



Sport Aviation

The Spirit of Aviation | www.eaa.org

Vol. 59 No. 6 | June 2010



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For additional information on many of the topics in this issue visit www.SportAviation.org.

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"Everyone reads that general aviation (GA) barely exists in Europe due to overregulation and high landing fees, but GA is alive and well in Ireland."

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ON THE COVER
EAA Chief Photographer Jim Ioeprnic captures cluster balloonist Jonathan Trappe in flight as he floats to a Guinness World Record.





FLYING AS IN

Dreams

CLUSTER BALLOONS SOAR


JONATHAN R. TRAPPE, EAA 879217

I'M THOUSANDS OF FEET IN THE AIR, strapped to a small harness. I don't have a propeller, rotor, or jet. I don't have an airfoil at all, or any fuel to speak of, at least not in the traditional sense. Yet there I am, at 17,000 feet, with absolutely nothing between me and the air...as if I'm not only flying but also part of the sky.



My aircraft makes no sound — nothing at all.

When some people dream of flying, they imagine themselves floating in silence, looking down at the world underneath them. Today I fly as in such dreams. My feet hang free, and I see the earth slip by silently beneath me. Above me are my N-number and then a towering cluster of toy balloons.

I'm a licensed pilot with a lighter-than-air rating. I've earned the right to fly two types of balloon systems: hot-air balloons and their rare brethren, gas balloons. I've taken the privileges and responsibilities of my FAA certificate and applied them to a rare fantasy of flight in a sport called cluster ballooning. (See "Earning a Balloon Rating" at www.SportAviation.org.)

ORIGIN OF THE SPORT

In 1937, Dr. Jean Felix Piccard, a professor of aeronautical engineering at the University of Minnesota, attached 95 rubber balloons to a tiny gondola and went aloft above Rochester. Dr. Piccard expected to reach an altitude of 2,000 to 3,000 feet on his voyage. After "having some trouble" with his balloons, Dr. Piccard unexpectedly soared to 11,000 feet before pulling out a revolver and shooting a dozen of his balloons. This rather uncommon flight input was successful in bringing the system back down to earth, but I don't recommend trying this method with your own aircraft.

Once at treetop level, the good professor was ready to end his six-hour flight. Unfortunately, Dr. Piccard used the exciting combination of

hydrogen-filled balloons and TNT blasting caps as his final flight input. For those of you unfamiliar with some of the exhilarating properties of hydrogen, the Hindenburg may bring an image to mind. Moments after Dr. Piccard landed the cluster balloon system in the treetops, the system burst into flames, obliterating the balloons and melting the metal gondola that had been Dr. Piccard's perch moments before. Dr. Piccard climbed down a tree, escaping unscathed.

In a more infamous balloon adventure, in 1982, "Lawnchair Larry" Walters attempted to satisfy his boyhood dream of flight in an aluminum-framed lawn chair to which he'd attached about 42 helium-filled balloons. His plan was to float freely about 30 feet above his

girlfriend's yard to get his bearings, while tethered to a 1962 Chevy Bonneville. Once released, his intent was to float east toward the San Gabriel Mountains/Mojave Desert, but the windstream carried him from near San Pedro, California, to nearly 16,000 feet in the airspace near Los Angeles International Airport. Eventually he used a pellet gun he'd taken into the air with him to shoot out some balloons to descend. But after accidentally dropping the gun overboard, he hit power lines and was suspended above the ground. A ladder was brought out for him to climb down...into the waiting arms of local law enforcement personnel.

THE AIRCRAFT

Today, I'm dedicated to making cluster balloon flights that are safe, legal, and reflect well on our flying community. This is a dream many of us had when we were young—just grabbing on to a large bunch of balloons and floating off into the sky. Most of us became reasonable adults and put this idea behind us. But there is that nagging little question: Could it possibly work?

My aircraft is technically a gas balloon. It differs from a hot-air balloon, which obtains its lift by burning a fuel, such as propane, to make the envelope of the balloon warmer and therefore less dense

This is a dream many of us had when we were young—just grabbing onto a large bunch of balloons and floating off into the sky.

(and lighter) than the surrounding air. Instead, my cluster balloon system uses a captive lighter-than-air gas. While there are about a dozen lighter-than-air gasses, most have properties that make them rather unfriendly to work with. My lifting

agent of choice is helium. It has about 92 percent of the lifting capacity of hydrogen, and it's non-volatile, nonflammable, nontoxic, and, regrettably expensive.

The balloons themselves vary in size from about 5.5 feet to about 8.5 feet; we cluster dozens of them together to build a system that towers roughly 50 feet high. To lift a human pilot, plus gear and ballast, we typically drain several dozen bottles of helium.

