McClure's Magazine — How I Became an Aëronaut and My Experience with Air-Ships

Alberto Santos-Dumont

1902

HOW I BECAME AN AËRONAUT AND MY EXPERIENCE WITH AIR-SHIPS

Part II

BY ALBERTO SANTOS-DUMONT

THE next year I built a new air-ship, which Paris at once christened the ‘‘Santos-Dumont No. 2.’’ It had the same length as the first and about the same form; but its radius was greater—1 meter .90 (6 feet, 4 inches) instead of 1 meter .75 (6 feet)—which brought the volume up to 200 cubic meters (7,062 cubic feet) and gave me 44 pounds more ascensional force. I had taken account of the insufficiency of the air-pump which had all but killed me; and I added a little aluminium ventilator, to make surer of stability in the form of the balloon.

The first trial was fixed for Thursday, May 11, 1899, the Feast of the Ascension. Unfortunately a steady rain came on, making the balloon of the air-ship heavy, and depriving me of the ascensional force requisite for undertaking the journey in sufficient security. I, therefore, contented myself with going through evolutions at the end of a cord. The trial, nevertheless, ended in the neighboring trees.

The balloon had doubled up under the combined action of the contraction of the hydrogen and the force of the wind.

My friends began again at me now, saying: ‘‘You must understand that it is impossible to keep the shape of your cylindrical balloon rigid. You must not risk your life again by taking a petroleum motor into the air.’’

I said to myself: ‘‘Errors do not count. Little by little I shall correct the defects that have been revealed by my accidents; and I shall end in complete success.’’

The First Flight Around the Eiffel Tower

Accordingly, during the same year, I built a new balloon, the ‘‘Santos-Dumont No. 3.’’ Its principal measurements were: Capacity, 500 cubic meters (17,655 cubic feet); length, 20 meters (66 feet); middle diameter, 7 meters. 50 (25 feet). The basket and machine remained the same; but I suppressed the little air-balloon that had worked so badly in my previous experiment. As will be noted from the dimensions, this balloon differed greatly from the others in shape; and its increased capacity permitted me to employ illuminating gas instead of hydrogen. When inflated thus, it lifted 231 pounds of ballast together with myself and the machine, basket, rigging, and utensils.

I started for the first time in the ‘‘Santos-Dumont No. 3’’ from the Parc d’ Aërostation, at Vaugirard, on November 13, 1899, at 3.30 P.M. The Eiffel Tower made the center for my evolutions. Around that wonderful landmark, for twenty minutes, I had the immense satisfaction of describing circles, figure eights, and whatever other manœuvers it pleased me to undertake, and in all directions, diagonally up and down as well as laterally. I had at last realized my fullest expectations. Very faithfully the air-ship obeyed the impulse of propeller and steering-rudder, fixed to the rear suspension-cord which served it as a hinge.

From the Eiffel Tower I took my course to the Parc des Princes, and then, making a great loop, passed over the training-fields at Bagatelle, near Longchamps. I had, indeed, decided to come down there again, where I had landed so unwillingly before; and this landing I effected under the best conditions—at the exact spot where ‘‘Santos-Dumont No.1’’ had fallen.

Had the air been calm, my speed on this trip might have reached 25 kilometers (154 miles) an hour. That day, however, the wind was so strong that a return to the starting-place appeared to me to present great difficulties, considering the small size of the Pare d’ Aërostation at Vaugirard, surrounded on all sides by the houses of the *quartier*. Landing in Paris, in general, is something next to impossible for any kind of balloon.

Considerations of this order made it desirable for me to have a plant of my own. The Aëro Club had acquired some land on the newly opened Côteaux de Longchamps, at Saint-Cloud; and I decided to become my own master by building on it a great shed, high enough to contain my air-ship with the balloon fully inflated, and furnished with a hydrogen generator. This Aërodrome, which I built at my own expense, was 30 meters (99 feet) long, 7 meters (23 feet) wide, and 11 meters (36 feet) high. While it was in the course of erection I made other successful trips in the ‘‘Santos-Dumont No. 3,’’ the last time losing my rudder and landing, luckily, on the plain at Ivry. I did not repair it. The balloon was too clumsy in form, and the motor was too weak. I now had my own Aerodrome and gas-plant; I would no longer be obliged to empty the balloon after each trip; I would be able, therefore, to experiment for longer periods and with more method.

Making Ready for the Deutsch Prize

The summer of the Universal Exposition was approaching; and I wished, too, to win the 100,000 franc *Grand Prix d Aërostation* that had just been founded in Paris by M. Deutsch (de la Meurthe). The winning of this prize demanded that the trip from the Saint-Cloud Parc d’Aërostation to the Eiffel Tower, around it, and back to the starting-place should be made within half an hour. The regulations obliged the contestant to convoke, on the eve of

each trial, the committee that made up the jury of the prize. I had good hopes of winning, but my chief aim was to continue, in any case, the trials which had already given such good results. So I did not hesitate to begin building an air-ship much more important than the previous ones. It was finished on August 1, 1900.

