Those Flying Machines

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Tonight we'll talk about aviation as it has been spoken of often from antiquity to the present day, and perhaps beyond. Actually, the modern evolution of aviation I am divorcing from that which has previously occurred according to the mythology of the ancients.

Ancient aviation has been mythologized in the flying carpets of Persia, the various discussions in the Veda's of India, the clay airplane figurines found in the museum of Bagdad, Iraq and in the Berlin Museum, the Egyptian Museum and other sites in Egypt. For example, inscribed with hieroglyphics on the walls of the Temple at Edfu is a tale of Horus in defense of RA attacking from the air in his 'Great Flying Disk'. The interesting thing is that the glyph basically shows a vehicle like our flying saucers of today. With this 'Great Winged Disk, Horus traveled both terrestrially and celestially. Other areas of Africa have similar stories, as well as the drawings on the Nazca plains of Peru, Chinese tales of their flying machines of millennia in the past, the American Indian

legends, etc. Although I could, but shall not, point you to each of these tales by chapter and verse from my personal library, I treat them as mythology then as possible but unsubstantiated history. Even, the tales from the Old Testament reflect ancient aviation (consider early aviation such as Ezekiel's wheel). We can also refer to the Greek myth of Daedalus and Icarus. These stories about flight go beyond Babylon to the tablets of AKKAD and SUMAR. The stories told in these clay tablets are about flight, not only through the atmosphere, but also through space. The god's who flew came from the stars. But let us not dwell on the modern entertainment thesis of "Ancient Astronauts".

The common kernel within these stories is the concept of human flight with the aid of some type of artificial machine or technologies. Descriptions of these machines and technologies vary widely among the various peoples. Each of these machines core technologies were considered a form of magic or a power provided by the gods. The common element between these tales and those of the South Sea Islanders concept of 'cargo' or gods from World War II is remarkable. This to the question that there may have been some truth in these ancient tales; however, the technology was so far beyond that of the humans that are reporting it that it smacks of "magic". An old cliché that may be appropriate in this discussion is: "truth is sometimes

stranger than fiction". Consider what your thoughts may be. Can there be an element of truth in this mythology?

Over the millennia since these ancient tales occurred, there's been a continuing interest in humankind about flight; however, modern, or present flight technology and the evolution of flight and flying machines really only dates back to Leonardo da Vinci and his 'Ornithopter'. "Although Ornithopter (flapping wing flying machines) was described for many centuries, the one designed by Leonardo was easily the most advanced.

The Sanskrit epic Ramayana (4th Century BC) describes an Ornithopter, the Pushpaka Vimana. The ancient Greek legend of Daedalus (Greek demigod engineer) and Icarus , (Daedalus' son), and the Chinese *Book of Han* (ca 19 AD) all **describe the use of feathers to make wings for a person but these are not actually aircraft. Some early manned flight attempts may have been intended to achieve flapping-wing flight though probably only a very steep glide was actually achieved. These include the flights of the 11th-century monk Eilmer of Malmesbury (recorded in the 12th century) and the 9th-century poet Abbas Ibn Firnas (recorded in the 17th century).**

Roger Bacon, writing in 1260, was also among the first to consider a technological means of flight. In 1485, Leonardo

daVinci began to study the flight of birds. He grasped that humans are too heavy, and not strong enough, to fly using wings simply attached to the arms. Therefore he sketched a device in which the aviator lies down on a plank and works two large, membranous wings using hand levers, foot pedals, and a system of pulleys.

Could it fly? What a hubristic question. He only drew some type of flying machine which he called an 'Ornithopter', you say. Additionally, Leonardo's Ornithopter designs were inspired by his study of birds, and conceived the use of flapping motion to generate thrust and provide the forward motion necessary for aerodynamic lift. However, using materials available at that time, the craft would be too heavy and require too much energy to produce sufficient lift or thrust for flight.

DaVinci's design had a very large wing area. He scaled the weight of a bird and its wing area to that for a man and machine. Although the size was actually insufficient for flight as we know it today, it was far better than any previous estimates, i.e., the feathered wings of Icarus as told by the Greeks.

While that is true, some modern engineers took his drawings and made actual replicas of them with the flapping wings,

pitch and yaw control, but without the necessary roll control. It flew over the southern Downs of England about nine years ago in 2004. No, they were unable to develop sufficient power to show human powered flight. They were able to show a gliding capability similar to that of Otto Lilienthal's many flights during the 19th century. They had the same problems (controllability) that ultimately killed Lilienthal), and therefore, when they built a gasoline engine powered version of the Ornithopter, it only flew as a tethered model, not as something to carry a human pilot due to the lack of controllability.