I breathe from an oxygen system and carry a handheld aircraft radio to speak with the controlling airspace authority. My transponder hangs in open air, suspended beneath my aircraft by a strap that clips in by my side.

FLIGHT CHARACTERISTICS

Cluster balloon systems fly differently than any other aircraft, even other balloons. As we've seen, early cluster ballooning pioneers were surprised to find themselves at altitudes many thousands of feet above what they had planned. Yet, with practice, cluster balloon systems can be controlled by an experienced lighter-than-air pilot.

A standard manned gas balloon is a "zero-pressure" system; the envelope of the balloon is open on the bottom at a narrow point called the appendix. The gas providing the

lift is free to expand as atmospheric pressure decreases with altitude. When the balloon is taut, the gas continues to expand and escapes freely through the

open appendix. This allows a standard gas balloon to reach a pressure altitude—a float altitude where the aircraft levels out.

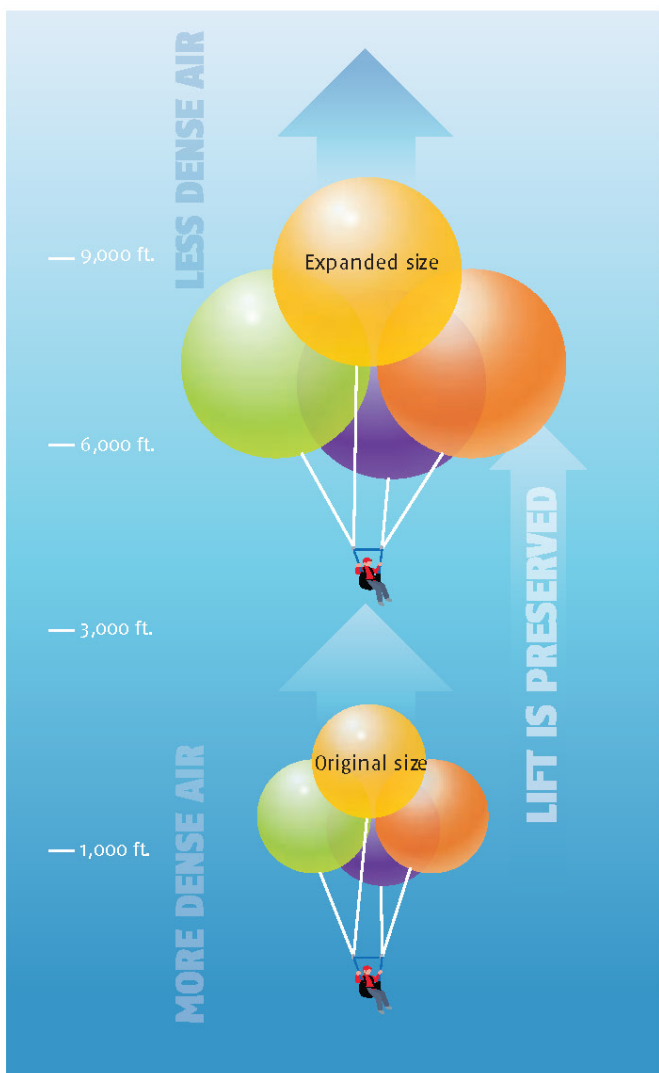
However, our cluster balloons are sealed at the bottom, just like a toy balloon. As we climb, the



Jonathan Trappe will attend AirVenture 2010 and plans to launch a cluster balloon flight sometime during the week. In mid-June, Jonathan plans to launch a cluster flight and fly across the English Channel.

balloons themselves expand. In flight we end up displacing an increasing volume of a less dense air. An aeronautical engineer might say that the increased cross-sectional area of an extensible balloon at higher altitude is almost perfectly countered by the reduction in local air density. The result is that lift is preserved; we get altitude for free.

The only caveat is that one has to make sure to fill the balloons using a protocol where the balloons are given room for expansion so they don't spontaneously burst in flight. Also, since lift is preserved even at ever-increasing altitudes, we have to be sure not to bump into Class A airspace (18,000 to 60,000 feet mean sea level). There are no instrument flight rules rated balloons, and we need a waiver to go up into that airspace.



As the balloon cluster ascends into less dense atmosphere, the balloons expand. The same amount of helium then occupies a larger volume, while providing the same amount of lift.

AIRCRAFT DATA

Aircraft Name: *The Spirit Cluster*

Departure Point: RALEIGH EXEC: The Raleigh Executive Jetport @ Sanford-Lee County

Landing Point: Near Freemont, North Carolina (N35 34.527, W77 57.265)

Balloon Count: 57

Balloon Size: from 5.5 to 8.5 feet diameter

Peak Altitude: 7,474 feet

In-flight Duration: 13 hours, 36 minutes, 57 seconds

Distance Flown (track over the ground): 109 miles

Significance: First ever cluster balloon system to launch in the daylight and fly through the night; longest documented flight by cluster balloons.