The measurements of the ‘‘Santos-Dumont No. 4’’ were: Volume, 420 cubic meters (14,-830 cubic feet); length, 29 meters (95 feet) ; middle diameter, 5 meters .60 ($18\frac{1}{2}$ feet). Beneath it hung a pole-keel of bamboo, 9 meters .40 (31 feet) long; and to the middle of this was attached the saddle, pedals, and part of the frame of an ordinary bicycle. Astraddle of the bicycle saddle I had under my feet the starting-pedals of a 9-horse-power motor, driving a propeller with two wings, 4 meters (13 feet) across. These were made of silk, stretched over a steel frame. With its aluminium hub the propeller, which was attached to the stem (instead of to the stern)of the pole-keel, weighed 28 kilos($61\frac{1}{2}$ pounds). It turned with a velocity of 100 revolutions to the minute and produced, *au point fixe*, an effort of 30 kilos (66 pounds). The pole-keel and mechanism weighed altogether 300 kilos (660 pounds). A hexagonal rudder—silk stretched over wooden rods—in spite of its great surface of 7 square meters, was light enough to be placed quite at the extremity of the balloon, on the stuff of the envelope itself. The balloon was rather elliptical in form; and though not at all a

return to the slender straightness of No. 1, it had so little of No. 3's podgy compactness that I thought it prudent to put the compensating air-balloon inside it again, this time fed by a rotary ventilator. Being smaller than No. 3, it would have less lifting-power; but this I would make up by going back to hydrogen gas.

Near the saddle on which I sat were the ends of the cords and other means for controlling the different parts of the mechanism—the electric lighting of the motor, the regulation of the carburator, the handling of the rudder, ballast, and the shifting weights (consisting of the guide-rope and bags of sand), the managing of the balloon's valves, and the emergency rope for tearing open the balloon. It may easily be gathered from this enumeration that an air-ship,even as simple as my own, is a very complex organism; and the work incumbent on theaëronaut isnosinecure.

With this air-ship I made almost daily trials from the Parc d'Aërostation at Saint-Cloud; but my most remarkable trial took place on September 19, 1900, in the presence of the International Congress of Aëronauts. Although an accident to the rudder prevented my making a free ascension, I held my own against the wind, and gave a clear proof of the effective working of an aërial propeller, driven by a petroleum motor. I then resolved to double the power of my motor, by adopting the four-cylinder type, but always without the water-jacket—which had just been invented. On account of this increase in weight, I was obliged to lengthen

my balloon 3 meters (10 feet). The Aërodrome itself then became 10 feet too short; and so I added to it and prepared a lodging for the ‘‘Santos-Dumont No. 5,’’ which I was to build in the beginning of 1901.

Inside the Aërodrome, with a velocity of 140 turns per minute, the propeller furnished a traction-power of 55 kilos (121 pounds). It worked so well that I contracted a severe cold in its current of cold air.

To get rid of this I went to the Riviera, where I constructed the keel of the ‘‘Santos-Dumont No. 5’’—a very light and rigid framework measuring 18 meters (60 feet) in length, and weighing but 50 kilos (110 pounds). It was—as it remains—a combination of curved pine scantlings, held together by aluminium joints, with cross-pieces of wood, and consolidated by a web of steel wires. The cross-section of the keel is an isosceles triangle, 1 meter ($3\frac{3}{10}$ feet) high, and 80 centimeters (2 feet, 7 inches) at the base. At its rear was attached the propeller, driven by a 16-horse-power motor. The shaft was of hollow steel. The whole was suspended, attached by steel wires, in the axis of the framework, like a spider in the midst of its web. The rudder was in the rear again, while the guide-rope hung from the front of the keel.

When I had finished its construction, in April, 1901, the Scientific Commission of the Deutsch Prize encouraged me

to continue my experiments by awarding me, for my labors of 1900, the interest on the 100,000 francs, which had not been won by any one during the preceding year. To encourage other experimenters, I left this sum (4,000 francs) at the disposition of the Aëro Club, to found a new prize. I made its conditions very simple:

‘‘The Santos-Dumont prize shall be awarded to the aëronaut, a member of the Aëro Club, who, between May 1 and October 1, 1901, starting from the Parc d’Aërostation of Saint-Cloud, shall turn round the Eiffel Tower and come back to the starting-point, at the end of whatsoever time, but without touching ground, and without other agency than the motive power carried on board the balloon.

‘‘If the Santos-Dumont prize is not won in 1901, it shall remain open for the following year—and so on, until the problem is solved.’’

