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LESSONS OF THE 1922 RHÖN SOARING FLIGHTS

By L. Prandtl, Göttingen

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LESSONS OF THE 1922 RHÖN SOARING FLIGHTS.*

By L. Prandtl, Göttingen.

1. It is a matter of common knowledge that soaring flight requires a glider with a low sinking speed, in order to obtain the utmost advantage from even small vertical wind velocities. Reduction of sinking speed is attained (aside from having a suitable wing section with a high lift-drag ratio c_a^3/c_w^2) by the reduction of the wing load, and by the reduction of all resistances. The first method, which leads to types of very light construction, obtained no real success in 1922. The winning gliders were relatively heavy aircraft, well able to withstand resistance. Since not only a low sinking speed is required in soaring flight, but also, in many cases, a high horizontal speed with still lower sinking speed, so that the glider may not be driven out of its course by strong winds, we shall see that, in the future, fairly heavy gliders will take precedence over very light gliders, though apart from their fragility, the latter are very good fliers. The utmost reduction of all resistances will therefore remain advantageous. The Hanover glider of 1921, designed by Madelung, will continue to be a guide in this respect, as was indicated in several instances in 1922. The kind of glider in which the pilot is covered to his head and still has good visibility and can sense the changes in the wind and the position of the glider, cannot be easily surpassed.

The conspicuous failure of the new 1922 Hanover type, the "Greif," seems to me only partly due to aerodynamical defects, as

* Translated from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," October 30, 1922, by Paris Office, National Advisory Committee for Aeronautics.

for instance to the rough upper surface of the undoped wing tips and to the injury done to the wing by cutting out the leading edge in the middle to make room for the pilot's head. It is probably a much more serious matter that the pilot sits so far forward that he cannot sense the position of his glider in space. The two men who have flown this glider both corroborate this opinion. It is said that a man cannot steer a ship from near the bow, because in looking ahead, he can not see how the ship lies. The farther aft the helmsman is, the better he can steer the ship through a narrow passage. It would appear that the same thing holds good for a soaring aircraft. It is better for the pilot to be able to see the wings. It is also important for the wind to whistle past his ears, so that he may form a correct estimate of his velocity. Several of the Rhön pilots declared they could tell when the glider was drifting by the fact that the ear exposed to the lateral wind became colder. From this point of view, it is not advisable to place the pilot's head in a cut-out section of the wing, as was done in the "Greif," and this circumstance may have had something to do with the fact that the "Greif" always acquired too great a speed, although, after the first flights, the center of gravity was shifted well to the rear.

2. So far as steering is concerned, we may take it for granted that the usual method is satisfactory, when the rudders are large enough. It is a great pity that the Darmstadt glider with wing control was not ready sooner. Perhaps, with longer practice,

it would have done as well as the Hanover glider. Since the fuselage was not quite so carefully designed as in the Hanover I, more would have had to be expected of the wing control. The idea of adding the usual tail rudder as an auxiliary steering device, but capable of being held stationary, like a throttle, seems to be a good one. In this way the danger of the wing steering devices proving insufficient in an emergency is effectively met and the pilot has to deal with only three controls, as in normal airplane flight. So far as I can remember, no aircraft with more than three controls acting simultaneously has ever flown successfully. The mishap to the Dresden wing-controlled glider may well have been due to the fact that the pilot could not manage all four controls. Wing control seems to me especially suitable for gliders on account of the possibility of utilizing each gust of wind almost instantaneously, and, above all, because of the method of taking off without external aid, which was invented and practiced by Herr Harth.*

3. A good deal of instructive data has been collected concerning the wind currents on mountain sides. The declivity of a laterally extended hill, the ridge of which lies athwart the wind, is much more suitable for soaring flight than a conical hill, for

* Another reason why the Harth-Messerschmitt glider fell so far short of the expectations, seems to have been largely due to lack of torsional rigidity of the wings of the 1922 glider, so that it could not be depended on to obey the controls. Mr. Harth is of the same opinion. It is much to be regretted that this defect prevented the Harth-Messerschmitt design from being properly appreciated. The lesson, that the wings must be made sufficiently rigid to withstand the torsional stress, is one that every glider constructor should take to heart.

in the former case the wind must blow over the hill, while in the latter case it can blow around it and therefore does not have so great vertical velocity. In a westerly wind, the Wasserkuppe is particularly good for soaring flight. Together with the "Pferdskopf," its southwestern spur, it sends up a broad current of air. The fact that Hentzen was able to climb to a height of 350 meters above his starting point shows to what an altitude the rising current may extend. Under favorable local conditions, this current continued to rise, until stopped by meteorological causes. It does not seem improbable that, once well above the peak, a man flying with the wind can remain for quite a long period in the ascending current. In the lower regions, as, for instance, over the foot-hills of the Wasserkuppe, it often happens that there is no ascending current. Here the air is mostly calm, owing to the sheltering effect of the foot-hills. On the other hand, when Martens was making his hour's soaring flight against the wind, he found even at a distance of several kilometers from the mountain, an ascending wind strong enough to support him without loss of altitude. From the mountain ridges and outstanding crags there may arise very disagreeable eddies which continue, in tubular form in the direction of the wind. Martens tells of one such eddy which whirled him to the right, in spite of all he could do in the way of wing warping and by keeping his rudder hard over to the left. These matters require very serious study and experimental data should be carefully collected and thoroughly worked out. When the knowledge of suitable wind zones is sufficiently advanced

long-distance flights from peak to peak in mountainous regions would seem to be well within the range of possibility for engineless aircraft.

4. A word in conclusion with regard to future soaring-flight contests. A three-hour flight has been made and it is only a question of personal endurance to make a flight of three times three hours. From a technical standpoint, therefore, the duration of a flight is of no further interest. On the other hand, the highest altitude attained means a test for the aircraft as well as for the heart and reins of the pilot. The aircraft with the smallest sinking speed will mount the highest, for the ascending wind, which is strongest in the immediate neighborhood of the mountain, decreases in strength as it rises above the summit. The task of the pilot will therefore consist in finding the most favorable places on the mountain and then using his glider to the best possible advantage. Of course we can only compare the altitudes attained by different gliders in the same time. After what happened the last day of the Wasserkuppe contest, there can be no serious objection to allowing two or three gliders to fly at the same time, with the condition that any contestant not in position within 20 minutes, to rise higher than his rival, should retire from the contest. Under these circumstances, the difference in altitude for like periods of time would have been determined.

Another important kind of contest, and one eminently calculated to test the pilot's ability and his knowledge of the air

currents, is long distance flight from one mountain to another. In such a contest, the required distance should be greater than that attainable by simply gliding from the highest altitude above the mountain and the goal should be left to the judgment of the competitors.

Along with these two chief events of a contest, flights should also be planned to previously determined goals. This year (1922) much interest was aroused by such flights and there is no doubt that when the landing points are well chosen, pilots find such contests very fascinating.

Besides the big problems set for the purpose of putting technicians on their mettle and furthering the progress of aviation, we must not forget to offer a number of more easily won prizes (especially gliding-flight prizes in the sense previously used) in order to attract the young men whom we must have for future successes. It would be a great pity, if future soaring flight were to be restricted to a small number of "professionals," for only by constant infusion of new blood can it retain its vitality.