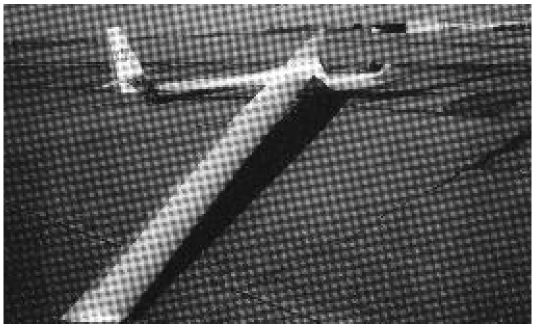
A FLIGHT TEST EVALUATION OF THE LAK-12 20.4 METER SAILPLANE

By Richard H. Johnson, Published in *Soaring* Magazine, July 1996

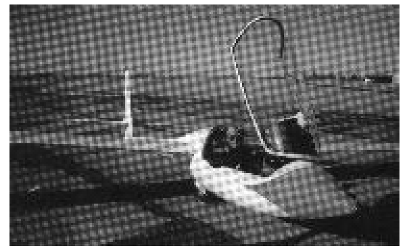
INTRODUCTION

The LAK-12 is a well-made, Lithuanian Open Class, high-performance, single-seated sailplane that has only become available relatively recently outside of the Soviet Union nations. It is manufactured at an aircraft factory in the Lithuanian Republic and is fabricated of modern epoxy, fiberglass and carbon fiber materials. The initials LAK stand for Lithuanian Aircraft Constructors, and it was founded during the 1960's. Formerly, the entire LAK production was utilized by the Soviet Nations for their state-supported gliding schools and clubs, and therefore was not available to the other countries of the world. It has been in production in Lithuania for about 10 years, and about 230 have been built, but only in recent times have they become available in the U.S.



LAK-12 on Caddo Mills Airport runway.

When Eduardo Iglesias of Houston, Texas, offered his recently purchased LAK-12 for flight testing at Caddo Mills, we quickly accepted his kind offer. His LAK-12 sailplane has serial number 6199, and it was built in January of 1992. It was essentially new, except for a single, 23-minute initial test flight. It had been consigned to storage after manufacture because the Soviet Union had to cease their sailplane purchases from the LAK factory that year. When that happened, I am told that most of their sailplane production was consigned to storage until markets could be developed. Subsequently, the LAK-12 sailplanes began to appear on the world sailplane markets. The LAK-12 sailplanes were attractively priced, and when Henry Gaudet began his role as U.S. dealer/representative for the LAK sailplanes, the LAK-12s began to arrive in the U.S. It is a robust, high-performance sailplane, enjoyable to fly, and affordable to many. Although its wing design uses the somewhat dated but proven Wortmann airfoils from the 1960's, it is endowed with modern, carbon-fiber wing spar caps, a reportedly crash-worthy cockpit, and an innovative low drag fuselage nose ventilation air inlet. Also, it is finished with a hopefully trouble-free, white epoxy paint, instead of the usual beautiful, but prone to crack, polyester gelcoat finish.



Test pilot Mike Davis ready for wing drag probe test flight. Note Rico Drag Monitor temporarily installed on top of instrument panel, and Kiel tube pitot on left side of canopy.

Double plated Schempp-Hirth type airbrakes fully open.

It is true that in contest flying the LAK-12 does not have all the performance that the current expensive 25- to 27-meter Open Class sailplanes enjoy. Also, since the U.S. Open Class rules currently do not provide any per-