I did not wish to complicate such a trial. I was sure that even under the most favorable conditions, it would be a great deal to come back to the starting-point after having reached a post determined in advance—an exploit, indeed, unheard of before 1901.

The conditions also left the competitors free to choose the state of the air most favorable to them.

The Aëro Club signified its approval by deciding to give its highest reward to the one who should win the prize I had

founded. Since then the 4,000 francs have remained in the treasury of the club; one competitor only has been entered; and he has not tried to fulfill the conditions.

As I had excluded myself from trying for my own prize, I wished at least to show that these were possible. This I did for the first time, July 13, 1901, after a practice-flight the day before. At 4.30 p.m. I had my air-ship brought to the Longchamps race-course. I did not take time to ask permission from the Jockey Club which, however, a few days later, placed this admirable open space at my disposition for future trials. Ten times in succession I made the circuit of Longchamps, stopping each time at a point which I had designated beforehand. After these first evolutions, which altogether made up a distance of about 35 kilometers (22 miles), I set out for Puteaux; and, after an excursion of some 3 kilometers, done in nine minutes, I came back again to Longchamps.

A Luncheon in the Tree Tops

I was now so satisfied with the results that I began looking for the Eiffel Tower. It had disappeared in the mists of the morning; but its direction was fairly known to me, and I steered toward it as well as I could. In ten minutes I had come to within 200 meters ($\frac{1}{8}$ mile) of the Champ de Mars. There one of the cords managing my rudder broke; and I was

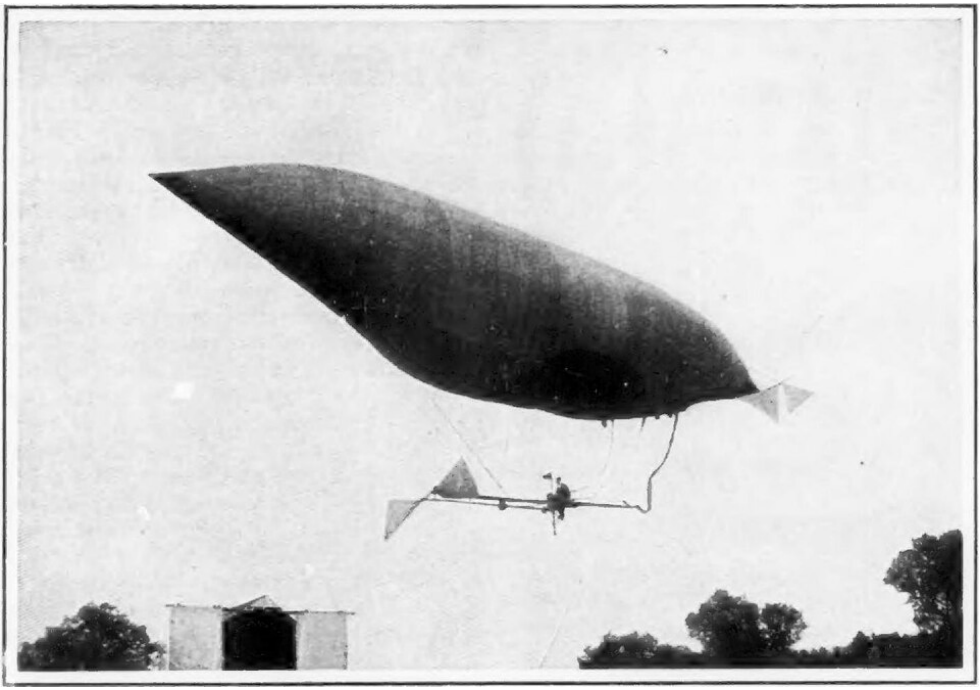
obliged to navigate diagonally downward and land in the Trocadero Gardens. A ladder was brought to me; and a few men at my request held it upright. I climbed up to its highest round and repaired the damage. Then I started off again, turned hastily round the Eiffel Tower, and came back to Longchamps after a trip, which, including the stop, had lasted one hour and six minutes. After a few minutes rest, I took a flight over to my Aërodrome, crossed the Seine at an altitude of 200 meters, and brought back my air-ship to its habitation.

The next day, July 13th, in presence of the committee, which had been regularly convoked, I set out at 6.41 A.M. I turned round the Eiffel Tower in the tenth minute, and came back against a head-wind to the Parc d'Aërostation, which I reached at the fortieth minute at an altitude of 200 meters, after a terrific struggle with the element. Just at this moment my capricious motor stopped and the air-ship drifted until it fell, with comparatively little damage and without the least scratch to myself, on the tallest chestnut tree in the park of M. Edmond de Rothschild. This was near the *hotel* of Princesse Ysabel, Comtesse d'Eu, who sent up to me in my tree a champagne lunch, with an invitation to come and tell her the story of my trip.

