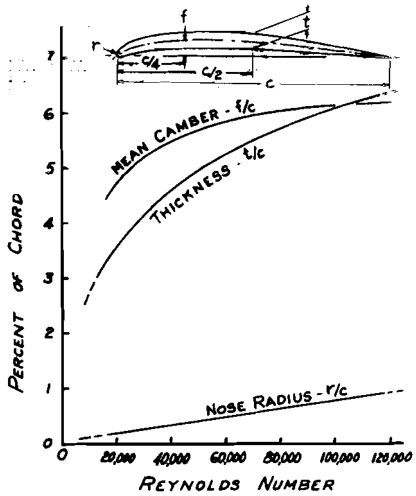


FIG. - 1

of Prof. F. W. Schmitz in "Aerodynamik des Flugmodells" are contained in Figure 1, which gives the camber, thickness, and nose radius in percent chord for any Reynolds number. A "Schmitz" airfoil is constructed as follows:

1. Choose the size and wing planform; this gives the wing chord (C).

2. Estimate the flying speed from the following approximate formula:

$$\text{Velocity (mph)} \cong 60 \times \sqrt{\frac{\text{Model weight in ounces}}{\text{Wing Area in square inches}}}$$

3. Find the Reynolds number from the formula Reynolds number $\cong$ 10,000 $\times$ V (mph) $\times$ C (ft)

4. From Figure 1, at this Reynolds number, pick off the camber ratio f/c, multiply it by the chord (in inches) to get the maximum mean camber in inches. Locate this point ¼ way between leading and trailing edges, i.e. at 25% chord.

5. Using a french curve or a bent and pinned strip of wood, draw in the mean camber line through the L.E., max camber pt., and T.E. (Keep the aft end rather flat for these airfoils).

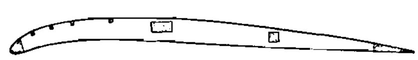
6. Add two circles, one at the LE with *radius* equal to (r/c) $\times$ C and another at the halfway station with *diameter* equal to (t/c) $\times$ C.

7. Fair in a nice-looking upper surface tangent to these circles and the T.E. (Use roughly the same curve as used for the camber-line).

8. Lay out several other circles tangent to this upper surface and centered on the camber line, then fair in the lower surface to these.

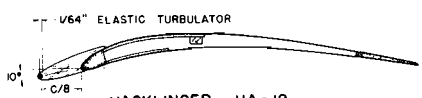
One of these airfoils, the Schmitz-Licher 6206, has been thoroughly and accurately glide-tested on a special test glider by the author and fellow members of the Tech Model Aircrafters while at M.I.T. It is shown in Figure 2. The tests showed this to be superior to the usual NACA 6409 and RAF 32 airfoils (and to a special drooped-trailing-edge British airfoil) at a Reynolds number of 40,000. However, because the lift is concentrated near the leading edge (due to the presence of a leading-edge bubble and the straight aft portion) the model must be balanced with the center-of-gravity more forward than usual when using Schmitz-type airfoils.

To improve the stall characteristics and permit even greater camber without serious separation, some German aeromodellers (notably Max Hacklinger) use a lightly stretched elastic-turbulator as shown in Figure



SCHMITZ-LICHER SL-6206

FIG. - 2



HACKLINGER HA-12

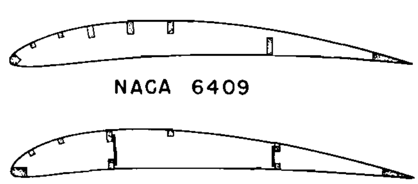
FIG. - 3

3. Round "Shirring" rubber from a sewing counter, or square rubber from a shock cord will do. Its position is important, and the supports should be spaced about 16 inches apart to allow the turbulator to vibrate in flight at frequency near middle-C. Some fiddling around with the location and tension usually results in improved results. It is significant that last two years' second place, and this year's first place, Nordic Championship models used such airfoils.

From the thin types we come to medium thickness category, in which the majority of commonly used sailplane airfoils fall. Proper construction can result in forced transition and good performance. Two of the most popular examples are shown, together with the recommended structure, in Fig. 4. For an average model sailplane the Reynolds number of these airfoil is below that required for natural transition, and it is *very* important to force transition by means of bumpy "multispars" (which the author prefers), or by surface or elastic turbulators. It has often been frustrating to some of the more skillful model builders when their smoothly sheeted and sanded wings were outperformed by the crude, angular products of beginners; the usual reason was that sharper leading-edges on the latter's wings assured a transition bubble with its favorable effects! For this reason a diagonal leading-edge strip, or one below the most-forward point (as shown) is beneficial. In cases where the glide seems poor, or stability is erratic (particularly if the stall is sharp and persistent) the addition of a 1/16-inch square surface turbulator just behind the leading edge is often helpful.

As far as the aft portion of normal airfoils is concerned, the main warning is to *avoid spars on the upper surface behind the 40% chord station*, for they provide a wonderful jumping-off bump for the airflow! On the other hand, it *is not necessary to make a knife-thin trailing edge so long as the bottom corner is kept sharp.* The reason is that the upper boundary layer is so thick that it doesn't know a sharp edge from a blunt one. But the lower boundary layer is much thinner (since flow is being pushed against it, whereby it accelerates, stays thin, and often remains laminar all the way back) so it needs a sharp edge to prevent the flow from curling around to the upper surface. In order to preserve the favorable laminar boundary-layer on the lower surface it pays to keep this surface smooth

(Continued on Page 22)



NACA 6409

MVA - 301

FIG. - 4

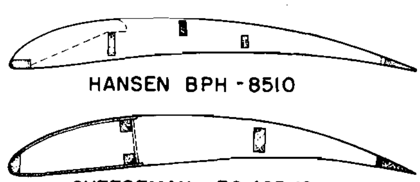


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FIG. - 5