A South American Record

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It is probably just as well that about this time our enthusiasm was dampened a hair by what we saw. From the ocean advancing rapidly toward us with a rain squall. Dense clouds boiled along at low altitude, some of them only 150 meters high.

We thought over the gravity of the situation. With such dense clouds, we would not be able to make the hill, for at that altitude the rate of climb would be nil. Nor could we reconcile ourselves to missing by a mere hour or so the record which Goetz had established the preceding year. We saw it was possible to do. Finally the moment arrived; the clouds began to hem us in on all sides and the hole in which we were circling became ever smaller. When it became so small we were unable to turn around inside of it, we had to reach a rapid decision. There was only one course to take. We dived.

We reached a velocity of nearly 120 km/hr., and passed through the base of the clouds with less than 200 meters left. At the same time we began to search for a place to set down, for at that altitude it was nearly impossible to sink further.

We spied our hill once more but strangely a wall of clouds surrounded it completely. We knew that near the ridge we would be able to regain altitude. We had to make a try, so we began to fly along the edge of the clouds where we believed the hill to be.

Frequently we had to execute split-second maneuvers to avoid penetrating the clouds, for in times of low visibility we knew that the clouds are frequently stuffed with hills. The rain was so strong that we had the impression that the celluloid cabin enclosure could not resist it.

Thus we flew for nearly an hour. Sometimes the weather improved a bit, but still we could not see the hill. The wind became less and less, but the record was already broken. We continued as long as possible, and when the wind would no longer sustain us, we abandoned the hill on which we had mixed such a variety of joys, hopes, doubts and joys again at the success which crowned our struggle.

In slow spirals we descended and made the field, landing exactly eight hours and twelve minutes after having released. The South American duration record for biplace sailplanes was broken. We also learned afterward that we had gained the prize for "Best Soaring Performance of the Third Contest," which was the biggest incentive and the prize for "Best Performance of a Two-Seater" offered by the National Defense League.

Theory of Soaring Flight

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$-3\left(\frac{w}{v}\right)^2$ where w is the vertical wind speed component amplitude. The coefficient -3 is the approximate value of $\frac{\pi A\ (A + 4)}{(A + 2)^2}$ where A is the effective aspect ratio*. If this apparent thrust were to make up for the entire drag of a conventional glider and endow it with the magic of effortless flight, the vertical wind speed component amplitudes would have to be pretty powerful, say between 1/10 and 1/5 of the flight speed. The higher the average lift coefficient, i.e. the higher the wing loading or the lower the flight speed the greater this speed amplitude ratio would have to be to sustain flight. Whether or not this effect plays a significant role among the tricks of soaring flight may be a debatable question. At any rate, the large inertia reactions which it would entail should be noticeable aboard and disagreeable to say the least.

Now as already Betz pointed out, the apparent thrust can be further increased by deliberately controlling the elevator in such a manner that the angle of attack of the wing is always adapted to furnish a maximum forward or a minimum rearward component in the average flight direction. I have calculated the magnitude of this optimal Betz effect for a sample sailplane having a wing section resembling Goettingen #398, converted to aspect ratio 10 which would give the bare wing a glide ratio of L/D = 26. The wind was assumed to harmonically pulsate vertically with a vertical velocity component amplitude = w, flight speed = v, and several ratios of w/v were studied namely sin 2½, 5, 7½ and 10°. The results of these calculations were plotted in the form of a branch off the regular polar curve. Its origin is of course at x/v = 0 and at the minimum drag coefficient point. The new polar branch crosses over to the negative drag at x/v = .08, average ε = .25. Only lightly loaded aircraft having fair aspect ratio can hope to realize a significant gain in this manner. For a slender winged bird weighing about 1 lb./sq. ft. and flying at 30 m.p.h. a vertical wind speed pulsation amplitude of 5 ft./sec. would suffice.

*This was demonstrated by T. V. Karman in 1922 by averaging the tangential components of lift and drag in a harmonic pulsation of the angle of attack. In the coefficients the value $\frac{2\pi A}{A + 2} = \frac{d\varepsilon}{d\alpha}$ viz: the slope of the lift coefficient versus attack curve.