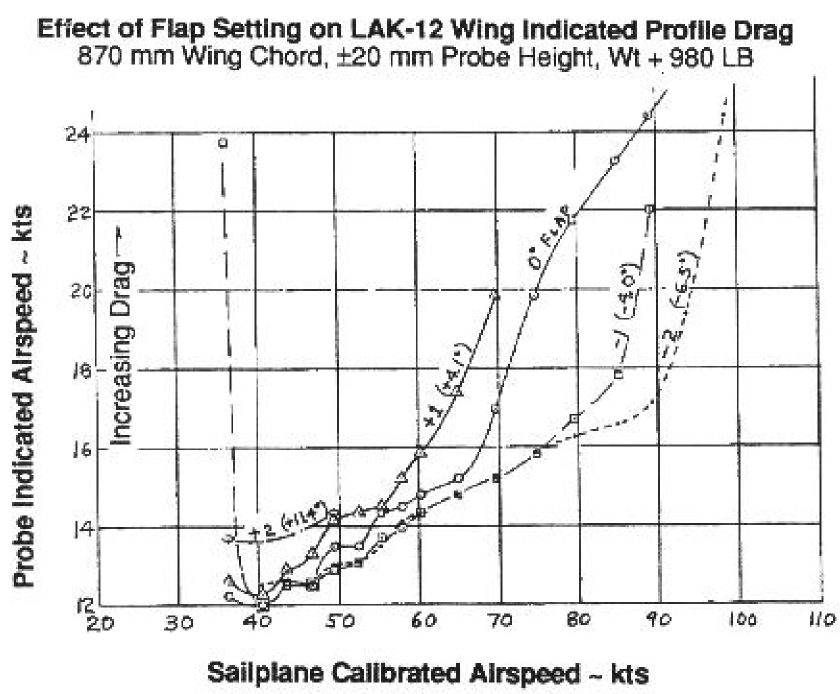


FIGURE 2.

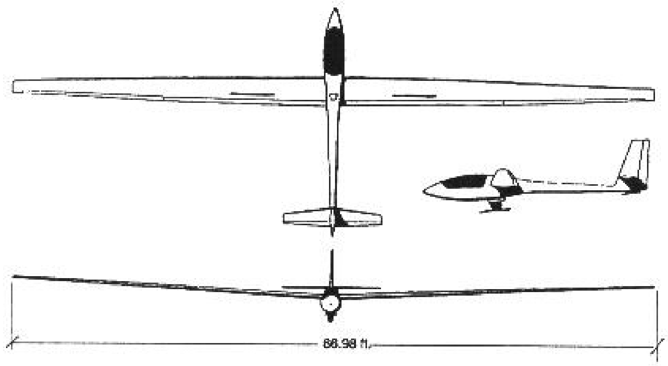
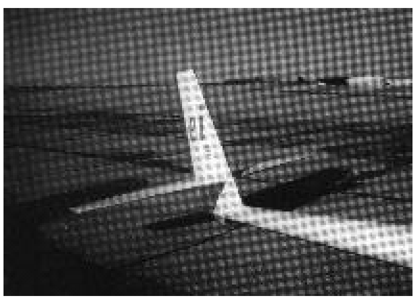


FIGURE 1. Three-view Drawing of LAK-12

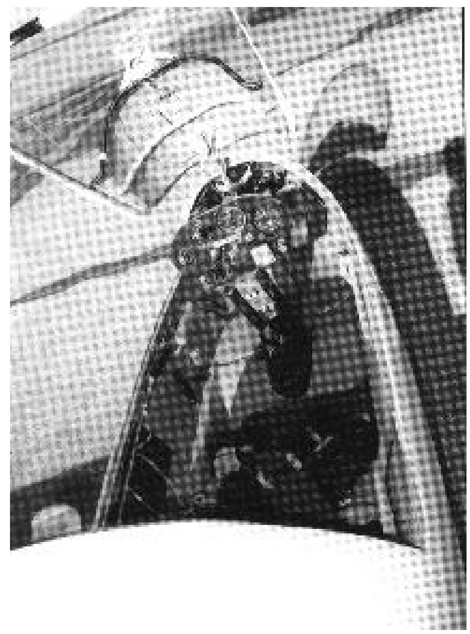
formance handicapping, the LAK-12's only logical U.S. contest role is in the Sports Class, an enjoyable and popular class for those who enjoy competition flying. However, the LAK-12's most important role is that of a high performance recreational, pleasure, and cross-country soaring sailplane.

