

A FLIGHT TEST EVALUATION OF THE SCHLEICHER ASW-24W

By Richard H. Johnson, Published in *Soaring Magazine*, May 1994

The ASW-24W is perhaps the most modern and highest performance Standard Class sailplane currently being produced in the world. The "AS" stands for the grand old Alexander Schleicher firm in Poppenhausen/

Wasserkuppe, Germany, which has produced high quality sailplanes since 1927. The "W" stands for engineer Gerhard Waibel, who joined that firm in about 1965, after participating in the revolutionary D-36 composite Open Class sailplane development, along with Klaus Holighaus and Wolf Lemke, while a student at Darmstadt. He is one of their outstanding designers whose initial Schleicher projects were the ASW-12, ASW-15 and ASW-17 composite sailplanes. In 1993 he was awarded the OSTIV Prize "...for exceptional contribution to sailplane pilot safety, relating in particular to the design and construction of crashworthy cockpits, which have

Three-View Drawing-ASW-24

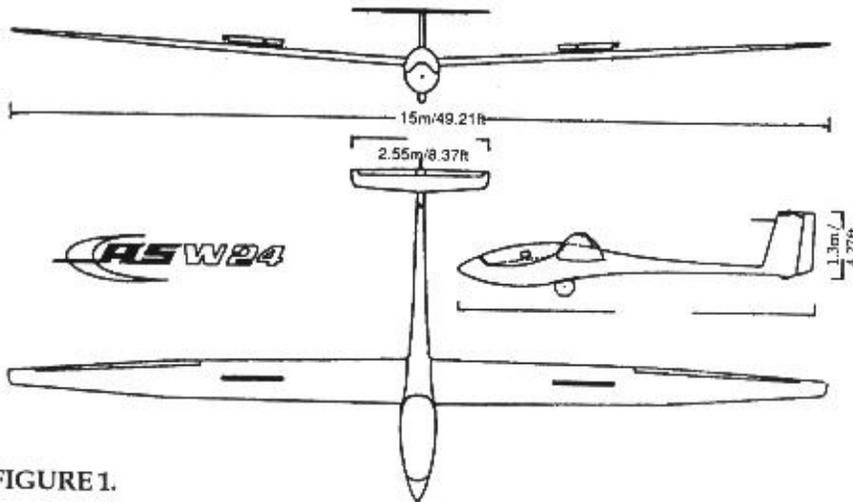


FIGURE 1.

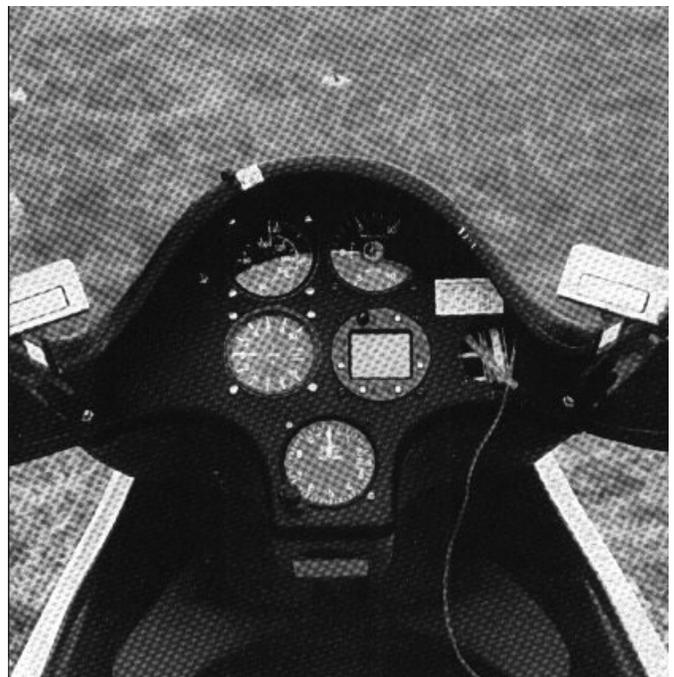
proved effective in accidents."

