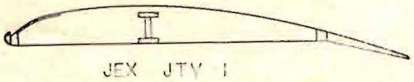
(*Continued from Page 19*)

and slick. Avoid doping the covering to any spars on the lower surface; better still, inset the spars as shown for the MVA 301.

Next come two of the more highly cambered airfoils, both designed especially for models (Fig. 5); one experimentally and the other theoretically. Scandinavian modelers found (through experiments with trailing edge flaps) that a "drooped" trailing-edge would decrease the sinking speed because of the resulting higher lift and lower flight speed, even at a small increase in drag. Hans Hansen's 1953 World Champion Nordic sailplane used the BPH 8510 airfoil and structure as shown on a wing of aspect-ratio 10:1. Notice the use of a sharp leading-edge, lack of sheeting, and location of the top spar in the flattest region, well forward of the separation point.

The second *really* high lift airfoil has been specifically designed for large model sailplane use by Gail Cheeseman of the NACA. *Providing* the Reynolds number is high enough (say around 100,000), and a turbulent boundary layer can be achieved



JEX JTV 1

FIG. 6

naturally or artifically, this airfoil is ideal. It is designed to operate at a lift coefficient of over 1.25 (for the sake of the technical readers!) and requires an aspect-ratio of 12 or more to show its mettle. Even so the structure should be no problem in such a thick wing.

One word of caution: these drooped trailing edge airfoils have a great diving tendency (airfoils try to follow their camber line, i.e. the more curved the aft portion is, the more the nose tries to tuck under). For this reason and the fact that their wake is very thick the tail should be longer, larger, and lower than usual.

The last airfoil has been saved 'til the end because it is both new and untried, but may prove to be quite effective. It is an attempt to combine the best features of good airfoils in a practical manner, all of this being made possible through the use of a "trapped vortex." (JTV-1 ≅ Jex Trapped Vortex airfoil, version 1). The sharp-cornered hollow just behind the leading edge causes a separation, under which a stable trapped vortex is formed. The separation forces transition and the vortex insures re-attachment of the turbulent layer. Because of the blunt leading-edge and the nature of a vortex-in-a-cavity, there should not be as much gust sensitivity as is the case with leading-edge bubbles. Finally, the combination of a flat forward undersurface and easily-adjusted sheet drooped trailing-edge makes for high lift with simple construction and covering.

About the only thing which is critical is a steep rise to the airfoil at the rear of the cavity to insure reattachment of the boundary layer there. Covering should be done *before* the addition of the pre-shaped leading and trailing edges. The latter should be attached approximately tangent to the upper surface to start and may be subsequently bent up or down during testing to achieve the longest duration.

Thus we have presented a group of low-speed airfoils especially suited to model sailplanes, of which all but the last two are internationally famous among experts. Now it is up to you to try 'em out and see which suits *your* glider best. Please feel free to write in any comments, pro or con. Good Luck!