Figure 1 is a 3-view of the sleek-looking, 20.43-meter (66.98 ft) wing span LAK-12 sailplane. The long two piece wing is constructed principally from fiberglass and epoxy resin, but to add stiffness and reduce weight, carbon fiber is utilized for the wing spar caps. Each wing panel weighs about 230 pounds; therefore, at least 3 people or equivalent support equipment are needed for its assembly to the fuselage. Only the flaps connect automatically, but the manual connections for the ailerons and air brakes utilize the same rugged and reliable connectors that many Polish sailplanes currently use. The elevators connect automatically when the two halves of the horizontal stabilizer are attached to the vertical fin. The single-piece, 230 lb wing panels are heavy to handle without support equipment, but they are only about 10 lbs heavier than the ASW-17's inner wing panels alone. By eliminating the wing panel joint, the LAK-12 reduces the sailplane's drag, weight, and cost, though at the expense of a longer trailer.



Conventional tail surfaces are reminiscent of the Schleicher ASW-17 of the 1970's.

The wing uses the well-proven Wortmann 67-K-170 airfoil at its root, tapering to the Wortmann 67-K-150 airfoil at the aileron root, and thereon along the entire aileron span. Those airfoils were used very successfully with the Nimbus 2 and PIK-20 sailplanes, except that they were prone to larger than average drag increases when contaminated with bug impacts, or flying in rain. I was able to fly the LAK-12 through some rain showers on a thermaling evaluation flight, and was pleased to note that the sailplane's sink rate did not seem to increase as badly as that of the Nimbus 2, and certainly not as much as that of the thicker-winged PIK-20.



Comfortable LAK-12 cockpit with drag monitor above instrument panel, Kiel tube taped to left side of canopy, landing gear handle on right top, water ballast dump handle on right bottom, wing flap handle on left top and airbrake handle at left bottom.

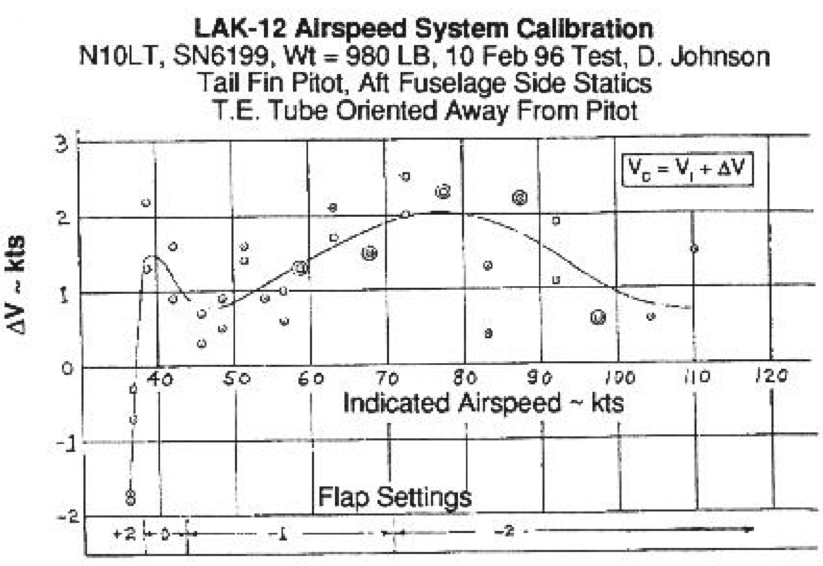


FIGURE 3.

The wing thickness-to-chord measurements of our test sailplane showed

.1756 near the wing root, tapering to .1607 at the airbrake tip, to .1530 at the aileron root, and .1562 at the aileron tips. Our test sailplane's wing surfaces were remarkably smooth, especially considering that the sailplane was 4 years old and had spent one hot summer in Texas. Wave gage chordwise measurements showed less than .005 in (.125 mm) peak-to-peak average waviness on the wing top surfaces, and about .004 in (.10 mm) on the bottom surfaces. The LAK-12 does not use a polyester gelcoat finish, but is finished with a white epoxy paint. No paint cracking was visible anywhere on our test sailplane.