Sharing equally in the ASW-24 design is the talented and well known Delft University of Technology (Holland) Faculty Member, researcher and glider pilot Loek Boermans. He is an outstanding aerodynamicist and airfoil designer, and is in charge of Delft University's highly regarded Low Speed Laboratory, including its superb wind tunnel. Gerhard Waibel was so impressed with Loek's aerodynamic prowess that he assigned the ASW-24 aero design to him, but with close cooperation with Gerhard and the Alexander Schleicher factory. Thereby, they created a real winning team. An excellent joint OSTIV paper describing the ASW-24 overall development was published in Reference A.

The ASW-24 series incorporate the cockpit crashworthiness features for which Gerhard Waibel worked hard to develop, and those features are now setting the standards worldwide for sailplane safety design. Bill Ruehle received his new ASW-24W, s/n 217 during late 1993 and it included Gerhard and Loek's new 30 cm (12 in) high wing tip winglets (the "W" stands for winglets). Figure 1 presents a 3-view of the basic



Designers Gerhard Waibel and Loek Boermans have once again created a work of art in the form of the ASW-24W Standard Class sailplane.



A comfortable cockpit and very well designed instrument panel can be found in the ASW-24W.

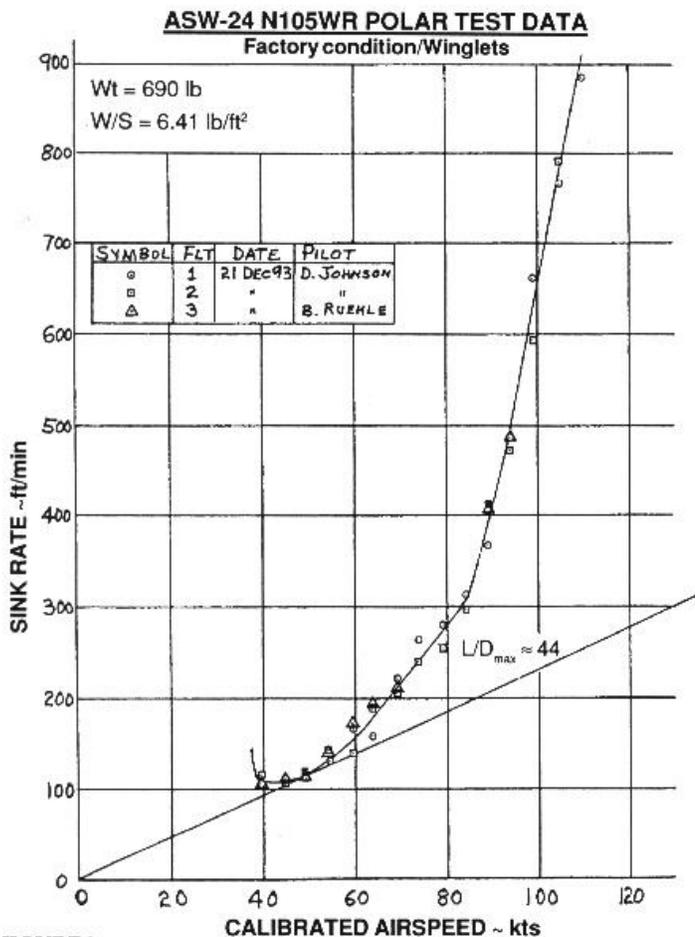


FIGURE 2.

range. The pitot is located on the vertical fin and the airspeed system static orifices are located on the aft fuselage sides. The tail fin tube is a standard Multi-Probe unit that combines the pitot, vario/computer static, and total energy tube into one unit. The Handbook requires the sailplane airspeed system static to use the aft fuselage side orifices, and not the Multi-Probe static.

The cockpit of the ASW-24 is comfortable and very well laid out. The extra-high side rails provide an unusually high degree of cockpit strength for pilot crash protection. To reduce the high rail's cockpit view obstruction, they are inset from the canopy by about three inches at midpoint; thereby still affording a good outside viewing from the cockpit. The canopy is an excellent forward hinged one piece unit that raises the instrument panel with it to allow easy cockpit ingress and egress.

