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THE PROGRESS OF AERONAUTICS.[1]

[Address of M. Janssen, president of the International Aeronautic Congress at the opening of the congress, September 15, 1900, at the Observatory of Meudon, near Paris.]

GENTLEMEN: First of all I must thank you for the great honor that you have just done me in calling me for the second time to preside at this congress. I feel it keenly and shall use my best endeavors to justify your choice.

I shall certainly be the interpreter of your sentiments in thanking the members of the committee on organization for the zeal and talent put forth by them in the arrangements for this congress, which unites in its bosom not only members of every nation and embraces the most diverse branches of aeronautics, but includes also elements of the civil and military order. I will affirm that, thanks to the elevation of intellect and of sentiments which has been shown on all hands, everything has been successfully and perfectly coordinated. This congress will certainly contribute to join in one spirit of progress and of confraternity two elements so important and so necessary to the greatness of nations.

I address the thanks of the committee on organization to our foreign colleagues who have responded with such warmth and amiability to our invitation. They have made us most happy and most proud, and we can assure them that no effort shall be spared to render their visit fruitful and agreeable. It is to be hoped that our foreign colleagues will, upon the occasion of this congress, knit ties of friendship that will not be loosed at its dissolution; for one of the fruits, perhaps the most important of the fruits, of reunions of this kind is the establishment of personal relations between men, no doubt already acquainted with one another's works and appreciative of them, but who nevertheless have never had an opportunity to see one another and to talk over the subjects of their studies.

The mind of a writer is not entirely expressed in his works. Often the best fruit of his meditations and labors is something of which he is not himself aware and which he can not record. A lively and friendly talk with a fellow-student who has followed the same career will bring these treasures up from their depths, and out of this spring new ideas, new points of view; nay, new subjects for study, enlarging and clearing the intellectual horizon.

[1] Translated from Annuaire du bureau des longitudes pour 1901. Printed also in Revue Scientifique, September 29, 1900.

Let us add that a mutual enjoyment and a durable friendship almost invariably spring from such encounters. I do not doubt that the present congress will bring a rich harvest of these excellent fruits.

Let us now glance rapidly at the most important items of progress in aeronautics since the last congress held its meeting in Paris in 1889. The progress has been great in all directions. New and highly important subjects of study have been opened up, so that this review will necessarily be extremely incomplete, and I must beg our colleagues to pardon me some omissions which circumstances force me to make, as well as some references that will be far more summary than I would like to have them.

The siege of Paris in 1870 attracted renewed attention to the employment of balloons and of carrier pigeons in war, matters which had been laid aside in France since the First Empire. America had been about the only power which before 1870 had considered military aerostation.

The Government of the Republic soon seriously took up the creation of special military services in aerostation and in peristerophily ("colombophilie"). For this purpose the fine central institution of Chalais was founded and organized, and rapidly got systematically to work. The duty of this institution is not merely to prepare the instruments and to instruct the persons which are to be employed for the aeronautic service of our armies and military stations, but, further, to investigate all the improvements of which those engines and services are susceptible, and even to undertake studies which promise to conduct to new inventions and discoveries in the field of aerial navigation.

The majority of the other nations of the Continent very soon followed the example set by France in this respect, and indeed it must be admitted that several of them improved upon their model, either in regard to the material or in that of the mode of using it. To-day these services have acquired great importance in those nations. It even happens in Germany and Russia that the aeronautic service of war often comes to the aid of civil aerostation by lending balloons for experiments of scientific interest. Aerostation and aeronautics will therefore have no insignificant part in future wars. But already the war of the rebellion in America and, quite recently, that of the Transvaal have shown us to what advantages skillful generals can turn a well-conducted aerostatic service. Indeed, if we reflect upon the ceaseless increments in the numbers of armies, in the range of the arms, whether of artillery or of infantry, we shall readily foresee a corresponding enlargement of the theaters of war, and this, in its turn, will render indispensable both balloon reconnoissances and also more and more powerful optical instruments; nor must we forget the important service of the balloon in directing the fire of artillery.

Nevertheless, great as has been the progress which the services of military reconnoissances by aerostation have accomplished in the hands

of the skillful officers who have been charged by their governments with the creation and functioning of these services, it must be confessed that important desiderata still remain. Thus it is possible now to get away from a besieged place almost without risk, but to get in again is quite another thing, for this second problem depends upon the famous one of steering a balloon, a problem which began to be solved in 1886 at Chalais-Meudon, but of which the complete solution is still in futuro.

Since 1889 this great question, how to steer a balloon, has been continually agitated. Yet we must confess that while highly interesting essays have been made, which merit all our sympathy, no decisive step has been taken. In Berlin two overbold experiments have resulted tragically. Yet experimenters have not been discouraged. M. Santo-Dumont is even now preparing to contest the prize of 100,000 francs that M. Henry Deutsch has founded at the Aero Club; and Count Zeppelin is making a new and grand attempt on the Lake of Constance with a partitioned balloon 117 meters long, moved by two petroleum engines acting on four screws.