ORDINATES FOR LOW SPEED AIRFOILS

PERCENT OF CHORD

| AIRFOIL | | NOSE RAD | STA. 0 | 1.0 | 2.5 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCHMITZ-LICHER G206 | U | (.8) | .7 | 2.2 | 3.6 | 4.9 | 5.8 | 6.7 | 7.7 | 8.2 | 8.4 | 8.5 | 8.3 | 7.6 | 6.5 | 5.3 | 3.8 | 2.2 | .5 |
| SL G206 | LWR | | .7 | -.02 | 0 | +.8 | 1.5 | 2.0 | 2.8 | 3.0 | 3.0 | 2.8 | 2.4 | 1.9 | 1.4 | 1.0 | .6 | .2 | 0 |
| HACKLINGER | U | (2.5) | 0 | 1.9 | 3.2 | 4.7 | 5.9 | 6.9 | 8.3 | 9.2 | 9.7 | 10.0 | 9.8 | 9.0 | 7.9 | 6.4 | 4.5 | 2.6 | .5 |
| HA 12 | L | | 0 | -.5 | -.4 | +.4 | 1.2 | 1.9 | 3.1 | 4.0 | 4.8 | 5.3 | 5.8 | 5.7 | 5.0 | 4.1 | 2.9 | 1.5 | 0 |
| NACA 6409 | U | (.5) | 0 | 1.6 | 2.9 | 4.3 | 5.5 | 6.3 | 7.8 | 8.9 | 9.7 | 10.1 | 10.4 | 9.8 | 8.8 | 7.5 | 5.3 | 2.9 | 0 |
| | L | | 0 | -.6 | -1.1 | -1.2 | -1.1 | -.9 | -.4 | +.2 | .6 | 1.1 | 1.7 | 1.9 | 1.9 | 1.8 | 1.4 | .7 | 0 |
| MVA 301 | U | (1.0) | 1.2 | 3.6 | 5.2 | 6.8 | 8.0 | 8.9 | 10.3 | 11.1 | 11.7 | 11.8 | 11.6 | 10.8 | 9.4 | 7.7 | 5.5 | 3.1 | .4 |
| | L | | +1.2 | +.2 | 0 | -.2 | .4 | .6 | 1.1 | 1.5 | 1.9 | 2.1 | 2.3 | 2.2 | 2.1 | 1.8 | 1.2 | .7 | 0 |
| HANSEN | U | (.8) | .8 | 3.0 | 4.5 | 6.4 | 7.8 | 8.9 | 10.5 | 11.5 | 12.0 | 12.3 | 12.5 | 12.0 | 11.0 | 9.5 | 7.0 | 4.0 | .5 |
| BPH 8510 | L | | .8 | 0 | 0 | 0 | 2 | 4 | 1.0 | 1.5 | 2.2 | 2.7 | 3.6 | 4.0 | 4.2 | 3.9 | 3.0 | 1.7 | 0 |
| CHEESEMAN | U | (1.5) | 1.8 | 3.3 | 4.7 | 6.4 | 7.8 | 8.9 | 10.6 | 11.7 | 12.7 | 13.3 | 13.8 | 13.6 | 12.8 | 11.1 | 8.5 | 4.6 | 0 |
| G.C 30-125-12 | L | | 0 | -.8 | -1.1 | -1.3 | -1.2 | -1.0 | -.4 | 0 | .6 | 1.1 | 2.2 | 3.0 | 3.6 | 3.7 | 3.2 | 1.7 | 0 |
| JEX | U | (1.5) | 2.0 | 3.3-2.0 | 3.2 | 5.0 | 6.3 | 7.1 | 8.0 | 8.5 | 8.8 | 9.0 | 8.8 | 8.0 | 6.7 | 4.6 | 2.0 | -.3 | -4.5 |
| JTV-1 | L | | 2.0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -2.5 | -5.0 |

# INTERESTING GLIDERS

*By* PETER M. BOWERS

The YAKIMA CLIPPER, designed and built by Charles McAllister, of Yakima, Washington, is probably the oldest airworthy glider in the United States. It was built in 1932, is in excellent shape structurally, and still has its original fabric.

In the past, this ship has erroneously been called a Darmstadt, a rather logical error, since it is a direct development of the famous German design. Actually, it is a thoroughly Americanized article, incorporating the lessons learned during the building and flying of two modified Darmstadt designs turned out in Washington by Volmer Jensen in the early 30's. Although only the single ship was built, it was given a type certificate. The stress analysis necessary for this certification was done by N. D. Showalter, now Chief Engineer at Boeing's Wichita plant.

In the years preceding World War II, the YAKIMA CLIPPER was the outstanding sailplane of the Pacific Northwest. At the time McAllister began flying it, thermal soaring was practically unknown, and slope soaring was the approved method. The terrain in the Ellensberg-Yakima section of Washington is ideal for this type of flying, and the winds at Ellensberg are famous for steady velocity and long duration. At one time, when the wind had been blowing its usual 30 to 40 MPH for several days, McAllister decided to make an attempt on the America duration record, held at the time (and still held) by Lt. Cocke with 21 hours. After the necessary preparations of crew and launching site, the CLIPPER was launched, and remained airborne for fourteen hours, at which time the wind died and the flight was terminated.

Construction is all wood, with fabric covered wings and tail surfaces. The wing is in three pieces, with a straight center section and tapered

(*Continued on Page 24*)