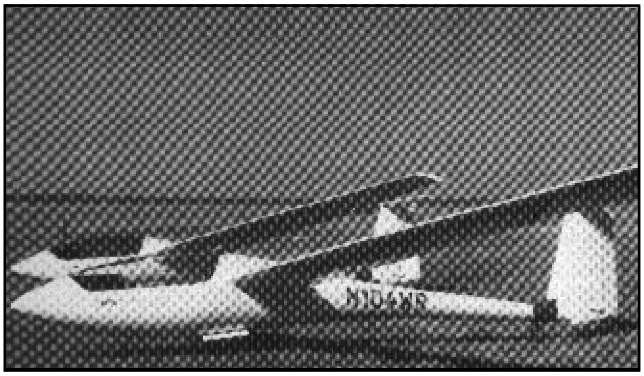
A FLIGHT TEST EVALUATION OF THE AS-W 20

By Richard H. Johnson, Published in *Soaring* Magazine, May 1978

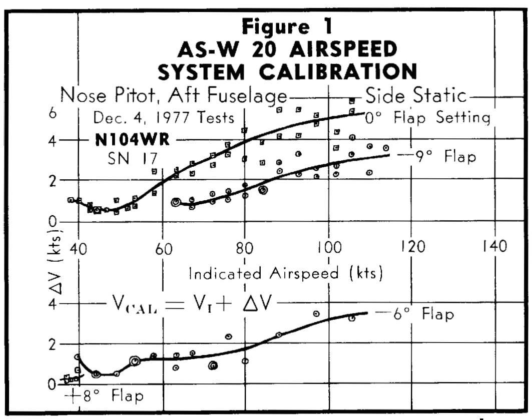


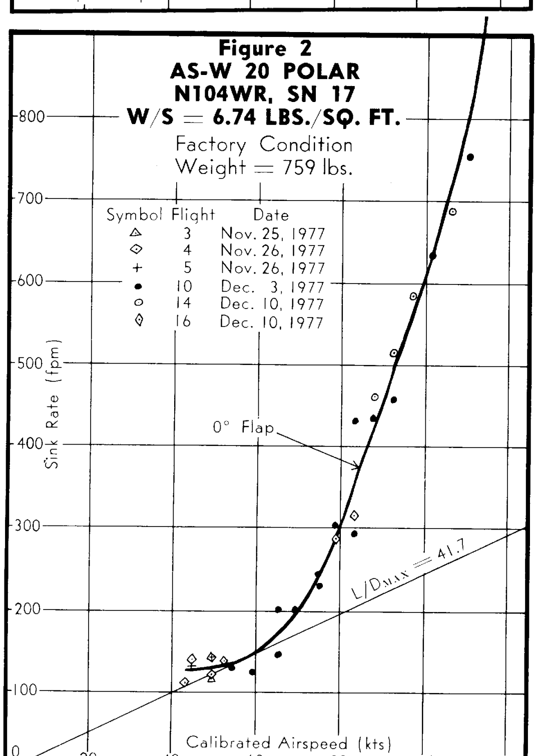
The test aircraft used in this article in Bill Ruehle's N104WR (foreground). It was flown with Bill McFarland's `20 (in background), but evidently no systematic comparison was made.

The Schleicher AS-W 20 is the 15-meter flapped sister ship to the unflapped 15-meter AS-W 19 that was reported in Reference A. This is Schleicher's 20th design and designer Gerhard Waibel's long-heralded entry into the new and fiercely contested 15-meter racing class market. It gained an early reputation as being one of the best of this new class, and its sleek lines supported its high performance claims. Was it really that good? I was certainly curious to find out.

Bill Ruehle of Duncanville, Texas, received delivery of his beautiful AS-W 20, SN 17, late last summer, and he kindly offered it for flight test measurements and evaluation. Its weight is somewhat high but typical of several others for this newer generation design, being about 565 pounds empty, without instruments, battery, or radio, and 582 pounds equipped. Gerhard does not design fragile sailplanes, and this one has a high 143-kt placard airspeed — if the air is not too rough. The wing panels average about 153 pounds each, with the right wing weighing 1 .6 pounds more than the left.

The handbook did not state what the wing area is nor the airfoil sections used. Our measurements showed about 112.6 ft.^{2} Qf wing area, and some of my PIK-20 leading edge airfoil templates fit the AS-W 20 wing almost perfectly from the fuselage out to the start of the aileron. Along the entire aileron portion, the AS-W 20 wing leading edge has a considerably larger nose radius than does the PIK-20's Wortmann FX67-K-170/150 airfoils. The PIK-20's wing measures 1 7% thickness-to-chord ratio from the fuselage out to the start of the ailerons, then a linear taper down to 15% thickness at the wingtips. Our giant caliper measurements of the AS-W 20 wing showed 15.3% thickness at the root, 14.2% at the inboard end of the aileron, and 12.9% thickness-to-chord at the wingtip. The AS-W 20 wing averages close to 2.5-t/c-percentage points thinner than the PIK-20's wing, a significant amount.