The canopy is latched by a forward movement of 2 white levers, one on each side near the midpoint of the canopy rails. For normal removal or emergency jettisoning the canopy, 2 red levers are located about three inches ahead of the normal latching white levers. When the red canopy jettison levers are pulled aft, they not only release the canopy's front attachment, they also force the white levers aft to their release positions, thus releasing all the canopy attachments simultaneously. It is the best canopy latching and jettisoning system that I have seen, and it fully meets the OSTIV Sailplane Development Panel's recommendation that canopy emergency jettison be accomplished through aft travel of two separate handles or levers.

The rudder pedals are in-flight adjustable, and the elevator trim system is similar to that of the excellent Glasflugel sailplanes where a reset trigger on the control stick releases the trim spring and allows the stick to be moved to a new trim position. Releasing the trigger then engages the trim spring at

ASW-24, and does not yet show the new winglets. The ASW-24W includes the optional winglets. The sailplane is equipped with well-installed seals on all control surfaces, as well as an apparently optimized zig-zag turbulator strips located on the wing bottom surfaces, the winglets, the horizontal stabilizer, and the vertical stabilizer surfaces. All the surfaces were very smooth, and appeared to have almost no unwanted waviness.

After Bill received his new ASW-24W, he kindly agreed to its use for flight test measurements, and the Texas Soaring Association graciously offered to provide the high aero tows needed. Three high flights were made on December 23, 1993 to measure the sailplane sink rates at various airspeeds. Those data were corrected to sea level/standard conditions, and are shown plotted versus calibrated airspeed in Figure 2. An impressively low minimum sink rate of about 108 ft/min (.55 m/sec) was shown at 45 kts, and a superb maximum glide ratio of about 44 was measured at 49 kts. Bill flew one of the sink rate test measurement flights and I flew the other two. The air was calm that day and there was very little scatter in the test data.

The last flight of that day was for the airspeed system calibration, which I flew, and those data are shown in Figure 3. The ASW-24 has a remarkably accurate airspeed system with only about one knot of error measured over the entire calibration



The ASW-24W, with winglets shown.

ASW-24 AIRSPEED SYSTEM CALIBRATION

N105WR, SN 24217, 690 lb, December 21, 1993 Test

Tail Fin Pitot, Aft Fuselage Side Statics

$$V_c = V_i + \Delta V$$

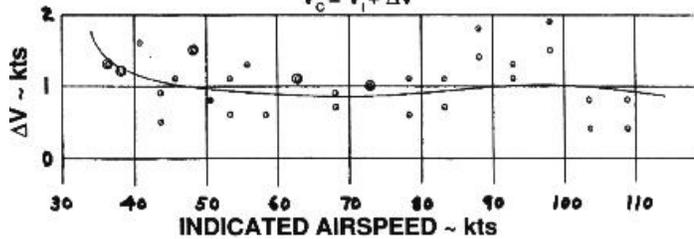


FIGURE 3.

portion of the left cockpit side mounted airbrake handle actuates the wheel brake, as it should. In the event of an excessively hard landing, Gerhard designed the replaceable landing wheel support struts to progressively collapse, thereby minimizing danger of injury to the pilot (1993 OSTIV Commendation Award). A semi-submerged 210 by 65 mm pneumatic tail wheel was installed in the test sailplane, but it can be interchanged with an optional streamlined skid for those who might want to minimize drag even further.

The calibrated stalling airspeed was about 36 kts at the 690 lb (313 kg) dry flight test weight. The indicated airspeed at stall was somewhat less, likely because the tail fin pitot starts to enter into the wing/fuselage wake. The stall is relatively gentle for a high performance sailplane, but of course it will drop a wing if provoked and will start to spin if the stick is held aft. That is similar to the manner exhibited by the excellent SZD-50-3 PUCHACZ two seated trainer recently tested at TSA, and reported in Reference B. Little yaw effect was seen on the airspeed system, at least at the normal sideslip angles tested. At 45 kts indicated, 45 degree-to-45 degree rolls could be accomplished in about 5 seconds, and there was adequate rudder control to keep the yaw string centered.

