A Flight Test Evaluation of the Grob 103 Twin II

by
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Photos by Skipp Epp

The Grob Werke GmbH & Co. is located in southern Germany and is well-known in recent years for its production of Grob 109 motorgliders and the *Astir* series of single and two-seated sailplanes. Its factory facilities are large, new, and modern and even include a private paved airstrip. Herr Burkhart Grob is the owner of this showcase modern factory, and I understand that Dr. Richard Eppler, the well-known airfoil aerodynamicist performs much of the design work for Grob.

Some 10 years ago Grob entered the fiberglass sailplane market with coproduction of the Standard *Cirrus* sailplanes, manufactured under license from Schempp-Hirth. Soon thereafter, they introduced their own *Astir* sailplanes, first single-seaters and later two-seated *Twin Astirs* designated G 103. These low-winged *Twin Astirs* are well-designed modern sailplanes with tandem seating, excellent cockpit layout, and 17.5-meter span wings. A relatively new Eppler 603 laminar-flow airfoil is featured with a measured thickness-to-chord ratio of about .20 from wing root to tip.

The earlier model Grob 103 Twin I design included a retracting main wheel that was located well forward of the sailplane's center of gravity. Its performance was no doubt quite good, but its heavy tail wheel load made ground handling difficult and therefore undesirable for many, including training and club operations.

By popular demand the current Twin II was developed, featuring three wheels with the large main wheel located slightly aft of the sailplane's flight-loaded *cg.* (See Figure 1.) None of these is retractable, but outstandingly good ground-handling characteristics were achieved without the need for a tail dolly. When empty, the sailplane rests principally on its large 6×6-in. main wheel and lightly on its pneumatic tail wheel. Therefore a relatively small down force applied at the sailplane's nose will lift its tail wheel and permit easy pivoting when ground handling.

Charlie Bangert and Jim Clayton's Twin II N427BG used for the flight test evaluation reported in this article.

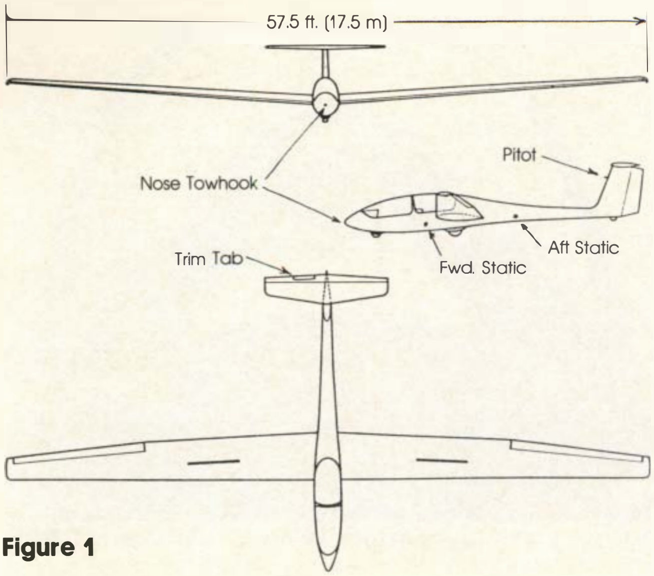


Figure 1

Uncluttered front cockpit with air/wheel brake lever on left side; tow release at lower left side of instrument panel pedestal.

When loaded for takeoff, the sailplane again rests principally upon its large main wheel in a nose-down attitude, touching lightly on a 260 × 85-mm nose wheel located beneath the front cockpit's instrument panel. This wheel arrangement provides not only excellent ground handling, but also ideal takeoff and landing characteristics, especially in crosswind operations. There is very little tendency for the sailplane to yaw or roll unintentionally because any drift or turn-induced ground sideloads are counteracted principally by the large main wheel located very close to the sailplane's *cg.* The rudder control remains effective at all times during normal operation.

A factory-new Twin II was recently delivered to proud owners Jim Clayton and Charlie Bangert at Caddo Mills, and they kindly offered it for flight test measurement and evaluation. The sailplane appeared to be quite well-designed and the workmanship details were almost equal to those of the best new competition sailplanes. Chordwise wave gauge measurements of the wing surfaces showed surprisingly little waviness, averaging about .004 in. (.10 mm) peak-to-peak on the top surfaces and about .0025 in. (.06 mm) on the flatter bottom surfaces. The wing airfoil is designated as the Eppler 603. Our thickness and chord length measurements showed that its t_{max}/c ratios were .197 at the wing roots and .202 at both the root and tip aileron stations of the wings. The wings appear to be carefully made with almost identical measurement magnitudes for chord and maximum thickness values on both left and right panels.

No wing flaps or water ballast tanks are included, so that simplified the flight testing required. Since this sailplane was a two-seater, we decided that all testing should be performed with two persons aboard, which also made data recording easier. Four high tows were made to measure the Twin II's smooth-air sink rates, and one additional flight was made for its airspeed system calibration. The air was only moderately smooth during the sink-rate measurements so there was some scatter in the data points. However, enough repeated measurements were taken to provide a fairly accurate polar estimate. These data are shown in Figure 2 where an LD_{max} of about 33 at 53 knots and a minimum sink rate of approximately 147 fpm (.75 m/s) at 43 knots are indicated.

That glide angle is quite good for a general purpose two-seated sailplane. At 80 knots its sink rate is a bit less than 350 fpm (1.78 m/s), and this provides much better penetration than that which most student pilots and instructors are accustomed to. The flight characteristics are all quite excellent in my opinion, including its gentle stall which is preceded by about 2 knots of warning buffet when approached gradually.