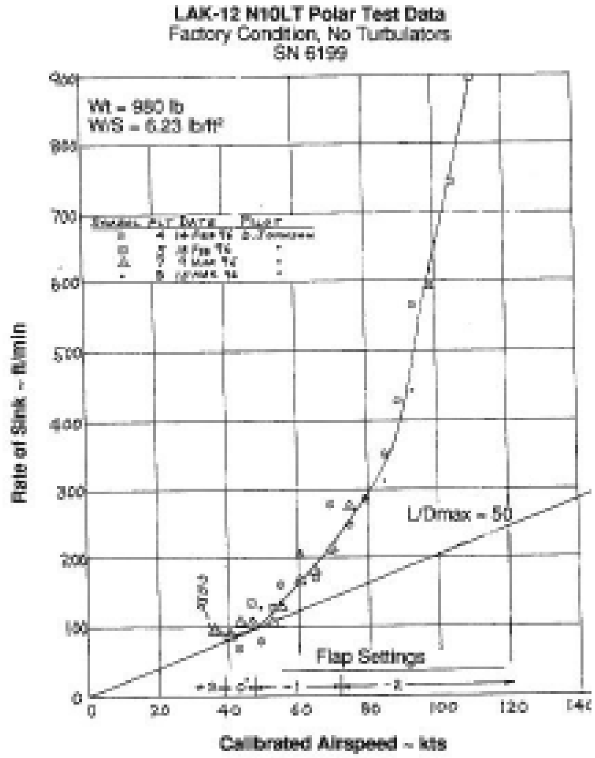
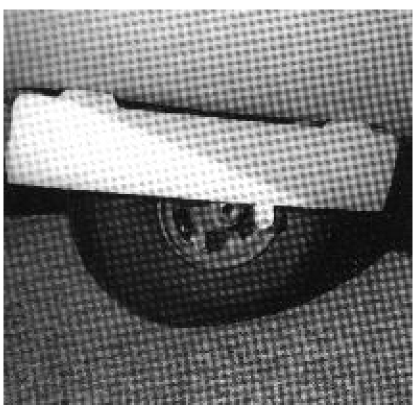


FIGURE 4.

WING DRAG RAKE TESTING

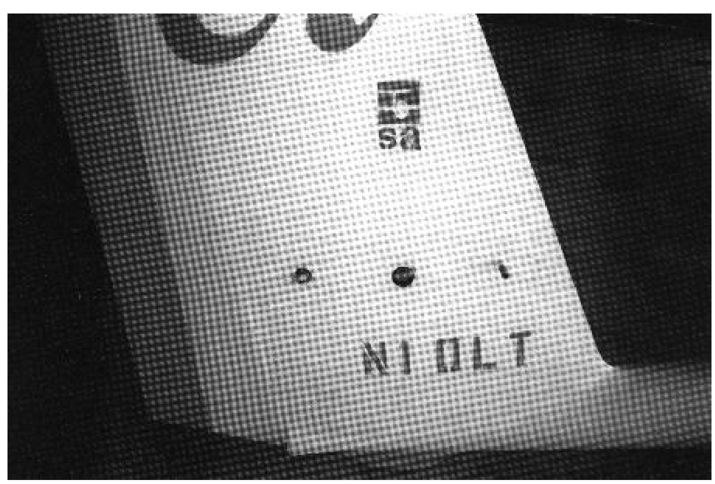
The first two test flights were performed with a drag rake mounted 4.5 feet out from the fuselage on the left wing trailing edge. The purpose of the first flight was to determine which flap settings were optimum at each of the planned flight test airspeeds. The second flight was used to determine if a .50 mm high ZZ turbulator mounted on the wing bottom surface at .70 chord would reduce the wing profile drag. It did not; therefore, no further turbulator testing was performed. The test data from the first flight is shown in Figure 2, as drag probe indicated airspeed (delta pressure) versus sailplane calibrated airspeed, for each of the 5 test flap settings. Note that the +1 (+4.1 deg) flap setting provided relatively low wing drag below 44 kts flight airspeed, but not quite as low as that measured with the zero flap setting. Also, between 48 and 75 kts, the -1 (-4.0 deg) and full negative -2 (-6.5 deg) flap settings were equally good. That indicated that it would make little difference in the sailplane's wing drag over the 48 to 75 kt airspeed range if the wing flap angle was set to -1 or -2. However, the fuselage and tail surfaces also contribute to the sailplane's drag. Based only on intuition, it was decided that for the subsequent sink rate flight test measurements we would shift the flap to -1 when we reached 48 kts, and -2 flap setting when we reached 75 kts.



