

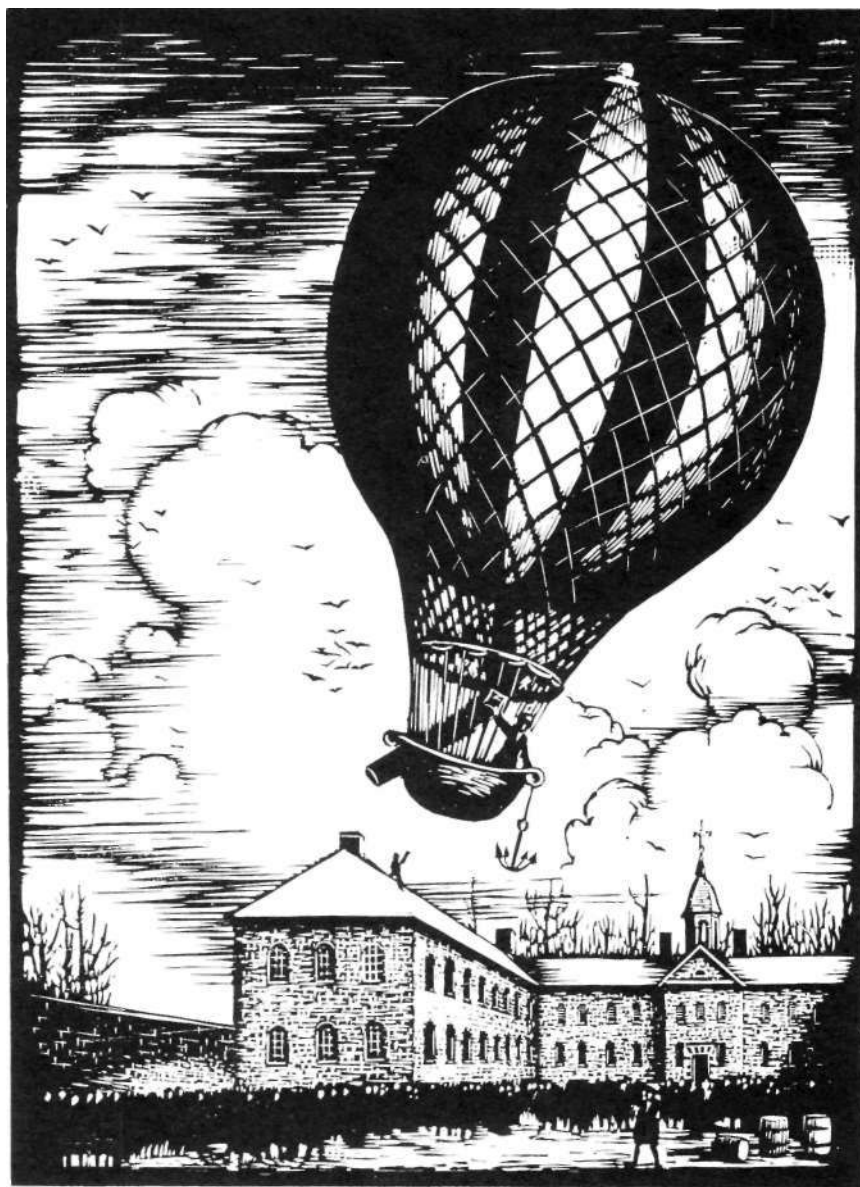
Lighter- Than-Air Flight In America 1784-1910

by Henry R. Palmer, Jr.

THE BEGINNING

Although men have used fire for many thousands of years in their daily lives, they must have marveled on countless occasions at its uncanny ability to force leaves, ash, embers and twigs skyward. Not until the end of the 18th century—less than 200 years ago—did anyone devise a method of utilizing this magical power to carry himself aloft. To the French brothers, Etienne and Joseph Montgolfier, paper manufacturers in Annonay, France, goes the undisputed credit for conceiving the idea of capturing a fire's lifting power to make a paper bag rise. Subsequently they built a massive bag of linen and paper that carried two men on a five-minute flight across Paris on November 21, 1783. The craft's occupants, Jean-Francois Pilatre deRozier and the Marquis Francois d'Arlandes, were the first men to leave the surface of the earth since the beginning of time, an event of unprecedented importance in the history of the world.

Why someone had not long before thought of this simple solution to the age-old problem of flight remains a mystery. Here was a natural, everyday, God-given medium which, when combined with simple materials in common usage by civilizations of many past centuries, could provide the means to fly that people had dreamed about for eons. Yet little evidence exists to



The first aerial voyage in America; Pierre Blanchard takes off from the Walnut Street Prison in Philadelphia, January 9, 1793. (The Penn Mutual Life Insurance Company)

indicate that anyone before the inspired Montgolfiers even thought of the idea. Until then man had remained firmly earth-bound.

Historical records down through the ages show scattered attempts to fly, all inspired by the flight of birds, but none successful: There was Bladid, King of Britain, who leapt with feathered wings from the Tower of Apollo in London in 853 A.D. and died; Eilmer, a Benedictine monk who broke both legs in an 11th century glide attempt from atop Mamesbury Abbey; Simon the Magician who was killed about the same time in an effort to fly from the Roman Forum; and an assortment of "tower jumpers" of the Middle Ages. Unfortunately, all of these flights headed in the wrong direction—down. Now, after 2600 years, an inspired new method of flying suddenly appeared and the era of aeronautics began.

The Montgolfier balloon received its lift from hot air rising from a fire in a brazier suspended beneath the envelope. As long as deRozier and d'Arlandes kept the fire stoked with bits of wood and wool, the balloon remained aloft. When they stopped, it descended. Flight was as simple as that, and word of their triumph quickly spread throughout the world.

Among the estimated 300,000 people who witnessed the flight was Benjamin Franklin, America's "First Minister" in Paris, present at that time to sign the peace treaty between Great Britain and the United States. The flight intrigued Franklin. Three days later he wrote the London Royal Society describing the event.¹ In December he addressed a letter to the Philadelphia American Philosophical Society enclosing a report of the flight printed in France. Impressed, the Society proposed the construction of an American balloon. "It appears to be a discovery of great importance," he wrote his friend Jan Ingenhaus in Vienna,² "and one which may possibly give a turn to human affairs."

Even George Washington showed interest, writing his friend General Duportail in France that the stories of the flight were marvelous, and suggesting jocularly that perhaps Frenchmen would soon be flying to America instead of ploughing there through the seas.

And on April 28, 1784, Thomas Jefferson, an inventor and innovator in his own right, wrote enthusiastically and prophetically to his cousin, Dr. Philip Turpin of Chesterfield, Virginia, about the amazing discovery, saying in part:

"The uses of this discovery are suggested to be:

1. Transportation of commodities under some circumstances.
2. Traversing deserts, countries possessed by an enemy, or ravaged by infectious disorders, pathless & inaccessible mountains.
3. Conveying intelligence into a besieged place, or perhaps enterprising on it, reconnoitering an army, &c.
4. Throwing new lights on the thermometer, barometer, hygrometer, rain, snow, hail, wind and other phenomena of which the atmosphere is the theatre.
5. The discovery of the Pole which is but one day's journey in a balloon, from where the ice has hitherto stopped adventurers.
6. Raising weights; lightening ships over bars.
7. Housebreaking, smuggling, &c.

"Some of these objects are ludicrous, others serious, important and probable."³

With the exception of such objects as lightening ships over bars, housebreaking and smuggling, Jefferson's suggested uses proved remarkably prophetic.

Quite possibly the first intelligent suggestion on balloon design by an American came from Francis Hopkinson of Philadelphia, expressed in a letter to his friend Benjamin Franklin on May 24, 1784. In it, Hopkinson described several experiments he had conducted with small balloons after learning of the Montgolfier flight. He went on to recommend that balloons be made oblong instead of spherical and that they be provided with a large, light "wheel" at the stern, consisting of many vanes or fans of canvas "whose planes should be considerably inclined with respect to the plane of its motion, like the wheel of a smoke jack. This would allow the operator to push the balloon like 'sculling a boat'."⁴ Nearly 70 years would lapse before this particular idea was tested.

In spite of the high level enthusiasm for the Montgolfier flight, Americans showed little inclination to experiment in the new art. The exception was Peter Carnes, who soon designed and built a hot air balloon which he demonstrated in a series of tethered flights on June 24, 1784, in Bladensburg, Maryland—before a paying crowd (tickets ran as high as \$2 apiece).⁵ On the last trip of the day the balloon carried a passenger—13-year-old Edward Warren, a cheerful volunteer whose courageous act earned him the undisputed title of first aloft in America. According to an account in the *Baltimore Journal and Adver-*

tiser, "Warren behaved with the fortitude of an old voyager. The gazing multitude below wafted to him their loud applause, the receipt of which, as he was soaring aloft, he politely acknowledged with a significant wave of his hat. When he returned to our serene element he met with a reward from some of the spectators which had a solid instead of an airy foundation, and of a species which is ever acceptable to residents of the lower world."

There appears to be no record of how Peter Carnes went about building his balloon. Undoubtedly he had read Jefferson's and Franklin's glowing accounts of the French successes and had been motivated by them, but neither of those accounts contained the technical information which he would have needed to design a balloon of his own. We do know that he was sponsored or partly sponsored by at least three well-known Americans: artist Charles Wilson Peale; Dr. Benjamin Rush, a signer of the Declaration of Independence; and Joshua Humphreys, designer of the famous frigates *CONSTITUTION* and *CONSTITUTION*. In any event, he did a fine job. The balloon measured about 35 feet in diameter, 30 feet high, and was built of "beautiful, costly and richly variegated silks."⁶ Lift was provided by a fire contained in a "cylindrical stove of iron suspended at the bottom by which the air is rarefied."⁷ It was fully capable of free flight, as unintentionally demonstrated once during tests when it broke loose and flew away.

A month after Warren's balloon ascension, Carnes attempted a free flight from the protected walls of the Walnut Street Prison yard in Philadelphia but he was spilled out of the basket when it hit the wall 10 or 12 feet up. The balloon continued on alone but quickly burst into flames. This mishap apparently dampened Carnes' interest in aerostation for he is not heard from again. Nor is there any further mention of young Edward Warren, whose name should be immortalized along with such other American flying greats as John Wise, the Wrights, Charles Lindbergh and Neil Armstrong.

Apparently no one else experimented with balloons in America until Josiah Meggs of New Haven, Connecticut, flew an 8-foot tethered balloon from the town Green on April 25, 1785. Several days later he lofted an even larger balloon, 11 feet long. The sight of such a fine target floating over their heads was too tempting for a group of minutemen who were drilling on the Green at the time. They fired at it and scored two hits. This is the first recorded anti-aircraft action in the history of aeronautics.

Peter Carnes' experiments proved of interest only to the locals who had witnessed them. Young and struggling America could not have cared less. Ballooning was a sport only, and an expensive one as well; a fine pastime for the wealthy and fun-loving French, perhaps, but not for Yankees who had neither the time nor money to engage in such frivolities.

For the next 47 years the only ballooning in America was performed by Frenchmen, who flew sporadically, lured to this virgin territory by the anticipation of reaping large exhibition fees, a prospect that never materialized. Americans, as it turned out, were not against others spending money on such foolish contraptions as balloons and spectators appeared in droves to watch the French aeronauts perform. But a balloon ascending and flying can be seen for miles around, and the Frenchmen's attempts to charge the Americans to watch a show that was right there for the looking were unsuccessful, and ballooning soon proved to be a financial failure.

The first aerial voyage by an American occurred five months after young Warren's ascension. Dr. John Jeffries, a Boston practitioner and a loyalist during the Revolution, flew with French aeronaut Jean Pierre Blanchard on November 30, 1784, over London. Two months later the pair flew across the English Channel—an earth-shaking event. The dramatic result of this flight was that England could no longer depend on her "water barrier" as a first line of defense against Europe.

Americans were not to see a real-life passenger carrying free balloon in action until January 9, 1793, when Blanchard showed them how it was done on a 46-minute flight from Philadelphia to Woodbury, New Jersey, a distance of 15 miles. This was the first aerial voyage in America. Incidentally, this was Blanchard's 45th ascension, a fact to ponder when one is considering America's overall place in the field of aerostation.

By this time most other aeronauts, Blanchard included, were using hydrogen instead of hot air with which to inflate their aerostats. The hot air balloon was more economical to operate, but it lacked quick response and maneuverability and its open fire was a constant source of danger. The hydrogen, or pressure balloon, which appeared in France shortly after the Montgolfier flight, offered greater flexibility, more range and larger load-carrying ability. It subsequently became the type used almost universally for the next century and a quarter. Hydrogen was expensive and slow to manufacture (it was made by pouring sulphuric acid and water over iron filings and turnings), and was highly inflammable (known in Blanchard's day as *inflammable air*). Its chief feature was lightness and it remained the prime lifter of lighter-than-air craft through the dirigible HINDENBURG era.

M. Blanchard arrived in America aboard the brig CERES on Dec. 8, 1792, after a 70-day voyage. Promoters billed him as "the greatest of the early aeronauts" and his forthcoming ascension in Philadelphia aroused nearly as much excitement then as the first moon shot did 177 years later at Cape Canaveral.

Blanchard erected his equipment in the yard of the Walnut Street Prison where Peter Carnes had crashed on takeoff nine years before. The site proved ideal, free of trees and protected by its walls from vandals and the idly curious. Of greatest importance from a financial point of view, the site provided an enclosure for the paying customers.

The process of inflating the aerostat began at 7:00 A.M. as Blanchard generated hydrogen gas with "4200 weight of vitriolic acid" brought with him from Europe, a quantity sufficient to effect but one flight. The day was clear and the temperature just above freezing. The event had been well publicized and a pair of cannon began firing reminding salutes at 15-minute intervals. Most people knew that President Washington and the French minister, M. Ternan, and other dignitaries planned to attend the event, and this added attraction brought them out in droves.

Philadelphia was then the capital of the nation, and such was the importance of the event that many famous government personalities also attended. Congress was then in session and among those likely to have been there were Vice President John Adams, Secretary of State Thomas Jefferson, Secretary of the Treasury Alexander Hamilton, Congressman James Madison, Secretary of War Henry Knox, and probably Senators Aaron Burr, James Monroe and Roger Sherman.

At launch time a 15-gun salute announced the arrival of President Washington, who then spoke briefly to Blanchard and

handed him a "passport" which gave him free right to "pass in such direction and to descend in such place as circumstances may render most convenient." Blanchard then took leave of the President and M. Ternan and stepped into the car of the balloon. Dressed in a blue suit, wearing a cocked hat and white feather and accompanied by a small dog presented to him at the last moment by a friend, Blanchard cast off at 10:09, dropped a small amount of ballast, and arose majestically while waving the colors of the United States and France.

Throughout the trip Blanchard made various scientific tests. In one he emptied six bottles containing "divers' liquors" and then stopped them tight to preserve the "atmospherical air wherein I was floating" for analysis after the flight. He checked the "pulsation of the artery" at his maximum height (5812 feet) as requested by Dr. Rush, but found it impossible to time it with a quarter-minute glass which the doctor had provided for that purpose. He then checked it with another watch, finding it to be 92 times a minute (considerably lower than the pulse rate of several United States aeronauts during takeoff). He experimented with loadstone (magnet), finding that it lifted but four ounces at altitude as compared with five and a half ounces at sea level. And he tried a snack of food and drink—a morsel of biscuit and a glass of wine. He then tidied up the car preparatory to landing and began his descent by valving off a portion of the gas. "I observed a large forest," Blanchard wrote later; "I tried to approach it—I judged it to be about 10,000 or 12,000 feet distant, but through my spy glass it appeared impenetrable to me and I gave up the idea of landing there."⁸

The balloon landed without difficulty in Deptford Township, County of Gloucester, New Jersey, about 15 miles from Philadelphia. The event was duly certified and sworn to by six witnesses in a "Certificate of descent" Mr. Blanchard caused to be drawn.

Following his premier flight in Philadelphia, Blanchard remained in the U.S. for two years, where he tried with little or no success to entice paying customers to watch his performances. To stimulate their interest on one occasion he dropped a dog, a car and a squirrel by parachute, quite possibly the first parachute drop in America, and the crowd loved it. His exhibitions, however, failed to pay off and Blanchard soon packed up his gear and returned to France.

At about this time, Peter Cooper, builder of the first locomotive in America, founder of Cooper Union College, New York industrialist and benefactor, began experimenting with an explosive type engine for aerial use. Cooper employed terchloride of nitrogen as the charge, and was hit in the eye with a piece of glass when the machine blew up, permanently injuring his sight. So far as is known, this ended his interest in aeronautics.

Not again until 1819 did Americans see another balloon, this one piloted by Frenchman Louis-Charles Guille, who performed in Philadelphia, Baltimore, Cincinnati, and Jersey City. It was over Jersey City that he reportedly bailed out in what must have been the first human parachute jump in the country. Guille's prowess enthralled the crowds but their unwillingness to pay to watch soon forced him out of business, as it had Blanchard.

