A FLIGHT TEST EVALUATION OF THE 16.6-METER VENTUS
By Richard H. Johnson, Published in Soaring Magazine, April 1984

During 1983 the excellent Ventus A and B models (with small and large cockpits, respectively) were first offered with new removable .8-meter-long wingtip extensions for those who desire lower minimum sink rates and higher L/Dmax values than their basic 15-meter spans can provide. With this option the wing span can be configured to either 15 meters, using the short tips, or 16.6 meters, using the long tips. Figure 1 shows the dual span wing configurations along with other pertinent physical data for the Ventus models.

Both the short and long wingtips are easily installed with plug-in sockets, essentially identical to those used on the Nimbus 3 to change its span from 22.9M to 24.5M (Reference A). As the photos show, the short tips comprise only 4.5 inches (114 mm) of each wing panel’s span. For that reason they do not include a movable aileron segment and have only down-turned wing tip skids. On the other hand, the extended span wingtips are each about 37.2 inches (.83M) long, and they include 21-inch-long (.53M) movable aileron extensions that connect to the basic wing panel outer aileron tips upon assembly. The addition of the long tips increases the wing total area by about 5 ft² (.45M²) and span by 4.9 ft. (1.5M). More significantly, the added span increases the wing aspect ratio from 23.7 to 27.7, which places the Ventus in a class approaching that of the larger modern Open Class sailplanes, but at a cost of roughly half that of its larger brethren (Nimbus 3’s and ASW-22’s AR≈37).

This tip extension scheme to increase performance of 15-meter sailplanes is not entirely new. The wooden Slingsby Dart 15/17M designed around 1965 is an early example. Later fiberglass designs with wing extensions were moderately successful but usually lacked the ability to safely carry ballast, and some failed to include movable aileron sections in the wing extension. Now with the introduction of modern carbon fiber structures, the latest 15-meter sailplanes can be designed to legally carry significant amounts of ballast when their wing tip extensions are installed. This provides cruising speed increases that yield, performance that can rival that of many larger sailplanes.

The 15M Ventus A that was flight tested earlier (Reference B) was modified to the 15/16.6M convertible model, and flight tested recently at Caddo Mills in its 16.6-meter span configuration. Figure 2 shows the still air sink rate data measured during the six test flights that were dedicated to such measurement. A surprisingly good L/Dmax of about 50 is indicated at 42 kts, and a low minimum sink rate of 85 ft/mm (.43M/sec) is shown at 40 kts. Note that these both occur with the flaps set to +5.1˚, not 0˚ where best L/ D almost always occurs. A moderately high drag knee in the polar appears at about 50 kts, similar to that reported during the earlier 15M tests at 54 kts (Reference B).

The wing profile drag monitor probe described in Reference C was installed during all the 16.6M testing, and it was utilized to determine the optimal flap setting for each airspeed from stall to VNE. The flap setting which resulted in the lowest probe differential airspeed reading for the wing drag monitor ASI was assumed to be that which would result in minimum drag. These optimal flap settings are shown in the lower portion of Figure 2. This use of the drag monitor probe allowed the flight performance testing to be accomplished with about half of the num-

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Figure 1

Figure 2

VENTUS A 16.6 M POLAR TEST DATA
Clean Condition
No Turbulent Strips On Wing

Figure 2

Original tips of Ventus wings add a mere 4 1/2 inches each to span.
number of test flights that a flapped sailplane normally requires.

The airspeed system for the normal flight ASI uses the same fuselage nose location for the pitot pressure source and fuselage side under-wing static that was used during the earlier 15M testing. Therefore the airspeed system errors for the 16.6M Ventus configuration should be very close to those measured with the 15M configuration, and indeed they are. Figure 3 shows the airspeed system error values that were measured during the recent 16.6M testing, Flt. No. 5. All the new airspeed error values with the 16.6M configuration lie within one knot of those measured during the earlier 15M testing.

With the wing flaps set to their +12.1˚ landing position, the 16.6M Ventus A could maintain steady level flight while indicating only 33 kts, when flown at unballasted weight by a relatively light (160 lbs. 72.6 kg) pilot. Adding the +3 kt calibration error shown in Figure 3 for that indicated airspeed, the actual airspeed is still only 36 kts. This is a relatively low achievable flight speed and partially accounts for the 16.6M configuration’s remarkably good climb performance.

Considerable weak winter thermaling was performed during the 16.6M testing, and the results were impressive. The 16.6M Ventus could easily outclimb all the 15 meter sailplanes, and one veteran Mini-Nimbus pilot likened the Ventus 16.6M performance to that of a 20.3-meter Nimbus II.

