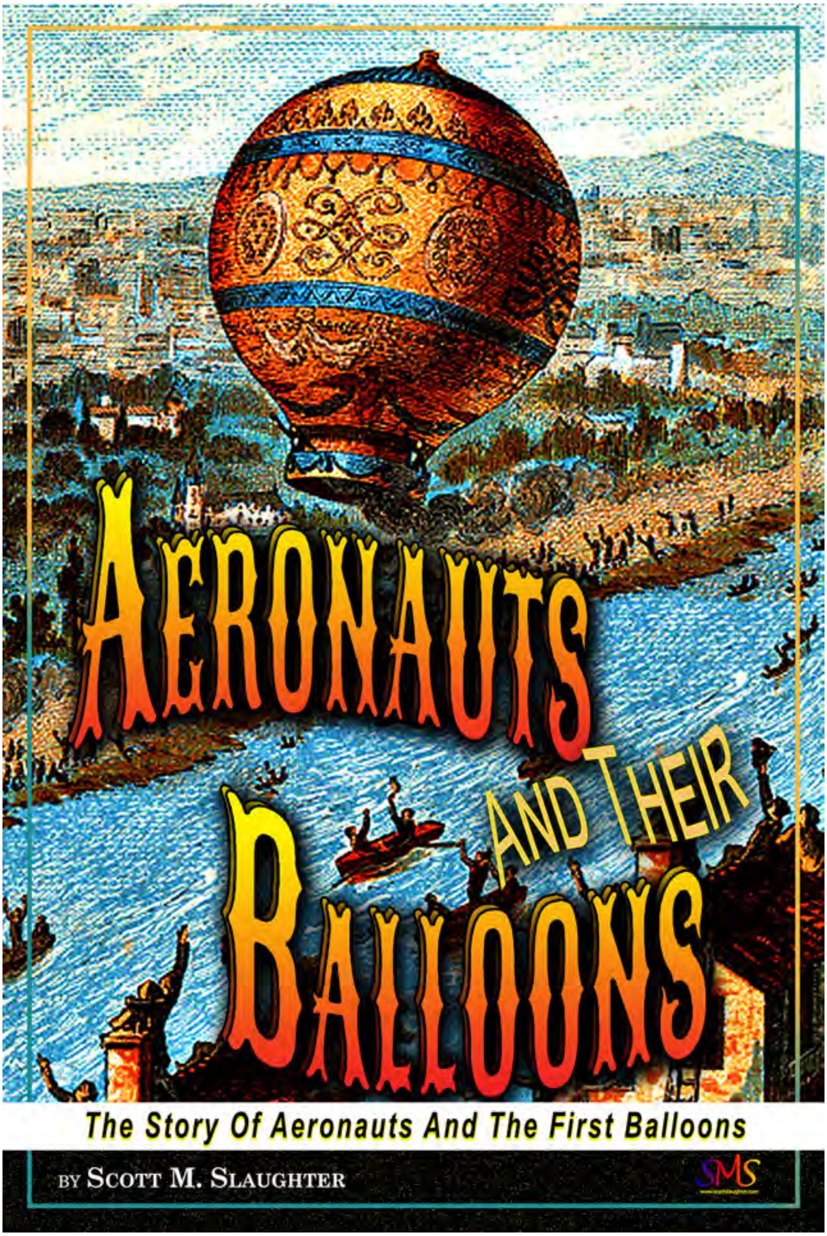

AERONAUTS
AND THEIR
BALLOONS
The Story Of Aeronauts And The First Balloons
BY SCOTT M. SLAUGHTER
SMS

*"Beautiful invention, mounting heavenward — so beautifully, so unguidably!
Emblem of our Age, of Hope itself"*

THOMAS CARLYLE, 1837

Introduction

Introduction

From ancient times right up through to the late 1700s a few brave souls (and not all were men) were so fascinated and obsessed with flight they wanted nothing more than to fly like the birds. However, as you'll read in the "Early Enthusiasm" chapter, their attempts to fly like the birds all failed on so many levels, and for many reasons, and often ended with disastrous results.

I learned in my elementary school days that December 17, 1903, was considered to be the most important date in aviation history. Most people probably still believe because December 17, 1903, is when the Wright brothers made the first controlled, powered, and sustained heavier-than-air human flight.

But an argument can also be made that October 15, 1783, should be the most important date in aviation history because that is when the long-sought dream of flying had finally been realized. A balloon called the *Aerostat Reveillon*, with scientist Jean-François Pilâtre de Rozier onboard, was launched in France. Although men on the ground held onto ropes attached to the *Aerostat Reveillon* so it couldn't float away (or what became known as either a tethered balloon or captive balloon), the *Aerostat Reveillon* rose to 250 feet and remained in the air for 15 minutes before it landed safely nearby.