Six years then lapsed before another flight was made, this one by Eugene Robertson, the third Frenchman to perform in America. Robertson made a half-dozen ascensions in the New York area in 1825 and 1826 from Castle Garden⁹ on the battery in New York City. New York was then a city of 250,000 people and

an estimated 50,000 of them turned out (among them General Lafayette) to watch Robertson and his multi-balloon. It was a large balloon containing 16,000 cubic feet of hydrogen and four smaller balloons attached around its perimeter.

On this flight he was accompanied by a charming young lady and great was the cheer that came from the assembled multitude as the balloon and its daring crew arose in the still of that fall evening and drifted slowly across the Hudson toward the setting sun. Forty minutes later Robertson landed his balloon in a field near Union, New Jersey, where his lady friend disembarked. He then proceeded on solo, landing an hour later in Westfield, New Jersey, thereby concluding a highly successful voyage.

It is unfortunate that the 50,000 people who witnessed Robertson's takeoff could not also have seen his landings, the most spectacular part of any flight, but this was the way with ballooning and one of its greatest drawbacks from a spectator's point of view. Instead, the show for them was limited to the takeoff, a generally mild affair, and several minutes of watching the balloon growing smaller in the distance. Once it had disappeared, that was it—there was no more. It is safe to say that of the many thousands of people who witnessed ascensions throughout the world in the 1800s, very few ever saw a landing.

A landing required more luck than skill, for the balloonist's control of his craft lay in one dimension only—the vertical. In no way could he change direction right or left of diagonally up and down. Nature handled those dimensions. Picture, then, the dilemma of the balloonist wishing to land, perhaps immediately. His choice of landing spots would lie precisely in the line of flight, whatever that might be. Fields to the right or left, or behind or below could not be reached. He could take only what turned up in front, and when a landing spot appeared, he had to act quickly—out with the grapnel and hope that it would hold. A tug on the gas release cord, not too much and not too little, and with a little luck the craft would jerk to a sudden halt and plop to the ground. In gentle weather the maneuver could be managed with comparative ease, a lovely sight to behold (for anyone lucky enough to be around). On the other hand, in moderate to strong winds the landing could prove disastrous and, as previously mentioned, spectacular. Before the emergency rip panel came into common usage, a balloon lay at the mercy of the wind while its gas slowly escaped through the valve. The panel ripped the envelope open from top to bottom with one stout pull, deflating the balloon instantly.

All manner of dreadful circumstances have occurred down through the years as balloonists have attempted to land their wayward craft. In the sparsely settled Midwest there could have been but few lucky witnesses. They would have been most welcome, too, for a balloonist could use all the help he could get to grab his lines and deflate the bag. Packing it up—envelope, netting, guide rope, lines and basket—and getting it all into a cart and carrying it home or to the nearest railroad station was a chore no man could handle alone. And more than one balloonist left his equipment forever ensnared in the trees of a deep forest.

As a means of transportation, ballooning was obviously unreliable, for unless the wind happened to be blowing precisely toward an aeronaut's chosen destination, he stood no chance of getting there. A broad sweep of his finger could as accurately predict his point of arrival. As far as estimating his flight time, he could only guess at the wind's speed and hope it remained

the same throughout the flight. Balloons offered little of a practical nature, and despite the attempts of many men to control the wanton craft, they flew only as the wind directed.

THE PACE INCREASES

By 1830 America's population had reached 12,866,020—two and a half times what it had been at the beginning of the century. This was an era of prosperity and great expansion for the country, the beginning of the industrial revolution. America traded throughout the world, setting the pace with fast merchant ships, the direct descendants of the Privateer used in the War of 1812, and the forebears of the Clippers to come. Speed was the name of the game, for the evidence was clear that he who got there first with the most stood to make the most.

Railroads laced the Eastern Seaboard and threatened soon to expand westward. Canals and roads probed the wilderness, aiming toward the Midwest and the bustling towns along the Mississippi. There the steamboat, newly invented, with its ability to go upstream, opened the entire Mississippi region, carrying raw products—largely cotton and sugar cane—from the burgeoning South to such mill towns as St. Louis, Louisville and Cincinnati. The Erie Canal led the way to the Great Lakes and the Northwest Territories beyond, carrying raw materials to factories, foundries and mills springing up there, as well as the manpower to operate those facilities.

A migration of workers, farmers and homesteaders began, a phenomenon hitherto unknown in America, where people had remained in one place for generations with no place to go. Now, with a ready means of transportation at hand, many pulled up stakes and headed for the promised lands toward the west. The country was on the move, literally and figuratively. Fortunes were in the making, and at least a few Americans were now in a position to pursue the field of aerostation on their own.

It is improbable that the surging interest in transportation in the U.S. during the 1830s in any way influenced the development of ballooning, although indeed a need existed for a fast and simple means of carrying people and cargoes across the country's natural barriers. The balloon, however, was hardly the vehicle for this need, and its use was limited largely to pleasure flying and spectator events.

First of the new breed of all-American airmen was Charles Fer-son Durant—poet, astronomer, naturalist, scientist, inventor, scholar and neophyte aeronaut. Durant had studied aerostation in Paris with Eugene Robertson and had made two flights with the master before returning to the United States. On September 9, 1830, he became the first American to make an aerial voyage in the United States, lifting off gracefully from Castle Garden in New York City and flying to South Amboy, New Jersey, completing the 30-mile trip in 60 minutes. Some 20,000 persons witnessed the momentous event and at South Amboy several citizens saw the landing, rushed to the spot and "afforded the necessary assistance in securing the balloon & car," according to an article in the *New York Evening Post*. So thrilled were the South Amboy citizens with the event that they brought Durant's basket and envelope to the local hotel, where they were inspected by a "large concourse" of ladies and gentlemen. The next morning he was conveyed through the streets, accompanied by music, and at 7:30 A.M. Mr. Durant embarked aboard the steamer THISTLE for New York City. Such was the state of the art in 1830.



First flight of an American in the United States. Charles P. Durant's balloon lifts off from Castle Garden in Lower Manhattan, September 9, 1830. (From a painting by Charles Burton)

Professor Durant¹⁰ was a charmer, an intelligent, humorous showman who captured the public's love and admiration. He flew just often enough to hold its attention. In four years he made but twelve flights—six at Castle Garden, one in Albany, two in Baltimore, and three in Boston. (On one of the Boston flights he was carried out to sea and then by some freak of nature driven back ashore unharmed.) He then retired from ballooning, having decided that he had had enough and that there was little more he could accomplish, although he envisioned a great future for balloons as air mail carriers, explorers of the upper regions, for map making, and for escaping from besieged cities. Among his contributions to aerostation was an altimeter especially built to withstand jarring and knocks.

Less than a year after Durant retired from the balloon profession, a rash of young balloonists appeared on the scene, encouraged, no doubt, by Durant's success and popularity: Hugh Parker, Nicholas Ash, George Elliott, Richard Clayton, Samuel Wallace, Thomas Kirkby, William Woodall, Louis Lauriat, Z. Mitchell, William Paullin, James Mills and John Wise. They were a dashing lot, imaginative, courageous, and, for the most part, educated and wealthy—necessary attributes, for ballooning was dangerous and expensive, and a man needed all his wits to stay alive. Their varnished silk and paper balloons were flimsy and prone to tears and rips. Those that were made of varnished muslin were stiff, heavy and clumsy. The hydrogen that inflated them was as explosive as anything known to man, and the ropes that tied them together were made of nothing stronger than hemp or linen. Ballooning was anything but a gentle art, and made particularly difficult and hazardous by the vast expanses of wilderness and lakes adjacent to most of the cities and towns where balloonists flew.

All of these young aeronauts were well known in their day, many of them flying in the Baltimore region throughout 1834, performing so regularly that the press commented in April that "We are rather used to such things." Again in November, one paper stated, "Balloon ascensions have become so common that we have ceased to notice them." Hardly a week passed without some Baltimore paper carrying an advertisement of a coming ascension. Often as not the flight was canceled at the last moment—technical difficulties, inclement weather and equipment problems were the main reasons—whereupon an ad would

appear in the paper announcing a new date. Cancellations of this nature incensed those who had gathered to witness the event, and a balloonist risked damage to his equipment and himself whenever forced to abort the attempt.

The balloon was definitely here to stay, and most of the early pioneers pursued their hobby for years. John Wise, for one, became so enamored with the sport that he devoted 40 years of his life to it, flying nearly everywhere between Illinois and Maine, and making a lifetime total of 443 flights, including one of the longest in ballooning history.

William Paulin, who did much of his early flying in and around Philadelphia in the mid-1830s, eventually moved on to South America and the West Indies where he performed for several years. He later flew with the Union forces during the War Between the States.

Thomas Kirkby moved to Cincinnati in 1834 where he constructed a 5000-seat amphitheatre from which to make balloon ascensions. Unfortunately, he failed on several occasions to meet scheduled takeoff dates, thereby arousing the anger of spectators who twice threatened to destroy the unhappy aeronaut and his craft. Luckily for them both, the mayor of Cincinnati and a detail of police arrived in time to prevent the mob from taking matters into its own hands, and Kirkby lived to make two successful ascensions two and a half weeks later. He is known to have flown again during the following year at St. Louis, but after that he disappears from the records.

James Mills moved to York, Pennsylvania, where he made his tenth ascension in July 1835, an event witnessed by many people. As the *York Republican* reported on July 29, the spectacle was "an entire novelty in this section of the country." The flight proved a huge success both for Mills and his audience. In the flowery language of the day, the *Republican* reporter described the takeoff:

The cords that confined the soaring airship to earth were loosed, and the adventurous traveller on a trackless and impalpable element, having taken his seat in the basket attached to the balloon, rose into the air among the cheers of the congregated and gratified multitude, which he returned by waving his hat, exhibiting no fear of "toppling down headlong" from this elevated position.

An account of Mills' flight above the city and across the river and his safe landing shortly thereafter follows, ending with this observation:

We believe that general satisfaction was given to the great number who were present on the occasion, and although the voyage was not long nor were any substantial additions to science made, yet a natural curiosity was gratified, and we in this ballooning age can boast of having seen the sight as well as our neighbors.

A month after this rousing exhibition of airmanship, the intrepid Mills was dead of apoplexy.

Hugh Parker also ran afoul of the violence so common among sporting fans of the day. In York, on September 15, 1835, Parker misjudged the amount of gas needed for takeoff, and when released, his balloon climbed sluggishly, tearing a hole in its envelope on the walls of the amphitheatre, then falling back to earth in a great clump. The sudden failure after hours of patient waiting was more than the crowd could bear. Maliciously, it moved toward the unlucky Parker, entwined in the folds of his damaged balloon, its expensive gas rapidly leaking away. "The rush of spectators toward the place of descension was tremendous," reported the *York Republican*. "We never viewed

a more 'living landscape', the crowd amounting to several thousands."

Parker was lucky. The crowd confined its ire to threats and taunts and soon dispersed. But he apparently never flew again.

Richard Clayton, a Cincinnati watchmaker and amateur balloonist, in 1835 built an 18,000 cubic foot capacity balloon, the largest in America and the first constructed west of the Alleghenies. The craft, named STAR OF THE WEST, was made entirely of oiled and varnished silk. During the course of its construction, Clayton announced that he would fly it on April 8 of that year for what he described as an "unusual length," and that as an added attraction he would release a live animal from it by parachute shortly after takeoff.

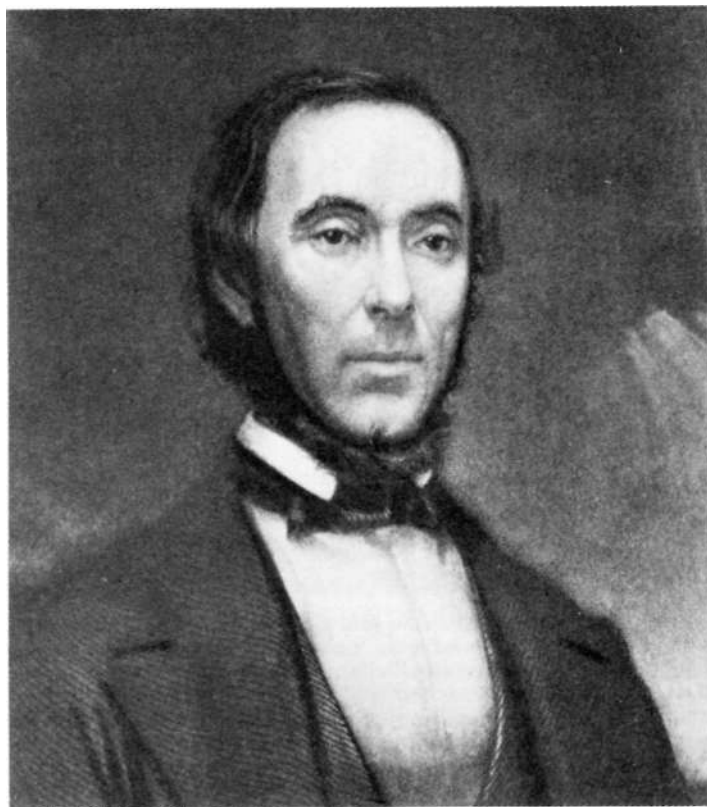
Remarkably, the event went off on schedule. STAR OF THE WEST arose from Thomas Kirkby's amphitheatre at exactly 5:00 P.M., its basket gaily decorated with colored silks and tassels. As the balloon climbed up over the city, Clayton was seen to toss out his live passenger, a small dog, which drifted safely back to earth and into the arms of a man who had followed the descent. The man bore the animal gleefully back to the amphitheatre much to the pleasure of the audience. Although offered cash for the dog by various enthusiastic spectators, the captor refused to sell it, remarking that he felt the dog was "popular enough to run for Vice President."

Clayton remained airborne most of the night, landing early the following morning in Monroe County, Virginia. He had flown 350 miles, further than any man had ever traveled by air before. Flying an untried craft cross-country at night over wild and uninhabited territory even today is not to be recommended. But Clayton was lucky. He received a hero's welcome and world-wide acclaim upon his arrival back in Cincinnati several days later.

Clayton made several more flights that year in Kentucky and Virginia, and the following year in New Orleans. He is known to have flown as late as 1850 when he gave Columbus, Ohio, its first ballooning exhibition.

John Wise, unlike most of his contemporaries, was keenly interested in aerostation—the art of ballooning, the science of flight, meteorology, the upper regions—and in finding ways and means of utilizing the balloon for something other than sport. On one of his very first flights (in 1835) his balloon had exploded in midair. "I was apprehensive that it might be my last voyage," wrote Wise, but to his amazement the deflated envelope parachuted him back to earth. It had been a harrowing experience, one that the average person would not care to repeat, and yet Wise chanced it some years later to publicly demonstrate that an explosion aloft would not necessarily mean finis for the occupant. At 13,000 feet, he tied down his safety valves and the balloon burst. As predicted, the envelope instantly collapsed, the lower half sucked into the upper to form an effective parachute. Several minutes later the deflated bag and the basket hit the ground with a resounding bump, but Wise stepped out of the wreckage unhurt.

Early in his career, Professor Wise observed that winds aloft blew mainly from west to east. He reasoned that they would carry a balloon from America to Europe. The idea so intrigued him that in 1843 he petitioned Congress for \$15,000 with which to build a 500,000 cubic foot capacity balloon with which to test his theory. Congress referred the petition to the Committee on Naval Affairs where, according to Wise, "it slept."



John Wise.

The prophetic Wise wrote in 1847 that ballooning then was "about half a century ahead of the age" and went on to say that if the spirit of mechanical progress kept pace with the outward march of intellect, "our children will travel to any part of the globe without the inconvenience of smoke, sparks and seasickness, and at the rate of one hundred miles per hour."

Like anyone who had piloted an airplane, Wise sometimes engaged in low flying, beating up the countryside and cutting things generally close. He once took off from Chester, Pennsylvania, in the face of thunderstorms and puffy winds and flew at treetop height for miles. Below, a man on horseback tried vainly to keep up with the rapidly moving balloon. Wise held out a newspaper to him and called, "Come on, come on! I'll give you the latest news from West Chester." Minutes later, his gas nearly depleted from keeping the balloon low and the storm bursting in full fury ahead, he tossed out his grapnel and landed.

Aerial disturbances intrigued Wise, and with no apparent thought for his own safety he flew repeatedly in conditions that would scare off many a present-day aviator. Once he traveled inside a "thunder gust" for a hundred miles, "a scene of awful grandeur." He was tempted to escape by rising or descending, but "like Lot's wife, I was curious to look back—not to be turned into a pillar of salt, but certainly to be well shaken, hurled round and round as it were by the nape of the neck."

But flying of this nature could not be witnessed by the earth-bound, and a more popular performer of the day was Frenchman Eugene Godard, whose aerial antics, often in company with Madame Godard, delighted countless thousands between New Hampshire and New Orleans in 1856. Their tour de force was to carry a horse with them (a small one, in all probability), M. Godard sitting or standing on its back, his wife occupying the basket. The *Scientific American* described the horse on one such flight as "hanging his head low down with eyes intently fixed upon the earth without struggling a particle."



