THE POTENTIAL OF MOTORLESS FLIGHT.

By Dr A. RASPET.

The progress which motorless flight is to make in the future depends to a large measure on how we organize to make that progress. We are fortunate in this respect in that a good basic organization exists in the OSTIV.

These past two years of activity in the frame of OSTIV under the direction of Mr de Lange have been extremely fruitful.

However in order to define a path for our future work we must consider the avenues by which we are to improve the performance of motorless flight in sport and science.

This will be the purpose of this address.

In the sport of soaring we have seen this past year the combination of a very high performance sailplane and a methodical and skilled pilot break the long standing distance record. Yet this record was broken not with a radically new art: it was strictly a thermal soaring flight in which the pilot carefully maximized his cross-country speed in order to fly a long distance in the limited daylight hours during which thermal activity was strong enough to support the sailplane.

We must not restrict our thinking and development to thermal soaring and we have not, for in April 1952 Dr Joachim Kuettner demonstrated the potential of wave soaring long distances with a flight of 600 km in four hours. The technique of this flight was, however, not radically different from thermal soaring. We must keep our eyes open for other sources of atmospheric energy and other techniques.

In particular we should consider the potential of extracting energy from atmospheric turbulence by means of the sailplane. This is the dynamic soaring predicted by Lord Rayleigh in 1883 but not yet performed under controlled conditions by man.

We have the means in the form of the sailplane as a probe to investigate the nature of atmospheric turbulence and from this we should evolve an aerodynamic device permitting the sailplane to extract some of the energy of turbulence.

Another potential technique for soaring is that of straight line thermal soaring. For this we need a sailplane of great speed range. With such a craft one would slow down through the up-currents and speed up between the up-currents always flying in a fixed direction with no circling. No aerodynamic parameters of a sailplane for straight line thermal soaring are intimately related to the nature of convection in the atmosphere. For studying the nature of convection the sailplane has already proved itself as an ideal instrument. Some years ago Dr Walter Georgii suggested the potential of prefrontal wave soaring. Thus far no outstanding flight has yet been made on these waves. Allied in concept is Dr Kuettner's jet stream wave technique of long distance soaring. This technique is promising of extremely high cross-country speeds. In the next two years there should be made flights which will prove or disprove the possibility of Georgii's and Kuettner's techniques.

The potential of motorless flight is contained absolutely in the youth which will be trained by our schools and clubs. Our technical section chairman, Mr Werner Ledermann, has clearly shown the necessity of a small, inexpensive and light training glider. Training techniques so fundamental to youth training are also under development by the Technical Section.

In aerodynamics we have come to a point in sailplane development where control of the exterior geometry no longer offers large increments in drag reduction. We will be compelled to devote considerable effort to boundary layer control systems employing artificial techniques such as suction through the porous wing surface. Because we have literally reached the limit in geometric control does not mean that we can make no more contributions to aviation in this field. As a matter of fact the powerful analytic techniques of motorless flight research are just beginning to be applied to motor planes. The performance measurement and analysis of airplanes in gliding flight give results superior in accuracy to the

full scale windtunnel, yet the cost is in the ratio of 1 to 1000.

We should see the sailplane in the next few years providing basic information on the nature of boundary layer flows. It is only with the sailplane that we can achieve the pure environment required for free laminar flows to exist. Windtunnels possess a noise field as well as a turbulence field of an intensity much greater than that around the sailplane. This is a unique contribution of the sailplane as a medium for boundary layer research; it offers a noise free and turbulence free testing environment.

In control and stability studies the slow speed sailplane permits a pilot to react fast enough even to control an unstable configuration. The great progress which Dr A.M. Lippisch made in tailless airplanes was entirely due to the use of glider prototypes for research in radical configurations. We should expect more such development in the future.

In a rather remote field from soaring by man we have made some progress by studying birds in soaring flight. The silently flying sailplane permits following the birds and making observations without disturbing the birds. More information about the biophysics of natural flight can be expected of motorless flight in the future.

As we develop sailplanes of lower and lower drag we are correspondingly reducing the power required for sustained flight. Before too long we should be able to reduce this power to that which man himself as a power plant can provide. Then we will have achieved the dream of Leonardo da Vinci of 450 years ago when he designed a man-powered flying machine.

The potential of motorless flight for contributing to society is not yet limited. We need only apply ourselves with a concentration to the scientific problems in order to realize more efficient sport soaring.