ferent, he is the very best thing of which we are sure. It behooves us, therefore, to make the most of him.

W. F. Ganong

Smith College

PRESENTATION OF THE LANGLEY MEDAL TO THE WRIGHT BROTHERS[1]

Mr. Chancellor: The award of the Langley medal to the Brothers Wilbur and Orville Wright emphasizes the fact that we are living in an age of great achievements.

The twentieth century had hardly dawned when the world was startled by the discovery of radium, which has opened up an entirely new field to science, and which has led us to modify profoundly our conceptions regarding the constitution of matter.

Another new field has been revealed to us through the development of wireless telegraphy and telephony; and we now utilize the vibrations of the ethereal medium of space for the transmission of thought.

Then again, we may note the most revolutionary changes going on before our eyes relating to methods of transportation.

The appearance of the hydroplane-boat probably foreshadows a revolution in marine architecture and propulsion. On land we see motor-cycles, automobiles and electric cars displacing the horse. Petroleum and electricity have become powerful rivals of steam; and we seem to be on the eve of a revolution in our methods of railroad transportation, through the application of the gyroscope to a monorail system. And now aerial transport has come, dispensing with rails and roads altogether. The air itself has become a highway; and dirigible balloons and flying machines are now realities.

[1] Historical address by Dr. Alexander Graham Bell at the Smithsonian Institution, February 10, 1910.

How well the predictions of Langley have been fulfilled. We now recognize that he was right, when he said a few years ago (1897) that:

> The world, indeed, will be supine if it do not realize that a new possibility has come to it, and that the great universal highway overhead is now soon to be opened.

It has been opened; and who can foretell the consequences to man?

One thing is certain: that the physical obstacles to travel have been overcome; and that there is no place on the surface of the globe that is inaccessible to civilized man, through the air.

Does this not point to the spread of civilization all over the world; and the bringing of light to the dark continents of the earth?

THE PIONEERS OF AERIAL FLIGHT

Who are responsible for the great developments in aerodromics of the last few years? Not simply the men of the present, but also the men of the past.

To one man especially is honor due—our own Dr. S. P. Langley, late secretary of the Smithsonian Institution. When we trace backwards the course of history we come unfailingly to him as *the great pioneer of aerial flight.*

We have honored his name by the establishment of the Langley medal; and it may not be out of place on this, the first occasion for the presentation of the medal, to say a few words concerning Langley's work.

LANGLEY'S WORK

Langley devoted his attention to aerodromics at a time when the idea of a flying machine was a subject for ridicule and scorn. It was as much as a man's reputation was worth to be known to be at work upon the subject. He bravely faced the issue, and gave to the world his celebrated

memoir entitled, "Experiments in Aerodynamics."

In this work he laid the foundations for a science and art of aerodromics; and raised the whole subject of aerial flight to a scientific plane.

The knowledge that this eminent man of science believed in the practicability of human flight gave a great stimulus to the activities of others, and started the modern movement in favor of aviation that is such a marked feature of to-day.

Every one now recognizes the influence exerted by Langley on the development of this art. The Wright Brothers too have laid their tribute at his feet. They say:

> The knowledge that the head of the most prominent scientific institution of America believed in the possibilty of human flight was one of the influences that led us to undertake the preliminary investigations that preceded our active work. He recommended to us the books which enabled us to form sane ideas at the outset. It was a helping hand at a critical time, and we shall always be grateful.

CONTRIBUTIONS TO THE SCIENCE OF AERODROMICS

Langley's experiments in aerodynamics gave to physicists, perhaps for the first time, firm ground on which to stand as to the long-disputed questions of air resistances and reactions. Chanute says:

(*a*) They established a more reliable coefficient for rectangular pressures than that of Smeaton.

(*b*) They proved that upon inclined planes the air pressures were really normal to the surface.

(*c*) They disproved the "Newtonian Law," that the normal pressure varied as the square of the angle of incidence on inclined planes.

(*d*) They showed that the empirical formula of Duchemin, proposed in 1836 and ignored for fifty years, was approximately correct.

(*e*) That the position of the center of pressure varied with the angle of inclination, and that on planes its movements approximately followed the law formulated by Joessel.

(*f*) That oblong planes, presented with their longest dimension to the line of motion, were more effective for support than when presented with their narrower side.

(*g*) That planes might be superposed without loss of supporting power if spaced apart certain distances which varied with the speed.

(*h*) That thin planes consumed less power for support at high speeds than at low speeds.

The paradoxical result obtained by Langley that it takes less power to support a plane at high speed than at low, opens up enormous possibilities for the aerodrome of the future. It results, as Chanute has pointed out, from the fact that the higher the speed, the less need be the angle of inclination to sustain a given weight, and the less therefore the horizontal component of the air pressure.

It is true only, however, of the plane itself; and not of the struts and framework that go to make up the rest of a flying machine. In order therefore to take full advantage of Langley's law, those portions of the machine that offer head resistance alone, without contributing anything to the support of the machine in the air, should be reduced to a minimum.

CONTRIBUTIONS TO THE ART OF AERODROMICS

After laying the foundations of a science of aerodromics, Langley proceeded to reduce his theories to practise.

Between 1891 and 1895 he built four aerodrome models; one driven by carbonic acid gas, and three by steam engines.