John Wise earned the enviable title of America's First Airmail Pilot when he took off in his balloon *Jupiter* from Lafayette, Indiana, on August 17, 1859, carrying an official mail pouch of letters destined for New York City. A crowd estimated at double Lafayette's 9000 population cheered him on, but it was a windless day, and the balloon remained becalmed over the city most of the afternoon. By nightfall, his gas and ballast nearly depleted from searching vainly for favorable winds aloft, Wise landed a scant 12 miles from his point of departure. Here the mail was sped on its way to New York via the New Albany and Salem Railroad. Of the 123 letters the pouch contained, all properly stamped and marked "Via Balloon Jupiter," only one is known to exist today. (Tippecanoe County Historical Assoc., Lafayette, Ind.)

On July 1, 1859, Wise undertook the most ambitious flight ever attempted—from St. Louis to New York. He fell short but established a non-stop record of 809 miles that stood for 50 years. In Wise's opinion, this record was "worthy of thoughtful consideration as a scientific experiment of the first importance to the human race." And indeed it was. With Wise on this flight were John LaMountane, aeronaut, O.A. Gager, *Scientific American* observer, and a Mr. Hyde, a reporter for the *St. Louis Republican*. Their balloon, the *ATLANTIC*, measured 50 feet in diameter, was 60 feet tall, and contained 65,000 feet of illuminating gas obtained from the St. Louis Gaslight Company, enough to support a total weight of some 4000 pounds. Aboard were 1000 pounds of sand ballast, food and drink. Suspended beneath the basket was a small boat, should they be forced to ditch. They cast off at 6:00 P.M. and flew uneventfully that night across Illinois and Indiana, reaching Lake Erie at dawn. At 500 feet above the waves they overtook a small steamer to which they spoke in true nautical fashion: "How do you do, Captain? A fine morning for boating." The Captain immediately responded, "Good morning my brave fellows; but where in the heavens did you come from?"

"From St. Louis, Sir, last evening."

"And pray where are you going?"

"Going eastward, Captain, first to Buffalo, and then to Europe, if we can."

"Good luck to you," shouted the Captain. "You are going like thunder."

Bad weather with winds of 60 miles per hour was encountered over Lake Ontario and only by tossing out everything possible did they manage to remain airborne. Several times the boat dragged in the water and once the balloon itself hit the waves,



John Wise's balloon, fully inflated, is shown here in this pre-Civil War photograph, about to take off from in front of the *Lancaster Intelligencer* in Lancaster, Pennsylvania, Wise's hometown. The great mass of spectators, packed around the balloon and watching from windows and rooftops, was typical of balloon ascensions of the era. (Lancaster Newspapers, Inc.)

then bounded up several hundred feet. With no land in sight, nothing remained to be thrown out except the boat itself—their one means of salvation. They neither could afford to keep it nor discard it. They were doomed if they did and doomed if they didn't. By a stroke of fortune, which seemed to follow Wise on his aerial voyages, the balloon stayed up just long enough to reach the shore and there it plowed with full fury into a large stand of trees, wrecking itself, but doing little damage to its crew. Although they failed to make New York City, they had flown over 800 miles, a record that would stand for 50 years.

Wise later commented that this voyage had been no haphazard scheme of reckless daredevils, but was a systematic attempt on the part of thoughtful men to demonstrate certain facts for the benefit of mankind, which it did in a most satisfactory manner.

John Wise's enthusiasm for ballooning was equaled only by Samuel Archer King, later to be known as "The Grand Old Man of Flying," whose aerial career ran from 1851 well into the 20th century. During this time King made over 450 flights, most of them in the northeast, at fairs and celebrations. In 1857 he introduced the sport to James Allen, a young printer from Barrington, R.I., destined to become one of America's great aeronauts. Allen in turn taught his entire family to fly. It was from Sam King's balloon that the first aerial photographs in the United States were taken—sparkling, clear views of Boston in 1860.

THE ANDREWS AEREON

One practical solution to the problem of controlled forward flight during this engineless era was offered by Dr. Solomon Andrews, whose strange aerial craft flew where directed, pro-

pelled solely and simply by the pull of gravity.

Andrews, a Perth Amboy physician, politician, manufacturer and inventor, in 1830 conceived the idea of an aerostat with flat upper and lower surfaces designed to resist vertical climb and descent, thus forcing the craft to move forward laterally. A standard spherical balloon will rise straight up under zero wind conditions. A flattened balloon, Andrews reasoned, would not climb in this manner but instead would take the path of less resistance, sliding off sideways while climbing and descending, therefore achieving forward movement.

Dr. Andrews' idea was based on the manner in which a flat plank, when released from the bottom of a still body of water, will rise at an angle, surfacing some distance from the point of release. Similarly, if weighted, the plank will return to the bottom following the same inclined plane, slipping off laterally to some point away from where it started. Under these conditions a plank could be made to travel any distance desired, following this sawtooth course.

Dr. Andrews' AEREON craft consisted of three cigar-shaped balloons, 80 feet long and 13 feet wide, attached to each other side by side, the concave voids at the joint of the hulls providing added resistance to vertical movement. Together they contained 26,000 cubic feet of hydrogen, barely enough to lift the craft and its lone occupant.

At the equilibrium point—the state where a lighter-than-air craft will neither rise nor descend without manipulating ballast or gas—AEREON was expected to move off obliquely at one mile per hour for approximately every pound of ballast or 30 cubic feet of gas released. By dropping 10 pounds or valving 300 cubic feet of gas, the craft should reach a speed of 10 miles per hour; 20 pounds or 600 cubic feet, 20 miles per hour, and so on. Should the wind be blowing, correspondingly larger amounts of both gas and ballast would have to be released.

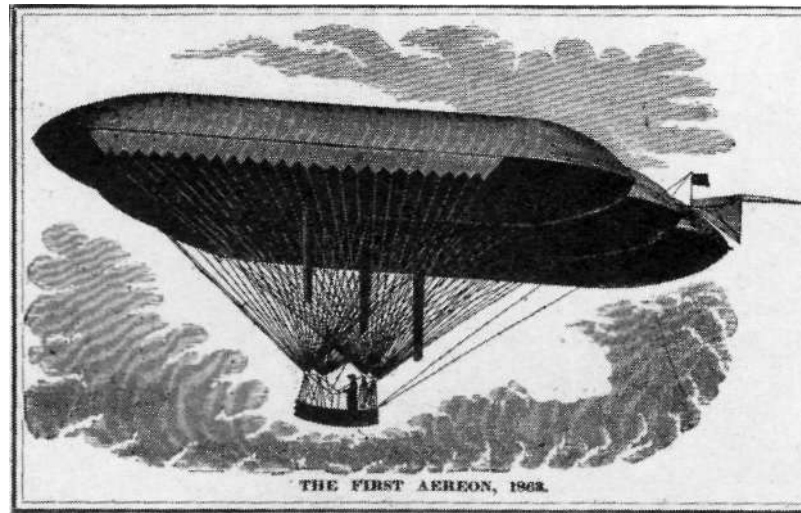
Andrews' idea was flawless in principle, simple in operation, but immensely wasteful of lifting gas and ballast, the very lifeblood of any balloon.

On September 4, 1863, Andrews cast off from the Commons in Perth Amboy and climbed steeply to 200 feet. Then, to everyone's amazement, he turned the craft around and brought it back to its starting point. Nothing like this had ever been seen or heard of before. Reported the *New York Herald Tribune*, "We have this week the pleasure to record the success of the most extraordinary invention of the age, if not the most so of any the world ever saw—at least the greatest stride in invention made by a single individual."

Two months later, to prove it had been no fluke, Andrews reportedly flew the craft again several times, achieving 360-degree turns with apparent ease and making speeds estimated by some to be over 100 mph. Commented the June 24, 1865 *Scientific American*, "It would be satisfactory to know to whom and by whom and by what methods the velocity was measured and what was the force of the wind against which it sailed." One wonders the same thing today.

Throughout the Civil War years Andrews tried to interest Lincoln and the War Department in his invention,¹² claiming it would be a far more effective observation ship than the tethered balloons then used by the Union army. But the military paid him no heed and the craft never saw action.

At the end of hostilities, Andrews formed the Aeronautical Navigation Company with offices in New York and disclosed



Dr. Solomon Andrews' Aereon, 1863. (Library of Congress)

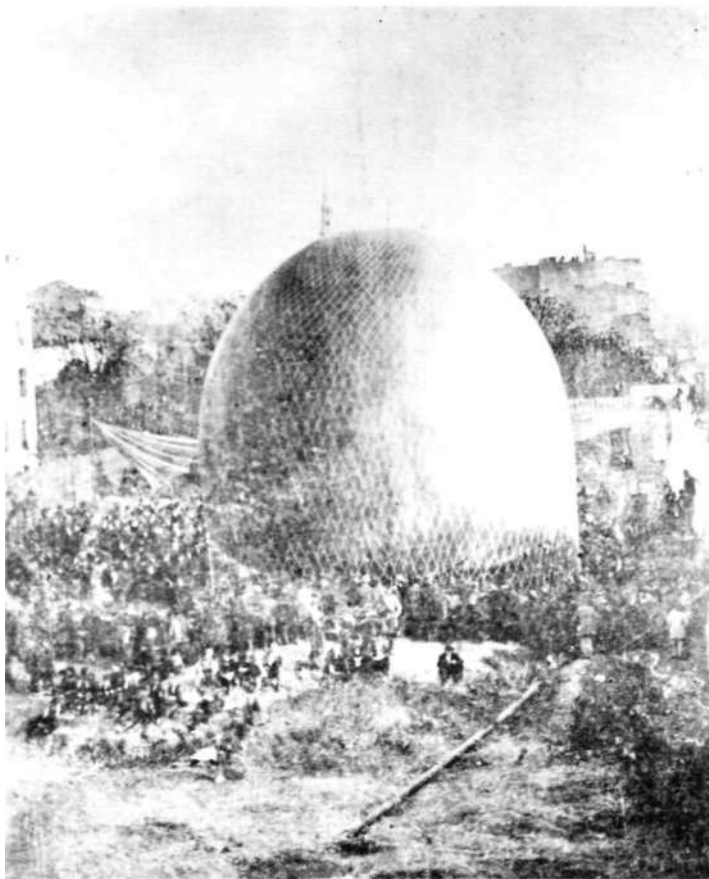
plans to provide air service between New York and Philadelphia. He immediately began construction of a new AEREON, considerably larger and of an entirely different design. Instead of three hulls like the first AEREON, it had only one, shaped like a huge lemon seed and made from the silk envelopes of the surplus Civil War balloons UNION and INTREPID. It contained 40,000 cubic feet of hydrogen which Andrews claimed would support more than two tons.

The trial flight of the new ship took place on May 25, 1866, from its site of construction on the corner of Greene and Houston streets in New York City. Aboard were Andrews and three of his partners—Trowbridge, Plumb and Hill. As the ship lifted, its rudder sheets snarled and it drifted toward the Battery out of control, then straightened out as Andrews regained control and, to everyone's amazement, proceeded north as far as Union Square. There the ship veered to the east where, according to the *Scientific American* in an account of the flight the next week, "it seemed less under control than before, being drifted forward in the direction which the wind was blowing, following that course until she was lost sight of."

AEREON crossed the East River over Blackwell's Island and on to Hunter's Point. There she headed into the wind and, as the account continues, "she lay perfectly still for five minutes, the breeze passing by and being distinctly felt by the occupants of the car blowing in their faces." She then turned and landed at Ravenswood, Long Island.

On June 5, Andrews again flew the ship, this time with his partner Plumb only. After experiencing the same rudder problems, they turned north and flew along Broadway as far as Welfare Island, where they turned and headed for Oyster Bay, landing the ship with its gas depleted.

Whether AEREON could have flown back to its starting place on either of these downwind jaunts to Long Island is not known. Indications are that the wind was light and from the northwest on both occasions. AEREON apparently flew northerly, somewhat northeasterly, in all probability crabbing at a right angle to the wind, then turned and flew directly before it to Long Island. Andrews claimed that storm clouds facing him in the east caused him to terminate the flight at Oyster Bay, but these could hardly have prevented him from going west. Perhaps his supply of gas and ballast had become depleted from the constant valving en route. A more plausible explanation is that the AEREON simply



The 30-foot lifeboat *Leontine* shown slung beneath the basket of the *City of New York* in a test suspension from a gin pole. The six-bladed horizontal propeller mounted on the prow was to have been driven by a four-horsepower steam engine, but is shown in the photo to be only hand-operated. With it Lowe hoped to control the balloon's altitude, thus eliminating the conventional method of discarded vitally important ballast—the very life blood of any balloon. Whatever prompted this idea—facetiousness, publicity or ignorance—is not known, but quite obviously it would have been utterly useless. (Smithsonian Institution)

Thaddeus Lowe's balloon, *Enterprise*, in process of being inflated in Cincinnati, Ohio, prior to departing for the East Coast, April 20, 1861. It landed nine and a half hours after takeoff in Unionville, North Carolina, some 350 to 400 miles away. Note pipe in foreground. This may well be carrying illuminating gas from the plant to the balloon. (Smithsonian Institution)

could not make forward progress into anything but the mildest of breezes.

Dr. Andrews' conception was imaginative and unique but with its usefulness limited to windless days, AEREON had no future. In the depression that followed the War, the Aeronautical Company closed its doors and Andrews never flew again.

THE ATLANTIC CHALLENGE

John Wise's petition to Congress in 1843 for funds with which to construct a giant balloon for an Atlantic crossing attempt was the first evidence of serious interest in the idea. The next year the *New York Sun* headlined the news that the balloon *VICTORIA*, carrying eight men, had accomplished the feat, flying in three days from Wales to North Carolina. America was astounded, then disgusted when it discovered the story to be a hoax, perpetrated by none other than Edgar Allan Poe.

John LaMountain, the official "aeronaut" aboard John Wise's *ATLANTIC*, on the first leg of the projected trip from St. Louis to Europe, salvaged what remained of the battered craft on the shore of Lake Ontario, rebuilt it and prepared for another attempt. On September 22, 1859, he departed Watertown, N.Y., on what was to have been a short training flight for the impending voyage across the ocean. With him was John Haddock, a Watertown newspaperman, inexperienced in ballooning affairs but anxious for an afternoon of fun. In a matter of hours after takeoff, the pair was lost to the world. Newspapers throughout the country reported the departure and disappearance of the two men and, as the days passed by with no word, gloomily speculated on the balloonists' fate. Neatly a week later they turned up, alive and well, 150 miles from Ottawa, blown into the Canadian wilds by unfavorable winds. There

they had force-landed to avoid being driven even further into the wastes. *ATLANTIC* was destroyed, and with it all of LaMountain's hopes of being the first to fly to Europe.

Still another aeronaut who longed to cross the Atlantic was 27-year-old Thaddeus Sobieski Constantine Lowe. In July 1859, Lowe began construction of the largest balloon the world had ever known, the *CITY OF NEW YORK*. The craft measured 130 feet in diameter, stood 200 feet high and contained 725,000 cubic feet of gas. Its lifting capacity was estimated at 17 tons if inflated with illuminating gas, 22 tons if with hydrogen—ample support for its crew, their supplies, ballast and 30-foot lifeboat slung beneath the basket—Lowe's single concession to the possibility of failure.

Lowe built the balloon in Hoboken, New Jersey, in a record three months' time, then moved it to a vacant block in New York City at the corner of 42nd Street and Fifth Avenue for inflation by the New York Gas Company. He had been promised 500,000 cubic feet of coal gas over a 24-hour period, but at the end of a week no more than 50,000 cubic feet had been produced, most of it leaking out of the none-too-tight envelope.

Chagrined by this turn of events and ridiculed by the press throughout the long week as the flaccid monster failed to fill and be on its way to Europe, Lowe abruptly aborted the attempt and moved bag and basket—two freight cars full—to Philadelphia where the Point Breeze Gas Works had offered to inflate the giant rapidly and at no charge. By then, however, it was November, too late in the year to be over the North Atlantic, and Lowe regretfully postponed the attempt to the following summer. On September 8, 1860, a half hour before lift-off time, the balloon suddenly exploded and was totally destroyed. Uninjured and undismayed by the disaster, Lowe sought financial support for construction of another balloon. Instead, he was

advised by a group of Philadelphians headed by Professor Joseph Henry of the Smithsonian Institution to first test the west-east prevailing wind theory on a less hazardous overland flight. Lowe took the advice and immediately departed for Cincinnati. From there he took off in ENTERPRISE, his original old balloon, on April 20, 1861. Driven by a northwesterly wind, he flew some 400 miles and landed in Unionville, South Carolina, nine and a half hours after takeoff. Lowe's faith in the theory was vindicated, but the transatlantic attempt was not to happen. Fort Sumpter had surrendered a week before and the country was submerged deep into civil war. With no further thought for his project, Lowe volunteered for duty with the Union Balloon Corps.

Lowe had proven that a west-east air flow did indeed exist. It had propelled him much of the way from Cincinnati to Unionville at 18,000 to 20,000 feet of altitude. Although John Wise had not flown at such heights on his 1859 dash from St. Louis to New York State, the air flow theory seemed borne out by the fact that he was carried eastward and at speeds approaching 60 miles per hour. Each man understandably remained firmly convinced that a 3000-mile transatlantic crossing was completely feasible. Simply because no balloon anywhere in the world had ever flown more than 800 miles or had remained airborne over 20 hours was apparently no reason to deter the men. Their reasoning was simple, if incorrect: to fly four times as far, they need only quadruple the size of their balloons.