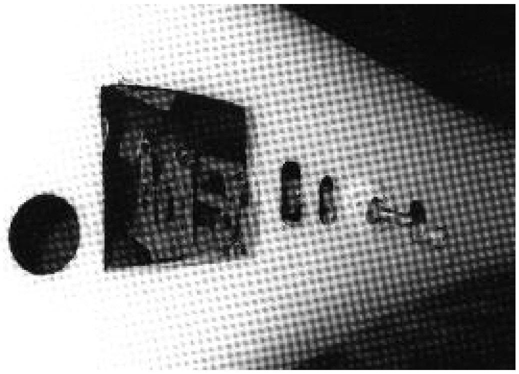
Rugged 13.8 tall by 5.9 inch wide retractable landing wheel, with water dump outlet slightly aft of gear door.

AIRSPEED SYSTEM CALIBRATION

Next, we calibrated the LAK-12's airspeed system. That was performed in two steps. The first was a ground test where the LAK's airspeed static and pitot lines was checked for leaks. None were found. Then the accuracy of the sailplane airspeed indicator was calibrated to measure its instrument alone errors. That was accomplished by connecting the LAK-12's tail fin pitot to our master calibrating ASI with a long vinyl tube, and using a squeeze bulb and valve connected into the tail fin pitot line to carefully provide various calibration air pressures to both instruments simultaneously. Our master ASI was recently calibrated on our water manometer test stand. The LAK-12's airspeed indicator (ASI) proved to be accurately marked to within about 2 kts over our 35 to 125 kt



LAK-12 vertical fin where horizontal stabilizer attaches. Note protruding torsion bar at rear that automatically connects the elevator control upon assembly; also, plain tail skid below.



Fuselage side where wing panel is attached. Vertical arms inside fuselage are where ailerons and airbrakes are manually connected. Protruding torsion bar at far rear automatically couples to wing flap upon assembly.

calibration range.

The second step was to install the master calibrating ASI temporarily in the cockpit with its high pressure inlet connected to a Kiel tube pitot taped to the side of the canopy, and its low pressure inlet connected to a static pressure measurement "bomb" by 50 feet of 7/32 inch O.D. vinyl tubing (see Reference A). After towing to 8,000 feet altitude, the static bomb was deployed through the cockpit side vent window to the full length of the vinyl tubing. Then constant airspeed runs are performed where the sailplane's corrected ASI readings are compared to the temporarily installed master ASI. The differences are called airspeed system errors, and the LAK-12 measured error values are shown in Figure 3. There it is shown that the LAK-12's airspeed system errors vary between about -2 to +2 kts over the 36 to 110 kt calibration range, and that is a relatively good system.

The values presented in the Figure 3 airspeed system error calibration curve do not include the ground measured ASI instrument errors. They do not include any instrument alone errors because every instrument has some unique and individual, but generally small, errors. The LAK-12 ASI static sources are located on the aft fuselage sides where the static pressure errors are generally small, except when at high angles of attack. At high angles of attack, the air cross flow around the fuselage sides create a suction at the static orifices. That causes the ASI to indicate higher than true values. That effect can be seen in the Figure 3 calibration curve, where at airspeeds below 37 kts, the error curve begins a rapid descent, and the ASI reads higher than true. The tail fin mounted pitot is usually error free, except at high, positive, angles-of-attack where the wing/fuselage wake makes the ASI readings jumpy and indicate lower than true values.