Figure 4 is a polar comparison plot showing the newly measured Ventus 16.6M polar, along with its 15M polar which was measured two and a half years earlier. Also shown is the Nimbus 3 polar measured in its 22.9M configuration (Reference A). All three polars are for the unballasted flight weights, and the wing loadings are within 10 per cent of each other. Note that the 16.6M Ventus has about the same 50:1 L/D max as the 22.9M Nimbus 3, but it occurs at about 5 kts lower airspeed. Between 45 and 80 kts the 15M Ventus appears to have a slightly lower sink rate than its 16.6M variant, but between 80 and 100 kts their polars appear nearly equal. The 16.6M Ventus achieved surprisingly good performance near 90 kts with rates almost as low as that for the 22.9M Nimbus 3.

The Ventus 16.6M has an attractive 300 fpm sink at 90 knots. This dry weight (680 lb.) cruise capability according to the wing loading formula should increase to about 106 kts CAS when ballasted to its maximum certified 948 lb. (430 kg) gross weight. A legal ballast load of 268 lb. (122 kg) or 32 gallons of water can be carried in our test 16.6M Ventus’s two integral wing tanks. However, because of our winter test conditions, no ballasted flight-testing was performed with the 16.6M version.

Part of the reason for the excellent high speed performance and ballast carrying capability with the wing extensions installed is most likely due to the inclusion of an aileron over most of the span of the wing tip extension. Not only does that provide better roll rates, but because the ailerons move up and down in unison with the flaps, a better span load distribution and lower wing drag are added to the benefits.

45 Degree to 45 Degree rolls at 45 kts with +8.2 thermaling flap required only about 5 seconds to perform, compared to 4.5 seconds for the same flap and airspeed in the 15M configuration. Most of the flight handling
Wing characteristics of the 16.6M configuration appear to be equal to or better than those with the short tips. Only small amounts of adverse yaw are apparent during rolls and the rudder is quite adequate to easily counter it. The level flight stall occurs at about 32 kts indicated with +8.2° flap, which is about 35.5 kts CAS, according to the Figure 3 calibration.

The stall characteristics are fairly good, and, in my opinion, adequate for this class of sailplane. With the wingtip extensions installed, the wing appears to stall somewhat more suddenly than it did in the 15M configuration. During some stalls a fairly pronounced wing drop occurred, but during others a normal non-rolling nose drop was observed. In either case a moderate forward movement of the control stick achieved immediate recovery.

Other than the longer wingtips, the Ventus’s wing was in about the same condition as it was during last year’s probe development. Wing surface chordwise waviness measurements still averaged less than .002 in. (.05 mm), which is remarkably good for a 2.5-year-old Texas heat-seasoned wing. However, the waviness was much larger locally over the 6-inch span region where I had bonded the wing extension sockets into the original wing tips. There the waviness amounted to about .008 in. (.2 mm) on both the top and bottom surfaces. The need for early flight-testing had taken priority over a craftsmanlike smoothing of that relatively small portion of the wing surface.

The test Ventus 16.6M carried the same drag monitor probe on its left wing that was used for the Reference C testing, and wing drag monitor data were recorded during each run of the six still air sink rate measurement flights performed with the wing extensions installed. Those test data are shown in Figure 5. There was very little insect or dust contamination on the wing surfaces during the just completed winter tests. Because of this the relative wing drag values were, in general, slightly lower than those measured earlier when some insect roughening was present. However, the wing drag measurement values were not entirely consistent from flight to flight, and occasionally they would vary by one or two knots during a single still air data run in which sailplane airspeed and flap setting remained constant. The data taken during Flight 7 was especially baffling. At 62 and 71 kts the probe indicated about two knots higher drag than it did during the earlier flights, but the sailplane’s simultaneously measured sink rates were actually somewhat lower. At 80 kts the probe drag continued to read somewhat high, and the sink rate was slightly higher than average. This of course indicates that a single wing
Long tips measure just over three feet each, and carry aileron extensions.

The probe is not always representative of the entire wing span, and perhaps the offending separation or turbulent transition is fairly localized.

The reason for the anomalous wing drag behavior is uncertain at present, but likely due to transitory laminar separation bubbles on the wing surfaces. Perhaps a separate probe for the wing upper and lower surfaces would give a better insight into this phenomena. The present Reference C probe design averages the upper and lower surface drag indications into a single instrument reading. Plugging the probe upper or lower pitot holes would provide single wing surface relative drag data.

The 16.6M testing was performed without the factory-provided lower surface turbulator strips installed because the earlier Ventus A testing had indicated better overall performance without the strips. These strips are normally installed by the factory at about the .78 chord location, which is about .2 inches (5 mm) forward from the hinge line gap. Later communication from Klaus Holighaus indicated that they needed to be somewhat farther forward to be effective in suppressing the lower surface laminar separation bubble. The wing drag monitor probe should be excellent for determining optimum locations of the turbulator strips. Such an investigation is being planned now.

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References