THE BALLOON AT WAR

In his letter to Jan Ingenhouze dated January 16, 1794, Benjamin Franklin wrote:

Five thousand balloons, capable of raising two men each, could not cost more than five ships of the line, and where is the prince who can afford so to covet his country with troops for its defense as that ten thousand men, descending from the clouds might not in many places do an infinite deal of mischief before a force could be brought together to repel them?¹³

Franklin's prophetic musings became a reality 150 years later with the airlifting of troops into Europe during World War II.

America recognized the balloon as a possible military instrument during the Seminole Indian War in Florida in 1840, when a colonel in the War Department in Washington, John H. Sherburne, proposed to Secretary of the Treasury Joel Poinsette that a balloon be used to spot Indian campfires at night. Sherburne went so far as to negotiate the purchase of a balloon from Charles Durant, who offered to sell him a new one complete for \$600, which included setting up and inflating instructions.

Sherburne reported the offer in detail to Poinsette in a letter dated November 10, 1840. Poinsette replied on January 28 of the following year, saying that he had conveyed Sherburne's plan to General W.K. Armistead, commander of the troops in Florida, and that Armistead had turned it down. "He considers this means of reconnaissance inapplicable to the country,"¹⁴ wrote Poinsette, and there the scheme died.

Considering the American Indian's natural ability to remain completely hidden from view in woods and jungles, thus frustrating any soldier bent on destroying them, the Colonel's idea of spotting their fires at night from a balloon flying overhead makes more sense than General Armistead's refusal to consider it.

During the Mexican War, at a point when American troops were unable to capture the fortified castle at Vera Cruz, John

Wise suggested to the War Department that bombs be dropped from a tethered balloon worked into position directly above the enemy. Wise estimated that a 500,000 cubic foot balloon could carry 18,000 pounds of bombs and torpedoes, enough to annihilate the fortress if they all hit it squarely. Very probably the scheme could have worked, but the War Department ignored it.

Shortly after the outbreak of the Civil War, John Wise volunteered his services to the Union Army as an officer of a small company of cavalry which he had organized and trained on his own. But much to his disappointment his offer was refused, and instead the high command assigned him to the Topographical Engineers as a civilian observation balloonist.

Wise reported for duty in Washington in his new capacity on July 19, 1861, and received immediate orders to inflate his balloon (which he had brought with him) and take it overland to Centerville (Bull Run), 25 miles away. The task proved a difficult one, with 22 men being forced to walk the clumsy device at night through woods, across canals, around telegraph poles and wires and over creeks, and dawn had broken before the exhausted men reached the battle area. At that point, to hasten their progress toward the lines, they hitched the balloon to a mule team which promptly walked it into a tree, so damaging the craft that it could not be used.

This time-consuming and awkward method of transporting and inflating balloons prompted Wise to design a portable generator, one that could inflate the craft in the field. But he failed to convince his superiors of the advantages of such a device. The staid and conventional Army officers saw little use in the balloon as an instrument of war anyway, and were not about to seek funds to finance Wise's operation. Here the matter rested.

This rebuff and other frictions soon discouraged Wise from staying on, and less than a month after assuming his first command, he resigned from the Army. He returned, however, shortly thereafter, this time as commander of the cavalry troop he had trained, and saw service for several months before ill health forced him to retire from the Army for good.

Thaddeus Lowe arrived in Washington on June 5, 1861, six weeks after completing his non-stop flight from Ohio to South Carolina, bent on convincing top brass of the Union Army of the need for good aerial observation along the front. He found James and Ezra Allen, John LaMountain and John Steiner already there with their balloons, but made no attempt to join them. Instead, he went directly to President Lincoln, who appeared much impressed with his plans. While awaiting the President's decision, Lowe made several flights with his balloon in Washington, on one occasion telegraphing this message to the President seated in the White House, the first such communication ever made from an aircraft in flight:

Dear Sir,

From this point of observation we command an extent of country nearly fifty miles in diameter. I have the pleasure of sending you this first telegram ever dispatched from an aerial station and acknowledging indebtedness to your encouragement for the opportunity of demonstrating the availability of the science of aeronautics in the service of the country. I am,

Your Excellency's obedient servant,

T. S.C. Lowe

Within a few days, Lowe found himself appointed to the position of civilian balloonist with General McClellan's Army of the Potomac on a salary scale of a full Colonel (approximately \$10 per day). By then Lowe had become convinced that none of the



current group of observation balloonists "had the least idea of the requirements of military ballooning," a somewhat superior attitude to take when no one knew anything about this totally new mode of warfare. But Lowe had his ideas and in time became the outstanding aerial observer of the war. He first saw action on July 24, 1861, when he spied on the enemy from his balloon, the *UNION*, between Manassas Junction and Fairfax, Virginia, to investigate rumors that troops were amassing for an attack on Washington. His observations proved the rumors to be groundless, and a growing panic in Washington was quickly abated.

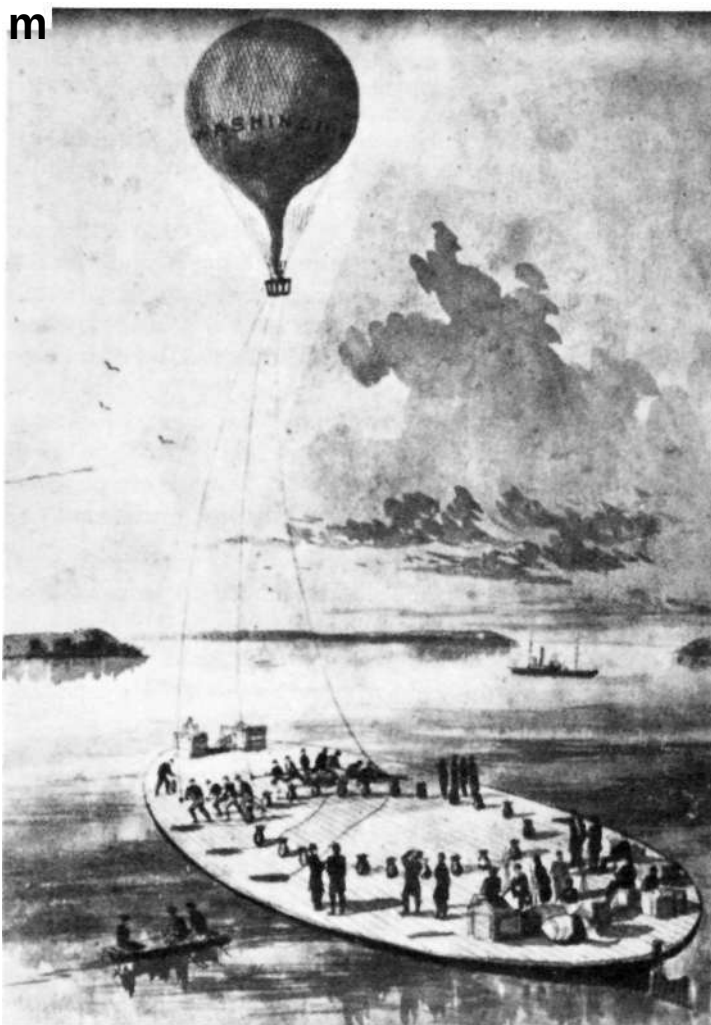
On those occasions when balloons happened to be on the right spot at the proper time they performed well. But they were clumsy affairs, hard to handle and slow to move. Getting them where the Army needed them most in a hurry more often than not proved impossible. John LaMountain helped solve this problem in August 1861 when he attached his balloon to the gunboat *FANNY*. From his mobile perch he observed enemy movements off Sewell's Point in Hampton Roads.

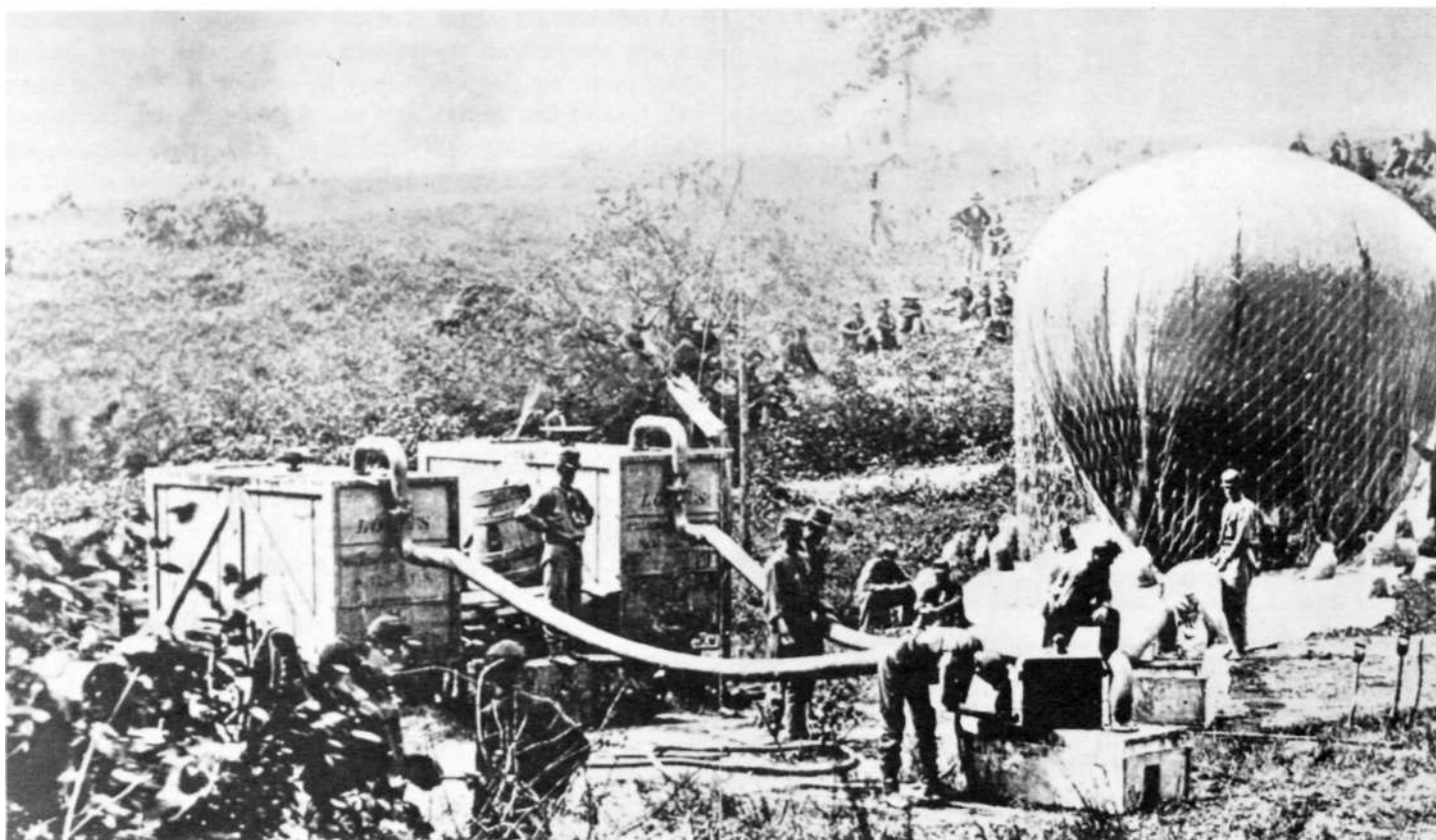
The following November Lowe and James Allen went LaMountain one better by converting the 122-foot barge *USS GEORGE WASHINGTON PARKE CUSTIS* [sic] into a floating platform equipped to carry their entire balloon paraphernalia, including a portable hydrogen gas generator which Lowe had designed. This barge, the world's first aircraft carrier, played an important part in the Virginia Peninsula campaign and encouraged the construction of several similar craft.

Like so many volunteer organizations, the Balloon Corps suffered from petty jealousies and dissension among its members. Lowe, the organizer, the doer, was regularly criticized by the others, especially after assuming command. John LaMountain openly scoffed at his telegraphic communication system which linked the balloon to the command post below, even though it was the only ultramodern device in the Corps. He advocated instead the use of free balloons which could float over and behind enemy lines where the observer could *really* see what was going on below. This audacious plan relied on luck alone to return the balloon to safety. LaMountain was finally granted permission to demonstrate his daring technique and while Lowe and a group of officers watched, he cast off and flew across the lines to send back information by previously arranged signals. By luck he landed in Union territory, but in a sector where he was unknown. Taken for an enemy spy, he was badly roughed up before convincing his captors of his innocence. The experiment

The portable hydrogen gas generator invented by Thaddeus Lowe for use in the field during the Civil War. Iron filings and sulphuric acid were combined in the pressure-tight boxes and the resulting hydrogen gas flowed through the hoses into tanks of water (which removed any impurities) and thence into the balloon. Approximately 3000 pounds of filings and 1500 pounds of acid were required to inflate the average balloon. Prior to the development of this portable apparatus, balloons were filled at the nearest city gas mains—sometimes many miles from the battle area. (National Air and Space Museum)

The *USS George Washington Parke Custis*, the world's first aircraft carrier, used by Lowe on the Potomac. The portable hydrogen generators can be seen forward. Note the sand bags forming a circle on deck. These held the envelope in position during inflation. (Smithsonian Institution)





Lowe's portable hydrogen gas generators in action. Lowe can be seen at the far right of the picture testing the expanding envelope. (Smithsonian Institution)



did nothing to relieve the tension between LaMountain and Lowe, and LaMountain was subsequently dismissed from the Corps.

Lowe eventually was appointed commander of the Balloon Corps, which by mid-1862 consisted of seven pilots, all of them civilians and none of them trained in military matters. This was their greatest weakness, for many knew neither how to observe nor what to observe. General Fitz John Porter complained bitterly of this lack of knowledge. At the Battle of Fair Oaks he claimed that the balloonist there reported the enemy moving upstream. "This was so contrary to what the enemy should do," said Porter, "that I called the balloon down and ascended myself—to see the enemy moving downstream, and my report reached General McClellan in time to prepare to meet the intended attack."

On the other hand, Lowe directed fire over Fort Corcoran, Virginia, on September 24, 1861, with deadly accuracy, the first time Union forces had fired at targets unseen by them. By a simple signaling system of raising, or waving, or lowering a white flag to indicate where the shots were falling, Lowe "walked" the barrage onto its target with demoralizing effect on the enemy.

During the march of the Army of the Potomac down the Peninsula toward Richmond in the spring of 1862, Lowe and other members of the Corps provided an almost continuous aerial surveillance of the area ahead and around. This was a massive move involving 125,000 men, their horses and supplies,

Lowe's *Intrepid* receives a transfusion of hydrogen from the *Constitution*. During the Battle of Fair Oaks there arose an immediate need to observe enemy troop movements behind their lines. *Intrepid* was being filled, but too slowly, and Lowe devised a makeshift way to transfer gas from the partially filled *Constitution*. He saved an hour's time in this maneuver and the reports he telegraphed back to the Union command played an important part in its victory. (Smithsonian Institution)



James Allen's *Monarch of the Air* being inflated at a city gas main on Exchange Place in downtown Providence, R.I., July 6, 1866. The 40,000 cubic foot capacity balloon, carrying Allen and four passengers, took off during a strong southerly wind and crash-landed in South Dedham, Massachusetts—28 miles away—in a little under an hour. (Rhode Island Historical Society)

and a knowledge of precisely what lay ahead was of utmost importance to General McClellan and his staff.

Lowe's greatest triumph occurred at the Battle of Fair Oaks on May 31-June 1, 1862. Here his accurate observations and reports gained him full credit from the high command for saving the army from destruction. So accurate was his spotting at times that the Confederates made special efforts to destroy his balloon. "The most shot at man in the War," Carl Sandburg calls him in his biography of Abraham Lincoln.¹⁵ To be a sitting duck suspended from a highly inflammable balloon hundreds of feet above the ground within full view and rifle range of furious enemy soldiers called for a special type of courage.

Ill health forced Lowe to relinquish his command of the Corps and James Allen took over as chief in May 1863. But by then the Corps was on its way out. Never officially recognized by the military, its volunteer members poorly paid and noncommissioned, the organization collapsed in June.

The Balloon Corps at its peak operated the following balloons: EAGLE, 13,000 cubic feet; EXCELSIOR, 13,000 cubic feet; WASHINGTON, 16,000 cubic feet; CONSTITUTION, 16,000 cubic feet; INTREPID, 35,000 cubic feet; ENTERPRISE, NORTH AMERICA, UNITED STATES and GENERAL SCOTT. All were operated in tethered flight, and most were secured by three guide ropes. All could carry at least two persons. INTREPID reportedly could carry five or six.

During the early months of the war, balloons were inflated with illuminating gas at city mains or, as in one instance, by pipeline carried out near to the field of battle. Thaddeus Lowe's portable hydrogen generators (which John Wise had invented but never built) soon antiquated these remote sources of supply. The generators, built by the Washington Navy Yard, were simple wood tanks mounted on standard carts. Each tank held 3000 pounds of iron filings and 1600 pounds of sulphuric acid which, when combined with water, produced enough hydrogen to inflate the average balloon. The process consumed three to four hours. An inflated balloon, barring leaks, could remain inflated for about ten days.