When my story was over, she said to me: ''Your evolutions in the air made me think of the flight of our great birds of Brazil. I hope that you will succeed for the glory of our common country.''

The First Serious Mishap

And now I come to a terrible day—August 8, 1901. At 6.30 a.m., I started for the Eiffel Tower again, in the presence of the committee, duly convoked. I turned the goal at the end of nine minutes, and took my way back to Saint-Cloud; but my balloon was losing hydrogen through the automatic valves, the spring of which had been accidentally weakened; and it shrank visibly. All at once, while over the fortifications of Paris, near La Muette, the screw-propeller touched and cutthe suspension-cords, which were sagging behind. I was obliged to stop the motor instantly; and at once I saw my air-ship drift straight back to the Eiffel Tower. I had no means of avoiding the terrible danger, except to wreck myself on the roofs of the Trocadero quarter. Without hesitation I opened the manœuver-valve, and sent my balloon downward.



SANTOS-DUMONT NO. 4

At 32 meters (106 feet) above the ground, and with the noise of an explosion, it struck the roof of the Trocadero Hotels. The balloon-envelope was torn to rags, and fell into the courtyard of the hotels, while I remained hanging 15 meters (50 feet) above the ground in my wicker basket, which had been turned almost over, but was supported by the keel. The keel of the ‘‘Santos-Dumont No. 5’’ saved my life that day.

After some minutes a rope was thrown down to me; and helping myself with feet and hands up the wall (the few narrow windows of which were grated like those of a prison), I was hauled up to the roof. The firemen from Passy had watched the fall of the air-ship from their Observatory.

They, too, hastened to the rescue. It was impossible to disengage the remains of the balloon-envelope and suspension apparatus except in strips and pieces.

My escape was narrow; but it was not from the particular danger always present to my mind during this period of my experiments. The position of the Eiffel Tower as a central landmark, visible to everybody from considerable distances, makes it a unique winning-post for an aërial race. Yet this does not alter the other fact that the feat of rounding the Eiffel Tower possesses a unique element of danger. What I feared when on the ground—I had no time to fear while in the air—was that, by some mistake of steering, or by the influence of some side-wind, I might be dashed against the Tower. The impact would burst my balloon, and I should fall to the ground like a stone. Though I never seek to fly at a great height—on the contrary, I hold the record for low altitude in a free balloon,—in passing over Paris I must necessarily move above all its chimney-pots and steeples. The Eiffel Tower was my one danger—yet it was my winning-post!

But in the air I have no time to fear. I have always kept a cool head. Alone in the air-ship, I am always very busy. I must not let go the rudder for a single instant. Then there is the strong joy of commanding. What does it feel like to sail in a dirigible balloon? While the wind was carrying me back to the Eiffel Tower, I realized that I might be killed; but I did not fee! fear. I was in no personal inconvenience. I knew my

resources. I was excessively occupied. I have felt fear while in the air, yes, miserable fear joined to pain; but never in a dirigible balloon. The remembrance of it sometimes haunts me in my dreams.

A Terrible Experience at Nice

It was at Nice, in 1900, when I went up from the Place Massena in a spherical balloon on a mere pleasure-trip. The weather was nice; but the barometer was low, which meant storm. I went in the direction of Cimiez for a time; but the wind threatened to carry me out to sea and I threw out ballast, rising to the height of about a mile. Shortly after this I let the balloon go down again, hoping to find a safer air-current. When within 300 yards of the ground, however, near the Var, I noticed that the balloon had ceased descending. As I had determined to land in any case, I opened the valve and let out some more gas. And here the terrible experience began.

The barometer assured me that I was going up, while I felt—by the wind and everything—that I was going down, as I ought to be, because I had let out gas. To my great uneasiness I presently discovered what was wrong. I was being lifted by an enormous column of air rushing upward. I opened the valve again: the balloon was surely having a great fall through the column; still the barometer showed that I had attained a higheraltitudeabovetheground, and I

co
uld
no
w
tak
e

THE FALL INTO THE COURTYARD OF THE TROCADERO HOTELS.
SANTOS-DUMONT NO. 5

account of it by the way the land was disappearing under me. I now closed the valve to save my gas and waited to see what would happen.

The upward-moving column of air continued to lift me to a height of 3,000 meters (almost 2 miles). At last the balloon stopped rising; and soon the barometer showed that the balloon was descending toward the earth. When I began to see land, I threw out ballast, not to come down too quickly. I could now perceive the storm beating the trees and shrubbery; up in the storm itself I had felt nothing. Carried along at a terrific rate, knocking against the tops of trees, and continually threatened with a painful death, I threw out my anchor. It caught in trees and shrubs and broke away. The basket itself caught and broke away. Had it been in heavy timber, it would have been all over with me. As it was, I was dragged through the small trees and yielding shrubbery, my face amass of cuts and bruises, my clothes torn from my back, in pain and strain, fearing the worst and able to do so little to save myself. Just as I had given myself up for lost, the guide-rope wound itself round a tree and held. I was precipitated from the basket and fell to the ground unconscious. When I came to, some peasants were standing there looking at me. They helped me back to Nice, where I went to bed and had the doctors sew me up.