Pilâtre de Rozier and a companion, the Marquis d'Arlandes, ascended only a month later to 500 feet in an untethered balloon and traveled about 5½ miles during a 20-minute flight. This was the first "free flight" made by man and occurred 120 years before the Wright Brothers historic December 17 flight at Kitty Hawk, North Carolina.

Although the early balloons of James Glaisher, Jean-François Pilâtre de Rozier, James Blanchard and others were impressive at the time, and set impresive altitude and endurance records, they're a far cry from the high-tech balloons seen floating in the sky today that are capable of reaching more than 50,000 feet.

This hot air balloon, for example, called the *Flying Cathedral*, is shaped as the Church of the Monastery of St. Gallen. It was launched by Jan Kaeser and Matin Zimmermann in Switzerland during the 2008 Internationalen Ballontagen Alpenrheintal.

Friedrich Böhringer (Photographer)

The science of ballooning and sending humans high above the ground had begun. Over the next several years, people had access to the skies over Europe like never before, and with the later development of hydrogen balloons, even the sky seemed to offer no limit.

Aeronauts And Their Balloons isn't meant to be a complete history of ballooning, but instead is a large collection of the more notable people, characters and incidents that have determined how the science and practice of aeronautics has progressed.

♦ Balloon Timeline ♦

The following is an outline of some of the major milestones in ballooning (most of which will be covered much more fully in *Aeronauts And Their Balloons*):

• 1783 •

The Montgolfier brothers (Joseph-Michel and Jacques-Étienne) receive credit for inventing the modern balloon when they made demonstrated the capability of a light vessel filled with heated air to rise freely in the surrounding atmosphere.

French scientist Jean-François Pilâtre de Rozier launches the first balloon carrying a duck, a sheep, and a cock (rooster). Pilâtre de Rozier used hot air to supply the necessary lift for the balloon. The flight lasted only about 15 minutes but it was a promising start.

Pilâtre de Rozier and François Laurent d'Arlandes flew from Paris in a true "hot air" balloon that was created out of paper-lined cloth by wealthy brothers and papermakers, Jacques Étienne and Joseph Michel Montgolfier.

Professor Jacques Alexandre César Charles and the two Robert brothers (Anne-Jean and Nicolas-Louis) designed and built the first hydrogen balloon it in their workshop at the Place des Victoires in Paris.

Charles and the Robert brothers launched the world's first (unmanned) hydrogen-filled balloon in August and in December 1783, Charles and his co-pilot Nicolas-Louis Robert ascended to a height of about 1,800 feet in a hydrogen balloon. Their pioneering use of hydrogen for lift led to this type of balloon to be called a charlière (as opposed to a montgolfière that used hot air).

• 1784 •

Joseph Montgolfier launched and ascended in the largest hot air balloon built to that time. The *Le Fleusseiles* had room for 30 passengers.

Although the credit for the first balloon flight in the U.K. should go to Scottish aviator James Tytler for his 1784 flight over Edinburgh, his historic accomplishment was quickly overshadowed by an Italian daredevil named Vincenzo Lunardi, who completes the first balloon flight in England.

Lunardi launched his hydrogen gas balloon in front of a staggering 200,000 spectators at London's Artillery Ground but he wasn't alone on this flight because he was joined by a dog, a cat, and a caged pigeon for 24 miles into Hertfordshire.

Lunardi became an overnight sensation in England after he travelled an impressive 13 miles during his 100 minute flight.

• 1785 •

As with the early days of space exploration in the 1960s when reaching the moon was considered to be the first step in space travel, crossing the English Channel in the early days of ballooning was considered the first step to long-distance ballooning.

Pilâtre de Rozier, who only two years earlier made his historic first manned balloon ride, was also the first person to attempt crossing the English Channel. He made the crossing attempt in 1785 using an unusual arrangement of a hydrogen balloon and a hot air balloon tied together. Pilâtre de Rozier's experimental balloon unfortunately exploded about 30 minutes after it launched and Pilâtre de Rozier and his copilot were killed.

This double balloon helium/hot air system, nevertheless, remained among the most successful designs for long-distance ballooning.

This same year, French balloonist Jean-Pierre Blanchard and American John Jeffries become the first to fly across the English Channel.

Blanchard and Jeffries also carried a letter with them, which could arguably be considered the world's first airmail letter.

• 1793 •

Although the early balloon experiments and flights were in Europe, specifically France and England, the idea of balloonmania began to take hold in North American in the 1790s.

Jean-Pierre Blanchard makes a 45-minute flight from Philadelphia, Pennsylvania to Gloucester County, New Jersey on January 9, 1793, with George Washington present to see the balloon launch for himself.

• 1797 •

The first parachute jump was made by A J Garnerin, a French balloonist and adventurer who dropped 3,000 feet from a gas balloon.