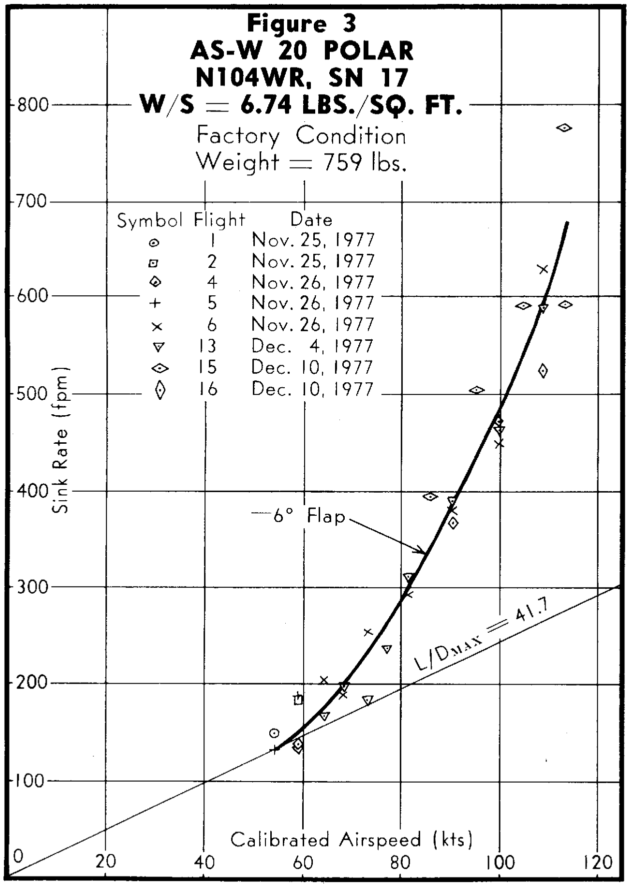


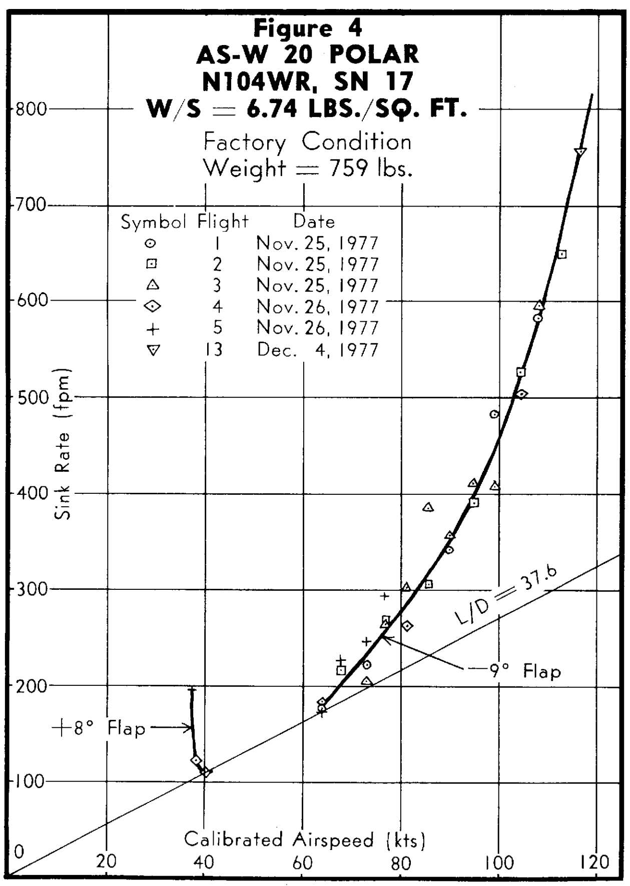


Practically all airspeed systems have some inherent errors; so these must be measured before a sailplane's true performance values can be determined. The AS-W 20 uses a nose pitot and aft fuselage side static system configuration identical to the AS-W 19, which measured a relatively high +7% error (Reference A). The only differences between the 19 and the '20 that might affect the airspeed system calibration appeared to be a slightly higher wing location for the AS-W 20 and its differing flapped airfoil section ahead of the aft fuselage static ports. The AS-W 20 airspeed calibration flights showed that the errors were smaller than the '19's but that they varied with wing flap setting. Because of this variation with flap settings, three high tows were needed to obtain adequate airspeed system calibration data.