But though the steering of balloons is the first and most important problem, yet it must not be forgotten that it is likewise of very high interest to perfect aeronautics, whether in the direction of rising to a great height, or of remaining aloft as long as possible, or of going to a point named in advance. For, aside from the immediate end pursued, these ascensions lead to improvement in the instruments and methods of aerial navigation. As examples, may be mentioned the remarkable voyage of Count de Castillon de St. Victor from Paris to Sweden, in which the balloon traveled more than 800 miles (1,300 kilometers), and that of the Count de la Vaulx, who succeeded in keeping his aerostat aloft for more than thirty hours without landing. Again, we may instance the voyage of M. Mallet, who, with the same balloon, made in a week the tour of France, landing each day. In the matter of height, the prize, or, to use the language of sport, the record belongs to Mr. Berson, attached to the Meteorological Institute of Berlin, who several times rose to 26,000 feet (8,000 meters) and once as high as 30,000 feet (9,150 meters), which is higher than the highest summits of the Himalayas. It is noteworthy that it was by the system of inhaling oxygen, which had already been tried in France, that Mr. Berson was enabled to bear the rarification of the air at such extraordinary heights.

Scientific ascensions have been much practiced in Germany, being stimulated by the Berlin Aerial Navigation Society and by the liberality of the Emperor. During the last five years no fewer than seventy-five such ascensions have been made, and the results have been discussed in the recent great work of Messrs. Asmann and Berson.

The heights attained by these balloons carrying observers are, however, necessarily limited. Even with the judicious use of oxygen, the

observer has to contend with the lack of pressure of the air, which causes an expansion of all the gases contained in his body, and, notwithstanding the respiratory reparation by oxygen, the expansion may kill the man. Other means must therefore be employed to carry the investigations of science to much greater altitudes. Since the 1889 congress, the plan of Le Monnier has been realized of sending up balloons by themselves with self-registering apparatus. Here, too, there is a limit to the attainable height, but it is much greater than that of balloons carrying men. We owe to Lieutenant-Colonel Renard excellent studies and advice for constructing and managing such balloons and to Messrs. Hermite and Besançon their first employment in France. The success of these first trials and of the studies made by means of them, especially by Messrs. Violle and Cailletet, was such as to lead to the appointment of an international commission representing almost every European nation, and this commission is now holding a meeting in Paris under the presidency of Mr. Hergesel. It is easy to see that these aerial soundings, if one may call them so, become infinitely more interesting when they are made simultaneously from stations throughout a region of the earth.

But balloons are now no longer the only instruments employed for meteorological researches. The highly ingenious plan of using kites is also put into practice. These little instruments, which in China and in ancient India were accessories of public spectacles, have become, in the hands of our meteorologist, in imitation of Franklin, serious scientific apparatus. We have lately been informed that Mr. Rotch, a highly distinguished American meteorologist, has succeeded in flying one of these apparatus carrying his self-registers to a height of 15,800 feet (4,815 meters), little short of that of Mont Blanc. M. Teisserenc de Bort, our devoted colleague, who has kindly consented to give a lecture to the congress, has founded out of his contributions at Trappes, not far from the old house of Port Royal, an exceedingly interesting observatory, where meteorology is studied by widely various means, and where kites are likewise employed. One of them has lately risen to 16,900 feet (5,150 meters). In Berlin, too, at the Meteorological Institute, a new service has been instituted in which kites, both alone and combined with a balloon, are employed for the observation of atmospheric phenomena.

It was natural that balloons, which are only rendered possible by the atmosphere, should at first be used for the study of the atmosphere. But now they begin to look higher, and the heavens will confer upon them a new and honorable office. For while there are astronomical investigations which require great instruments of the utmost stability, there is another class of phenomena which only need to be noted as taking place. Of this number are, for example, the apparitions of comets, shooting stars, and eclipses. This extremely interesting

application of the balloon dates from an earlier period; but it had long been neglected. I was always struck with its importance; and in 1898, when the Leonid shower was expected, M. Hausky made an ascension under my direction, and obtained interesting results. Last year, at my request, these observations were repeated in Paris by Mlle. Klumpke and by Messrs. Tikhoff, the Count de la Vaulx, Mallet, and de Fonvielle. Ascensions were also made at St. Petersburg, at Strassburg, and in England for the same purpose. The Leonid shower of next November will have a quite special interest. I hope it will not pass unobserved.