• 1836 •

The Great Balloon of Nassau travelled about 500 miles in 18 hours from London to Weilburg in Germany in the first truly great long-distance balloon flight.

• 1876 •

The British Balloon Corps was created to develop the use of steel storage cylinders for hydrogen. Balloons by that time were widely used for military purposes, for example, balloons carried passengers, pigeons and mail during the siege of Paris.

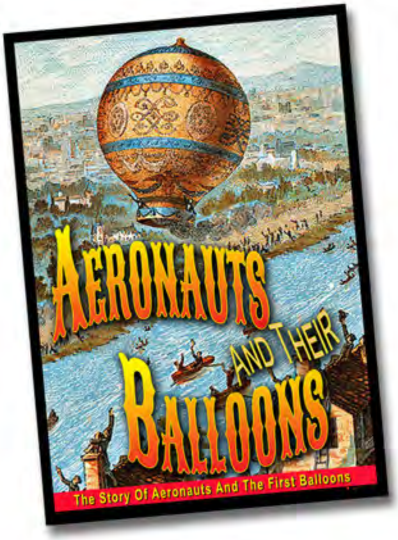
• 1794 to 1945 •

Balloons are used for military observation during the Franco-Prussian War and in what seems like an action scene of a Hollywood movie, a French Minister uses a balloon to make a dramatic escape from a besieged Paris.

Balloons were used quite effectively beginning with the U.S. Civil War up through World War I and into World War II for surveillance, transportation, and communication, and even as offensive weapons platforms.

• 1897 •

Swedish aeronaut Salomon Andrea tried to reach the North Pole by balloon but unfortunately didn't make it.


AERONAUTS
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♦ PART 1 ♦

PART 1

• Chapters In Part 1 •

Early Enthusiasm

Early Enthusiasm

THEY MIGHT HAVE BEEN Babylonians, Assyrians, Egyptians, or Greeks but regardless of where they were from, they likely had at least one thing in common. People who have been stuck on the ground since the beginning of recorded time, and perhaps even earlier, must have looked up at some point and been fascinated by, perhaps even been jealous of, birds and their ability to fly.

Therefore, our ancestors gave wings to their gods and myths in pictures, statues and stories. Some gods could fly by magic but others rode across the sky on animals such as horses, goats, tigers, lions, bulls, and even dragons. Other gods rode through the air in chariots or boats of all sizes pulled by flying beasts. Only the gods could fly and travel through the great unseen ocean of air above the earth, it was well beyond the capability of mere mortal man.

Mercury, the Roman god of merchants, is usually shown wearing winged sandals and a winged cap. This woodcut shows Mercury in the clouds. It was created by German painter and engraver Hans Brosamer and is derived from a drawing by Albrecht Dürer.

Courtesy U.S. Library of Congress

One of the best known biblical stories of flight is the ascension of the Hebrew prophet Elijah, who was picked up by a chariot and horses of fire and "went up by a whirlwind into heaven."

Courtesy U.S. Library of Congress

The fascination people have with birds hasn't really gone away because we continue even today to watch, wonder, and admire the fast flapping wings of a hummingbird or the long, impressive wings of a soaring eagle or listened to the delightful songs of a meadowlark and other songbirds.

You've probably seen the photos or drawings of the brave souls who made several attempts to fly and soar under their own power. Their attempts, of course, met with predictable results but other attempts, fortunately, were eventually made by men who were just as enthusiastic but had at least a bit more common sense.

You may already be familiar with one of the oldest stories of flying: The classic Greek mythological story of Daedalus and his son Icarus.

Daedalus, an Athenian, was jealous of his talented nephew Talus so he killed him and fled with his son Icarus to Crete, where he built the celebrated labyrinth for Minos, the king. They had to later, however, escape from the anger of Minos so they used wax to fasten wings of feathers to themselves and took to flight like the birds from the island of Crete.

Daedalus told Icarus not to fly too low or too high, but instead to follow him. Icarus, however, was excited about his ability to fly, forgot his father's advice, and rose to such a height that the heat of the sun melted the wax of his wings, and he fell into the sea near Samos. The island of Icaria and the Icarian Sea, which is part of the Aegean Sea, are believed named for Icarus. Daedalus, however, completed his flight safely.

The belief that Greek gods possessed the power of flight and could span both time and distance at will was well established by the 700s B.C. but only the gods had the power of flight.

The winged figure of Victory, standing behind the mother holding a child with an olive branch, goes back to Nike, which isn't a reference to the sports apparel company but who served as an angel or messenger of the gods in Greek mythology. Nike came to personify victory and was usually shown as a powerful and majestic woman with beautiful wings.

The same was true for the Roman gods. Mercury, the Roman god of merchants, for example, is usually shown wearing winged sandals and a winged cap. Even though Venus, the Roman goddess of love and beauty, was seldom shown with wings, she was a powerful goddess and capable of flight.