On August 2, 2010, Todd Reichert of the University of Toronto Institute for Aerospace Studies piloted a human-powered Ornithopter named Snowbird. The 105 ft. wingspan weighing only 93 lb. aircraft was constructed from modern materials; carbon fiber, balsa wood, and plastic foam. The pilot sat in a small cockpit suspended below the wings and pumped a bar with his feet to operate a system of wires that flapped the wings up and down. Towed by a car until airborne, it then sustained flight for almost 20 seconds. It flew 476 ft. with an average speed of 16 mph. Similar tow-launched flights were made, and improved data collection verified that his Ornithopter was capable of self-powered flight once aloft. Thus, the tale of the

Ornithopter continues; however, our discussion of this aspect of aviation ends, for now.

The scientific discoveries of the 18th century came quickly. For millennia man had known that there were only 4 elements; fire, water, air and earth. Oops! In 1772, a Swedish pharmacist, Carl Wilhelm Scheele heated mercuric oxide (HgO) and found oxygen, the first element discovered.

In August 1774, Joseph Priestly similarly heated by sunlight HgO inside a glass tube and found "dephlogisticated air", his name for oxygen, and published a paper. Thus, Priestly was known for many years as the discoverer of the first element. The 'lighter than air elements had not yet been discovered. They started coming along quickly.

The next advance after daVinci in human flight was developed in France in the 1780s by the Montgolfier brothers (Joseph and Étienne). Their father was in the paper manufacturing business in Annonay Arde'che, France. Joseph observed that sheets dried over a fire seemed to rise in the air. He also observed the clouds in the sky, filled with moisture also rose to great heights.

Joseph believed they could build a larger version of both the sheets and the clouds with their father's paper supply that would carry them into the sky. Joseph's first

version was built in Nov. 1782. Together they built a paper version of what we now know as a hot air balloon. Their first attempt using moist hot air failed as the balloon filled with steam (like the clouds they observed in the sky). This resulted in a sodden mess. The next attempt was with hot air from a small fire in a pannier (basket) beneath the balloon, which promptly ignited the paper balloon. Etienne was then called to family duty to replace their father upon his retirement. Joseph carried on the experiments. Next they tried the newly discovered element, Hydrogen, which worked, but only for a very short time until it leaked and burned into water. With Hydrogen, they found they couldn't smoke in their balloon, thus the burning. Finally, success with hot air with the fire further away and the paper coated with chemicals (clay) as a fire retardant. Ah, success after so many trials and tribulations in their trials with many errors. The hot air balloon had been born. It could carry humans, which the 'Chinese lantern' never did (at least as far as we know).

A short time later, in 1786, Prof. Charles (the man who with Prof. Boyle both from the Paris Institute defined the gas properties for the various gases, designed a gas filled balloon. The Paris Institute sponsored Prof. Charles with a Hydrogen filled cloth balloon coated with painters varnish.

This flew in Paris twice semi-successfully, but with two major problems. The first flight showed him that the cloth balloon coated with common painters varnish had a limited capability of containing the new element, Hydrogen. The second flight improved the varnish but showed that the lack of control could cause great harm to the operator (pilot).

On the second attempt, Prof. Charles filled his balloon and launched it from the parade grounds by the Palais Royale. A troop of 'chevaliers' were delegated to escort the noted Professor on his flight. However, after launch, the balloon did not follow the boulevards of Paris. It flew on a path dictated by the vagaries of the wind. The horsemen were zig-zagging from street to street, twisting and turning, trying to keep the balloon in sight. It flew too fast for them, and they could only follow it due to its altitude.

It seems that the balloon flew beyond Paris into the rural countryside. The rapidly moving shadow, the man aboard, and the height of this flying 'dragon' terrified the peasants. This was evidence of the devil at work. The parish priest was called and the peasants picked up pitchforks, which were really wooden straight rakes without wire tines, but with wooden pegs. After chasing the balloon, the Hydrogen slowly allowed the balloon to descend. The imminent attack was immediate, but every time a pitchfork would hit, the

balloon it would bounce off the new varnish on the balloon and drive it back up in the air, further convincing the crowd that it was surely of the devil. The priest gave the prayer of exorcism, without effect. Then the priest cast holy water on this devilish demon. The holy water used by the priest to rebuke the devil just bubbled off the sides due to the leaking hydrogen. This was further evidence of the power of the devil. Then, as the priest tried to cast out the flying demon, there was no apparent effect upon the flight of the balloon. Yet the balloon drifted lower until Prof Charles feared for his life. Finally, the troop of the 'chevaliers' from the French army charged with protecting this member of the Paris Institute, arrived. They came and rescued Professor Charles, fortunately for the many discoveries he later published. Their horses had been unable to keep up as the wind blew the balloon across Paris. It was only as it neared the ground and slowed that the rescue was possible. This was the last documented attempt to fly a hydrogen filled balloon for nearly a century.