INITIATING A CLIMB, OR ARRESTING A DESCENT

As we assemble our cluster balloon system on the airfield, a process that takes about three hours, we start with hundreds of pounds of extra weight to hold the aircraft in place. To initiate flight, the pilot slowly removes weights until the desired level of positive buoyancy is attained.

By the time we launch, we still have a good amount of extra weight. This extra weight, in the form of water ballast, can be thought of as fuel. If we want to climb, we release ballast; the water falls from the system, turning from a steady stream into an unbounded number of droplets that gracefully arc back to earth, and we climb.

If you don't have any ballast left, it is somewhat like running out of fuel. This reminds one of the old pilot adage "When is the only time you have too much fuel?" Answer: "When you're on fire." But, what if your fuel is water? Can you have too much? For us, more ballast means more options, and we take off with plenty.

INITIATING A DESCENT, OR ARRESTING A CLIMB.

I joke about Dr. Piccard using his revolver to control flight, but the principle is certainly correct. When the cluster balloon pilot reaches a point in flight where he wants to arrest his ascent, he must make a flight input. We do this by—and we've heard all the jokes—venting gas. That is, we release a controlled amount of the lighter-than-air gas.

We can do this by popping individual balloons during flight; however, this creates a tremendous sound that rather interrupts our quiet enjoyment of silent flight. Remember, these individual balloons range up to 8 feet in diameter; one doesn't pop them with a pin; a knife works quite handily. (Woom!) However, this sudden release of helium can cause the entire system to shake suddenly—which can be somewhat dramatic when suspended in a tiny harness thousands of feet in the air.

Or we can cut away balloons and allow them to float away, literally up into the stratosphere. Our tests demonstrate that the balloons will typically float into very thin air before rupturing, typically somewhere above the Armstrong Line: say, 65,000 feet. This is rather like the millions of weather balloons the National Weather Service has launched since the 1930s.

Another option is to release helium from individual balloons. On my first cluster balloon system, I rigged up a series of clever vents involving tubes and shutoff valves connected down to the gondola; they didn't work at all. (It turns out the helium wants to go up, not down a tube and out a valve.) This experiment reliably demonstrated the invalidity of our approach.

Finally, one could let nature run its course via two methods. The helium providing our lift would eventually diffuse through the membrane of the balloon, just like it does with a toy balloon that winds up on the floor the day after a party. In practice, however, nightfall comes before helium diffusion has a chance to have much of an impact. When the sun sets, the balloons cool and contract; this initiates a descent of our cluster balloon system, just like it does in a standard gas balloon. The evening cooling brings us back to earth, and we have to expend ballast to remain aloft.

STEERING

Balloonists steer by climbing or descending to take advantage of invisible currents of air at different altitudes, selecting the wind that will bring us to our desired destination. Balloon pilots will sometimes scout out a narrow band of wind only 50 feet high and park their balloon in that stream to guide them to their intended field.

In competition, experienced hot-air balloonists will launch miles from the competition target and drop a baggie on an "X" before flying on to their next target; accuracy is sometimes measured in rather small units, where 3 inches from the "X" might get you second place.



[On April 22, Jonathan was notified by the Guinness Book of World Records that his night flight qualifies as a world record flight. —Eds.]

Flying Through the Night... and setting a World Record

In early April, members of EAA Chapter 1114 of Cary, North Carolina, plus volunteers from the Wings of Carolina flying club, helped me stand a 45-foot-high tower of balloons, building a manned aircraft that was christened The Spirit Cluster.



That day we attached 57 balloons to a small harness, and I floated into the sky above North Carolina for a photo shoot with EAA for this article... and, possibly, to make my first flight through the night. After sampling the winds up to 7,500 feet, I verified that the weather forecasts were correct, and I made the decision to attempt to survive the night.

This would be a first; I had flown cluster balloon systems on flights of up to 10 hours, but I had never attempted to take the system into the dark sky. After my decision was made, I deployed my night aviation lights, and floated into the quiet night. The sun set, and I wouldn't see the earth for another dozen hours.

With permission from air traffic controllers, I floated above North Carolina's capital city, Raleigh. Working with the tower controller at Raleigh/Durham International Airport (RDU), who helped maintain safe separation from other aircraft, I floated about a mile above my home city, enjoying a soundless nighttime tour of the city lights, before the winds shifted and carried me back to the countryside.