The image of a person using a flying carpet to travel to a faraway adventure became part of Western folklore after the first European translations of *The Thousand and One Nights*, a compilation of stories taken from Persian, Arabic, and Indian sources.

The Bible also includes stories of flight, perhaps the best known of which is the ascension of the Hebrew prophet Elijah (2 Kings 2:1). A chariot and horses of fire picked him up and he "went up by a whirlwind into heaven." [1] It's safe to consider flying in this story to represent the idea of the afterlife or possibly reincarnation.

An Ancient Greek named Archytas (428-347 B.C.) was a philosopher, mathematician, astronomer, statesman, as well as a good friend of Plato. He was also a scientist of the Pythagorean school and famous for likely being the founder of mathematical mechanics.

Some people believe he launched the first "flying stag" into the air. He also, at least according to the Greek writers, "made a pigeon of wood, which flew, but which could not raise itself again after having fallen." [2] Its flight, the Greek writers said, "was accomplished by means of a mechanical contrivance, by the vibrations of which it was sustained in the air." [3] In other words, it's likely that this was an early special effect and was done using fine strings or wires invisible to those watching the action, much like the techniques used at theaters.

Archytas also achieved even more everlasting fame when a crater on the moon was named in his honor.

In 66 A.D., during the time of Nero in Rome, Simon Magus, also known as Simon the magician as well as other names (he referred to himself as "the mechanician") made certain experiments at Rome of flying at a certain height. Many early Christians believed that Simon Magus received this power directly from the devil. St. Peter, the namesake of Simon Magus, was noticed to be feverishly praying while Simon was amusing himself in space. Perhaps it was in answer to one of St. Peter's prayers that the magician failed in his flight and broke his neck when he fell upon the Forum.

In apocryphal works, such as the Acts of Peter and the Epistle of the Apostles, Simon also appears as a formidable sorcerer with the ability to levitate and fly at will.

A certain Saracen living at the time of the reign of the Emperor Comnenus met a similar fate as Simon when he attempted a flight from the summit of the tower of the hippodrome at Constantinople. His experiments were conducted on the principle of the inclined plane. He descended in an oblique course and used the resistance of the air as a support. His long, large robe with its flaps extended on an osier frame saved him from suddenly falling.

Because birds needed their wings to fly, it was only natural that the first attempt by a man to fly would also be by using wings and so the first experimenter attached artificial wings to his arms and legs in an attempt to fly like the birds. It took several serious and tragic results before men realized his wasn't the answer to flight.

Men then began working on more awkward, cumbersome, and complex devices and contraptions.

English philosopher and Franciscan friar Roger Bacon (1214-1292?) who placed considerable emphasis on the study of nature through empirical methods, was responsible in the 1200s for beginning a more scientific era for mankind.

The date, and even the location, where Bacon wrote his *Epistola de Secretis Operibus Artis et Naturae, et de Nullitate Magiae* (meaning "Letter on the Secret Workings of Art and Nature, and on the Vanity of Magic") are unknown. But what is known is that this treatise dismisses magical practices like necromancy, and contains most

The Challenge From The Sky

VERY LITTLE CHANGED IN the world from the time of English philosopher and Franciscan friar Roger Bacon through to the late 1400s and the time of Leonardo da Vinci.

The years and decades meantime passed without any success in flight, despite the strong desire that mortal man still had to fly. The birds were still flying and soaring overhead — almost challenging men to discover their secret. It wasn't until the late 1400s when the world began to change. The possibility of flight began to intrigue and stir the imagination of the great Leonardo da Vinci.

It's easy, and correct, to consider Leonardo (1452-1519) an Italian Renaissance polymath because he was an artist, sculptor, architect, engineer, inventor, scientist and so much more.

Most of us know Leonardo as a painter or sculptor but his work as engineer, inventor and scientist is also remarkable. He did, after all, predict the steam engine, the tank, the submarine and many other items long before those items were invented and used.

Leonardo also took a great interest in flight when he was in his mid-30s so that he had already collected several years of theory on flight by the time he was 50 years old. He spent time not only carefully studying the birds and watching how they moved, but he also studied the air itself.

It's also likely, or at least possible, that Leonardo built a complex flying machine during this time that closely imitated a bird. The machine, called an ornithopter, featured flapping wings, similar to those of a bird, that were worked by a man's arms and legs.

Although no one is certain whether Leonardo actually built and tested a full-size ornithopter, one of Leonardo's associates and close friends, Gerolamo Cardano, wrote in 1550 that Leonardo desperately tried to get the ornithopter off the ground.

It's therefore possible that Leonardo took his ornithopter for a test run, although it would have been a less than successful test run. Leonardo was working on so many ideas that it's also possible that the ornithopter design, like many of Leonardo's designs, never made it past the planning stages during his lifetime and weren't built until much later.