These data are shown in Figure 1, as functions of both flap setting and indicated airspeed. Here the airspeed system errors are about +5% when the flap is set at 0°, and they become smaller when the flaps are set at negative angles. Flight test measurements of unflapped sailplanes are considerably less complicated and expensive to perform than are those of most flapped designs.

Next, the high tows to measure sink rates at various airspeeds and flap settings were performed, and these test data are shown in Figures 2 through 4. Designer Gerhard Waibel had written to me in anticipation of the testing, saying the German tests were somewhat inconclusive as to which flap settings are optimum. He asked that DGA perform extra measurements to confirm which flap settings were best, and thereby blew our tow bill right through our (normal) ceiling! A total of 15 high tows were made to obtain





the needed sink rate data. However, many of these tows were only to 7000 feet or less because of weather and/or towplane limitations.

We did not have enough funds to measure complete polars for each flap setting, as with last spring's PIK-20B testing, but our goal here was to define the most important airspeed ranges for each of the AS-W 20's four flap settings. Figure 2 shows the test sink rate data taken with the flaps set to 0°. Surprisingly good performance is shown in the 50 to 70-kt speed range, with an L/D_{max} of about 41.7 indicated at 57 knots. Apparently the AS-W 20 wing is achieving extensive low drag laminar flow in that airspeed region and the performance is better than I had expected.

Figure 3 shows the data taken with the flaps set to -6°, and these data also indicate that about 41.7 L/D_{max} is being achieved. Figure 4 presents the data taken with the flaps set to their full negative -9° setting, and also those with the flaps set at the +8° position that is used for thermaling. Here a somewhat lower 37.6 L/D is indicated for the -9° setting, principally because the testing did not include airspeeds below 64 knots with that flap setting. Likely, about 40 to 1 would have been achieved at 7 knots less airspeed, but funding limitations precluded getting all the data I would like to have taken.

The +8° flap setting also was more limited than I wanted, but it did indicate excellent thermaling performance with about 110 ft./min.-sink rate at a remarkably slow 40 knots. Unfortunately, I had little opportunity to thermal the AS-W 20 because our winter thermals were unusually poor during the flight test days. Bill McFarland of Tennessee brought his new AS-W 20 to Texas during the test period, and we did soar together for about a half-hour, but flying two '20's together gave little indication as to how they compared to other designs.

Figure 5 is a summary plot showing the four separate polar curves from Figures 2 through 4, and it shows two interesting things. First, that the -6° flap setting appears to have no useful value because the 0° and -9° settings appear to provide equal or lower sink rates at all tested airspeeds. The second is that a scallop type break occurs in the best measured polar where the 0° and the -9° flap setting polars intersect at 76 knots. This break suggests that a better flap setting might exist at that airspeed region, perhaps -4°. Why the tested -6° flap setting did not perform better is unknown.

Figure 6 is a plot showing the measured polars of the AS-W 20 compared to those of the Mini-Nimbus and PIK-20B, reported in References B and C, respectively. Here a clear performance advantage is shown for the AS-W 20 in the 50 to 75-kt speed range, which will make it hard to beat in weak weather contests. In the important 75 to 85-kt speed region, which is normally used for cruise during better weather, the Mini-Nimbus' performance is about equal to that of the AS-W 20, provided it is ballasted to an equal 6.74 lb/ft^2 wing loading. Above 90 knots, the AS-W 20 is superior to either the Mini-Nimbus or PIK-20B.