SINK RATE MEASUREMENTS

When using our normal calibrated altimeter and stopwatch method of sink rate measurements, still smooth air and high tows are needed. To find the air still enough for good sink rate measurements with a high performance sailplane, it is generally required that the winds be less than 15 kts all the way up to 12,000 feet, and that no large changes in wind direction occur over that altitude range. As is often the case, either the sailplane availability or our patience wears out before the ideally calm testing day arrives. In that case, there is an inevitable scatter in the sink rate data measurements, and additional test flight data is needed to fair a curve through the data points with reasonable confidence. The upper air winds were 20 to 25 kts when I made the LAK-12's first two sink rate test flights (flights 4 and 5), and somewhat higher when I made the following test flights 6 and 7. The sink rate data from flight 6 was too scattered to be useful; therefore, it was discarded. A 5th and final sink rate test flight was performed under fairly good conditions on 15 March. The data from the 4 sink rate test flights were considered adequate for our evaluation, but not as good as they would have been if we had waited for the rare Texas winter days where the winds were light all the way to 12,000 feet.

The sink rate test data from the 4 acceptable test flights are shown in Figure 4. A line drawn through the center of those test data indicates that the manufacturer's claim of 47:1 is somewhat modest, and perhaps 50:1 is closer to that which we actually achieved. Our unballasted test data indicate a minimum sink rate of about 90 ft/min at 42 kts, an L/D max of about 50 at 46 kts, and a sinking speed of only about 290 ft/min at 80 kts The sailplane was essentially in factory delivered condition, except for some canopy sealing that Eduardo had added. Since the wing flap and ailerons are bottom surface hinged, their joints were adequately sealed with simply a factory in-stalled spanwise strip of adhesive tape applied along their bottom surface joint with the wing. No Mylar or other air seals were installed along their top surface joints, as that was apparently unnecessary. No turbulators were installed anywhere.

GENERAL CHARACTERISTICS

The cockpit is roomy in width, but not in length or height. The rudder pedals are inflight adjustable over a range of about 5.9 inches (150 mm), and the seat back is ground adjustable over a range of about 5.0 inches (127 mm). My height is a moderate 70 inches (1.80 m), and when wearing a modern backpack parachute, I need to set the rudder pedals full forward and the seat back in its aftermost notch. Even when sitting on a modest seat pan cushion, I have only about one-half inch clearance between my head and the canopy. The adjustable seat back can be removed from the cockpit, and that will provide about 4 more inches to the cockpit length. On the positive side, the cockpit seating provides good thigh support, and it is comfortable during long flights. I flew one 5 hour test flight without any discomfort. Yes, the LAK-12 comes equipped with a well-designed male urinal system, stowed neatly in a recess under the forward seat pan.

The controls are well-configured within the cockpit, and not difficult to operate, except possibly for the thumb-operated locking pin on the landing-gear slide tube.

The handle must be held straight down in order to engage or disengage the locking pin.

The one-piece, forward-hinged canopy has good optics and the pilot's visibility is quite good. Only one small area of the canopy above the right side of the instrument panel showed significant distortion, but that did not have much effect on overall visibility, and I hardly noticed it.

The canopy is moderately heavy, and it does not have a gas strut or spring system to balance it during opening and closing. A spring-loaded, over center strut is provided to support the canopy when it is in its open position, and the strut can be unlocked when seated in the cockpit by pulling on an instrument panel mounted tee handle. Unfortu-nately, the red painted canopy jettison handle is identical in shape to the black canopy strut release handle, and it also is mounted near the center of the instrument panel. One must be careful to not actuate the wrong handle! It is necessary to support the canopy with one hand before pulling the black over center release handle, or the canopy will come crashing down and possibly injure the pilot or break the Plexiglas. It appears that a linear viscous damper or gas strut could easily be attached to the hinge mechanism, and that would greatly improve the safety of the canopy operating system.