In any event, his ornithopter at the time would have failed for the same reason that the "Tower Jumpers" from the 1000s failed. Our muscles are simply not strong enough to lift us by flapping wings (they're not even designed for that purpose). Even if some type of engine power replaced human power, the ornithopter wouldn't have worked because Leonardo made the wings so they'd flap downward and then back. He never learned that birds flap their wings downward and forward. Despite his ingenuity, work and study, even Leonardo, the greatest thinker of his time, wasn't able to overcome the challenge from the sky.

We shouldn't blame Leonardo for this because he had no real blueprint or history from which to work. Despite the failure of the ornithopter, Leonardo was the first real scientist in the history of flight. Unfortunately, his writings and articles on flight were lost after his death in 1519 until other scientists finally were able to see and read the information in 1797.

Leonardo da Vinci wasn't the only Renaissance-era person to be interested in flight. Giovanni Battista Danti, who was an Italian mathematician from Perugia who lived in the latter part of the 1400s, was one of the many people throughout the Middle Ages and Early Renaissance to be mistaken about the anatomy of birds.

He, therefore, believed that a thin, slight man could be the answer and if artificial wings were attached to such a man, he might be able to raise himself off the ground into the air.

Giovanni, as with countless others before him, and even some after him, simply glued feathers to his arms and moved them rapidly up and down believing it was the feathers that had some physical property assisting the birds in flight. The predictable results during his trial flights near Lake Trasimeno were in him falling hard on the roof of Saint Mary's Church.

Although he lived about 100 years after Leonardo and Giovanni, another Renaissance-era man was Paolo Guidotti.

He was another who believed strongly in the bird/feather/wing theory even though he likely heard about the earlier failures using similar techniques. He built his "wings" a bit differently from the earlier artificial wings. Guidotti made his wings from whalebone and curved into shape using springs but as with the earlier artificial wings, they were covered in feathers.

We should give Guidotti credit for a bit of success, however. He didn't exactly drop straight down as did the earlier experimenters before him because he was able to fly, more-or-less, for about 400 yards. His landing though was similar to the others before him when fell through a roof and broke his leg. It apparently was only then that he decided that painting was a more enjoyable, if not safer, career than aviation.

Another Renaissance-era man interested in aviation was Joao Torto from Portugal.

He was well-educated and certainly had several types of jobs in his life, including nurse, barber, certified bleeder and healer, astrologer and teacher. His well-rounded education and background also helped feed his large ego, which may have led him to wanting to add aviator to his other careers. It turned out to be a bad career move.

Torto used two pairs of calico cloth-covered wings attached to his arms and even an eagle-shaped helmet. He jumped from the cathedral tower in St. Mateus Square on June 20, 1540, in front of a large crowd and fell a short distance to a nearby chapel.

The fall onto the chapel may have hurt nothing more than his ego but, unfortunately, the impact caused his helmet to slip over his face so he wasn't able to see exactly how precarious of a situation he was in. If he was able to see where he was at, he might have been able to stop his slide down the chapel roof and climb or move to a safer location but he continued to fall to the ground and was killed.

Meanwhile in 1670, an Italian Jesuit priest, Francesco de Lana, also accepted the early challenge of flight with a plan that perhaps was more ingenious but not less fallacious.

Portrait of Italian naturalist, mathematician, aeronautics pioneer and Jesuit priest Francesco Lana de Terzi.

He wasn't about to strap feather covered wings onto his arms in 1670 because he wasn't interested so much in birds as he was in the air itself. Father Francesco knew that the air has weight so he wondered then why couldn't something lighter than air float upward similar to a bit of cork floating in the water?

Courtesy U.S. Library of Congress

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Father Francesco then went to work designing an airship. His plan included a body that resembled a boat and featured a mast and a sail. Four large hollow globes or balls, from which the air had been removed, of very thin copper were attached to the boat. The idea was for the globes to rise up from the ground and carry the boat with them.

Each of his balls were about 25 feet in diameter but each had only a thickness of 0.00444 inches. The metal weighed 365 pounds and the weight of the air which it should contain would be about 670 pounds. This meant that, after a vacuum had been formed, an excess of 305 pounds remained for the ascension.

The hope was for the four balls to rise into the air with a combined force of 1,220 pounds, which Lana considered to be sufficient to transport a boat carrying several passengers as well as being completely furnished with masts, sails, oars and rudders.

seemed so incredible to those who came to witness it, that the persons who knew most about it—who were, at the same time, the most favourably predisposed in its favour—doubted o£ its success.

At last the brothers Montgolfier commenced their work. They first of all began to make the smoke necessary for their experiment. The machine—which at first seemed only a covering of cloth, lined with paper, a sort of sack thirty-five feet high—became inflated, and grew large even under the eyes of the spectator, took consistence, assumed a beautiful form, stretched itself on all sides, and struggled to escape. Meanwhile, strong arms were holding it down until the signal was given, when it loosened itself, and with a rush rose to the height of 1,000 fathoms in less than ten minutes.

