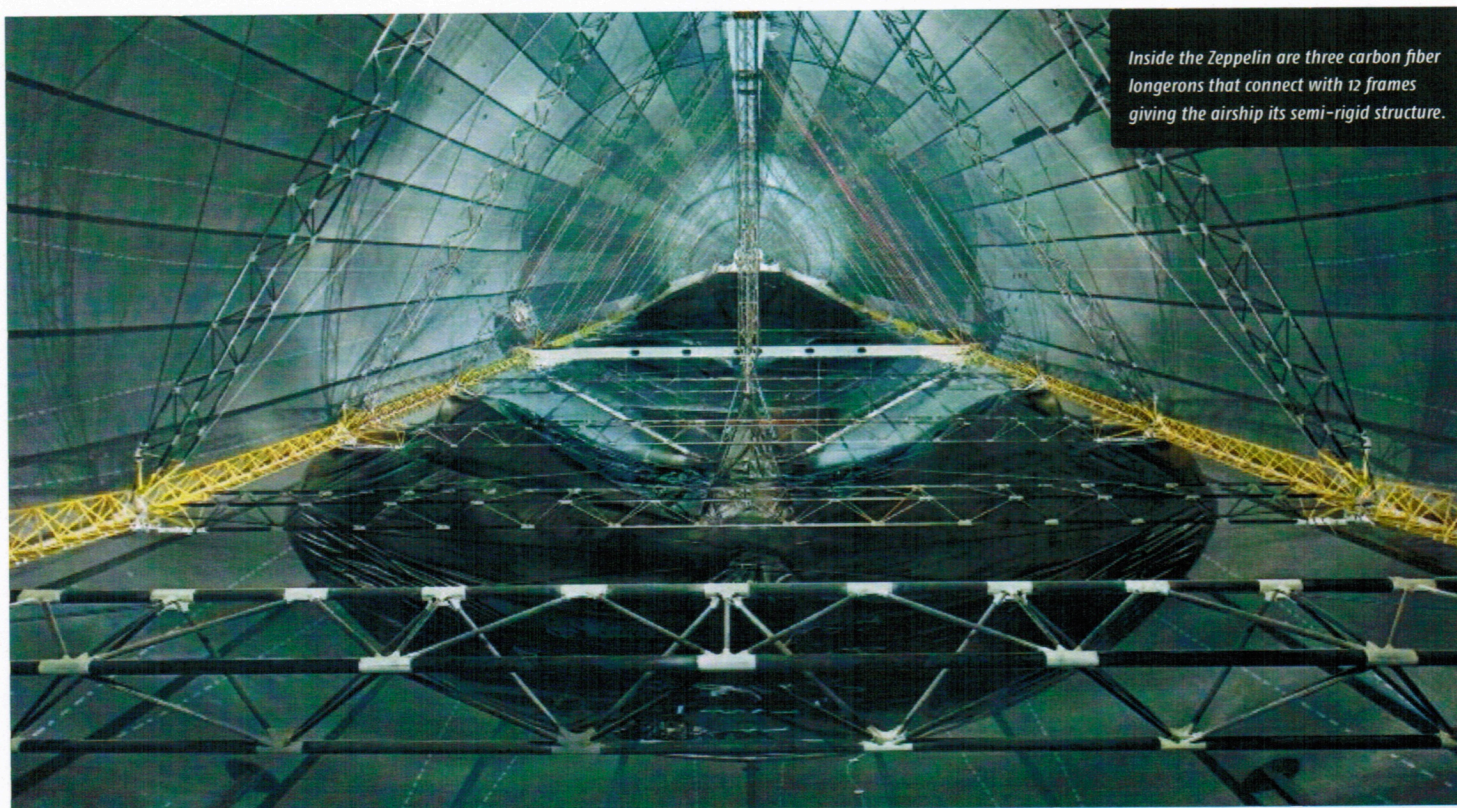


ZEPPELIN OVER AMERICA

Flying an airship across the country

BY STEVE SCHAPIRO

If you missed AirVenture Oshkosh 2011, you missed the biggest aircraft that has ever landed in Oshkosh. And it didn't even use the runway. All it needed was a patch of grass at Pioneer Airport.



Inside the Zeppelin are three carbon fiber longerons that connect with 12 frames giving the airship its semi-rigid structure.

"It's a little bit airplane, a little bit balloon, and a little bit helicopter," pilot Corky Belanger said of the Farmers Airship.