A balloon unit consisted of several standard arms wagons containing the balloon and related paraphernalia: ropes, basket, spare parts, etc., approximately 20 carboys of acid, one and a half tons of iron filings, and two portable gas generators with their hoses, cooling tubes and so on. Each unit, or train, was accompanied by a commanding officer and a squad of 20 foot soldiers. These men handled all aspects of the operation except the actual piloting.

The Confederacy also operated several observation balloons of its own but these were primitive affairs compared with those of the North and far less effective. The first of these, a hot air balloon inflated by the heat of a pine knot and turpentine fire, sported for General Beauregard's army during the summer of 1861 in the Manassas area. Unlike most hot air balloons, it carried no heat source of its own, and hence could remain aloft at the end of its tether for only seconds at a time. In spite of this handicap, it performed well enough on several flights to prove its value to the command and a second, similar balloon went into action the following April at Richmond.

The inability of these balloons to stay up long enough for more than a fleeting look at enemy activities prompted the construction of a pressure balloon similar to those used by the North. This type was made entirely of patterned silk such as that used in ladies' dresses and consequently became known as the "Silk Dress Balloon." (It was not, however, made of dresses donated by the ladies of the South as some historians have recorded.) The balloon was built in Savannah and shipped by rail to Richmond where it was inflated at the gas works. From there a locomotive towed it down the York River Railroad to whatever point lay closest to the enemy (and back again, of course, for reinflation).

When General McClellan dug in at Harrison's Landing on the James River, the balloon was attached to the small steam tug TEASER, which towed it down within sight of his encampment. On July 4, 1862, TEASER ran aground while moving the balloon further downstream and was captured by the Union ironclad MONITOR and the MARATANZA.

Within a month of the loss of the "silk dress" balloon, a second, similar balloon was delivered to the Air Arm at Savannah and used in the Savannah-Charleston area for approximately a year, after which it was lost in a storm. This last incident ended all aerial activities in the Confederacy.

As described by F.S. Haydon in *Aeronautics in the Union and Confederate Armies*, the Union Balloon Corps was a "loosely organized, poorly administered and decentralized mixture of civilians and military personnel." It consisted of volunteers, eager to help but treated skeptically by the tough Army pros. It all added up to a nearly impossible situation, and by mid-1863 the Corps had ceased to exist.

Confederate General E.P. Alexander wrote about this in later years:

I have never understood why the enemy abandoned the use of military balloons early in 1863 after having used them extensively up to that time. Even if the observers never saw anything, they would have been worth all they cost for the annoyance and delays they caused us in trying to keep out movements out of their sight.

Why indeed? Fifty years later, during World War I, both sides used observation balloons by the hundreds, since nothing, including the airplane, could match their ability to direct fire into the enemy, and to quietly spy on his movements.

THE POSTWAR YEARS

Miraculously, no deaths or even injuries occurred in the Union Balloon Corps during its two and a half years at the front, and following the Corps dissolution, its pilots returned to civilian life to take up where they had left off.

Lowe carried passengers in New York's Central Park for awhile, then gave up flying for good. John Wise continued flying as actively and enthusiastically as ever and in 1873 again tried to raise money for his cherished transatlantic flight, this time in company with young Washington Donaldson, an irrepressible and daredevil aeronaut. Together they approached certain well-to-do Philadelphians without success, then tried the *New York Daily Graphic*. Here they met immediate acceptance and on June 27 an agreement was signed and construction of the balloon began at once.

For its day, Wise's new balloon was a highly sophisticated craft, but for reasons not clear he disagreed with certain points of the design and equipment and backed out of the venture at the last minute. In view of his lifelong ambition to make the crossing, one must assume that deficiencies, whatever they were, must have been most serious for him to step down on the very eve of departure. Donaldson then took over command of the ship and with two rookie aeronauts for a crew, departed Brooklyn on October 6, 1873. Four hours later they crashed, unhurt, near New Canaan, Connecticut. Wise's decision not to go was apparently well founded.

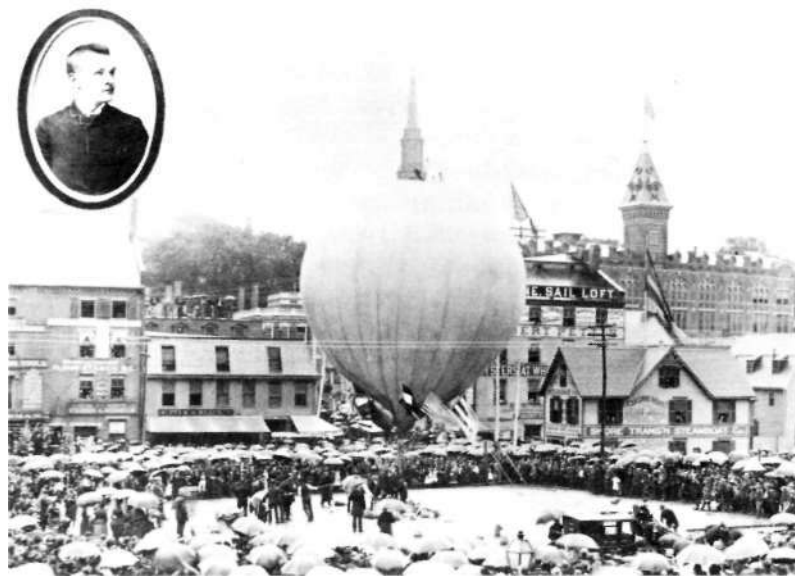
Shortly thereafter, Wise retired from ballooning, but six years later, at the age of 72, he gave in to an urge to make one more flight. It turned out to be his last. Shortly after taking off from St. Louis, his balloon disappeared in the overcast and he was never seen again. It was presumed that he had crashed into Lake Michigan.

James and Ezra Allen, who had flown extensively with the Union Balloon Corps, accepted an invitation in 1867 from the Brazilian Government to organize a balloon observation corps there to help in its war with Paraguay. There they made a dozen or more flights, James later reporting that their accurate spotting had helped bring the war, which had been going on for several months, to a halt within three weeks.

Returning to Providence, they assumed their peacetime flying, now joined by their sons James Jr. and Malvern Hill, and occasionally by their wives. There and throughout New England they flew new balloons: the EMPYREAN, its envelope emblazoned by a likeness of Abraham Lincoln and the words "You All Did Love Him Once, Not Without Cause"; the OUR COUNTRY, picturing General Grant; and the MONARCH OF THE AIR. The Aliens, sometimes referred to as the most air-minded family in New England, flew until the end of the century.

Sam King joined the ranks of those aspiring to fly the Atlantic when he set out from Minneapolis in 1888 in a 1,000,000 cubic foot balloon. But unfavorable winds forced him down shortly after takeoff, and he made no further attempts thereafter.

These were the old guard, the veteran aeronauts who had been flying since long before the Civil War. Others who appeared later and whose names for the most part have been lost to history, barnstormed around the country as far west as California, apparently drawing crowds and making a living even though most of the novelty of balloon ascensions had begun to wane. A successful takeoff was pleasant to watch, but having seen a few, the average person tended to feel he had seen them



Malvern Hill Allen's balloon prepares for takeoff from downtown Providence, R.I., on a rainy July 4, 1889. Shortly after this photo was taken, while flying at a thousand feet, the balloon burst and plummeted earthward. Hill escaped death when the envelope billowed out like a huge parachute and wafted him safely back to earth. (The R.I. Historical Society)

all. To counteract this growing apathy, balloonists introduced new acts, spicing their programs with stunts and aerial extravaganzas.

Among the first of this new breed of aerial showmen was Washington Donaldson, whose attempt to cross the Atlantic in the CITY OF NEW YORK had fallen short by several thousand miles in 1873. For many years Donaldson had been a theatrical and circus performer, a magician, ventriloquist, knife thrower, acrobat and tightrope walker. In 1871 he added ballooning to his repertoire and almost immediately introduced an aerial trapeze act that practically revitalized the entire sport. From a bar which replaced the conventional basket, he regularly executed a series of daring contortions that left audiences spellbound. His acts were the ultimate in trapeze work, the no-net technique being performed hundreds of feet up where a slip meant instant death, earning him the title of "The Daring Young Man on the Flying Trapeze." In July 1874, he joined P.T. Barnum, and that year made 45 flights from Barnum's New York Hippodrome. The following year he performed in Philadelphia, Cincinnati and Chicago.

The perfect showman (Barnum later called him the world's greatest), Donaldson varied his acts, sometimes stunting, sometimes carrying passengers, once flying in a balloon he had built entirely of brown wrapping paper—the first (and most likely the last) time this trick was to be attempted. On one occasion he carried a wedding party aloft, bride, groom, witness, minister, himself and flowers, all stuffed into the basket. This was the sort of showmanship America loved, and 50,000 people watched in awe as the balloon arose and the couple solemnly exchanged their vows.

Donaldson lost his life on July 15, 1875, shortly after taking off from the Chicago Hippodrome during a severe storm that drove his balloon out over Lake Michigan, the nemesis of many midwestern balloonists. During his four years of ballooning, Donaldson made 139 flights and carried 232 passengers.

The Aliens, too, often resorted to extravaganzas to attract the paying customers: James K. provided an aerial wedding service

aboard his balloon *BRIDAL CHARIOT*, one such affair drawing 40,000 spectators and an illustration on the cover of *Leslie's Newspaper*. James Sr. introduced in 1872 a luxurious failsafe aerial sightseeing service with a huge tethered balloon first in Boston, then in Providence. *CASTLE IN THE AIR* contained "elegantly upholstered" seats for 10 and lockers for refreshments. A steam winch restrained it from climbing more than a thousand feet, then pulled it safely back to earth. Two years later Allen took a similar craft, the *SIERRA NEVADA*, to San Francisco (via Panama). "The first aeronaut of long-trying professional experience that has ever visited the West Coast," reported the *San Francisco Morning Call*. The act apparently did not prove popular, however, for Allen shortly returned to Rhode Island.

In 1875 in Mohawk, N.Y., Carl E. Myers, an amateur meteorologist, and his wife Mary, began building small weather balloons, sending them up for several years thereafter on daily observations of the upper regions. These balloons were made of a special hydrogen-tight fabric, light and strong, developed and patented by the Myerses after long experimentation. These fabrics were the forerunners of those used by them in later years at their "Balloon Farm" in Frankfort, N.Y. Here, headquartered in a large Victorian mansion, they taught flying, staged aerial exhibitions and built balloons of all types, advertising "Hydrogen-tight Balloons, Buoyant Airships of all sizes built at short notice—Balloon Farm, Frankfort, N.Y.—the Only Aeronautical Institute in America." At one time the farm produced balloons at the rate of one a day for showmen and the U.S. Government, which used them for weather observation purposes. The farm was self-supporting and very likely was the only money-making aeronautical enterprise in the country.

THE LADY FLIERS

Although ballooning was predominately a man's sport, several lady aeronauts flew in America during the latter part of the 19th century, among them Miss Lucretia Bradley, who nearly came a cropper on her first solo flight in an old balloon she had bought from John Wise. Miss Bradley climbed too rapidly and the balloon burst from overpressure. With great presence of mind, she threw out her anchor and ballast to delay the descent, and the ruptured bag parachuted her down to the ground. Her coolness impressed Wise, who wrote: "It shows a fortitude and presence of mind not common to the human family, and seldom to be found among the characteristics of the female sex."

A more daring female aeronaut, Leona Dare, a circus performer from New Haven, Connecticut, regularly hung by her legs from a trapeze suspended below her balloon, holding in her teeth a strap to which was attached her male companion, Tommy Hall. An account in the *New Haven Palladium* in August 1872 reads: "Everything was as still as death and Hall weakened a little, but the plucky 'Queen of Antilles,' Leona, was perfectly cool. She spun Hall around and at 300 feet they performed the 'double trapeze' and everything else they did in the tent, only here there was no net."

John Wise's daughter-in-law, Louisa Wise, made several ascensions although there is no record of her ever having flown solo. "I am not an advocate of women's rights in the modern acceptance of the term," Mrs. Wise wrote in an article published in a Lancaster, Pennsylvania, newspaper, "but have nevertheless a notion that a lady might take a ride through the

ethereal regions of space without sinning against the proprieties of her sex, or in the least infringing upon the good order of a 'time for all things'."

Mary Myers demonstrated one of her husband's balloons before an Independence Day crowd of 15,000 people at Little Falls, New York, in 1880. Mary made an instant hit and soon became America's best-known woman balloonist. Assuming the more romantic title of "Carlotta, the Lady Aeronaut," she performed regularly for years in New York State and as far west as Michigan, drawing large crowds wherever she appeared, despite the fact that she performed no feats—no stunts, no acts. Such was the attraction of a liberated woman.

In Providence, two members of the flying Allen family, Ezra Allen's wife and daughter-in-law, both flew on occasions during the 1880s.

THE FATAL ACCIDENTS

Although generally docile in nature and a most dependable vehicle if properly handled, the balloon could on occasion be a killer. Pilot error and carelessness, two of today's major causes of aircraft accidents, killed several American balloonists during the 19th century—Ira Thurston, for one. On August 16, 1858, this skilled aeronaut had just completed a flight with a passenger over Adrian, Michigan, and had begun to deflate his aerostat. To speed the process, he ordered his assistants to detach the car while he held on to the still partially inflated envelope. Thus lightened, the balloon suddenly shot upward with Thurston clinging as best he could to the loose folds. Before he realized what had happened, he was too high to let go, and he disappeared into the distance before the horrified gaze of the onlookers. No one saw him fall, but his body was found a month later, ten miles from the point of his unfortunate departure.

The envelope of Miss Lucretia Bradley's balloon bursts in midair.





On July 4, 1873, LaMountain's improvised rig gave way while he flew above the clouds, and this daring aeronaut who had survived the Civil War and endless numbers of spectacular aerial voyages crashed helplessly to his death before thousands who had come to watch him fly.

A student of John Wise, a young man named Connor, lost his life on May 10, 1860, on takeoff from Palace Garden, N.Y. For reasons known only to himself, he chose not to use an extra strong net given to him by Wise, and used a smaller, weaker one instead. He also chose to fly on that day despite high winds. Consequently, on takeoff the balloon smashed savagely into a nearby building. The net failed to hold, dashing Connors senseless against the roof. He died that night of internal injuries.

Even the great John LaMountain fell victim to a human error—an experiment of fastening the basket of his balloon to a hoop on the top by individual ropes rather than by the conventional, failsafe netting used universally by balloonists since the first flight in 1784. On July 4, 1873, LaMountain's improvised rig gave way while he flew above the clouds, and this daring aeronaut who had survived the Civil War and endless numbers of spectacular aerial voyages crashed helplessly to his death before thousands who had come to watch him fly.

Men have often inadvertently been hauled aloft by suddenly lightened aircraft. On October 21, 1872, George Knapp, editor of the *Orange County Union*, started to climb into a balloon basket with pilot Professor Wilbur. Suddenly the tie-down rope parted. Both men leaped for the rapidly ascending basket, but

managed to grab only the ropes hanging from it. Wilbur let go at 30 feet, suffering only minor injuries. Knapp, however, held on while the balloon whirled him aloft to at least a mile up, where he finally let go from exhaustion. In full view of his horrified wife and daughter, the unlucky Knapp plunged head first into the ground.

Immediately after taking off from Boston Garden on July 4, 1892, G.A. Rogers and two passengers found themselves being driven out to sea, the balloonist's most dreaded predicament. In his haste to get down before it was too late, Rogers pulled the ripcord, and the balloon collapsed into Boston Harbor. The passengers escaped, but Rogers, a veteran of 118 flights, drowned.

A new use for the balloon appeared in 1887 with the introduction of parachute jumping in the United States. Thomas Scott Baldwin, destined that year to become one of America's all-time great aeronauts, bailed out of his balloon on January 30 from 1000 feet above the Golden Gate Park in San Francisco in a silk parachute of his own making. Ten thousand people watched this spectacular show, the first live jump in the western hemisphere, for which Baldwin received one dollar per foot. Several months later he jumped at Quincy, Illinois, where the delighted townspeople presented him with diamonds and \$500 in cash.