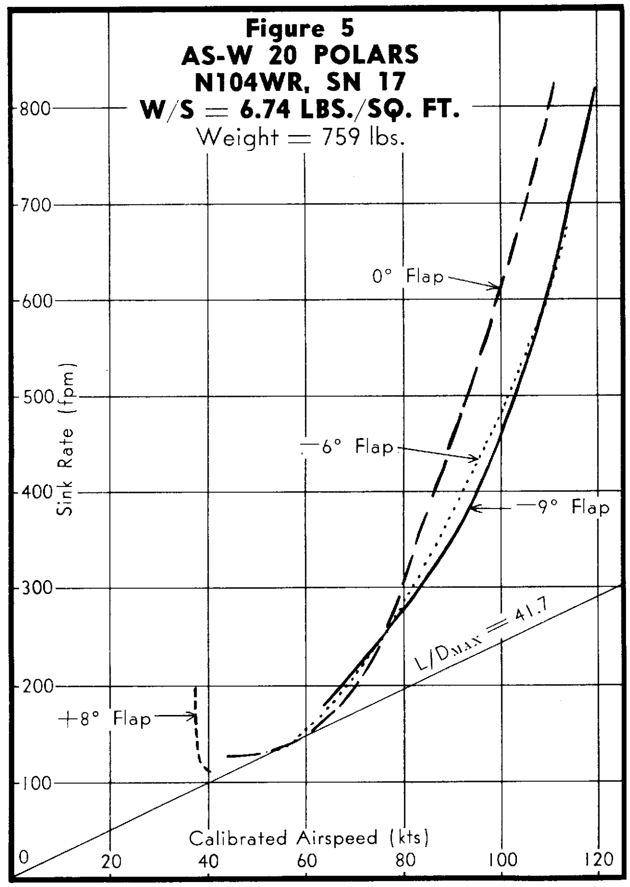
The last tests were performed with the tape "bugs" applied on the AS-W 20's wing leading edges, in our standard 20/meter pattern. These data are shown in Figure 7. They indicate a moderately large 22% decrease in L/D_{max} over the clean wing data and a very severe 47% increase in sink rate at 90 knots. Below 90 knots the "buggy" Mini-Nimbus appears to have measurably better performance than the AS-W 20, and about equal performance above 90 knots. The AS-W 20 clearly does suffer a higher-than-average performance penalty with the roughened wing leading edges, which apparently destroy its beautiful low drag laminar airflows.

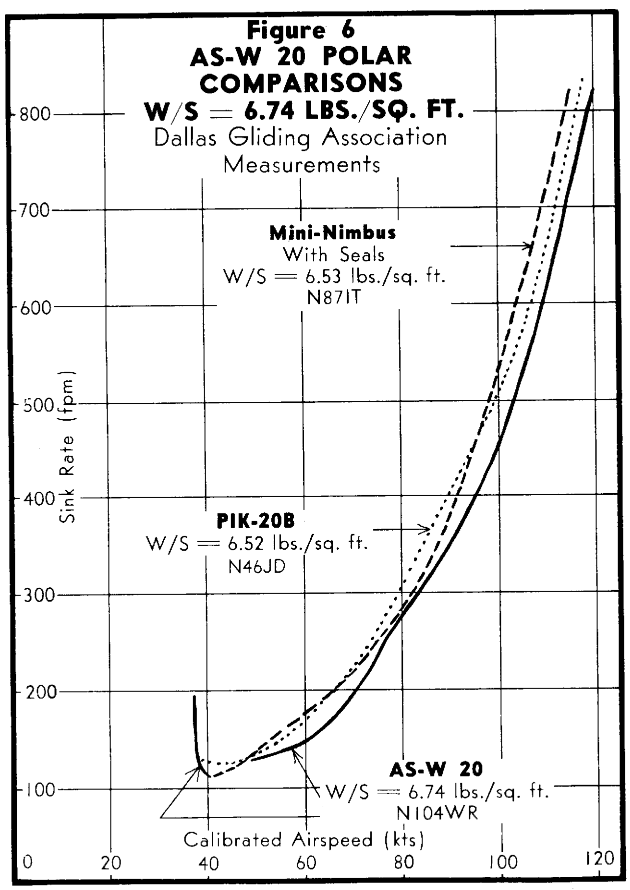
The cockpit layout and forward-hinge canopy system of the '20 appears to be identical to that of the AS-W 19, which is excellent. The only cockpit arrangement difference is that of an additional lever installed on the left side of the cockpit to control the flap movement. Gerhard went to a lot of effort to provide the '20 with a really first-class flap and aileron system. Friction is low, and yet the flaps move differentially with the aileron roll movements to provide additional roll control, as with the AS-W 17. With +8° thermaling flaps and only 46 knots calibrated airspeed the +45° bank to 45° bank roll can be performed in about 5 seconds, which is very good roll performance.