SANTOS-DUMONT NO.6

When I fell to the roofs of the Trocadero Hotels, the danger was as real, but I had none of these emotions. Seeing that I must fall, I had chosen my spot—the Gardens of the Trocadero—and I was busily engaged in my attempt to fall as gently as possible upon it.

On the very evening of the catastrophe I gave the order for a ‘‘Santos-Dumont No. 6,’’ and in twenty-two days it was finished and inflated. The new balloon had the shape of an elongated ellipsoid, 32 meters(105 feet) on its great axis, and 6 meters (20 feet) on its short axis, terminated fore and aft by cones. Its capacity was 605 cubic meters (21,362 cubic feet), giving it a lifting-power of 620 kilos (1,362 pounds). Of this, 1,100 pounds were represented by keel, machinery, and my own weight, leaving a net lifting-power of 120 kilos (261 pounds). I eliminated every pound of this with ballast, so that while the system belongs to the category of aërial machines lighter than the air (because it can be made to rise by throwing out ballast), it at the same time resembles flying-machines heavier than the air (because it is regularly raised by its propeller, and descends as soon as its propeller stops). The propeller was moved by an 18-horse-power Buchet motor, cooled automatically by the circulation of water round its cylinders. This arrangement would permit me to utilize, without fear of over-heating or jamming *en route*, the full power of the motor, which communicated to the propeller (when the bow of the balloon was pointed upward) an added ascensional force of 30 kilos (66 pounds).

Among the peculiarities of the air-ships which I built in 1901, were the steel piano wires $\frac{8}{10}$ of a millimeter in diameter, to sustain the keel. Possessed of a high coëfficient of rupture and slight surface, they advantageouslyreplace the hempen cords of all previous dirigible balloons. The

resistance of such cords to movement through the air might be compared to the resistance of the balloon-envelope itself.

For the first time, also, I made use of liquid ballast—two brass reservoirs, very thin and holding together 54 liters (60 quarts), placed between the motor and propeller, and provided with two spigots, which can be opened or closed from my basket by means of two steel wires.

Inside the balloon, sewed to the middle of the lower part of its envelope, was an air-balloon holding 60 cubic meters (2,118 cubic feet), fed with air by an aluminium ventilator. This air-balloon had a valve underneath opening into the balloon, while the balloon proper had two such valves communicating with the outer air. These valves were automatic, opening outward from within under pressure from either the air or the hydrogen, as the case might be. Their springs were regulated so that the valves of the air-balloon always opened first, to allow the air in it to escape, while the valves of the balloon could lose their hydrogen only afterward, if the pressure demanded it.