It then described a horizontal line of 7,200 feet, and as it had lost a considerable amount of gas, it began to descend quietly. It reached the ground in safety; and this first attempt, crowned with such decisive success, secured for ever to the brothers Montgolfier the glory of one of the most astonishing discoveries.

When we reflect for a moment upon the numberless difficulties which such a bold attempt entailed, upon the bitter criticism to which it would have exposed its projectors had it failed through any accident, and upon the sums that must have been spent in carrying it out, we cannot withhold the highest admiration for the men who conceived the idea and carried it out to such a successful issue.

Etienne Montgolfier has left us a description of this first balloon. "The aerostatic machine," he says, "was constructed of cloth lined with paper, fastened together on a network of strings fixed to the cloth. It was spherical; its circumference was no feet, and a wooden frame sixteen feet square held it fixed at the bottom. Its contents were about 22,000 cubic feet, and it accordingly displaced a volume of air weighing 1,980 lbs. The weight of the gas was nearly half the weight of the air, for it weighed 990 lbs., and the machine itself, with the frame, weighed 500: it was, therefore, impelled upwards with the force of 490 lbs. Two men sufficed to raise it and to fill it with gas, but it took eight to hold it down till the signal was given. The different pieces of the covering were fastened together with buttons and button-holes. It remained ten minutes in the air, but the loss of gas by the button-holes, and by other imperfections, did not permit it to continue longer. The wind at the moment of the ascent was from the north. The machine came down so lightly that no part of it was broken.

"

The Montgolfiers initially believed that either smoke or possibly some type of unknown gas inside the fire made the balloon rise but they soon realized that the fire simply heated the air in the balloon. Hot air is lighter than cool air and the balloon floated until the air inside it fell in temperature until it matched the air surrounding it.

The Montgolfier brothers had discovered the hot air balloon and it was a very big discovery, indeed.

But the brothers would soon have a rival who had a strong scientific background and who was more interested in using hydrogen instead of hot air with his balloons. His name was Jacques Alexandre César Charles (See the "A Monster And The First Lost Balloon" chapter for more information.)

This drawing shows Joseph-Michel Montgolfier (who was called Giuseppe Michele, or the Italian form of his name, in this drawing) standing by his balloon ropes.

Courtesy U.S. Library of Congress

The success of the Montgolfiers created a sensation throughout Europe but it was in France, and Paris in particular, where balloonmania had the greatest effect.

The Royal Academy of Sciences invited Joseph Montgolfier to repeat his experiments, so he prepared another balloon made from coarse linen with a paper lining. This balloon, unfortunately, was destroyed by continual and violent rain before Montgolfier could use it. Montgolfier simply had another balloon built and ascended from Versailles on September 19, 1783. (See the "A Cock, A Duck And A Sheep" chapter for more information.)

It was a beginning for aeronauts as ballooning became reality as bigger, bolder attempts soon followed, first in France and then in England, as aeronauts began planning flights in their balloons and fragile cars.

A Monster And The First Lost Balloon

A Monster And The First Lost Balloon

MONTGOLFIER'S INVENTION WAS THE outstanding event of the time — an event that would have no trouble rivaling the Super Bowl today in excitement and importance. People would always remember what they were doing when they heard the news about what happened on June 5, 1783, in Annonay.

The Paris Academy of Sciences, which had been officially informed of the event, decided that the impressive experiment in Annonay had to be repeated but this time with King Louis XVI, whose reign was just beginning in France, in attendance.

Meanwhile, another Frenchmen was also ready to take to the air but with a different type of balloon. This balloon was designed by a gentlemen-physicist named Professor Jacques Alexandre César Charles (1746-1823) who was also known as Alexandre Charles to avoid confusion with another member of the Paris Academy of Sciences at about the same time named Jacques Charles.

Head-and-shoulders portrait of French balloonist Professor Jacques Alexandre Cesar Charles, who made the first flight in a hydrogen balloon, December 1, 1783.

Courtesy U.S. Library of Congress

Charles was well known because of the success he had performing difficult experiments as well as for the completeness and perfection of his instruments he used in those experiments. He was also well known for his exceptional lectures.

Charles also couldn't wait for the royal extravaganza of repeating the balloon launch that the Paris Academy of Sciences was preparing for King Louis XVI and the royal court. He knew the people of France were anticipating a repeat of the Annonay balloon launch but he was, instead, determined to give the people of Paris something different at which they could marvel.