For many years there were flights by those commonly called Aeronauts using hot air balloons. The majority of these took place in Europe, primarily France; however, there were Aeronaut clubs that are known to be formed in England, Germany, and the US. The US club was formed under the auspices of the Smithsonian. This was the state-of-the-art

until in the 1850s when a further attempt at lighter than air balloon flight was tested in the USA by Science and Engineering Professor, Thaddeus Lowe.

He in the winter taught at Dartmouth College, figured out how to seal a fabric to contain lighter than air gas (in his initial attempt, coke gas, then helium, and later, hydrogen). These newly discovered elements were subjects of great curiosity and constant research for their practical applications. We still continue this search for new applications of the helium and hydrogen, but the coke gas has fallen away.

Prof. Lowe was a very interesting, intensely curious, and a largely uneducated researcher in science, chemistry, astronomy, and meteorology. He was born and grew up on a small farm in New Hampshire where, like Lincoln, he could only study during the winter and after his work was done at night. He borrowed books from wherever he could find them as the community had no library nor did the community school, except for the Bible and Fox's Book of Martyrs. Occasionally, another religious book would cross his path.

At age 14 Thad left home to find his own way in life. First he moved to Portland Maine, and then to Boston, where he worked with his elder brother for a short time. While in Boston a traveling lecturer, Prof. (?) Reginald Dinkelhoff

gave talks on lighter than air gases. The professor claimed expertise in chemistry. Thad joined him as an assistant, as much to learn about chemistry as it was to find a means of supporting himself. Two years later, Professor Dinkelhoff retired from his summer lecture tour, and Thad took over his lecture business, nominating himself as Professor of Chemistry but having learned much other science during the 2 years in which he was a helper. He also had the ability to understand basic engineering, meteorology, and science.

In his travels, he watched several exhibitions by Aeronaut's and his curiosity, which was always boundless, was piqued. He made himself a hot air balloon and learned to fly it.

During 1855 while traveling with another quasi-professor Prof. Lowe learned more about hot air balloons and their hazards. Actually, due to a fabric failure, his balloon ripped and he plummeted to the ground. Although unhurt, he did learn of the hazards.

He had learned of and demonstrated in his lectures several 'lighter-than-air' gases and was curious enough to wonder if there was a way to make a balloon other than by using hot air. In his travels he had learned of the resources of the Smithsonian and from them heard about the attempts at utilizing hydrogen, as well as, the difficulties in sealing a balloon fabric from leaking the hydrogen. He started

experimenting with various coatings. Prof. Lowe discovered a technique for safely coating a fabric for a lighter than air gas retention using a newly developed paint he called anabolic dope (not precisely a scientific use of the word). Being an astute businessman, as well as an erstwhile professor, he patented the technology.

Now the question was how to use this lighter than air gas to make a balloon? He started work immediately, and looked at potential ways of containing these lighter than air gases. His first attempt was with Coke gas, followed by helium, and finally using hydrogen. His experience with the testing of these lighter than air gases taught him how to contain them with lightweight envelopes coated with his paint compound he now simply called dope. He had his first balloon, utilizing silk rather than the cotton used in Europe and by most other Aeronaut's. His first flight was a tethered flight in Hoboken New Jersey in 1857. After that flight, the tether line was withdrawn; and, he said to his wife, "You and I shall further develop this technology".

This particular invention, which he patented, he later used to build two large balloons, one named The Enterprise, and one called The City of New York, which was later, renamed The Great Western. The Enterprise and the Great Western were to be used to attempt a transatlantic crossing by

balloon. Wall Street, the Smithsonian, and the Franklin Institute in Philadelphia all participated in this attempt. The first attempt from New York was unsuccessful because the New York Gas Company could not provide the coke gas he needed for the flight. Prof. John Creesson of the Franklin Institute who was also the Chairman of the Board of the Philadelphia Gas Company, agreed to provide the gas for the trip. While waiting the time of departure, The Enterprise was taken to Cincinnati Ohio where it was launched April 19, 1861, two days after Virginia seceded from the union. Following the vagaries of the wind, The Enterprise landed in Uniondale, South Carolina and Prof. Lowe was immediately arrested as a union spy. After intercession by the Smithsonian as to his credentials as a scientist attempting an experimental flight, he was released by the Confederacy and allowed to return to Norristown Pennsylvania. This was the first of many adventures he had during Civil War. He was considered the top expert Aeronaut in the United States and perhaps in the world at the time.