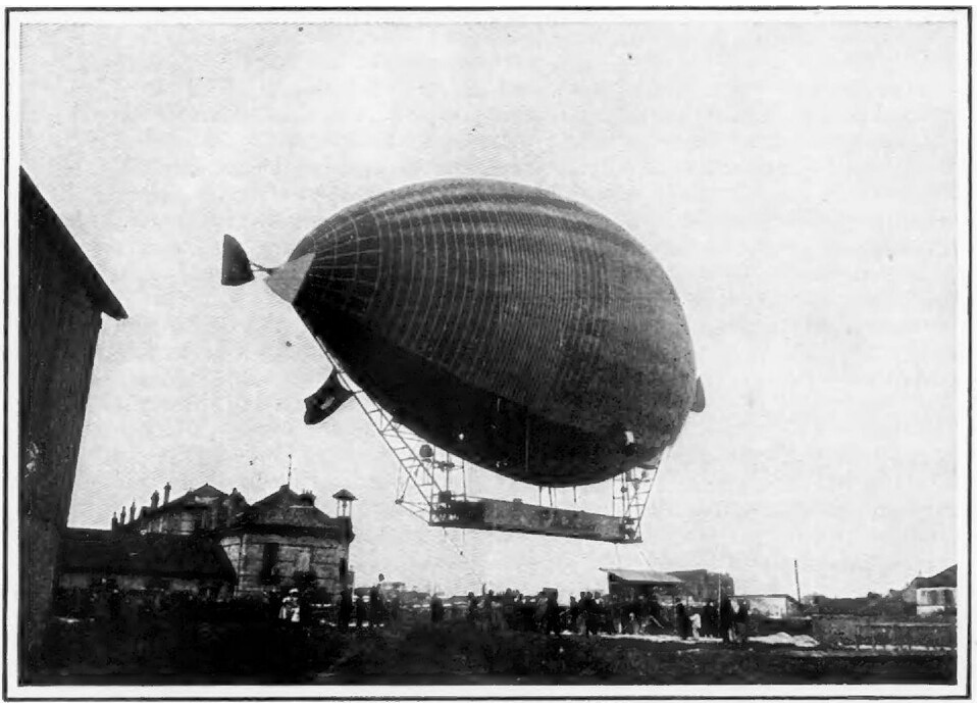
Dumont's Theory of Severo's Fall

One of the hypotheses to account for the terrible accident to the unhappy Severo's dirigible ''Pax,''[1] is concerned with this very delicate problem of valves. I have three valves, including the manœuver-valve; the ''Pax'' as originally

constructed by M. Lachambre, had two. M. Severo, who was a theoretical but certainly not a practical aëronaut, actually stopped up one of these valves with wax before starting on his first and last voyage. In view of the decreasing pressure of the air as one goes higher, the ascent of a dirigible balloon should always be slow; gas will expand on the rise of a few yards. It is quite different from a spherical balloon in which there is no pressure. A dirigible, whose envelope is held as tight as a drum-head, depends entirely on these valves not to burst by reason of mere gas-expansion. With one of its valves stopped with wax, the ‘‘Pax’’ was allowed to shoot up from the earth; and immediately its occupants seem to have lost their heads. Instead of checking the rise of the balloon, one or other of them threw out ballast. Think of it—a handful of sand will send a great spherical balloon up perceptibly. Severo’s mechanician, in his excitement, is said to have thrown out a whole bag. Up shot the air-ship higher and higher—and the expansion, the explosion, and the awful fall, came as the consequence.

On September 6, 1901, a series of successful evolutions over Longchamps were ended by an accident of my own. The balloon was reinflated by September 15th; and four days later it crashed against a tree. Such slight accidents I have always regarded as, in a way, a kind of insurance against more terrible ones. Were I to give a single word of caution to all dirigible balloonists, it would be: ‘‘Keep close to earth!’’ The place of the air-ship is not in high altitudes.

On October 19, 1901, I was prepared to make another trial—which this time proved successful. The day before, I sent out the necessary telegrams convoking the Committee, but at 2 p.m., the hour announced for the trial, the atmospheric conditions were so unfavorable that, of the twenty-five members, only five were present. A southeast wind was blowing at at a speed of 6 meters (20 feet) per second, at the altitude of the Eiffel Tower. My first air-ship, in 1898, developed *au point fixe* the promise of a speed of 8 meters (26 feet) per second. I therefore was now setting out to win a difficult race against a time limit, in a wind blowing almost as fast as the highest theoretical speed that I had hoped to realize with my first air-ship.



SEVERO'S BALLOON, THE ''PAX,'' WHICH, ON ITS FIRST ASCENT AT A HEIGHT OF ABOUT 2,000 FEET, BURST AND EXPLODED, SENDING TO A TERRIBLE DEATH BOTH M. SEVERO AND HIS ASSISTANT

Winning the Great Prize

The official start took place at 2.42 p.m. In spite of the side-wind, I held my course straight to the goal. I gradually drove the air-ship horizontally upward, to a height of about 15 meters (50 feet) above the flag on the summit of the Eiffel Tower. As I passed it, I turned, bringing the air-ship round the lightning-conductor at a distance of about 50 meters (165 feet). The Tower was thus turned at 2.51 P.M.—the distance of $5\frac{1}{2}$ kilometers ($3\frac{2}{5}$ miles) having been covered in nine minutes. The return trip was almost directly in the teeth of the wind. During the trip to the Tower, also, the motor had worked fairly well; but a petroleum motor of lightconstruction is adelicate and capricious machine. Five hundred meters ($\frac{1}{3}$ mile) from the Eiffel Tower, it was actually on the point of stopping, and I had a moment of terrible uncertainty. If the motor stopped the air-ship would undoubtedly be dashed against the Tower. I had to make a quick decision—it was to abandon the steering-wheel for a moment, at the risk of drifting from my course, to devote my attention to the lever controlling the electric spark. The

motor began to work again. A second's hesitation might have cost me my life.

Just above the fortifications of Paris, the motor almost failed again. Again I had to devote myself to keeping it in motion. The screw almost came to a stop; and the air-ship, a trifle heavier than the air, was rapidly falling. Up to this moment I had not used my ballast. Now I threw out enough sand to reëstablish my equilibrium. The balloon, buffeted by the wind, advanced with difficulty. From time to time a pitching movement must have been visibie to those below. Some day I may be able to correct such pitching by means of a horizontal rudder; it is due to the irregular motion of the petroleum motor. Were the electric motor possible, it would be altogether avoided.

