Modifying the LAISTER-KAUFFMANN

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A. Raspet, Chairman of the SSA Technical Committee, trying out a new molded conopy on an L-K.

BEFORE any prototype sailplane can develop its true capabilities it should be performance tested and the data so obtained analyzed to determine how closely the prototype meets the specifications to which it was designed. Built during the war when aerodynamic refinement was not a prime consideration, the TG-4A sailplane offers possibilities of radical improvement in its performance. This paper is written primarily to illustrate the technique of analyzing performance data as a guide to systematic modification of aerodynamic lines in order to gain performance.

On examining the lines of the standard TG-4A it is readily apparent that the sharp corners on the windshield would make the flow turbulent resulting finally in a poor wing efficiency. On a mid-wing sailplane turbulent flow acting as a spoiler over the fuselage can cause a severe loss in lift. The sharp corner on the windshield could easily cause turbulent flow over the fuselage at high angles of attack. The separated flow over the fuselage would cause a loss in lift over the center section of the wing. The distribution of the lift is, then, such that a low wing efficiency results.

The foregoing statements can readily be verified by computing the polar from the velocity polar of the standard TG-4A in Figure 2. The plot of C_L^2 vs C_D of the standard TG-4A is shown in Figure 3. The efficiency of the sailplane given as the ratio of effective aspect ratio to geometric aspect ratio is seen to be only 66%. The maximum drag coefficient is also seen to be quite high.

Based on the diagnosis of the flight test data, it appeared that a molded canopy should be a first modification in an attempt to improve the flow over the center section. The flight test data for such a canopy (molded by Parker Leonard) is shown on Figure 2 and the polar C_L^2 vs C_D in Figure 3. A remarkable improvement in aerodynamic efficiency is immediately apparent. However, the minimum drag coefficient was not markedly improved. Furthermore it will be seen that the polar C_L^2 vs C_D falls off at high lift coefficients. This indicates that at high angles of attack, the condition for soaring, the induced drag was still large. Such a behavior can be ascribed to wing-fuselage interference of a mid-wing having an incorrectly designed juncture. It has been mentioned before (Ref. 1) that good performance can most readily be achieved on a sailplane by limiting the fuselage projection above the top surface of the wing. A high wing is to be preferred where a precise analytic development of aerodynamic lines is not made.

A second step in the systematic modification of the TG-4A appeared to be one of removing the canopy and superstructure down to the primary structure and either reclining the pilot or dropping the seat so that there would be little protuberance above the wing. It was fortunate to this analysis that Eugene Miller made such a modification on his TG-4A and had it at the Annual Soaring Contest in July 1948 (below). The ship was test flown and the data shown in Figure 2 and 3 collected. From Figure 2 it is immediately apparent that the maximum L/D was improved by a factor of 4, from 22 for the TG-4A to 26 for the Miller modification. It is not fair to compare sink-

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The Miller Flat Top, with canopy balanced on the fuselage back of the cockpit, awaits its owner.