On May 6, 1896, his "Aerodrome No. 5" was tried upon the Potomac River near Quantico. I was myself a witness of this celebrated experiment; and secured photographs of the machine in the air, which have been widely published.[2]

This aerodrome carried a steam engine, and had a spread of wing of from twelve to fourteen feet. It was shot into the air from the top of a house-boat anchored in a quiet bay near Quantico.

[2] A photograph of this flight was here shown.

It made a beautiful flight of about 3,000 feet, considerably over half a mile. It was indeed a most inspiring spectacle to see a steam engine in the air flying with wings like a bird. The equilibrium seemed to be perfect, although no man was on board to control and guide the machine.

I witnessed two flights of this aerodrome on the same day; and came to the conclusion that the possibility of aerial flight by heavier-than-air machines had been fully demonstrated. The world took the same view; and the progress of practical aerodromics was immensely stimulated by the experiments.

Langley afterwards constructed a number of other aerodrome models which were flown with equal success, and he then felt that he had brought his researches to a conclusion, and desired to leave to others the task of bringing the experiments to the man-carrying stage.

Later, however, encouraged by the appreciation of the War Department, which recognized in the Langley aerodrome a possible new engine of war, and stimulated by an appropriation of $50,000, he constructed a full-sized aerodrome to carry a man.

Two attempts were made, with Mr. Charles Manley on board as aviator, to shoot the machine into the air from the top of a house-boat; but on each occasion the machine caught on the launching ways, and was precipitated into the water. The public, not knowing the nature of the defect which prevented the aerodrome from taking the air, received the impression that the machine itself was a failure and could not fly.

This conclusion was not warranted by the facts; and to me, and to others who have examined the apparatus, it seems to be a perfectly good flying machine—excellently constructed, and the fruit of years of labor. It was simply never launched into the air, and so has never had the opportunity of showing what it could do. Who can say what a third trial might have demonstrated. The general ridicule, however, with which the first two failures were received prevented any further appropriation of money to give it another trial.

CONCLUSION

Langley never recovered from his disappointment. He was humiliated by the ridicule with which his efforts had been received; and had, shortly afterwards, a stroke of paralysis. Within a few months a second stroke came, and deprived him of life.

He had some consolation, however, at the end. Upon his death-bed he received the resolution of the newly formed "Aero Club of America," conveying the sympathy of the members, and their high appreciation of his work.

Langley's faith never wavered, but he never saw a man-carrying aerodrome in the air.

His greatest achievements in practical aerodromics consisted in the successful construction of power-driven models which actually flew. With their construction he thought that he had finished his work; and, in 1901, in announcing the supposed conclusion of his labors he said:

> I have brought to a close the portion of the work which seemed to be specially mine—the demonstration of the practicability of mechanical flight—and for the next stage, which is the commercial and practical development of the idea, it is probable that the world may look to others.

He was right, and the others have appeared. The aerodrome has reached the commercial and practical stage; and chief among those who are developing this field are the brothers Wilbur and Orville Wright. They are eminently deserving of

the highest honor from us for their great achievements.

I wish to express my admiration for their work; and believe that they have justly merited the award of the Langley medal by their magnificent demonstrations of mechanical flight.

MEMORIAL TO THE LATE MORRIS KETCHUM JESUP[1]

Members of the American Museum of Natural History: We commemorate this afternoon the founding of the museum in 1869. For their services to our city and country we pay our tribute to the first presidents, John David Wolfe and Robert L. Stuart, and especially to the third president, Morris Ketchum Jesup, distinguished by his long and eventful administration.

As the oldest institution of the kind in the city of New York we welcome representatives of our twin sister, the Metropolitan Museum of Art, of our younger companions the Public Library, the Brooklyn Museum, the Zoological Park, the Aquarium and the Botanical Garden—all animated by the same purpose, all under a similar government, and together forming a chain of free educational institutions of which the city may well be proud.

We are honored by the presence of delegates from the president of the United States, from the governor of this state, from several of the great American universities and national institutions of scientific research.

The leading officers of the city government and of the board of education are present. His honor, the mayor, the president of the park department and the comptroller are members of our board. It is significant that these heads of the second great municipality of the world are uniting with us to play the part of hosts in this celebration, because the city and trustees have enjoyed from the first a free and cordial union. From their entire community of purpose there is no reason why they should ever disagree. Through the original application of the museum for land, this institution is legally under the department of parks, but although the relation is amicable and effective, the museums are less a part of public recreation than of the great civic system of education.

A few words may be said as to the kind of educational spirit which has been developed under past administrations and will be increasingly developed in the coming years in other branches of science. They are words as to our future. We believe that we are only on the threshold of the applications of science, or knowledge of the laws of nature as they bear on human morals, welfare and happiness. If there is one new direction which this museum shall take it is in the applications of science to human life. Here people shall have a vision not only of the beauty, the romance, the wonder of nature, but of man's place in nature, of laws as inexorable as the moral commands of God handed down by great religious teachers. Over the portals of our new hall of public health we may well place the inscription, "Learn the Natural Commandments of God and Obey Them." If nature is stern and holds in one hand the penalty for violation of her laws, she is also gentle and beneficent and holds in the other hand the remedy, which it is the duty of science to discover and make known.

What is the part the museum exhibition halls should play in this teaching? An ideal museum is a mute school, a speechless university, a voiceless pulpit; its sermons are written in stones, its books in the life of the running brooks; every specimen, every exhibition, every well-arranged hall

[1] Address of Henry Fairfield Osborn at the celebration of the forty-first anniversary of the American Museum of Natural History.