The airship is one of only two Zeppelin NTs in the world, and at 246 feet, it's 15 feet longer than a 747 and just a tad longer than the 238-foot Airbus A380. The newest Zeppelin is the most advanced airship ever built with a glass panel and fly-by-wire controls.

The Farmers Airship, christened *Eureka*, is owned and operated by Airship Ventures, which has been offering "flightseeing" tours from its base at Moffett Field near San Jose, California, since 2008. In April it embarked on a six-month coast-to-coast tour through 26 states, marking the first time this Zeppelin has traveled the country.

"Being on tour is a whole new experience," Brian Hall, Airship Ventures CEO and founder, said. "It's a cross between a traveling circus and 1920s barnstorming. It's something unique to take all across the country."

HISTORY RETURNS AFTER 70 YEARS

The airship has its roots in the Civil War, but its heyday was the 1920s and 1930s, during a time before jet engines and transoceanic flights made in hours, not days.

Count Ferdinand von Zeppelin, a German officer, visited the United States as a military observer in 1863. During his visit he flew in a balloon for the first time, and then spent the next few decades designing an airship with a rigid internal structure. His first airship was patented in the United States in 1899 and made its first flight a year later over Lake Constance in Friedrichshafen, Germany—the home of Zeppelin Luftschifftechnik GmbH, maker of today's Zeppelin NTs.

By 1909, several advances in the airframe led to the formation of the world's first passenger airline, DELAG (Deutsche Luftschiffahrts-Aktiengesellschaft, or German Airship Transportation Corporation Ltd.). During World War I, Germany used Zeppelins to bomb England as airplanes were still evolving into weapons of war.

The most successful Zeppelin ever built was the Graf Zeppelin. In 1928 it made the first commercial trans-Atlantic flight. By the time it was retired nine years later it

had flown more than one million miles, carrying thousands of passengers and mail. It circled the globe and was known throughout the world, inspiring an international Zeppelin fever in the late 1920s and early 1930s.

The U.S. Navy built its first Zeppelin, the *Shenandoah*, in 1923. It was the first airship to use helium rather than hydrogen, despite its limited supply and high cost, following the fiery crash of a British dirigible filled with hydrogen. During World War II the United States started building blimps—airships without a rigid internal structure.

“Goodyear built more than 300 of them just for sub patrol,” Corky said. “The Navy flew them until 1962.

But the jet age started. Planes started going faster so there really wasn’t a need for an airship.”

While the Goodyear blimp and others have continued to fly and gain popularity as marketing tools over the past few decades, the last time a Zeppelin, graced the skies over the United States was in 1937 when the *Hindenburg* tragically caught fire while landing in Lakehurst, New Jersey. Seventy years later, Airship Ventures brought the *Eureka* over from Germany and reintroduced America to the charm of airship travel.

IT’S WHAT’S INSIDE THAT COUNTS

At first look, the *Eureka*, flown in the colors of Farmers Insurance, appears to be a large blimp. The main difference between a Zeppelin and a blimp is the semirigid internal frame made of carbon fiber and aluminum that gives the Zeppelin its shape. A blimp has no internal structure, and its shape is maintained by the pressure from the lifting gas.

The Zeppelin NT (for new technology) has three longerons that run the length of the airship—one on top and one on either side. The longerons are connected by 12 triangular frames, and each frame has six Kevlar bracing cables. At frame five is the main carbon fiber crossbeam connecting the two side longerons. This is the “structural heart of the airship,” Matthew Kilkerr, the chief of maintenance, said.

The frame is covered with a synthetic canvas hull made by the same company that makes the fabric for NASA’s space suits. It is held on with 4,700 zip ties and creates an 8,400-cubic-meter envelope filled with helium. “We never put that much helium in,” Matthew said. “We run it around 7,150 cubic meters.”



The Farmers Airship comes in for landing like a helicopter, with its side engines vectored 90 degrees up, requiring only three ground crew for assistance.



UPPER: Large windows provide passengers with panoramic views.

ABOVE: The cockpit features a glass panel display and a large throttle quadrant to control the three Lycoming IO-360 engines.



The rest of the volume is filled by two inflatable bags called ballonets—one forward, one aft—that are filled with air. There are valves and fans that can be manually operated or set to automatically adjust the air pressure in the ballonets to counter the expansion or contraction of the helium as it heats or cools. “The ballonets can be up to 27 percent of the volume,” Matthew said.