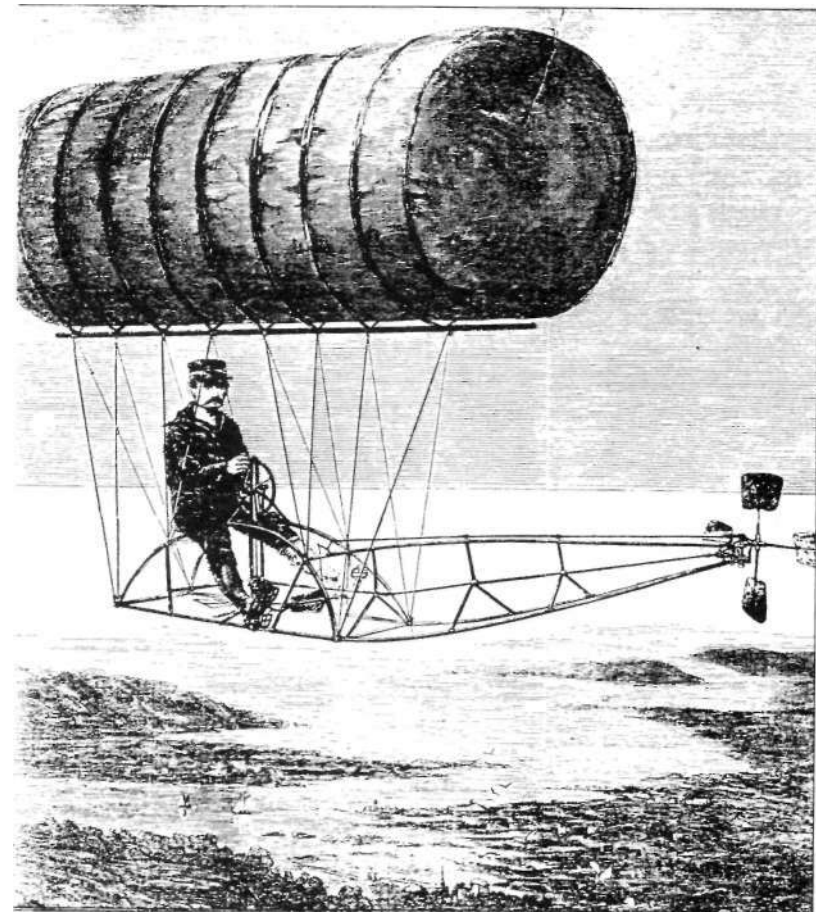
The sight of a person throwing himself off into thin air from a perch hundreds of feet aloft, then wafting slowly earthward beneath a canopy of cloth was unbelievable, and Baldwin instantly became a worldwide hit. Twice he toured the world, jumping in England, France, Italy, Spain, Japan and Australia, netting himself a small fortune. Before retiring from the game in 1897, he had made better than 800 jumps from balloons.

It should be noted that Baldwin (and many contemporary parachutists) jumped from hot air balloons. Not only was this early type less expensive to build than the pressure balloon, but it was simpler and much cheaper to inflate. Furthermore, the deflated envelope was more easily recovered after the jumper had let go, the rapidly cooling air dropping it swiftly back to earth.

Baldwin returned to pressure ballooning for a time following his retirement from parachuting, and in 1898 built a huge balloon which he proposed to fly from Denver, Colorado, to the east coast. He remained aloft for 48 hours in a vain attempt to find favorable winds. The balloon was wrecked in a second attempt a year or two later.

THE POWERED BALLOON

No effective means of propelling the balloon was devised until the beginning of the 20th century. For more than a hundred years, the free balloon remained the one and only way to fly despite the efforts of a whole succession of dreamers bent on controlling its wayward nature: Rufus Porter, Edmund Clarence Stedman, Arthur Kinsella, Peterson, Braun, Ayers—the names go on and on. These inventors to a man ignored the utter lack of any suitable power source, glossing over this vital deficiency by vague references to steam or electricity as the means of propelling their creations, badly underestimating the power requirements as well. Porter, for example, had specified six "light boilers" of two horsepower each with which to drive a proposed 800-foot-long monster at an estimated 100 miles per hour. To expect to propel such a massive craft with so little power would be akin today to attempting to drive a Greyhound bus with a



Charles Ritchel's pedal-driven Flying Machine, shown over Bridgeport, Connecticut, in 1878.

lawnmower engine.

Obstacles notwithstanding, several men achieved a semblance of mechanical flight during the second half of the 19th century. In Europe in 1852 Henri Giffard managed "various circular movements and lateral changes of course" in a pointed balloon propelled by a three-horsepower steam engine weighing, with its boiler, coal and water, a hefty 464 pounds. Giffard's achievement was hardly a breakthrough (30 years would lapse before anyone duplicated the performance) but the possibility of powered flight had now become a reality.

In San Francisco, Frederick Mariott, one-time publicity agent for two of England's aeronautical pioneers, Henson and Stringfellow, in 1868 formed the Aerial Steam Navigation Company. Capitalized for 1 million dollars, the California company proposed (upon the sale of stock) to build and fly large steam-powered aerial ships designed by Mariott. Stock certificates were offered for sale, bearing a facsimile of the projected air cruiser, wings sprouting from either side, smoke belching from its stack. The offer attracted few takers, however, and the ship was never constructed.

Mariott did, however, build a model of the craft, 37 feet long, 14 feet wide, powered by a miniature steam engine and two small propellers. He called his creation the AVITOR [sic] HERMEJR. The model flew successfully on July 2, 1869, in a large hall near San Francisco, making two circuits of the floor at an estimated speed of five miles per hour. According to an account in the *San Francisco Times*, the total distance traveled was a little over a mile:

The appearance of the vessel in the air was really beautiful. As seen in the building, she looks awkward. . . . The moment of

opening the steam valve was one of suspense; as the vessel rose and forced slowly ahead, the suspense was scarcely dissipated; but in a very few seconds her speed increased—in obedience to the rudder she commenced to swing around the curve; the men at the guys broke into a trot, and cheer upon cheer rose from the little group of anxious spectators. . . . The guests cheered long and loud, and many fairly danced with delight at the success. The trip back and forth across the hall was performed several times with success.

Later attempts to fly the dirigible outside the building in a slight breeze proved unsuccessful. The vehicle simply lacked the power. Nevertheless, its success indoors marks it as an important step in the development of powered aircraft, and Mariott deserves far more credit for this achievement than he is generally given by aviation historians.

Full credit goes to Charles Ritchel for producing the first propeller-driven, man-carrying aircraft in America, a barrel-shaped balloon powered by hand. With a two-handed cranking wheel the operator drove the front and vertical propellers separately or simultaneously, forward or backward, providing the craft with theoretically unlimited maneuvering potential.

Ritchel built the craft in Bridgeport, Connecticut, early in 1878 and then moved it to Philadelphia where it was exhibited and flown daily in the Concert Hall. In June, Ritchel took his craft to Hartford, Ct., for the first outdoor flight. Taking off on June 12 from Colt's Meadow, he climbed to 200 feet, then headed for the Connecticut River. For an hour or more the craft flew slowly over Hartford, changing direction at the pilot's will, then returned to its starting point.

Because the craft's lifting power could barely support Ritchel, most of the flights were performed by lightweights. Mark Quinlan, 96 pounds, flew the craft at Hartford on its second flight on June 13, but was unable to cope with a mild breeze that sprang up shortly after takeoff and he and the craft were blown off to Newington, several miles away.

Ritchel built a total of five airships, all hand-powered, his faith in manual propulsion remaining unshaken throughout his lifetime. As late as 1905 he stated that hand propulsion was the only reliable source of power, that no engine could be depended upon.

He was right, of course. At the time, no engine could be depended upon. But man's own inability to develop more than a half-horsepower (and then only for short periods at a time) made him even less dependable.

The hand-driven propeller idea was also a favorite with Carl Myers, the balloon builder, throughout the latter part of the 19th century. Myers had begun experimenting in 1881 with what he called a "Guiding Apparatus for Balloons," a large hand-cranked fan and a cloth rudder. Carlotta Myers tested several of these quaint rigs, managing at times, according to her account, to generate sufficient breeze to force the balloon gently upward, but apparently never really achieving the prime purpose of forward motion. A small woman, no matter how rugged, could hardly be expected to crank such a clumsy device fast enough to make any effect upon the balloon's direction. Myers received a patent for this dubious invention in 1885.

Another man-powered airship, somewhat similar to Charles Ritchel's, appeared in 1888 over Brooklyn with Civil War aeronaut James Allen as pilot and source of power. This craft was the creation of Peter Campbell, a Brooklyn jeweler who had been experimenting for 20 years with balloons and the means of driving them mechanically. Campbell's propulsion mechanism on this

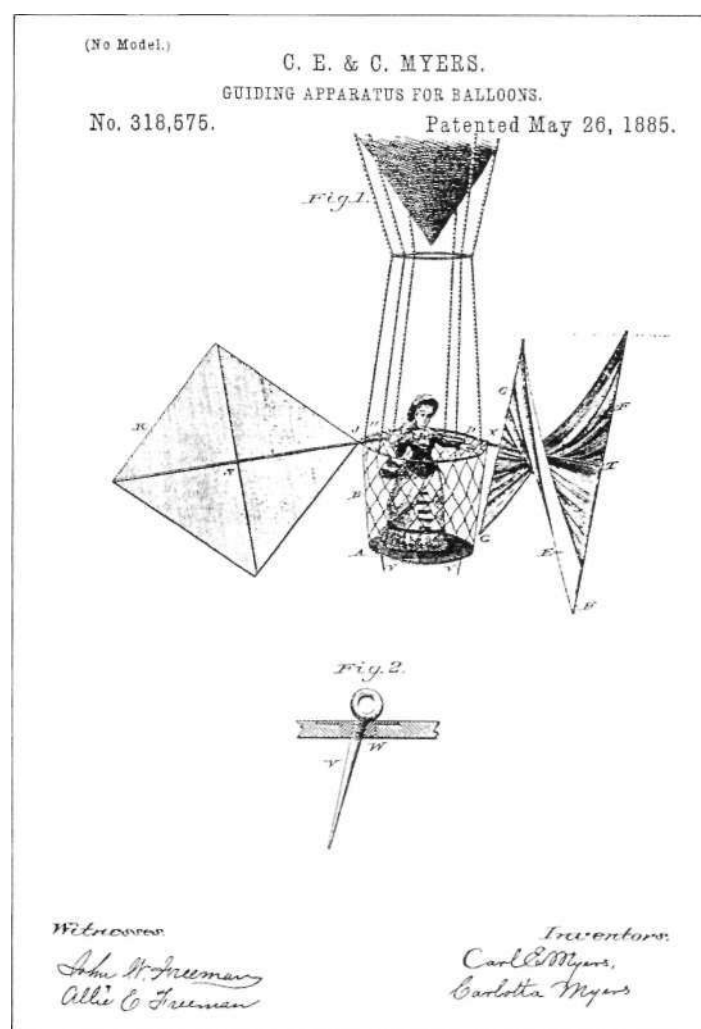
latest creation was far more complicated than the one on Ritchel's machine. It consisted of two pairs of propellers fore and aft for lateral control, a large propeller in the rear for propulsion, and a horizontal fan for climbing and descending. An elaborate system of gears, levels, cranks and treadles spun the complicated assortment of propellers, presumably taking care of all three dimensions. The envelope, built for Campbell by Carl Myers, measured 42 feet in length, 24 feet in diameter, and contained 18,000 cubic feet of hydrogen.

Allen took off from a vacant lot adjacent to the Sea Breeze Palace at Coney Island and climbed to 500 feet. Here he leveled off, using the horizontal fan; then, without valving gas, slowly pedaled the craft back to its starting point. After a brief pause, he climbed once again to 500 feet, and with the rear propeller engaged, proceeded to make a 360-degree turn. For the next two hours, Allen laboriously pumped his way around the skies of Brooklyn, covering roughly 10 miles for a five-mile-per-hour average before landing back where the craft had started.

All in all, Campbell's design proved no more efficient than had Ritchel's. A man can generate limited energy only, and presumably Allen was no stronger or weaker than Ritchel or Mark Quinlan, nor was his mount any more efficient. On the other hand, Carl Myers appears to have enjoyed considerably more success with his hand- and foot-operated craft which he called his *Sky Cycles* or *Aerial Bicycles*. Smaller and less complicated than Ritchel's and Campbell's machines, they proved reasonably maneuverable in no wind conditions. According to an account in the *New York World* on August 4, 1895, one of its reporters pedaled a *Sky Cycle* from Brooklyn across the East River to Manhattan, up to the Bronx and over to Yonkers. If true,¹⁶ this must be the first mechanically propelled airship to make such a flight. Myers so loved his *Sky Cycles* that he flew them regularly until his retirement in 1910.

French attempts to drive dirigibles with steam engines and electric motors had demonstrated that powered flight was possible, but their experiments had also proved that the use of such ponderous machinery was totally impractical. Further tests with mechanically propelled aircraft ended until the invention of the

Avitor Herme, Jr., Frederick Mariott's steam-powered model which first flew on July 2, 1869, in a large hall near San Francisco. The craft measured 37 feet in length. (The Huntington Library, San Marino, CA)



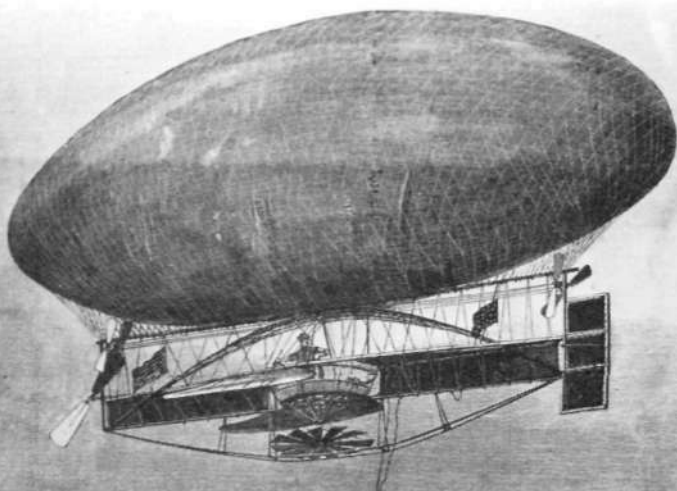
The propelling and steering mechanism patented by Carl E. Myers in 1885 and used on several demonstrations by his wife, Mary, here depicted operating the apparatus.

internal-combustion engine several years later.

The breakthrough, although not recognized as such at the time, occurred during the 1870s in Germany where N.A. Otto and Gottlieb Daimler created a workable, albeit ponderous, internal-combustion engine. Although the engine was totally unsuitable for aerial use because of its massive size, slow speed and low power, the principle on which it operated—that of alternately sucking an explosive mixture into the engine's cylinder, then exploding the mixture to force a piston into motion—was sound. In fact, this principle remains in universal use in automobiles, boats, and most private aircraft to this day.

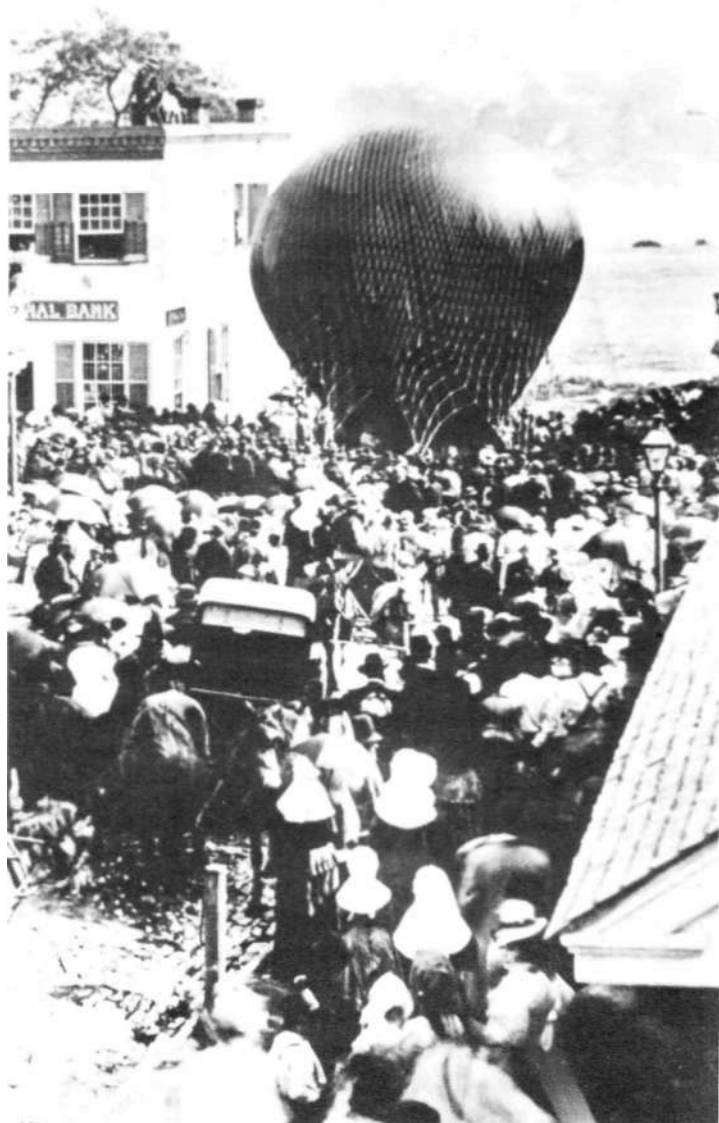
By 1885 the engine had appeared in the world's first automobiles, the Benz and the Daimler, but was still too heavy to be used in any sort of flying machine.

In 1890 (according to Octave Chanute in his *Progress in Flying Machines*), the lightest engines then in use weighed 60 pounds per horsepower for steam, 88 per horsepower for gasoline, and 130 Per horsepower for electric. These figures, when compared with a present-day average of two pounds per horsepower for reciprocating aircraft engines, emphasized the problem confronting pioneer designers. The means for powered flight, however, were at last within the grasp of anyone clever enough to build a proper aircraft engine that would use the internal combustion principle.