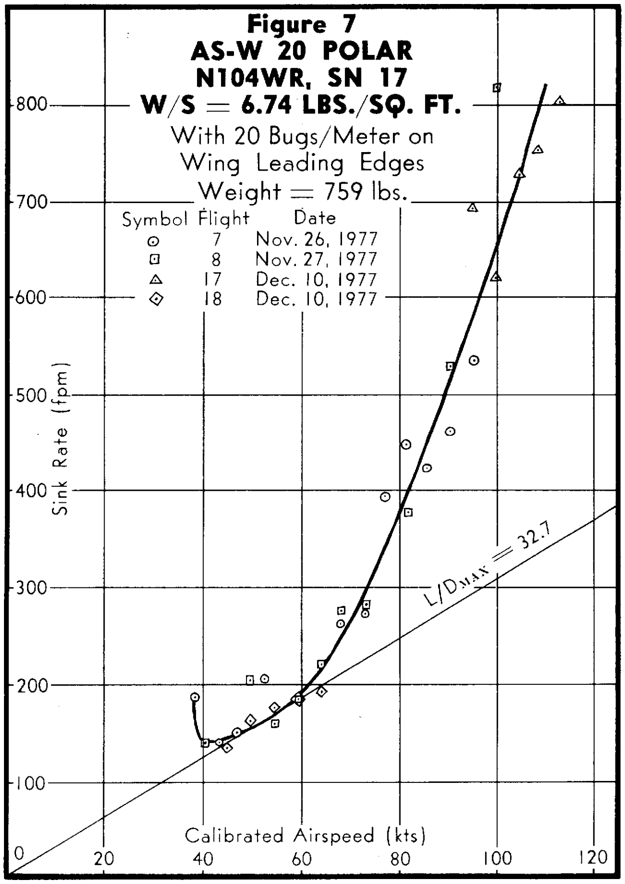
Also, for those who like to land slowly, the wing flaps come down to a full +55°, which brings the calibrated stall speed down to about 33 knots. In addition, the ailerons automatically move up to a -8° position to provide better lateral control when the wing flaps are deflected beyond about 15° in the positive direction. This provides good roll control even during landing rollout, without having to place the flaps in a full up position to avoid aileron stalling and sudden wing dropping during the final part of landing rollout. The +55° flap position produces sufficient drag to provide PIK-20A/B type glide path control, provided the approach is made from normal altitudes. For those who really want to descend steeply, top wing surface airbrakes are also included. With both the flaps and airbrakes extended, the glide ratio is reportedly 4 to 1, and one has to be careful that sufficient airspeed is available to round out the final portion of the approach. It would be dangerous to use the full +55° flap setting under windy conditions because a sudden lull or wind shear could result in insufficient airspeed for control of the sailplane when rounding out.

Directional stability is good and it is not difficult to keep the yaw string centered. Stall characteristics from both straight and turning flight are quite satisfactory. Longitudinal stability is somewhat low but probably adequate for a racing class sailplane. The horizontal tail appears to be

Aileron/flap interconnect can be seen in positive and negative setting in place.







exactly like that of the AS-W 19, except that 6 inches of span have been removed from the tips on each side. The longitudinal stability is better than that of the Mini-Nimbus, but still a bit low, especially when flying with the flaps set at 0° or -6°. With the flaps set to -9° the high speed stability seems to be somewhat improved.

The tow release mechanism is attached to the forward part of the landing gear, and, for this reason, the landing gear cannot be retracted until after tow release. This low and aft towhook location, combined with the fairly small horizontal tail, causes the AS-W 20's aerotow characteristics to be less than fully satisfactory. Continuous pilot attention is needed while towing to maintain correct position, but then perhaps the pilot does not have anything better to do anyway.

The landing wheel is the full sized 13.6-inch diameter by 5-inch wide type that should give good service. The wheel brake control lever is nicely mounted on the control stick where it belongs, but the wheel braking effectiveness appeared a bit low. To achieve greater brake actuation forces, I am told that some AS-W 19 and '20 owners are replacing their brake control handles with longer ones, such as those used on the Standard Cirrus and Nimbus II. Also, that installation of a better cable housing and clamping system helps too.

"Aw Shucks!" Author Dick Johnson has just recorded better that 40:1 for the AS-W 20 – a glide ratio he believed to be beyond the capability of 15-Meter racers.

The canopy apparently seals itself quite well just as it comes from the factory. The cockpit stays remarkably quiet, even during high-speed dives. The whole sailplane is nicely finished in customary Schleicher fashion. The wave gage measurements of the wing surfaces showed an average peak-to-peak wave height of about .0035 inches on the top surfaces and about .004 inches on the bottom surfaces. These values are relatively low and about equal to those measured on the best factory-prepared wing surfaces.

All considered, I could find very little fault with the AS-W 20 sailplane, and its performance is remarkably good. I really thought that a true 40-to-i 15-meter sailplane was a hoax, but I am now convinced that it is not. I expect that the AS-W 20 owners will happily try to dominate the future 15-Meter Class contests, as they have a very fine bird with which to try.

Thanks go to Bill Ruehle for the use of his beautiful new sailplane, to the Dallas Gliding Association for providing the many high tows, to Bob Gibbons for reducing and checking the flight test sink rate data, and to those who assisted with the testing operations at Caddo Mills Airport.

References

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