The Zeppelin is propelled by three 200-hp Lycoming IO-360 engines—one on either side of the hull, which are attached to the main crossbeam, and one at the tail end of the ship.

There is a 110-gallon fuel tank on each side of the main crossbeam, and an aft fuel tank that holds about 85 gallons. “One really interesting thing, we can transfer fuel from aft to forward, forward to aft, right to left, left to right. But we don’t have fuel lines,” Corky said. “The fuel goes through the carbon fiber frame so they didn’t have to add weight by adding fuel lines. It’s cool. You can transfer fuel to adjust your trim.”

The side engines provide vectored thrust with the ability to rotate up to 120 degrees with variable-pitch propellers. The aft engine drives two propellers, one that provides lateral thrust similar to a helicopter tail rotor and the other that can rotate 90 degrees down to provide hover capabilities or forward thrust when it isn’t rotated down. “The most significant thing they [Zeppelin] did is they put two props in the tail,” Corky said.

Combined with fly-by-wire controls connected to three tail fins, the airship is extremely maneuverable. It can stop, hover, land, and climb vertically, which allows Airship Ventures to land the aircraft with only a three-person ground crew.

The vectored thrust engines give the airship the ability to literally land on a dime. “It’s by far the most controllable airship ever built,” Corky said.

A blimp, with no internal structure, has the engines fixed to the gondola, creating more noise and vibration than the Zeppelin. A blimp is flown much more like a fixed-wing aircraft, needing space for a final approach for landing and a large ground crew to help secure it.

AT THE CONTROLS

One look at the panel and you know this isn’t your usual aircraft. The throttle quadrant is in the shape of a “T”—blue pitch control levers are on the top left close to the panel, with the red mixture controls to

INSIDE A MODERN AIRSHIP

Airship Venture's Zeppelin NT, Eureka, is one of two flying in the world. Its range is 560 miles; it can fly at a height of 9,350 feet, and reach a top speed of 78 mph.

ENVELOPE: 296,643 cubic feet. Filled with nonflammable helium and made of a laminate material from the same company that creates the fabric for NASA space suits.

SEMI-RIGID STRUCTURE: Unlike a blimp, which has no internal structure, *Eureka* is braced by aluminum and carbon fiber. All main components are mounted to this framework.



LATERAL ENGINES (two): Provide thrust and are positioned to provide maximum maneuverability.

COCKPIT: The pilot controls the airship with a sidestick using fly-by-wire technology to precisely control speed and direction.

CAPACITY: 12 passengers **SIZE:** 35 feet long

BOEING 747: 232 FEET

ZEPPELIN NT: 246 FEET

STERN ENGINE: Two propellers powered by one engine. One provides thrust, the other provides lateral control like a helicopter tail rotor.

the right. In the middle are two throttles, with the third just aft if you are moving your hand away from the panel. If this configuration isn't curious enough, there are yellow levers labeled "swivel" just below and to the side of the throttles to rotate the engines.

Above the pilot's head are levers that hang down like the engine controls in a Grumman Goose. There are three blue air valve release levers and two red helium valve releases.

The glass panel in the center shows the standard engine data in triplicate: manifold pressure, rpm, oil temp and pressure, etc. Below that is a display showing two outlines of the airship. One shows the ballonnet pressure and whether the valves are open and if the fans are on. The lower image shows helium pressure, valves, and the water ballast levels.

The ballast is adjusted according to the payload. There is a tank in the gondola that holds 700 liters of water, which can be dumped if needed. The airship flies with a minimum of 100 liters of water as ballast. There are also compartments that can be filled with 10-kilogram bags of lead shot. "We use water more than lead," Corky said. "You don't want to be dropping lead shot bags over somebody's house. Lead is used as a last resort in ballasting this particular ship. Goodyear—that's all they have."

One thing noticeably absent are rudder pedals. With the propeller on the aft engine controlling lateral movement through the stick, rudder pedals are unnecessary.

TAKEOFF

Despite the complexity of managing three engines that swivel, Corky makes taking off sound relatively simple. "You're at full mixture, full power," he said. Then you rotate the side engines up about 30 to 40 degrees. "You could go all the way to 90 degrees if you want to take off vertically," Corky said. The aft engine is pointed down 90 degrees during takeoff and landing.