At one point the tower was having difficulty distinguishing my slow-moving system from the surrounding stars. The controller asked me to flash the tower with a

one-million candle power spotlight I had onboard, which gave the controller an instant fix. Even later in the night, once the controller could no longer receive my handheld radio transmissions—though I could still hear him—the spotlight again became a communication device, as I acknowledged his radio calls with a brilliant flash that carried over 20 miles through the night.

It would be 5 hours of completely silent flight before I would hear another human or machine sound. Silent flight is a beautiful thing; it was also a period of time that I will never forget. I was not lonely, but rather deeply contemplative as I floated without even the hint of a distant prop or jet.

I flew for 14 hours non-stop, and welcomed the sunrise from the sky. Can you imagine seeing the sunrise while floating a mile high in complete silence? It was indescribably beautiful.

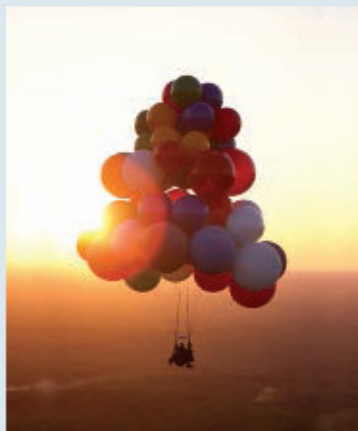
The return of the sun was welcome; it had been below freezing in the deep of the night, and I was grateful for the return of warmth.

Do you see what EAA and its members can do? We make dreams come true; I had long planned for this flight, where we would silently travel from day-to-night and then greet the day once again without setting foot on the earth in between, all suspended from a cluster of toy balloons.

The spirit of aviation is indeed alive. **EAA**



For a time-lapse slide show highlighting the building of the tower of balloons, a photo gallery, and more, visit www.SportAviation.org.





The necessary gear for building, launching, and flying a cluster balloon system. Water bladders provide ballast for climbing/descending.

With our cluster balloon system, we have an uncommonly wide array of winds to choose from. As I mentioned, I get altitude for free, so I can sample the winds up to any reasonable altitude and then settle back into the current that best suits my flight that day.

I've made cluster balloon flights that scrape 18,000 feet. That gave me an excellent array of steering options that day, allowing me to steer away from Lake Michigan and Chicago, on that particular occasion, and into open farmland.

By the way, when climbing up above 17,900 feet, I halted my climb for reasons of regulatory compliance and air traffic control coordination, not performance. Both the balloons and I love to soar high; we have a service ceiling that enters the stratosphere, provided we handle the human physiology components!

FAA RELATIONSHIP

I've worked with a wonderful cadre of dedicated professionals at the FAA. These individuals have a duty to help maintain a safe flying environment for everyone who shares the sky. Once it was demonstrated that we are certificated pilots and that we take the safety of our sport seriously, the FAA was extremely gracious.

We fly our cluster balloon systems in strict compliance with all FAA regulations. The FAA insists on a fireproof dataplate, and mine is somewhat over-engineered for my aircraft. We have no flame or source of ignition, or anything likely to burst into flame! In addition, we're flying helium, an inert gas that will not burn. But my dataplate is FAA compliant and fireproof.

We work with air traffic controllers both before and during our flight to help ensure a safe, enjoyable experience. We notify the appropriate Flight Standards District Office (FSDO) anytime we will be planning a flight in their area, typically at a predetermined fly-in or air show, to let them know there will be an unusual aircraft floating through the skies.

My initial cluster balloon flights were flown under Part 103 ultralight rules. With the help of EAA, our aircraft received the first experimental exhibition airworthiness certificate ever issued to a cluster balloon system.

It was a rare experience to first persuade the FAA that our particular aircraft was airworthy and then to also have the opportunity to teach the FAA how our aircraft flies. The FAA was rather curious about certain properties of our system in flight, such as "Can you fly level?" Answer: Yes, certainly. The issuance

of our experimental exhibition certificate allows us to participate at air shows and events that require airworthiness certification.

INSPIRATION

EAA members have a shared passion: the joy of flight. For some of us this joy manifests itself in engines that roar or aerobatic aircraft that somersault gloriously through the sky. For me, it is that sound of silence that calls me aloft. There is no rush of wind; I move perfectly with the wind.

When our towering cluster of balloons lifts off from an air show, with the pilot suspended underneath, children's eyes sparkle in wonder. Truthfully, I see that same look of amazement in their parents' eyes. Come Monday morning, those individuals will be talking about all the amazing things they saw at the air show, including the man who silently floated away beneath a cluster of toy balloons.

For me, that is what this uncommon form of flight is about: igniting wonder in those around us and instilling the dream of flight. **■**

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