A FLIGHT TEST EVALUATION OF AN LS-4A, PART II
By Richard H. Johnson, Published in Soaring Magazine, March 1985

Our December '83 tests of an otherwise excellent LS4a sailplane at Caddo Mills had regrettably indicated somewhat less performance than expected. (Ref. A). Therefore we were pleased when Ron Hatcher, an ex-USAF F-106 pilot and currently an airline DC-9 pilot, offered his LS-4a for further testing. His sailplane was about six months old and carried a 384 serial number, compared to 321 for the LS-4a tested earlier.

Both sailplanes were beautifully finished throughout, and both displayed excellently smoothed wing surfaces. Wave gauge chordwise measurements of both averaged only about .002 inch (.05 mm) peak-to-peak waviness on both top and bottom wing surfaces. The newer LS-4a wing panel thickness and chord measurements showed that its tmax/chord ratios were .1630 at the wing roots, .1652 at the aileron root stations, and .1488 at the aileron tip. These t/c values are essentially the same as those measured for the earlier #321 sailplane.

About the only difference noted between the two test LS4a sailplanes was that #384 carried a bit more wing sealing, and it was equipped with a landing gear mounted towhook compared to #321's fuselage nose towhook installation. For the above reason #384 used a fuselage nose airspeed pitot, whereas 321 used a pitot mounted in the leading edge of its vertical tail fin. The ailerons of the better sealed #384 appeared to be a bit heavier to operate, but still not unpleasant.

Flight noise heard by ground observers was significantly lower with the newer sailplane.

Four high tows were made during the fairly still weather conditions of the first test weekend, and one additional tow was made during the following Sunday to measure #384's sink rates versus airspeed, i.e., its polar. The data from those flights are shown in Figure 1. A minimum sink rate of roughly 105 ft./min. is shown at 40 kts, and an excellent ~40 to 1 L/Dmax is shown at about 58 kts. A modest drag knee is indicated at 55 kts, but not as pronounced as with the #321 test. Above 65 kts the new polar was essentially identical to that of the earlier tested LS-4a sailplane.

For some reason Ron Hatcher’s three test points between 90 and 105 kts showed somewhat less sink rate than did my four test points. Ron is about 40 lbs. heavier than I, but I corrected his points by the square-root-of-the-weight-ratio theoretical factor to my and test pilot Sherman Griffith’s lighter gross weights. The sailplane’s cg was about one-half inch (13 mm) forward of aft limit during all flights, therefore both of the heavy pilots used four pounds (1.8 kg) of tail ballast. Happily all four test pilots’ data agreed well near the 40 to 1 L/Dmax airspeed of 58 kts.

Mike Newgard performed the airspeed calibration, and his data are shown in Figure 2. These data are close to those measured earlier with #321 at airspeeds below 60 kts. Both sailplanes used the same hand-book specified statics located on the lower portion of the fuselage nose sides, about 20 inches (.51 m) aft of the nose tip. However, Ron’s newer #384 used a fuselage nose pitot instead of the tail fin pitot found on the earlier #321.

Although we did not measure the LS-4a’s pitot and static system errors separately, recent test data from an AS-W 19 and an AS-K 21 did show a significant amount of pitot pressure loss at high airspeeds with those flush fuselage nose pitot systems. That is likely the reason for #384 indicating about two knots lower airspeed at 120 than #321 with its better tail fin pitot. The basic too-high readings above 45 kts for both are probably due to nose-induced suction pressures at the fuselage nose static port location.

The last test performed with #384 before it left for its new Phoenix, Arizona home was to install the wing profile drag monitor probe on its left wing trailing edge, 30 inches (.75 m) out from the fuselage side. A final high tow was then made to record wing drag data in smooth air. Those data are shown in Figure 3. The probe used during this test was the same one used before for the #321 test, and located at the same span position.

Note that the new #384 data indicates a more classical flat-bottomed laminar bucket shape, with lowest drag indicated between about 45 and 80 kts. The earlier #321 test data indicated less wing drag above 46 kts sailplane airspeed than did those shown in Figure 3 for #384, probably because of a slightly deficient pitot reference.

The wing drag probe system requires full pitot pressure into the pitot side of the indicator instrument to achieve accurate drag probe readings. Because it was suspected that the
LS-4a’s fuselage nose pitot would be somewhat deficient at higher airspeeds due to cross-flow effects, a Kiel tube (Ref. B) was temporarily taped on #384’s canopy to provide full pitot pressure to the drag instrument.

Last year’s test of #321 used the tail fin pitot for both sailplane airspeed and drag probe systems. It is quite possible that the tail fin pitot tube did not provide the required full pressure needed for accurate drag probe readings at the higher airspeeds.

Also, it is possible that my lag compensation system may not have been accurate enough during one or both flights. The large internal volume of our current test Kollsman ASI makes this instrument somewhat difficult to dynamically balance properly, and thus obtain accurate and repeatable data. Larger diameter tubing to the probe is planned for future use to reduce this possible source of error.

Thanks to Ron for the kind use of his fine new sailplane, and to those who assisted in its testing, and to the Dallas Gliding Association for providing the test tow funds.

REFERENCES