"You get your thrust by changing the pitch of the props, not by adding power. The power is already in there, and the engines are governed so they won't over-speed," he said. "Then you just run the props all the way forward. And you can feel it. It's amazing; there's quite a bit of thrust."



The airship casts a large shadow as it takes off.



Passengers board the Zeppelin by climbing a set of air stairs. To maintain an even ballast, passengers are exchanged one or two at a time—one gets off, one gets on.

Takeoff is smooth and stable. It feels a bit like a helicopter as the earth slowly falls away. But you know you're flying something special as soon as you gain enough altitude to see the massive shadow of the airship below you.

As you ascend, you trade vertical speed for forward speed. Once the airship reaches 25 knots, the prop in the back is rotated up into a pusher configuration because there is enough air flowing over the tail surfaces to provide "ruddervator" control. At 30 knots the side engines are rolled forward and "you're off and running," Corky said. Once in cruise, the rpm is adjusted and the mixture is leaned.

With a top speed of 67 knots and a cruising speed of 35 knots, that run is more like a trot. The range is 500 nautical miles, so the airship won't be taking you too far, too fast.

The cabin seats 12 passengers and two crew—the pilot and flight attendant. The panoramic windows and a slow cruise speed provide



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Delivery is expected in 2014.**

an excellent view of the farms, towns, and golf courses below. Once the airship is in cruise, you are free to walk around. In fact, the flight attendant encourages you to stick your head or camera out the windows to take photos. Or you can sit on the bench seat at the back framed by a wrap-around window and take a photo from there. Even the bathroom has a window, so you won't miss a thing.

LANDING

To land, like any aircraft, you bring the power back, start to descend, and slow down. The side engines are vectored to control the rate of descent. "You just set them at an angle where your descent rate is exactly where you want it to be," Corky said. "If you end up being a little bit high, you lower them a little bit so you fall a little faster. If you're coming in too fast, put them in reverse a little bit."

Once airspeed slows to less than 30 knots, the aft prop is rotated 90 degrees to point down. At that point all of the flight controls go to the stick. "When you're in cruise flight, your stick operates your ruddervators. But when you go into a landing configuration, the stick controls the pitch of the props and the tail as well," Corky said. "So now you're going into a quasi-helicopter mode. And then you control your forward speed with your engines, your props on the side. You control your pitch and yaw with your stick."

It's important not to flare the Zeppelin, as you would in a fixed-wing aircraft or even a blimp. It has a tail wheel, and the gear structure is located inside the airship's helium envelope.

"If you flare it, you'll smack that tail wheel, and that's a big no-no," Corky said. "If you get structural damage, there aren't a lot of Zeppelin hangars around to go in and repair it."

So the airship is landed tail high, with the main gear under the gondola touching down first. Once it's on the ground, the crew chief tells the pilot how high off the ground the tail wheel is, calling out altitude until it sets down very gently.

With the lateral propeller controlling yaw, the pilot is able to keep the airship pointed into the wind. Therefore, the Zeppelin lands with the crew chief in front grabbing one guide rope, and two other crew members are on the side to assist, mostly with passengers disembarking. By comparison, the Goodyear blimp requires 13 ground crew to help with guide wires to keep the blimp pointed into the wind.

Once it's on the ground, the airship is moored to a 27,000-ton mast truck using a winch.

A GROWING TREND

Although the Farmers Airship is the only Zeppelin in the United States, Goodyear recently ordered three Zeppelins to replace its fleet of blimps. Delivery is expected in 2014. And those aren't the only Zeppelins that might be filling the sky.

"There's a future in airships now I think because so many companies are working on building larger ones for a lot of different uses," Corky said. "For instance, a few years ago I was training some guys to go up to the North Pole, and they were going to measure the thickness of the sea ice. I worked down in the Caribbean looking for gun runners and smugglers. You can stay up so long. With this ship, we could easily stay up 40 hours without refueling."

Several organizations, like Woods Hole, NASA, and the National Oceanic and Atmospheric Administration, have hired Airship Ventures to use the Zeppelin for scientific missions. In the future, the company plans on adding a second Zeppelin to be based on the East Coast, and a third that could continuously tour the country, although there isn't a time frame for either acquisition yet.

For now, if you're lucky, the Farmers Airship will be coming to a town near you this fall. Otherwise, if you're looking to experience flight in a whole different way, head out to Airship Ventures headquarters at Moffett Field in California. **EAA**



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