The retractable landing gear appears to be strong, and the wheel is a well sized 350 x 150 mm (13.8 in. O.D. by 5.9 in. wide) unit equipped with an internal drum brake that functions well via a squeeze handle on the control stick. Commendably, the landing wheel is mounted on a well-designed, air-oil oleo strut, possibly the same unit that is used with the I-23 Super Blanik. The wheel well is fully sealed, and that keeps air, dirt, and wind noise from entering the fuselage interior. The landing wheel is not located very far ahead of the sailplane's flight center-of-gravity, and I found that I could not apply very much braking before the tail would rise. No tail wheel is provided, just a simple skid. The LAK-12's tall vertical fin provides good directional static stability, but unfortunately that also tends to cause the sailplane to weathercock into the wind during crosswind operations. For those who desire a tail wheel (me included), it does not appear that it would be difficult to install one. A good, low-drag, solid-rubber tail wheel, such as the ones that Dick Brandt made for my Ventus A and Nimbus 3, make crosswind takeoffs and landings much easier to control.

The aileron stick forces are somewhat heavy, but the ailerons are moderately effective and no wing dropping tendencies were noted during takeoffs. When flying at 50 kts with +2 thermaling flap setting, plus to minus 45 degree rolls can be performed in about 6.5 seconds. The wings have a fairly high inertia in both roll and yaw, as do most large-spanned sailplanes, and that takes a little time to become accustomed to. It took me 8 flights and about 25 hours of flying to become completely at ease when flying the LAK-12. A 200 mile cross-country flight was happily achieved by the author during his last test flight, using late winter Texas thermals. Because of the high wing inertia and relatively slow control response, extra care and planning must be taken when maneuvering around other sail-planes or entering occupied thermals.

The large rudder is powerful, and, especially during takeoff, one must understand that any rudder or otherwise induced take more time to halt than will a smaller-spanned sail-plane. The ailerons droop and raise in unison with the wing flaps, which is aerodynamically efficient. The stall characteristics are relatively gentle, and there is not much tendency for the sailplane to roll during a stall unless rudder is incorrectly applied. At my 980 lb gross weight, a light buffet could be felt when flying below 40 kts By applying further aft stick, the LAK-12 will wallow and mush in a similar manner to that of the remarkable Schleicher ASW-17. Airspeed indications down to about 35 kts could be achieved with +2 thermaling flap for brief periods during level flight with little tendency for the sailplane to roll into a spin.

The airbrakes are upper-surface-only, double-plated, Schempp-Hirth type devices that are easy to operate. Because the sailplane is relatively heavy, their effectiveness for glide path control is only moderate. Therefore, care must be taken to avoid overly high approaches when landing, or the resulting excessive airspeed will require a long landing run. The Flight Handbook indicates that a total of 190 liters (50 gal) of water ballast can be carried in the wing leading edges. That can bring the sailplane's gross weight up to its full certified value of 1433 lb (650 kg). Because of time and expense considerations, we did not include any ballasted flight testing of the LAK-12.

In summary, the LAK-12 appears to be a well-made and robust sail-plane with good value performance wise for its cost. I would recommend adding a tail wheel to help keep it straight during crosswind takeoffs and landings. Also, some sort of canopy hinge damper or gas strut support would be highly desirable for cockpit safety and ease of operation.

Thanks go to Eduardo Iglesias for bringing his fine and almost new LAK-12 sailplane to Caddo Mills for testing, and to the Dallas Gliding Association for providing the hangarage and high tows needed.

EPILOGUE

Recently the LAK factory has undertaken to complete the development and start production of the American designed Standard Class Genesis sailplane. A prototype has been constructed there and test flying is said to be underway. We are looking forward to seeing this new source for that interesting new sailplane soon.

REFERENCE

A. “Sailplane Performance Flight Test Methods,” R.H. Johnson, *Soaring* Magazine, May, 1989.