Suddenly the sound of cheering came faintly up to me. It was the applause of the multitude on the Auteuil race-track. The Prix Fin-Picard had just been run, and preparations for the next race were being made. For a moment I looked down on the scene, from my altitude of 80 meters (264 feet). A few minutes later I arrived above Longchamps, crossed the Seine, and passed on at full speed over the heads of the Committee and spectators and around the Saint-Cloud Aërodrome. It was then 11 minutes, 30 seconds past 3 o'clock, making the actual time exactly 29 minutes, 31 seconds. The air-ship, carried by its impetus, passed on across the line like a yacht or a race-horse. I turned and drove myself back to the Aërodrome, to have my guide-rope

caught and be drawn down at 12 minutes, 40$\frac{3}{5}$ seconds past 3 o'clock, 30 minutes, 40 seconds from the start.

I had now won the Deutsch Prize, and winter was approaching. From my friend, the Duc de Dino, and his charming American wife, I had received an invitation to their Monte Carlo villa; while from the Prince of Monaco assurances were sent me that the Prince, himself a man of science, would be pleased to build me a balloon-house directly on the beach of the Condamine, from where I might continue my experiments throughout the winter over the Mediterranean.

Monte Carlo

The story of these experiments has been already told in McCLURE'S MAGAZINE.[2] I will, therefore, add here only a few observations touching on the accident which caused me once again deliberately to wreck my air-ship.

As Mr. Heilig has written,[2] the "Santos-Dumont No. 6" left the Aërodrome of the Condamine at 2.30 p.m. of February 14, 1902, imperfectly inflated and imperfectly ballasted. The experimenter with dirigible balloons must be continually on his guard against the little errors and neglects of his aids. I have four men who have been with me three years; they are now, in their way, experts, and I have every

confidence in them. Yet this thing happened. Imagine, then, what might be the dangers with a set of inexperienced subordinates.

In spite of their simplicity, my air-ships require constant surveillance on a few capital heads. Is the balloon properly filled? Is there possibility of a leak? Is the rigging in condition? Is the motor in condition? Do the cords commanding rudder, motor, water-ballast, and the shifting weights work freely? Is the ballast properly balanced? Looked on as a mere machine, the air-ship requires no more care than an automobile; but, from the point of view of consequences, the need of faithful and intelligent surveillance is simply imperious.

In the first years of my experiments I insisted on doing everything for myself. I ‘‘groomed‘‘ my balloons with my own hands. My present aids understand my present air-ships. Yet were I to begin experiments with a new type, I should have to train them all anew.

The air-ship left the Aërodrome imperfectly balanced, because there was no space outside in which to send it up and ascertain if its ballast were properly distributed. As a consequence, I perceived when over the bay that the whole system was too heavy behind. Thus, the push of the propeller sent the air-ship obliquely upward. It had been cool inside the shaded Aërodrome. Outside the direct rays of the sun immediately expanded the hydrogen. The balloon being

imperfectly filled, the gas in its upward-pointing end became heated first, causing an upward rush of still more hydrogen and further exaggerating the inclination. That nothing should be lacking, the effect of all this was to react powerfully on the center of gravity of the whole system: ordinarily the keel is held rigidly parallel with the balloon, by piano wires tightly stretched; but now the strain of the inclined position, already an angle of almost forty-five degrees, dragged the keel downward and backward until the balloon's nose pointed almost vertically to the zenith.

The rigging sagged behind; it caught in the propeller; then the guide-rope caught. I did not dare to stop the propeller, because the strong wind would have dashed me against the houses of Monte Carlo. Yet the propeller was tearing the rigging. There was nothing to do but to pull open the manœuver-valve, let out a quantity of gas, and come down gradually into the water.

Dangers and Difficulties

I have often been asked what present utility is to be expected of the dirigible balloon when it becomes thoroughly practicable. I have never pretended that its commercial possibilities could go far. The question of the air-ship in war, however, is otherwise. Mr. Hiram Maxim has declared that a flying machine in South Africa would have been worth four times its weight in gold. Henri Rochefort has said: ‘‘The day

when it is established that a man can direct an air-ship in a given direction and cause it to manœuver as he wills. . . there will remain little for the nations to do but to lay down their arms.’’

Experience with spherical war balloons in South Africa has shown that they may be shot at and pierced with bullets without other effect than to let out gas very slowly. It must be admitted that the case is not quite the same with dirigibles. The spherical balloon is under no pressure; the dirigible balloon is held tight as a drum-head by the interior pressure. It is therefore possible that a bullet, penetrating it, might cause an explosion. We must wait and see. War-ships on the high seas when struck at the waterline sink with all hands on board; yet this does not prevent the nations from building them.