The left wing panel of N105WR weighed 122.8 lb and the right 124.8 lb empty. Twenty one gallon (79.4 liter) Smiley water bags in each wing panel will add about 3 lbs to each wing when empty, and a total of about 356 lb (161.5 kg) when filled. Add 3 lb for the manually operated 1.5 inch diameter PVC drain valve system located in the wheel well, which reportedly can dump the entire 42 gallons of water ballast in slightly over 2 minutes. The wing ballast is located so close to the flight C.G. that the complication of a tail fin water ballast tank was considered as unnecessary. Up to 13.23 lb (6 kg) of battery and/or fixed ballast can be installed in the upper tail fin, to balance out heavy cockpit loads.

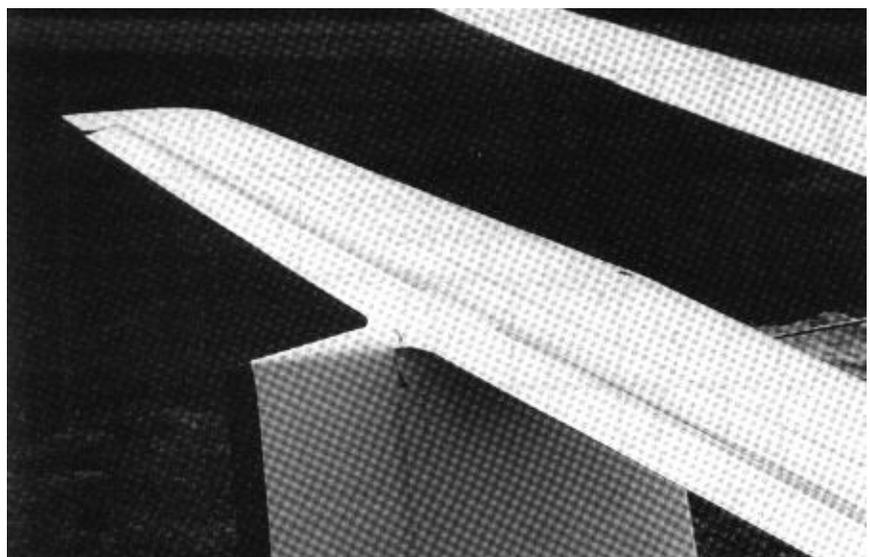
The wing bottom surfaces are equipped with .5 mm (.020 in) thick by 12 mm (.47 in) wide zig-zag turbulator tape strips from the panel roots to near the tips. Their aft edges are located at .793 chord at the panel roots, at .769 c at the aileron roots, and .72 c at the aileron tips. The wing airfoil is specified as the Boermans DU 84-158 design. Its thickness-to-chord ratio is specified as 15.8 percent, and it appears to function well.

To investigate the effectiveness of the turbulator tape on the DU 84-158 airfoil, the Reference C wing profile drag rake was installed on the left wing trailing edge 1.374 m (4.51 ft) outboard from the wing/fuselage joint. The first test was with the factory turbulator strip installed on the clean wing. The next flight test was with the turbulator strip removed for about 12 inches on both sides of the probe. The third test flight was with the turbulator tape replaced and with about 40 duct tape simulated bugs per meter span applied to the wing leading edge ahead of the drag probe.

Those test data are shown in Figure 4 (expressed as the free stream pitot

the new stick position. The airbrakes are Schempp-Hirth type top surface only devices with good effectiveness, and are easily operated. Commendably, all controls connect automatically upon assembly.

Another outstanding feature of the ASW-24 is its large and carefully sprung 5.00-5 main landing wheel which is equipped with a fine Cleveland hydraulic disc brake that really works. It appears to be the same wheel and brake system that my 750 kg (1656 lb) Nimbus 3 uses. The final opening por-



A view of the tail section of the ASW-24W.