♦ The Debut Of The Hydrogen Balloon ♦

The idea that hydrogen would be a suitable lifting agent for balloons came to Charles after he spent time studying the work of Robert Boyle (Boyle's Law) that was published about 100 years earlier in 1662, and three of his contemporaries, Henry Cavendish, Joseph Black, and Tiberius Cavallo.

The English chemist Henry Cavendish discovered hydrogen in 1766. Even though it was the lightest substance known and weighed much less than air, no one before Professor Charles had ever, for whatever reasons, thought of using it in a balloon.

The "gas" that the Montgolfier brothers used with their balloon had a weight about 75% that of the air, but the weight of the hydrogen (which was also called inflammable air at the time) was several times lighter. The method of producing and using hydrogen was difficult for most people but was virtually effortless for a scientist like Jacques Charles, who often used it in his experiments. The problem of collecting it into an impervious envelope was also solved, thanks to the recent discovery of caoutchouc (unvulcanized natural rubber), and Charles knew how to prepare a thin sheet.

Charles certainly had ability and knowledge, which were two of the necessary qualities needed for his balloon to be a success, but he lacked the money to proceed. Charles, therefore, turned to his friend Barthélemy Faujas de Saint-Fond for help.

Faujas de Saint-Fond (1741-1819), who liked to travel, was at the time working as a geologist for the king in different areas in Europe. In addition to a career as a geologist, Faujas de Saint-Fond also studied law in Grenoble where he was admitted as an advocate to the parlement. (The parlement, not to be confused with parliament, was a provincial appellate court in France.)

He apparently had enough of his own money but was also well-connected enough to find more if needed. One of his connections, for example, just happened to be the landlord of the Caveau Cafe, an establishment often frequented by the lovers of literature in Paris. Barthelemy Faujas de Saint-Fond began a subscription there, the condition of which was that each subscriber of a crown would have the right of entry to the enclosure from which the ascent was to be made, and could bring two friends.

Professor Charles designed the balloon and then worked with two brothers named Anne-Jean Robert and Nicolas-Louis Robert, who were usually known collectively as the Robert brothers, to build it in their workshop at the Place des Victoires in

Paris. The Robert brothers invented the methodology for the lightweight, airtight gas bag by dissolving rubber in a solution of turpentine and varnished the sheets of silk that were stitched together to make the main envelope.

Charles, not too surprisingly, followed many geometrical principles when he made his bag. For example, he gave it a spherical shape, which at the time was considered to be the most solid and perfect shape for the purpose because it provided the greatest capacity with the least weight. They used alternate strips of red and white silk but due to the discoloration of the varnishing/rubberizing process, the white strips eventually became more yellow. The government provided no funding so the project was funded entirely by a subscription organized by Faujas de Saint-Fond.

This balloon was also different because it was filled with hydrogen instead of the hot air used earlier by Pilâtre de Rozier and the Marquis d'Arlandes in their balloon.

We have many methods of making hydrogen today, including steam reforming from hydrocarbons, electrolysis and thermolysis, but those methods weren't available to Charles and the Robert brothers in 1783 to create the hydrogen gas for their balloon so they used sulfuric acid and scrap iron.

They poured almost 550 pounds of sulfuric acid onto about 1,100 pounds of scrap iron to generate hydrogen gas. The resulting hydrogen gas was then fed into the balloon through lead pipes and then into the balloon. What they didn't know was they should've placed the lead pipes in cold water to cool the hydrogen that was being fed through the pipes. Because they first didn't cool the hydrogen, it contracted as it cooled in the balloon and that meant the three men had problems filling the balloon completely.

By the time the Montgolfiers travelled the approximately 330 miles between Annonay and Paris, they were already too late to receive the first of what they expected to be many awards and rewards of their balloon discovery. Charles' balloon was sewn together, varnished and almost ready to go. All he needed to do was to inflate it with the hydrogen and he hoped he'd have a more impressive balloon ascent and flight than the Montgolfiers had.

Charles' appearance with his new type of balloon was a major and sudden setback on many levels for the Montgolfier brothers. They almost lost support immediately upon their arrival in Paris from both the French king and the Paris Academy of Sciences; their very idea, in a very real sense, had been taken out of their hands.

They were full of enthusiasm and expecting great honors when they arrived in Paris but their world changed so quickly that by the time they had reached Paris, balloons had essentially been reinvented.

Professor Charles' balloon was 30 feet in diameter, but weighed only 25 pounds compared to the weight of 400 pounds of the Montgolfier's balloon. Part of the weight came from an unusual accessory consisting of a pipe with a tap placed at the lower part.

Charles, who was quite proud of the tap, considered the pipe and tap to be absolutely necessary and was quite confident in its operation. The Montgolfiers balloon had a hole in the same location, by which, if they neglected to close it, all their gas escaped. Charles, on the other hand, believed his tap might cause his balloon to slowly lose some power (on the principle of endosmose, or interchange of gases) there was still no reason whatsoever for the balloon to fall.