James Allen flies Peter Campbell's man-powered airship over Brooklyn, N.Y. in 1888. (*Scientific American*)

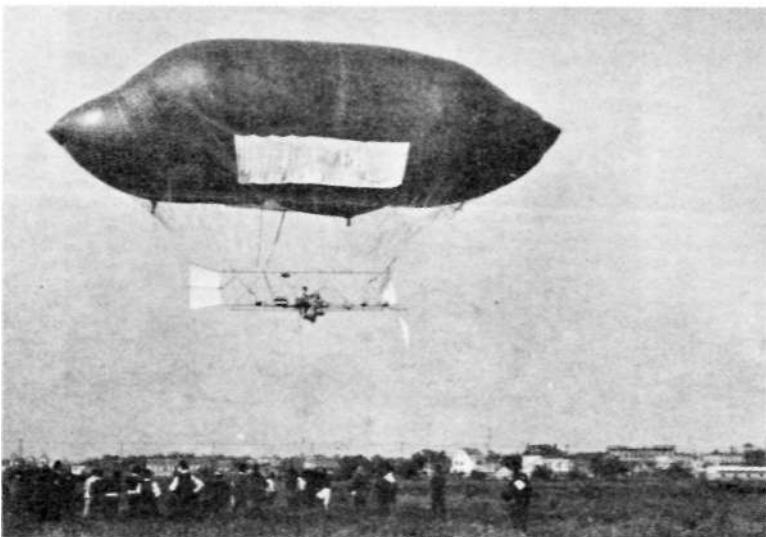
A typical USA balloon ascension, St. Charles, Missouri, 1880. (Smithsonian Institution)



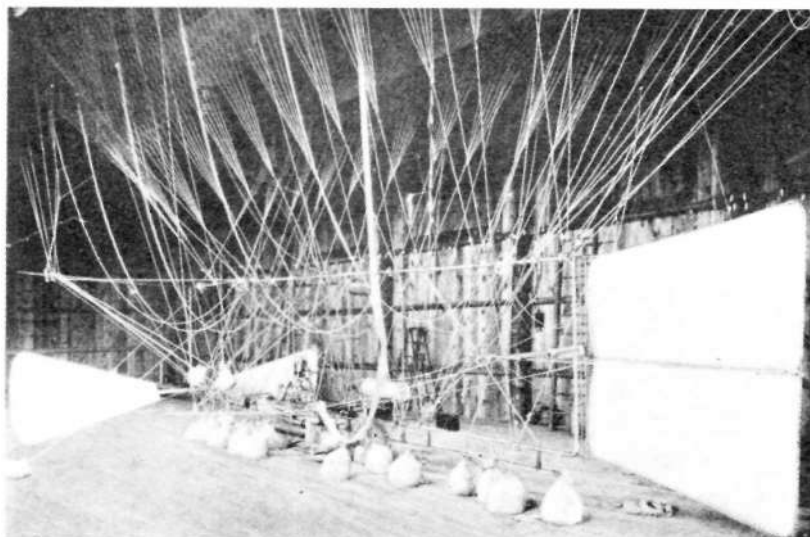
Tom Baldwin, perched in the netting, poses with a basketful of cash customers before takeoff from Central Park, San Francisco, 1895.

A typical Fourth of July balloon ascension, Springfield, N.Y., 1885. (Eastman House)





The second ascent of Stevens' airship at Manhattan Beach.



General view of the framework. (*Scientific American*)

First aerial use of the petrol engine resulted in disaster. In June of 1897 two Germans, Dr. Karl Wolfert and Robert Knabe, lost their lives when their small dirigible, driven by a Daimler petroleum engine, exploded and crashed in flames at Templehoff. Five months later a third German, Jaegels Platz, crashed in the same manner at the same spot. His craft also was powered by a Daimler engine. To blame for these tragedies was the ignition system of the power plants: a platinum tube heated by an open flame burning close to the balloon's hydrogen vent.

The following year Parisian Alberto Santos-Dumont installed a tiny 3.5-horsepower deDion gasoline engine in the basket of a pointed balloon, the *Santos-Dumont No. 1*. In his autobiography he wrote:

The rumor had spread among the aeronauts of Paris who formed the nucleus of the Aero Club that I was going to carry up a petroleum motor in my basket. They were sincerely disquieted by what they called my temerity, and some of them made friendly efforts to show me the permanent danger of such a motor under a balloon filled with a highly inflammable gas. They begged me instead to use the electric motor—"which is infinitely less dangerous."

The aeronauts had worried needlessly. The craft managed to sputter around somewhat unconvincingly, but it did not explode as predicted. Two years and five dirigibles later, Santos-Dumont managed a round-trip flight from the Aero Club of France in St. Cloud to and around the Eiffel Tower to win a prize for the first aircraft to make the voyage in under 30 minutes.

News of the aerial achievement soon trickled back to America where several enthusiasts had begun investigating the possibilities of powered lighter-than-air flight. Leo Stevens, a famous balloonist and parachutist of the 19th century, often called "America's Foremost Aeronaut," experimented with a powered craft in tethered flight over Manhattan Beach, Long Island, during the fall of 1902. Eighty-six feet long and shaped somewhat like a malformed sweet potato, the ship was powered by a 7.5-horsepower engine attached to a large fan in the forward end of the control platform.

Like Santos-Dumont's airships, its outer envelope was kept under pressure by a blower mounted on the engine, the original ballonnet used on all later non-rigid aircraft. The large cloth panels seen hanging from the sides of the envelope in the photo were designed to billow out and parachute the craft back to earth in the event of a loss of gas.

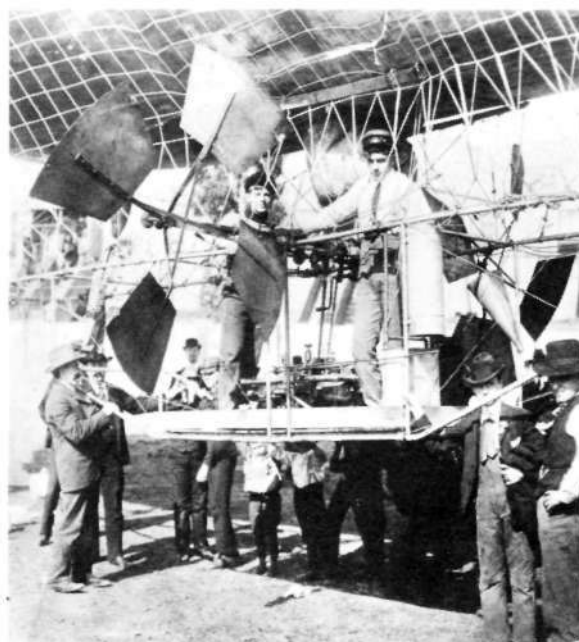
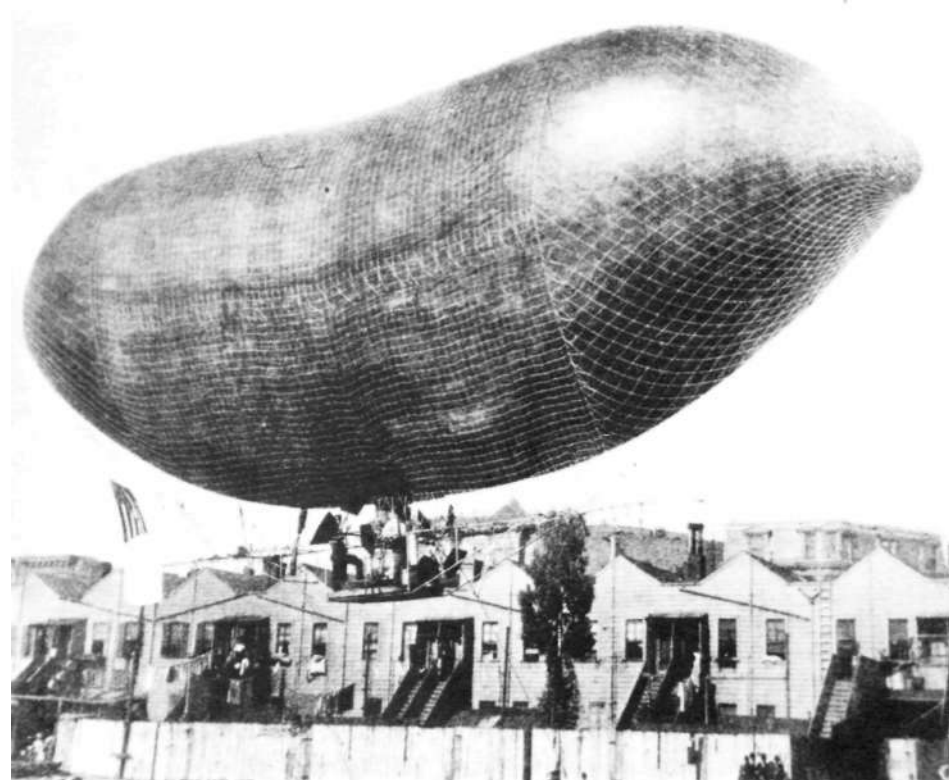
The craft, first of its type built in the United States, was well conceived and constructed, but its engine proved an utter failure, depriving Stevens of ever achieving controlled flight.

A more successful craft appeared the next year in California, the creation of August Greth, a San Francisco physician who spent two years and all of his money building it. The squashy double-ender, christened *CALIFORNIA EAGLE*, 75 feet long and driven by an overweight, low-powered Brennan automobile engine, managed to climb to 500 feet over San Francisco on October 18, 1903, make a 360-degree turn and then fly down Van Ness Avenue and across to Presidio. At that point its engine failed, forcing Greth to ditch in San Francisco Bay. In April 1904 he managed two flights of somewhat the same caliber, then abandoned the project, apparently because of his inability to obtain a more appropriate engine.

That year balloonist Tom Baldwin built a dirigible which became the first in America to take off and return to its starting point under its own power. *CALIFORNIA ARROW*, a 54-foot by 17-foot vaguely streamlined, floppy gas bag, was powered by a second-hand motorcycle engine built by Glenn Curtiss. It was by far the finest lightweight engine in America at the time, and with it Baldwin took off from Idora Park in Oakland, California, flew out over San Francisco Bay and returned to the Park on July 29 in a flawless flight (by the day's standards) that encouraged him to sign up immediately for the St. Louis World's Fair Balloon Exposition to be held the following month.

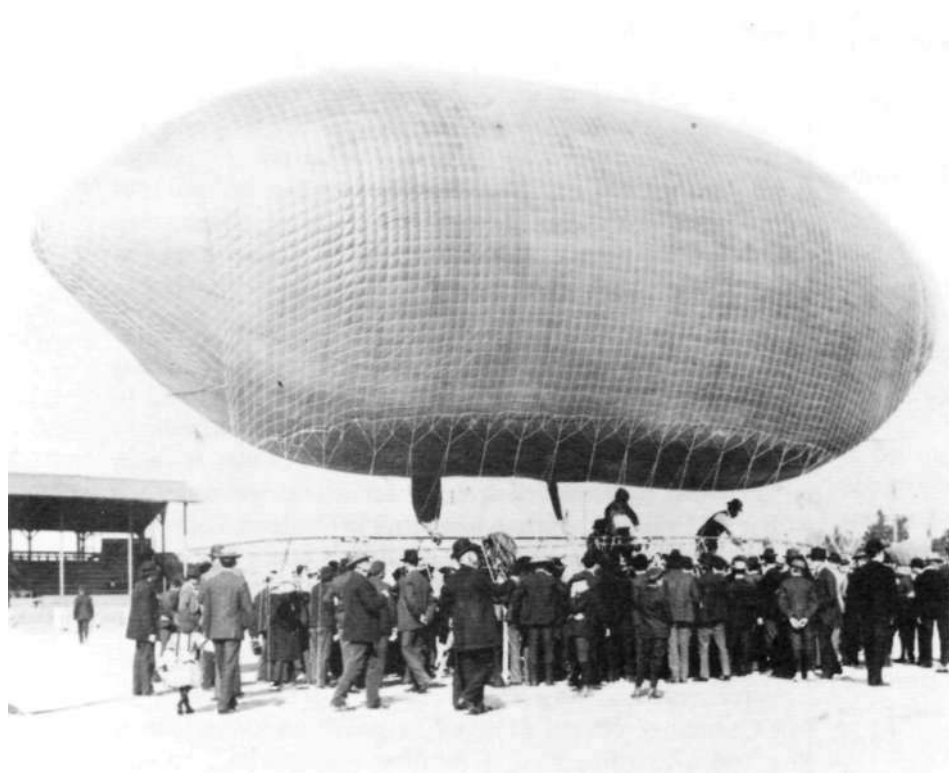
As enticement to the world's meager supply of aeronauts, the Fair Committee offered \$150,000 in prizes, including one of \$100,000 to the first man to fly three laps around a 10-mile triangular course at 20 miles per hour or more. Despite the rugged requirement, several flyers entered the contest, among them France's Alberto Santos-Dumont. His entry loomed as a real threat at St. Louis.

Others who announced their intentions of participating were A. Leo Stevens, Tom Baldwin, Dr. Greth, and Thomas Benbow. Greth had hoped to fly his *CALIFORNIA EAGLE* directly to the fair from California, an obviously absurd dream. As things turned out, the temperamental Brennan engine kept him grounded at St. Louis during the entire meet. Saboteurs ruined Santos-Dumont's ship, and Leo Stevens dropped out at the very begin-



Dr. August Greth and a crewman stand in the gondola of the Greth Airship in San Francisco, 1903.

The Greth airship taking off from a backyard in San Francisco, October 18, 1903. (Smithsonian Institution)



Roy Knabenshue, pilot of Captain Tom Baldwin's *California Arrow*, aboard the craft at the St. Louis Exposition, October 1904. This was the first dirigible in America to complete a circular course. (Smithsonian)

Tom Baldwin's *California Arrow* at Chutes Park, Los Angeles, December 25, 1904. (Smithsonian Institution)

ning. "The speed expected is too great," he wrote the editor of the *Scientific American*¹⁷ in explanation. "The rules call for a speed of at least twenty miles per hour. This is impossible. The man who enters this contest has everything to lose and nothing to gain." The speed rules were later modified to 18 miles per hour and the course distance to 10 miles—still not within any of the entries' capabilities. Little is known of how Benbow fared other than that he appeared with the 14,000 cubic foot airship *METEOR*, powered by a 10-horsepower engine and "two large side wheels or fans," and made what was simply described in the 182

Scientific American as "a successful flight on October 27th."

Because Baldwin weighed over 200 pounds at the time of the race, he wisely turned over the piloting duties of the *ARROW* to a lighter albeit totally inexperienced young man, A. Roy Knabenshue. Knabenshue learned to fly *ARROW* by trial and error and on several occasions during practice flights at St. Louis he reportedly managed to return to his starting point. On October 25, 1904, he made a complete circuit of the fairgrounds, thereby conclusively demonstrating the craft's dirigibility, but he failed to meet the rules governing the event.

Despite its unconvincing performance at St. Louis, the powered airship set off a new flying craze in America. The balloon had suddenly become passe. The airplane was virtually unknown. Aeronauts with many years of ballooning experience gravitated to the dirigible, now the hottest thing in the skies.

Following his success in St. Louis, Roy Knabenshue teamed up with Tom Baldwin in California, flying regularly and spectacularly, once beating a fast Pope-Toledo automobile in a race from Los Angeles to Pasadena. A few months later he left Baldwin, moving back to his native Ohio where he built TOLEDO I, said to be the first streamlined airship in America, and which he once piloted from the fairgrounds in Toledo to the top of the city's tallest building and back. On August 5, 1905, he flew TOLEDO II over Manhattan on two occasions as thousands watched. "So great was the curiosity of the New Yorkers to view the flights," reported the *Scientific American*, "that almost all business and street traffic was at a standstill and throngs followed the course of the great dirigible balloon hovering over the city."

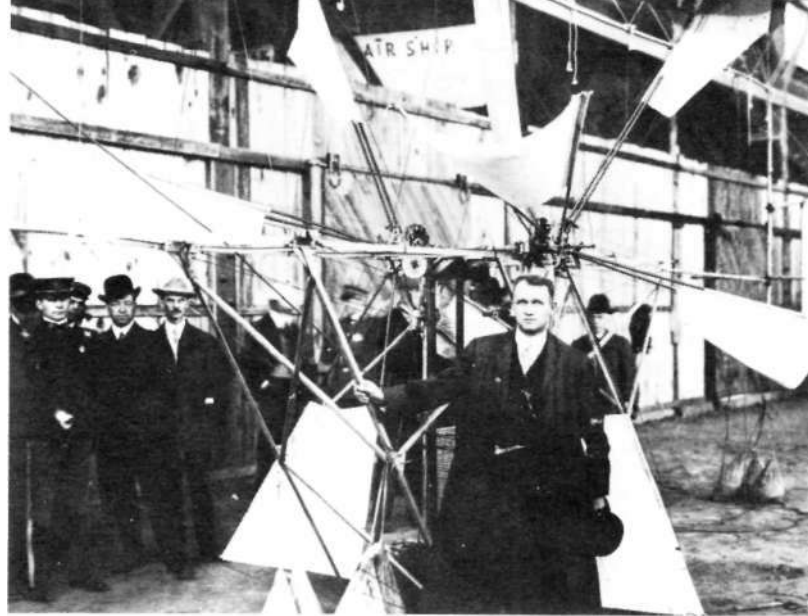
Shortly after Knabenshue had left him, Baldwin built the CITY OF PORTLAND, a 10,000 cubic foot airship powered by a new Curtiss engine, and hired young balloonist Lincoln Beachey to fly it for him. At the Lewis and Clarke Exposition in Portland during the summer of 1905 Beachey thrilled the city with spectacular flights at rooftop level. All told, he managed to make 23 round-trip flights out of 25, a performance so impressive that the Exposition judges awarded the Curtiss Manufacturing Company a gold medal and citation for excellence.