The danger from storms is likewise shared with the ship at sea. When I experimented with my earlier, smaller air-ships, I knew there was danger of being blown away or dashed against buildings by a sudden storm. The danger is not so great now that my air-ships are larger and more powerful; and when the great ones of the future find themselves in storms, they will do what ships at sea have always done, either hold head against the wind, or else run with it. But it will never be possible to land in a storm.

One of my greatest dangers passed unperceived at the time either by myself or any one else. It was while they were

rescuing me over the Bay of Monaco. The air-ship was only a few feet above the smoke-stack of

the steam chaloupe engaged in towing me. Now the smoke-stack was belching hot black smoke and red-hot sparks, any one of which might have set fire to my escaping hydrogen and blown my balloon and me to atoms.

As to the danger of suspending a properly working petroleum motor beneath a balloon filled with hydrogen gas, everything depends upon how it is done. There is no danger from illuminating gas in houses, although danger was predicted at the beginning by the scientific men of England and America. I do not fear fire while in the air so long as my motor works properly. Yet it is true that once in a long while an automobile blows up. When this happens on the highway the consequences are not necessarily serious; but I confess that such an explosion of a petroleum reservoir in the air would be a different thing. This, however, is a different risk from that of setting fire to the balloon's hydrogen; that is so remote that I do not consider it.

Poor Severo is dead, as is the unfortunate mechanician who accompanied him; and I would not say a word of unkind criticism of a man who has given up his life in aërial experimentation. Yet in the interest of others who may be tempted to follow his example I can only say that it is folly for any one to attempt unprepared these ascensions. The plan of M. Severo's air-ship invited disaster. The flame-spitting motor was only about three feet from the envelope.[3] In my

air-ship it is at least sixteen feet below the balloon and far to the rear—a total distance of perhaps fifty feet from possible chances of gas ignition. The moment the gas escaped from M. Severo's balloon, however, it caught fire. M. Lachambre, the balloon constructor, saw the catastrophe. He has told me that the ''Pax'' shot up with great rapidity, that the gas must have expanded greatly, that there was a detonation, a sheet of fire, and instantly the balloon was in flames; the next second the whole thing came crashing down to earth.

The cause of aërial navigation is injured by such accidents. There have been moments when I have known that, were I to lose my head for an instant, were my skill to fail me for a second, I too should be lost. But we might as well say that because men have gone to their deaths in unsafe vessels, a Columbus should not be encouraged to sail out upon unknown seas.

1. ↑ In the early morning of May 12, 1902, M. Augusto Severo, a Brazilian like M. Santos-Dumont, accompanied by his mechanician, Sachet, started from Paris on a first trial trip with the dirigible ''Pax,'' the invention and construction of M. Severo. The ''Pax'' rose at once to a height almost double that of the Eiffel Tower, when, for reasons unknown, it exploded and came crashing down with its two passengers. The fall took eight seconds to accomplish, and the luckless passengers were picked up shapeless and broken masses.—EDITOR.

2. ↑ 2.0 2.1 McClure's Magazine for July, 1902
3. ↑ The Scientific Committee of the Aëro Club of Paris, in its meeting of May 26, 1902, after a long discussion of the ‘‘Pax‘‘ disaster, decided that the explosion was due to the proximity of the motor to the escape valve of the balloon, and that, under such conditions, the Committee would never have admitted M. Severo to the Aëro Club’s competitions.

This work is in the **public domain** in the **United States** because it was published in 1902, before the cutoff of January 1, 1930.

The longest-living author of this work died in 1932, so this work is in the **public domain** in countries and areas where the copyright term is the author's **life plus 92 years or less**. This work may be in the **public domain** in countries and areas with longer native copyright terms that apply the **rule of the shorter term** to *foreign works*.

About this digital edition

This e-book comes from the online library Wikisource. This multilingual digital library, built by volunteers, is committed to developing a free accessible collection of publications of every kind: novels, poems, magazines, letters...

We distribute our books for free, starting from works not copyrighted or published under a free license. You are free to use our e-books for any purpose (including commercial exploitation), under the terms of the Creative Commons Attribution-ShareAlike 4.0 Unported license or, at your choice, those of the GNU FDL.

Wikisource is constantly looking for new members. During the transcription and proofreading of this book, it's possible that we made some errors. You can report them at this page.

The following users contributed to this book:

- Erick Soares3
- ShakespeareFan00
- GiFontenelle
- Jarekt
- Rocket000
- Dbenbenn
- Zscout370

- Jacobolus
- Indolences
- Technion
- Dha
- Abigor
- Reisio
- Blurpeace
- Dschwen
- Steinsplitter
- Boris23
- KABALINI
- Bromskloss
- Tene~commonswiki
- AzaToth
- Bender235
- PatríciaR