The Count Vergennes, who was the French Minister of Foreign Affairs, notified all the European governments about the construction of Charles' wonderful new machine that would land one day in their countries or territories. They were requested to notify the Court of France if the balloon descended in their area so the Academy might be informed of the fact. France was at war with England at the time but according to one report, the French thought it was so important that a messenger was sent under a flag of truce to the King of England to notify him of the upcoming momentous event in Paris.

The citizens of Paris eagerly read daily bulletins about the progress of inflating the balloon. The original plan that Charles and the Roberts had was to launch the balloon from the place where it was inflated, which was in the neighborhood of the Place des Victoires and the Caveau Cafe.

So many curious onlookers, however, showed up to watch the unusual sight that on the night of August 26, Charles and the Robert brothers decided it was impossible to take the balloon through Paris during the daytime so they secretly moved the balloon about 2½ miles to the Champ de Mars. They did this by torchlight during the night accompanied by a detachment of soldiers. But first, they couldn't resist testing its strength and Charles proved that it had an ascending force of 21 pounds, and that it could rise even when dragging a 100-foot long rope.

Although the great number of torches certainly increased the risk of setting the balloon on fire, Charles considered it to be a less serious danger than the risk of having the balloon torn to pieces by a curious group of onlookers.

Even though the balloon deservedly received a lot of attention, it was unmanned despite the amount of work that went into making it and the publicity surrounding it. The balloon, furthermore, was relatively small, only about 1,230 cubic feet sphere, and only capable of lifting about 20 pounds.

The balloon launched from the Champ de Mars, which is now the site of the Eiffel Tower, on August 27, 1783. The Champ de Mars was surrounded by several soldiers to prevent those who had not tickets from entering the reserved space. This, however, didn't stop the spectators from jamming the avenues, streets, roofs and quays (piers) waiting impatiently until the balloon, should ascend. Ben Franklin was among the crowd of excited onlookers.

A cannon was fired as a signal at about 5:00 P.M. and the balloon rose magnificently and impressively from the ground. The cannon blast also seemed to signal a change in the weather as rain started falling but it didn't prevent or even slow the ascent. The falling rain also apparently didn't seem to bother the thousands of well-dressed spectators, including many fashionable ladies, who were determined to watch such an unusual but wonderful spectacle.

All their eyes were focused on the balloon until it disappeared into a cloud. A second salvo from the cannon was blasted as the balloon emerged from the clouds until a few moments later when it was lost from sight in the distance.

So many well-known astronomers of the day had gathered on the rooftops of the public buildings that it seemed they were waiting for an approaching meteor and not to take measurements of the balloon. The astronomers, however, were unable to provide much useful information about the flight itself.

As it flew in a northerly direction, the balloon was followed closely by ground chasers riding on horseback. The balloon landed about 13 miles away in the village of Gonesse after a 45 minute flight.

The story of this first hydrogen balloon might have ended there in Gonesse had the balloon team not made one small, but critical, error.

Hydrogen was very expensive and time-consuming to create and a lot of time was needed to inflate the balloon with the gas. Professor Charles and the Roberts must have thought the expensive hydrogen gas would somehow escape from the balloon if they left the hole open in the bottom of the balloon.

To be fair, people at the time weren't yet familiar working with hydrogen and what Charles and the Roberts brothers didn't realize was that hydrogen is so much lighter than air and it could not escape through the hole in the bottom of the balloon.

When Charles and the Robert brothers sealed the envelope shut, they had, in fact, guaranteed a rather spectacular end to the maiden flight of their balloon. The higher the balloon rose, the less and less air pressure it was encountered, and this drop in pressure allowed the gas inside the balloon to expand.

If they had left the bottom of the balloon open, the rapidly expanding gas could simply have vented out the bottom, but, as it was, the envelope stretched and stretched like blowing up a kids balloon.

And as with blowing up a kid's balloon too much, a balloon can only expand so much before it bursts. The balloon had silently floated virtually unnoticed over the French countryside until it burst right over the heads of "a number of peasants, whose terror at the sight and the sound of this strange monster from the skies was beyond description" according to reports.

What the superstitious and terrified peasants saw was a large, round object that was silhouetted against the clouds. Some thought the object was the moon that somehow turned black and was about to crash to the earth. Others thought it was a sign of the Judgment Day foretold in the Bible.

At least two local monks ran to the scene but they only made a confusing situation worse by telling the alarmed crowd, which was more of a mob by that time, that the object was the hide of some unknown monstrous animal.

This image shows the terrified villagers attacking the balloon built by Professor Charles and the Robert brothers after it landed near their homes.

At least two local monks ran to the scene but they only made the situation worse by telling the alarmed crowd, which was more of a mob by that time, that the object was the hide of some unknown monstrous animal.

Courtesy U.S. Library of Congress