Baldwin's third airship, the 20TH CENTURY, was driven by a 16-horsepower, 4-cylinder Curtiss engine attached to two propellers. This ship reportedly made a total of 51 round trips in 53 attempts. The craft was later destroyed in the San Francisco earthquake.

Beachey struck out on his own during the fall of 1905, moving to Toledo, where he built his own airship with the help of Roy Knabenshue and 18-year-old flying enthusiast Charles Earl Hess. The following spring he made a series of flights in the ship at Luna Park in Pittsburgh, then turned it over to young Hess, who flew it extensively at various events in Hagerstown, Maryland; Washington, D.C.; and Birmingham, Alabama, in the latter part of 1906.

Up until this point very few, if any, people in America had flown purely for the sport of it. Ballooning was a commercial venture to be engaged in by professionals out to make a living. America was a young and growing country with little or no time for such frivolities as flying. Furthermore, for years it had been so sparsely settled that flying over it presented too great a risk. Nor could most afford the cost.

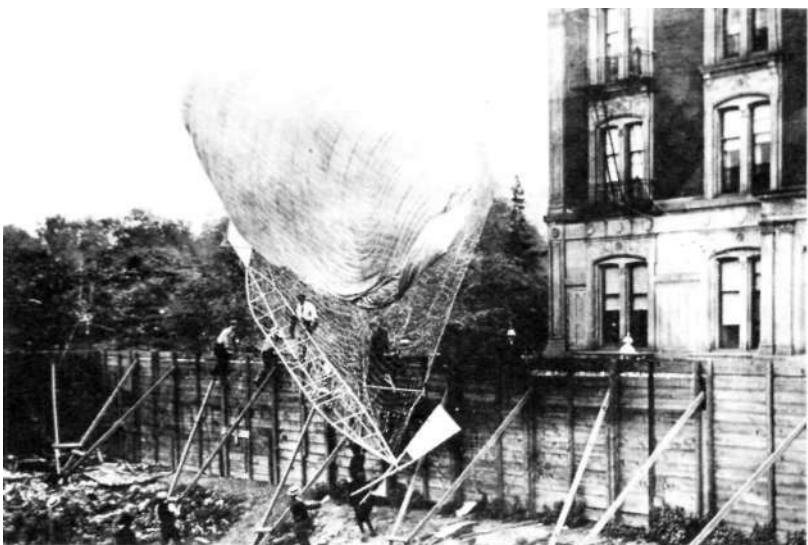
But with the rapid development of the airship and the airplane during the first years of the twentieth century, attitudes changed. The country was opening up. Prosperity flourished. The automobile craze had already begun and enthusiasts naturally gravitated to the flying machine. The Automobile Club of America formed the Aero Club of America in 1905, the first such organization in the country, its objectives to promote and develop the science of aerial navigation. By 1906 the club owned a pair of balloons purchased in France and flown in Pittsfield, Massachusetts. Interest spread to North Adams, Massachusetts, which became the "Ballooning center of the East,"¹⁸ and thence on to Philadelphia and St. Louis.



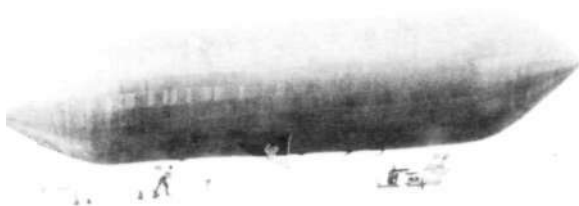
Thomas Benbow stands before the Benbow airship at the St. Louis Exposition in October 1904. This craft was 75 feet in length, 20 feet in beam, and contained 16,000 cubic feet of gas. Its 10-horsepower gasoline engine drove two "paddle wheels." The craft reportedly flew on November 5, 1904. (Smithsonian Institution)



Roy Knabenshue flying his dirigible *Toledo I* over the Ohio State Fair in Toledo, July 4, 1905. (Smithsonian Institution)



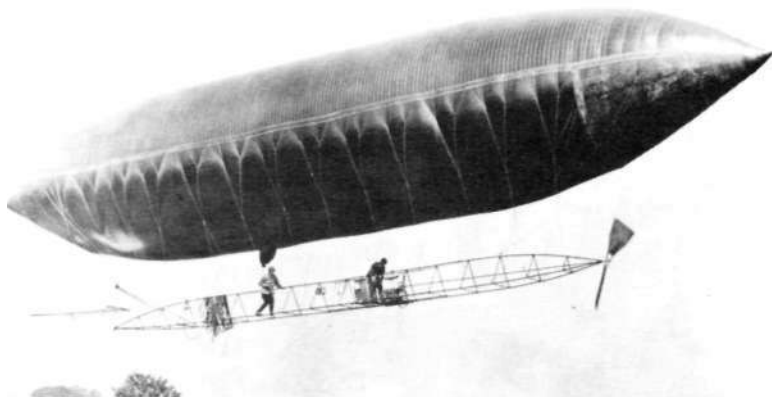
Following a spectacular flight over New York City, Roy Knabenshue's *Toledo II* comes a cropper on the fence surrounding the takeoff area in Central Park, August 1905. This 38-foot-long dirigible contained 7000 cubic feet of hydrogen and was driven by a 4-cylinder, 10-horsepower engine. Its speed was estimated at 15 miles per hour and it carried sufficient fuel for a five-hour flight—providing the engine could be made to run that long. (Smithsonian Institution)



U.S. Government Airship Number 1, built by Captain Thomas Baldwin and officially accepted by the War Department August 18, 1908, after meeting the requirements that it maintain a speed of over 16 miles per hour for at least two hours carrying two passengers and 100 pounds of ballast. The craft was 96 feet in length, contained 20,000 cubic feet of hydrogen and was driven by a four-cylinder, 30-horsepower Curtiss engine. (Smithsonian Institution)



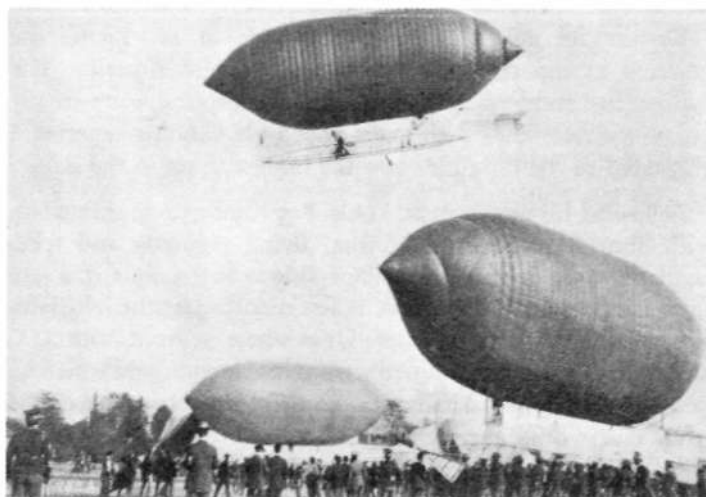
Captain Horace B. Wild climbing above Chicago rooftops in his dirigible *Eagle*, 1906. (Chicago Historical Society)



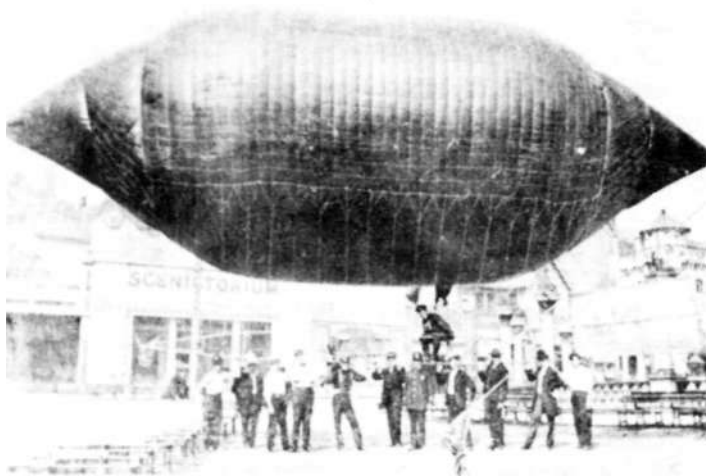
Roy Knabenshue aloft in his dirigible in Toledo, Ohio, 1908. (Smithsonian Institution)

The sudden rejuvenation of interest in the balloon long after it had appeared doomed by the powered aircraft can be explained by the fact that it was, as it is today, the least expensive way for several persons to fly together for any appreciable amount of time. Also, the balloon was a perfect training vehicle for airship and in fact remained in use in this capacity throughout the lighter-than-airship era.

On September 30, 1906, the United States team of Frank Lahm and Alan Hawley won the first Gordon Bennett International Balloon Race, flying from Paris to the northwest coast of England, a distance of 404 miles, in 22 hours. This event, established by *New York Herald* owner James Gordon Bennett, was held annually thereafter, except from 1914 to 1919, through 1938, and produced winners from half a dozen countries.



Airships at the 1907 Aero Club of St. Louis-sponsored dirigible contest held during the Gordon Bennett International Balloon Races. Lincoln Beachey, winner, is seen at the top of the photograph. (*Scientific American*)



Lincoln Beachey's airship at Luna Park, Pittsburgh, PA, during the Spring of 1906. (Smithsonian Institution)

America won the race nine times.

The rules stated that the race should be held in the country of the previous year's winner, and the 1907 event was staged in St. Louis under the auspices of the Aero Club there. Nine balloons entered the contest: three from the United States, three from Germany, two from France and one from England. Commented the *New York Herald*: "Never has there been seen in America such an inspiring or novel spectacle as that presented in the balloon field in Forest Park when the time came to get ready for the actual ascent." It estimated that 300,000 people watched the start. The German balloon POMMERON won the event with a flight of 872 miles to Asbury Park, New Jersey, shattering the American distance record of 808 miles set in 1859 by John Wise.

A special feature of the 1907 race was a contest for dirigibles sponsored by the Aero Club of St. Louis that offered prizes totaling \$5500 for the highest speeds over a course of a little more than a mile in length. Among the aeronauts entering this event were Lincoln Beachey, who won, Tom Baldwin, Horace Wild, Cromwell Dixon and Jack Dallas. Wild had been a free balloonist in the 1880s and 1890s, shifting over to powered craft in 1903. He had poor luck at St. Louis but the following year set an endurance record of five hours and twenty minutes. Dixon, a youth of fifteen, flew his *Skycycle*, a foot-pedaled gas bag, 32

feet long, sewed together by his mother. The craft could not compete with his engine-driven competitors, but he won the affection of the crowd with several short flights around the fair-ground and one across the Mississippi to Venice, Illinois.

Dallas, one of the Beachey team, flew a craft built by Charles J. Strobel, a Toledo airship builder who had also built Beachey's winner. Strobel, sometimes known as "The Airship King," operated as many as six different ships at a time, and employed such well-known pilots as Knabenshue, Beachey, Godet, Wild, Dallas, Vaughn, Goodale and Ginter to fly them.

Earl Hess rejoined Knabenshue in 1907 and flew for him throughout New England and on into Canada, then returned to Toledo to help him construct the first three-passenger dirigible in America. On its maiden flight this 105-footer lost power over the Toledo ball park and sank ingloriously into the bleachers during a game between the Toledo Mud Hens and the Indianapolis Indians.

To help commemorate the 300th anniversary in 1909 of Henry Hudson's voyage up the Hudson River, the *New York World* offered a prize of \$10,000 to the first person who could fly the route in any sort of aircraft. The big money attracted the Wright Brothers and Glenn Curtiss with their airplanes, and Tom Baldwin and George L. Tomlinson with their Baldwin-built dirigibles. This was one of the rare occasions where airplanes were pitted against lighter-than-air craft in any sort of contest. Unfortunately, high winds that persisted all week prevented the planes from making more than a brief test flight or two. The dirigibles at least made an attempt, both setting forth during a period of relative calm, only to be forced down by mechanical failure within an hour or so of their departure. The inability of these craft to negotiate the course reveals the painfully slow progress in the development of the airship in America in the six years since Roy Knabenshue managed his closed-course flight at St. Louis.

In 1907 Walter Wellman attempted a 700-mile flight in the dirigible AMERICA from Spitsbergen to the North Pole. The ship, built for him in France, measured 185 feet in length, contained 258,500 cubic feet of hydrogen, and was propelled by a single 75-horsepower Lorraine-Dietrich automobile engine.

This was an ambitious and foolhardy venture at a time when the dirigible could scarcely keep itself aloft, let alone make any appreciable headway in other than the gentlest of breezes, but Wellman set off, confident that the craft could make the trip in 70 hours. Three hours after takeoff, a squall hit the craft from the northwest, forcing it down on the ice and ending the attempt for that year. A second attempt in 1909 ended shortly after takeoff when the ship's equilibrator caught on an ice flow and broke off. Again they force-landed, and this ended Wellman's Polar attempts.

In 1910 Wellman set out from Atlantic City, New Jersey, in an enlarged version of AMERICA, determined to cross the Atlantic Ocean. For 71 hours the craft struggled valiantly against head winds, fog and mechanical troubles, then ditched alongside a rescuing ship 400 miles due east of Cape Hatteras. Although failing in his objective, Wellman broke the world's endurance record for powered flight.

All told, American airship pilots made several hundred flights throughout the country before 1910. The floppy, sluggish gas bags creeping slowly around a course or hovering overhead were less than spectacular, but they were far more fun to watch than the free balloon which would arise with great splendor, then



The Morrell airship, measuring 485 feet in length and driven by six 40-horsepower gasoline engines, begins to collapse in midair over Berkeley, California, on its maiden voyage, June 13, 1908. Aboard were 19 persons, including eight engineers, five valve tenders, two photographers and an aeronaut. None was hurt in the accident. (Smithsonian Institution)



George Tomlinson heads his dirigible across the Hudson River from the Palisades Amusement Park during the Hudson-Fulton celebration in 1909. (Smithsonian Institution)

promptly disappear from view, never to be seen again. The dirigible would at least stick around in full view, its antics watched by all, its pilot scrambling back and forth along the platform hanging below to nose the ship up or down, its engine popping madly like strings of firecrackers, its great paddle propellers churning slowly.

By 1910 the dirigible had all but vanished from American skies, forced down by the faster and more versatile airplane. Pilots who had flown the painfully slow, unresponsive airships quickly made the transition to heavier-than-air craft, demonstrating their skills to wide-eyed audiences throughout the country. It appeared that lighter-than-air flying in America had ended. But in reality it had simply hibernated, to be rejuvenated a few years later with the demands of World War I, and to continue with varying degrees of gusto to the present day.

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1. *The Writings of Benjamin Franklin*, Vol. 9, pp. 79-85.
2. *Ibid*.
3. *From Dream Machines*.
4. *Life and Works of Benjamin Franklin*, Vol. 10, p. 93.
5. Carnes's flight took place near the Indian Queen Tavern, which was then owned by him and which has recently been restored.
6. *Baltimore Journal and Advertiser*, June 22, 1784.
7. Carnes favored the "common rarefied air" to the "inflammable air (or hydrogen) now so much in use in Europe."
8. Quoted from *The First Aerial Voyage in America*.
9. Emigration Depot at Battery Park.
10. American balloonists often bore the title "Professor" as aerostation was looked upon by many as a science.
11. *From Through the Air* by Wise.
12. Andrews received Patent No. 43,449 for this invention on July 5, 1864.
13. *The Writings of Benjamin Franklin*, Vol. 9, pp. 79-85.
14. Smithsonian Institution.
15. *The War Years*, Vol. 1, p. 495.
16. Reporters of the day often tended to exaggerate news accounts, particularly those involving the brand new art of aerostation.
17. March 26, 1904.
18. *North Adams Evening Transcript*.

ABOUT THE AUTHOR

Henry R. Palmer, Jr. took his first flying lessons in 1929. He became the first President of the New England Flying Club in 1935 and was President of the flying club at Brown University, where he graduated in 1936. He ran a fixed-base land and seaplane service in his hometown of Stonington, Connecticut, for two years after World War II.

Although most of his life has been spent in the marine industry, he has maintained a keen interest in early aviation history, and is the author of several books and articles on the subject. He owns an extensive aeronautical library and photo collection, and he is currently restoring the 1930 Thompson Trophy-winning Laird *Solution* biplane owned by the Connecticut Aeronautical Historical Association. He and his wife reside in Stonington, where he is engaged in marine surveying and appraising.



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