LETTERS TO THE EDITOR

Re: Basic Dolphin Tactics

Reading No 2, Vol VII of Technical Soaring, I feel a bit disturbed at finding a grossly erroneous and unqualified paper like "Basic Dolphin Tactics" by Wojtek Mozdyniewicz published in your otherwise excellent publication.

The policy of subjecting submitted papers to a technical review before publication, stated on page 1, should be adhered to. Mr. Mozdyniewicz shows a lack of understanding of elementary mechanics when assuming that an increased load factor has the same effect on the velocity polar of a glider as an increased weight. While increasing the weight increases the component of weight in the flight path direction during a glide, the incremental force due to increased load factor acts perpendicular to the flight path, thus being of no benefit for performance in an air mass at rest. Induced drag is increased however. A velocity polar for a glider at an arbitrary load factor n, $w_n = f(V_n)$, can easily be derived from the normal velocity polar (at n=1), w = f (V), as follows:

$$V_n = V\sqrt{n}$$
$$W_n = W\sqrt{n^3}$$

(Aerodynamic effects of flight path curvature, changed Reynolds Number, or of changed aeroelastic effects are neglected.) This of course shows quite a different effect of the load factor than Mr. Mozdyniewicz's "analysis."

The flight tests only confirm that energy loss in a pull-up/push-over maneuver decreases with increasing pull-up load factor, as shown by Frank Irving in his paper "The Energy Loss in Pitching Maneuvers" (Technical Soaring Vol. V, No. 4). The reason is that the brevity of a high load factor wins over the losses associated with the high load factor by itself.

Obviously, Mr. Mozdyniewicz did not use a constant load factor of 2 during the deceleration from V = 234 km/h in Test III as this would have put the glider in an inverted position before V = 83 km/h was reached.

The computed average airspeeds for tests II and III should be 100.1 km/h and 104.2 km/h. Making this correction the "gain" due to maneuvering disappears as expected.

Lars Helmersson

Atlasgathan 11, 5-58243 Linköping, Sweden

Re: Basic Dolphin Tactics

In Technical Soaring VIII, 2, pp 37-44, 1984, Wojtek Mozdyniewicz proposed a surprising type of dolphin flight style where "change of speed of the sailplane plays the basic role." The author claimed that "wing loading changes momentarily modify the performance at a given airspeed and a given wing loading during steady flight." An important part of that paper obviously is the assumption that the reduced sink rates of the water carrying airplane cruising at high air speeds, also apply for the dynamically accelerated empty glider flying at the same speed and lift coefficient. This is not in accordance with the laws of mechanics:

Increased lift coefficients always lead to higher induced drag (which is a function of the lift coefficient squared). The effect is less pronounced at elevated speeds. So far the drag depends on C_L irrespective of whether it is produced by the glider's mass at g = 1 or by a lower mass accelerated at elevated g-numbers during a pull-up maneuver. Clearly, energy losses due to the drag will lower the total energy reservoir of the glider accordingly; but the total energy available is proportional to the mass of the glider. The total energy consists of the potential energy which is the glider's mass times the earth's acceleration, times the height above the landing field, and the kinetic energy. The latter is the mass times the ground speed squared divided by two. Hence, the sailplane which carries water ballast will have a larger energy reservoir available compared to a light glider at the same height and speed. Therefore the accelerated empty plane will suffer more height loss compared to the heavier plane when the same distance is crossed at similar drag. This is the reason why different polars are used. In order to describe accelerated flight as it is executed during circling, the circling polar holds. A full account of the mechanics of accelerated flight was given by Frank Irving in his paper on "The energy loss in pitching maneuvers," T.S., V/4, 39-45, 1980. Dr. Mozdyniewicz should have made use of that analysis.

As far as his experiments are concerned, we know from measurements conducted by the DFVLR in Germany and by Dick Johnson that the evaluation of the sink rates is tedious work where many sources of error exist. In my opinion the author did not sufficiently discuss his methods nor have possible errors been analyzed. Therefore, his conclusions do not convince me.

Although no g-related analysis of flight modes through moving air masses was presented, Mozdyniewicz "observed here that the optimum results with these techniques should be obtained by flying through the downdraft portion (in the high wing loaded condition - positive g mode) before encountering the lift area...". Furthermore, he noted "the results upon entering the core of a strong thermal, or other strong lift area, at minimum speed in the zero g mode...". This is just the opposite of what a mathematical analysis of the mechanics of flight through vertically moving air masses would predict to be optimal.

For reference see the article in the same issue of Technical Soaring, by Justyn Sandauer. For further references see my paper "Load variation flight style and its implications to the theory of soaring," Technical Soaring, VII/1, 36-42, 1981, our paper (together with Lee Collins), "Dolphin-style soaring - A computer simulation with respect to the glider's energy balance," Technical Soaring, V/2, 16-21, 1978, and my technical note on "Energy gain in pitching maneuvers," Technical Soaring VI/3, 34-35, 1981.

Wolfram Gorisch

Bayernstr. 38, D-9750 Aschaffenburg
West Germany

Contributors

Send manuscripts to: TECHNICAL SOARING, c/o Dr. John McMasters, Rt. 4, Box 955, Vashon, Wa. 98070, USA. Papers should be typed, dual column, on 8½ by 11½ paper (see Technical Soaring format) if possible. Equations and symbols may be handwritten or typed. Figures should be capable of being reduced to single column width without loss of legibility. Photographs should be glossy prints, not matte. Each figure and table must have a caption. Papers should be accompanied by a 100-200 word abstract summarising, in a single paragraph, the subjects treated in the paper and the principal observations or conclusions of the investigation.