Also, while awaiting the scheduled departure for the trans-Atlantic crossing, he developed a reliable and very mobile telegraph machine. He quickly became expert at the code.

Later at the request of Salmon P Chase he showed Pres. Abraham Lincoln his ballooning technology. After the

demonstration, flying 500 feet over the White House, and telegraphing what he could see back to Lincoln, he was appointed the Commander of the Union Army Balloon Corps, where he served both as Aeronaut and manufacturer of the balloons throughout the Civil War. He provided the Union Army with a better view of the Confederate Army than the normal lookout on a hilltop with a naval telescope and then communicated what was seen using his mobile telegraph connection. Prof. Lowe then also obtained a patent on the method of using his newly invented telegraph to send messages from his balloons to the ground. This was the first air to ground communication technology.

Prof. Lowe quickly changed from hydrogen filled balloons to helium filled balloons after losing some early balloons to ground fire and the consequent ignition of the hydrogen. All the helium was mainly available at the southernmost part of the Mississippi River basin, and the Union Army was able to keep control of that area most of the Civil War, at least sufficiently to maintain the necessary supply of helium for the Balloon Corps.

During the Civil War, Prof. Lowe, found it necessary to train the servicemen on how to be Aeronauts. On one of training exercises, in the midst of the first battle of Bull Run, Prof. Lowe was acting as an observer teaching a serviceman

how to make observations for Gen. Irvin McDowell; however, after being struck by ground fire, the balloon lost sufficient helium and came down in Confederate territory. The tether lines, which were being held by Union troops on the ground, could not be retracted quickly enough. Professor Lowe sprained his ankle. The Army sent a cavalry brigade to the rescue of the Professor and his trainee, but Thad was unable to leave with the 31st New York volunteers. They concealed him with his mobile telegraph in a thicket where he reported difficulty. As the Confederate army searched, Prof. Lowe, along with his mobile telegraph, were in constant danger of capture. Prof. Lowe's wife, Leontine, made herself up as an old hag, mounted a buckboard and during a lull scurried across the field, retrieved and concealed him under a canvas tarp, thus extricating him for further future service to the Union Army. Thad merely took his mobile telegraph equipment back to their base for future use. The Civil War made him a multimillionaire. His business acumen further enhanced his personal fortune. He continued his scientific explorations and investments.

He later moved from Norristown, Pennsylvania to Pasadena, California, where he raised his family, built both an amusement park on one mountaintop and an observatory on another. For both he designed and built tramways for access. He also invested in real estate and businesses in

Southern California. Actually, I'm sure most of you have visited one or more of the businesses he created (i.e., Lowe's hardware, which still remains in family hands).

We're not done with Thaddeus Lowe by a long shot. His story continues on in transportation and other areas (through several generations, of whom I have met his granddaughter and great-grandson) in railroads, trams, and airplanes. A man of his quick wit, curiosity, and intellectual diversity is not so easily relegated to the vicissitudes of history.

This brings us to the first air taxi service which was operated in Paris by a Frenchman from Brazil, or perhaps a Brazilian expatriate to France named Alberto Santos Dumont. He built his first dirigible based upon the patent of Count Otto von Zeppelin, a combination of the winged glider and a hydrogen filled balloon, powered by a small gasoline engine turning a propeller. With this dirigible he was able to show controlled flight and actually win the international Deutsche de la Meurthe prize. For many years he was accorded a reputation of having been the first man to fly. Today he is recognized as a national hero in Brazil where the Rio airport is named for him. The new Rio Airport replaced the earlier one, but the private airport remains honoring him.

In 1904 he toured the United States, including Cincinnati, demonstrating his dirigible and that it was capable of operating as an air taxi. His most significant planned demonstration was at the St. Louis World's Fair. That demonstration failed when in the morning it was found that during the night the balloon had been slashed.

Between 1898 in 1905, Santos Dumont designed and built 11 dirigibles which he flew around Paris. This mongrelized airplane cum balloon solved the problem of roll control prior to the Wrights. It operated between hotels, residences, and businesses throughout Paris just like a normal taxi except it usually discharged its passengers in windows on the second floor of the edifice, from 1898 until 1909. It was only superseded by another longer ranged comparable to what we know today air taxi after the Wright brothers put on their display in Paris in 1911.

