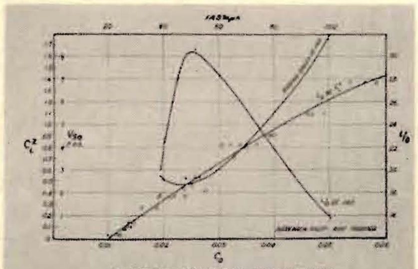
(Continued from Previous Page)

Naphthalene sublimation tests made on the wing of Tiny Mite showed that boundary layer remained laminar behind the leading edge. The minimum drag of the RAF 34 airfoil on a clean portion of Tiny Mite's wing is 0.0062. This value is just slightly lower than



PERFORMANCE CURVES FOR TINY MITE MODIFICATION OF 1954

FIG. 5

the lowest drag measured on the RJ-5 airfoil. Looking at the profile drag of other portions of the wing one can see clearly the influence of Reynolds number as the chord gets smaller toward the tip. On top of this profile drag variation there is evidence of aileron gap drag and dive brake drag.

The high profile drag of the tip section on Tiny Mite is no doubt due to its low Reynolds number but may also be caused by the leading edge

COMPARISON OF TINY MITE AND GEHRLEIN 1-23 D VERSUS 1-23 MULLOY

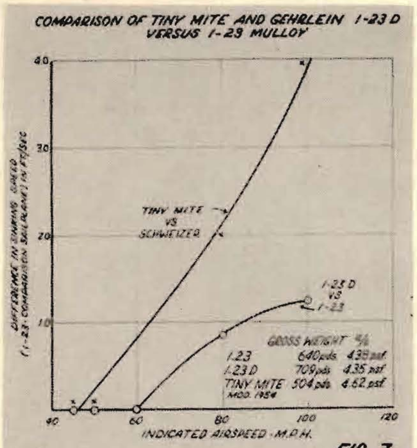


FIG. 7

shape. In order to eliminate the tip stalling to which this wing was prone the leading edge radius was nearly doubled. Since no pressure distributions or boundary layer explorations were made on this tip after modification, it can well be that laminar separation is occurring on the tip. However, the leading edge modification did solve the tip stalling problem so that Tiny Mite now retains lateral stability through the stall.

Separated Polar

By integrating the profile drag polars taken at various stations over the wing, we obtain a profile drag polar representative of the entire wing. In Figure 8 this average profile drag is displayed as a function of lift coefficient squared. Also shown is the lineralized drag polar. By substracting the profile drag from the total drag, we obtain a curve which represents the variation of total drag minus profile drag, or of induced drag plus parasite drag in function of lift coefficient squared. From the slope of this last curve we can compute the span efficiently which is truly indicative of the wing fuselage intersection drag and such variation of parasite drag as takes place with angle of attack. The span efficiency factor obtained in this manner is 93.5 per cent whereas when obtained from the total drag we obtained only

DRAG POLARS OF THE TINY MITE MODIFICATIONS OF 1954

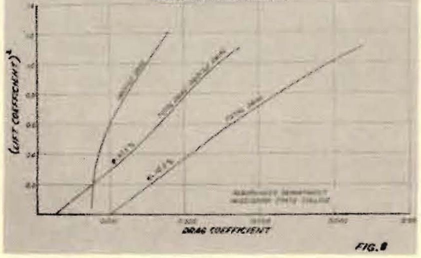


FIG. 8

72.5 per cent. The latter measurement, of course, contains the variation of profile drag with lift coefficient.

What this span efficiency measurement does illustrate is that an airfoil should be chosen in such a way that its profile drag variation does not materially detract from the span efficiency factor.

The minimum effective parasite drag taken at $C_L^2=0$ is seen to be 0.0025. This represents only one-third of the wing drag.

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Conclusions

The recent work on Tiny Mite has been rewarding in that the sailplane has achieved an extremely low minimum drag. The performance of this little sailplane now ranks in the upper brackets with its larger counterparts.

SKIN FRICTION COEFFICIENT VS REYNOLDS NUMBER FOR VARIOUS SAILPLANES

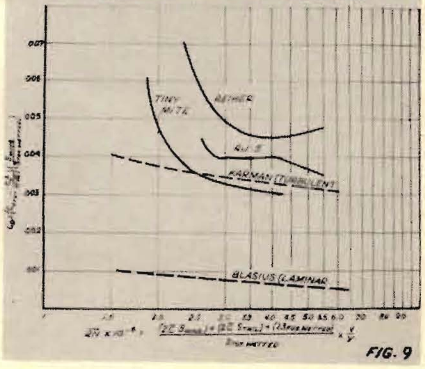

FIG. 9

This little craft has now gone through two major modifications,[4] it has seen many minor modifications each leading to lower energy losses. A comparison of the refinement of the boundary layer flow on the three sailplanes, Reiher, RJ-5, and Tiny Mite is shown in Figure 9. The gains made on Tiny Mite are clearly evident.

Further Improvements

Tiny Mite now has reached quite close to the ultimate which geometric

SUBLIMATION PHOTO ON FUSELAGE CANOPY REGION

FIG. 10

boundary layer control can offer. A few items are still contributing to the drag, viz., the aileron control fittings, and the corners between the bubble and hatch. See Figure 10 which shows the turbulent flow in the corner.

Since the wing has a drag coefficient three times larger than the fuselage and tail it appears that some effort applied to the wing should be effective in performance improve-

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