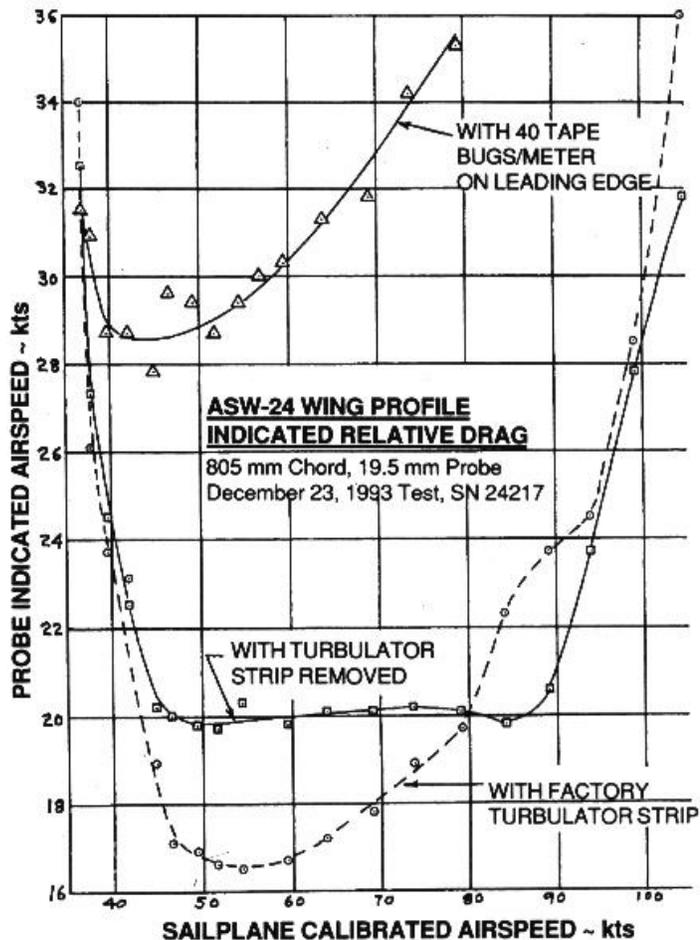


FIGURE 4.

In summary, it appears that the ASW-24W is the new standard of excellence for competition sailplanes, and its co-designers Gerhard Waibel and Loek Boermans have many reasons to be proud of it. They both certainly deserve congratulations on their outstanding work and contributions to modern sailplane development. They will be long remembered for that.

Thanks go to Bill Ruehle for sharing his fine new sailplane for the test measurements, and to the Texas Soaring Association for generously providing the 8 high tows needed for the testing, and their tow pilots who kindly contributed their piloting skills and time to the test program.

Reference:

- A. Boermans, L. M. M. and Waibel, Gerhard, "Aerodynamic Design Of The Standard Class Sailplane ASW-24", *Technical Soaring*, Vol. 13, No. 3, July, 1989
- B. Johnson, R. H., "A Flight Test Evaluation Of The SZD-50-3 PUCHACZ 2-Place Trainer", *Soaring Magazine*, April, 1994
- C. Johnson, R. H., "At Last; An Instrument That Reads Drag", *Soaring Magazine*, October, 1983

pressure minus the rake integrated pressure) as a function of sailplane calibrated airspeed. For convenience the differential pressures are expressed as knots (an airspeed indicator is actually a differential pressure gage). A low differential pressure, shown here as knots, indicates a low wing profile drag, but only in relative units.

The Fig. 4 data indicates that the factory installed wing turbulator worked very well between 37 and 80 kts, achieving an impressive 3.5 kts drag reduction at sailplane airspeeds of 47 to 62 kts. Above 80 kts the turbulator incurs a penalty, especially in the 84 to 92 kt region where a 2 to 3 kt drag increase is indicated. That appears to be acceptable, considering the large drag reductions afforded at the lower airspeeds. Perhaps some sort of retractable turbulator will be developed in the future, such as a blow hole system controlled by an airspeed sensing valve system. The test ASW-24 was equipped with blow hole ducts in each wing, but no turbulator holes were drilled as yet. Likely that is planned for the future.

It is not surprising that the highest drag curve shown in Figure 4 is that where the 40 simulated bugs were attached to the wing leading edge. There a whopping 8 to 12 kt drag increase is shown, and that is to be expected when the airflow of a highly laminar low drag wing is severely disturbed.