In 1905, Santos Dumont turned to the design of aircraft while continuing his work on dirigibles. His first heavier-than-air vehicle he flew unsuccessfully late in 1905. In 1906 he designed a helicopter and a new airplane, which finally flew successfully late 1906. We shall return to Santos Dumont later in the discussion of early aircraft.

Count Ferdinand von Zeppelin pioneered the new type of airship in which he described in 1874, completed detail plans in 1893, patented in Germany in 1895, and in the USA in 1899 which added a rigid support structure to the balloon. These vehicles he called Luftschiff Zeppelin and numbered each one produced as LZ1, LZ2 etc. Because these numbers were well known, the German military added an arbitrary 30 to the number when identifying them during WW I.

After World War I, and with the constraints of the Treaty of Versailles, the Germans started again producing the Zeppelin's. LZ120 and LZ121 were built for commercial transport, but were taken without payment to Italy and France as war reparations. LZ 122 to LZ125 were never finished. LZ126 became the USS Los Angeles. In 1928 LZ127, the Graf Zeppelin was built and entered commercial service. The most famous airship was the infamous Hindenburg LZ129, which was designed to use Helium, but because of US prices and export restrictions, actually used hydrogen rather than helium. It crashed and burned on 6 May 1937 in Lakehurst New Jersey. Until then the Zeppelins had been used for international transatlantic travel. There was a regular route from Berlin/Hamburg to US and thence to Brazil and Argentina. A terminal and pylon for use by the Zeppelins was built at Lunken Airport, but not used by them.

This means of transportation lasted only a few years. The basic problem was that Europe used Hydrogen as the lighter than air gas, as we in the US controlled most of the world's helium supply. Being proper businessmen, we charged sufficient to show a magnificent profit. It only took one spark to ignite the Hydrogen in the Hindenburg, and then the doped coating of the fabric, or visa-versa. This was the end, at least until now, of commercial transportation via balloon. In 1997, Zeppelin produced the NT (New Technology) model.

However, this was not the end of ballooning or the Aeronaut's in the United States. In the US, ballooning was in the realm of the Army, namely the Signal Corps. In the late 19th century and early 20th century, the licensed aeronauts were primarily military pilots, licensed by the Aviation Club of America, according to their records.

A 1901 display of licensed Aeronauts include the following from the ACA archives. (*Do NOT read*.)

Veterans of the balloon. Left to right: Mr. Frank P. Lahm, Major J. C. McCoy, Balloon Pilot No. 1; Colonel A. L. Fulton, Major Harry R. Vaughn, Colonel James Prentice, Major E. Lazaire, Colonel H. B. Hersey

Later, during WW I, the U.S. Navy adopted balloon technology for antisubmarine warfare. Shortly after World War I, the U.S. Navy obtained their first the USS Los Angeles (the only rigid airship that the U.S. Navy procured with its structural framework), from the German Company Zeppelin, thus saving the Zeppelin Company from bankruptcy post-WW I.

The Navy also procured Blimps during WW I from the British as well as after WW I constructing them by American vendors. These vendors included the Goodyear Company, and Goodrich Company. They respectively built the Akron and the Macon. The three blimps were primarily used prior to and early in World War II. Although the Akron was lost in northern Ohio just prior to World War II, and the Los Angeles was lost off the coast of California just after the start of World War II. The Macon operated out of Lakehurst New Jersey on submarine patrol.

During the late 30s, U.S. Navy started procuring additional blimps which were assigned to either the East Coast or the West Coast. The Navy ceased using the blimps during the 1960s; however, they have restarted within the past decade the lines again at Goodyear, who has been the primary supplier of blimps since World War II, with new N class blimps. During the interim, Goodyear produced blimps for

various advertising and photographic support purposes (a la, a different view of sports events).

In general, blimps have provided a very serviceable platform for antisubmarine warfare, early warning radar installations, various advertising feats, and other transportation purposes which did not require high-speed. The greatest difficulty has been in attaching them to the various masts, taking them from hangars in wind conditions, and other similar issues. Because the US blimps are all filled with helium, the fatalities that occurred during accidents have been quite small. They have a great operational safety history.

Although my story has hardly begun, as I presently have over 70 additional pages which I could present to you, this is a little much for one paper for this auspicious body; therefore, I will defer the story of aircraft until another paper. Then I will tell stories of what I heard from barnstormers I knew, early manufacturers I've known, experiences many of which are funny, and other things I think you'll find interesting.

Thank you.

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