I can not close this recapitulation without at least referring to work in the direction of machines to be sustained and propelled exclusively by forces which they produce. The most remarkable results obtained in this direction are unquestionably those of Mr. Langley, correspondent of the Institute of France and Secretary of the Smithsonian Institution at Washington. Independently of the fine and profound researches of this scientist upon the resistance of the air, Mr. Langley has constructed an aeroplane which has progressed and has sustained itself during a time notably longer than any of the apparatus previously constructed. Dr. Richet has repeated and varied these fine experiments on the shore of the Mediterranean. Time is wanting to speak of other work upon aeroplanes, but it is impossible not to mention the endeavors of M. Ader to construct a flying bird, or not to recall the cruel accident which caused the death of a scientist of great merit. I need not tell you that I refer to the unfortunate Lilienthal, whose works on the properties of curved surfaces in aeronautics will not allow the world to forget his name.

While we are speaking of the dead, permit me to devote a word in memory of the scientists and aeronauts whom we have lost: Eugène Godard, the elder, an experienced aeronaut, the constructor of the balloons of the siege at the railway stations of Orleans and of the East, whom I personally have cause to remember with gratitude for the excellent counsels he gave me at the moment of my departure from Paris, December 2, 1870, with the balloon Volta; Hureau de Villeneuve, founder of the journal L'Aéronaute and one of the founders of the Society for Aerial Navigation; Gaston Tissandier, too, patriotic aeronaut of the army of the Loire, the witness to the terrible drama of the Zenith; the author, with his brother Albert, of experiments upon using electricity to steer balloons, and founder, also, with Albert, of the interesting journal La Nature. And still I have to mention Coxwell, the aeronaut of Mr. Glaisher, whose noble and green old age we salute to day.

Such, gentlemen, is the picture, necessarily very incomplete, of the state of aeronautics at this moment. Is it not, however, sufficient to show how remarkable has been the progress accomplished in the decennial period it covers?

It must, however, be confessed that aeronautics has not, generally speaking, been endowed and encouraged by the powers that be as it should have been in order to attract to it all the varied orders of capability which it demands and to furnish the resources necessary for its researches and indispensable for its experiments. Let us not deceive ourselves. Some nation will have the wisdom to make a great advance in this direction, and will thereby acquire a power and advantages of which the results can not to-day be foreseen. Thus, in the ancient world certain great minds felt beforehand the vast importance of the part which the liquid element was destined to play in the relations between peoples. Themistocles said, "He who shall make himself master of the sea is destined to become master of the land." This flash of genius, true already even then, has by this time attained such a degree of truth as to be obvious. What supremacy has not our neighbor been able to gain from her fleets, which dominate the seas which are tied round the continents, and which are mistresses of almost all the telegraphic connections of the globe? Now, if the ocean has given this power to the nation that has been wise enough to seize it, what will be the power of the coming mistress of the atmosphere? The sea has its limits and its frontiers; the atmosphere knows no such thing. The sea offers a mere surface to the navigator; the aeronaut can profit by the whole depth of the atmosphere. The sea severs the continents; the air unites everything and dominates everything. [That the sea separates, while the air unites, is a proposition the sense of which may easily escape the reader. The sea renders it difficult to pass, for example, between an island and the mainland, and a number of vessels sailing round and round the island could cut off any attempt to make the passage. Through the air, on the other hand, there will always be a path from any one point on the earth's surface to any other, and no matter how vigilant a patrol were instituted there would be plenty of room to pass with impunity.] When that mistress, whatever nation she may be, accedes, in what sense will the frontiers between one State and another any longer exist, while aerial fleets sail over them with complete impunity? True, the day of the realization of all that seems remote enough; yet it is probable, in the light of experience, that it is less remote than it seems. It is quite certain that come it eventually will, and that man will not give over his ambition before having made a complete conquest of the atmosphere. It is the part of good sense to consider beforehand what are destined to be the consequences of that revolution upon the economic conditions of life and upon the relations between nations. Let us hope that that conquest, which supposes an all-powerful industry and a transcendent science, will come when civilization has reached such an elevation that it will recognize justice, right, and peace as alone concordant with the welfare of mankind. It may be that this wish is vain, but at any rate the discov-

eries, when they come, will present one aspect under which their benefits will be undeniable and their fruits will be unmixed with any bitter; and that is their scientific aspect. When man takes possession of this new estate he will garner as his first harvest a complete meteorology, phenomena, and cause, through the whole depth of the atmosphere, and this knowlege, be sure, will have consequences that we can hardly imagine to-day. Agriculture, industry, navigation, will be transformed. The same knowledge will be utilized the better to avail one's self of the energy now wasted in the tides, in great waterfalls, and in the solar energy which in a given time is scattered over the earth in six hundred thousand times the amount of what is brought up from coal mines. Such will be the benefits which posterity will reap from those pacific conquests which I love to contemplate. Here, at least, we have no reason for other sentiments than those of joy and admiration. Happy are we to have been called to contribute our stone to such an edifice; happier still our posterity, who shall have the glory of crowning it. This seizure of a domain from which nature seemed to have closed all access will certainly constitute, by the constancy and intensity of the efforts it will have cost, by the discoveries and marvelous inventions that it will have provoked, one of the highest titles to glory of which the human race will be able to boast.