An aerotow release hook is provided in the tip of the long

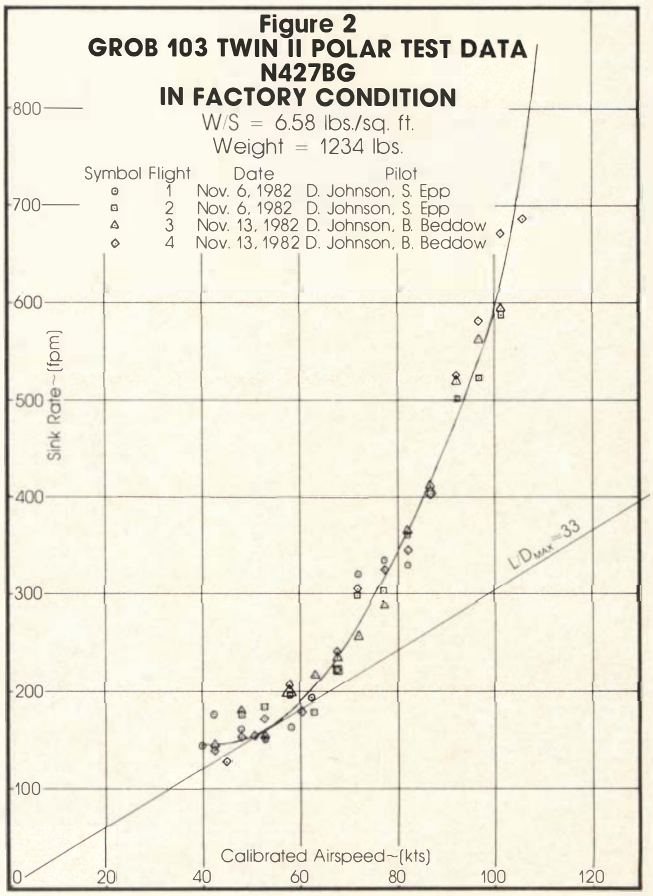


Figure 2
GROB 103 TWIN II POLAR TEST DATA
N427BG
IN FACTORY CONDITION

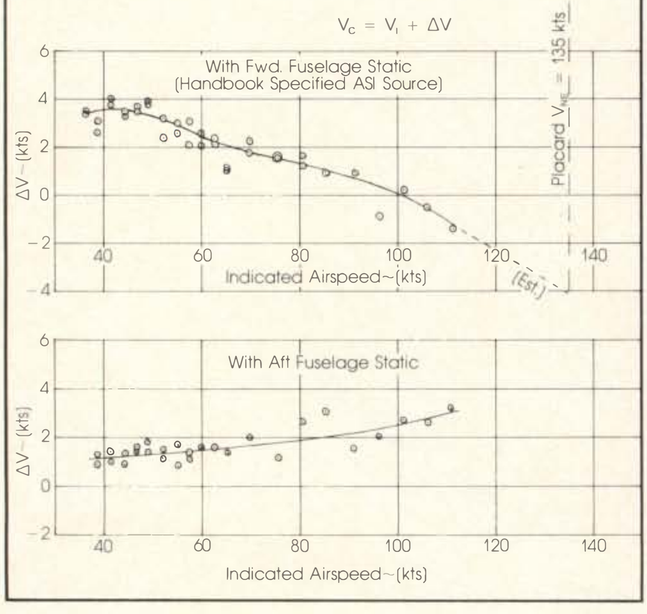
fuselage nose; this provides a natural tendency for the Twin II to obediently follow the towplane while on tow. Hands-off towing is possible much of the time! A second winch/auto tow release is provided farther aft on the fuselage bottom about 20 inches (.50 m) forward of the main wheel. This was not used during our testing, but it appeared to be excellently positioned for its intended purpose. A very generously-sized horizontal tail is provided, complete with fixed stabilizer and movable elevator trim tab. The tab provides trimmed elevator stick forces between about 42 knots CAS and 100 knots. The horizontal tail span of our new *Twin Astir* measured 10.85 feet (3.31 m); a surface that large should give good stabilization and control during spin recovery training and ground tow operations.

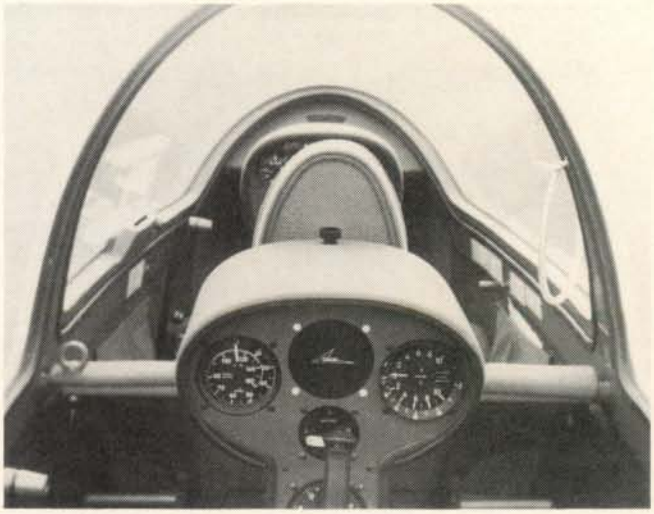
The airspeed system of the Twin II uses a pitot mounted high on the vertical stabilizer, and it appears to function well there. As stall is approached, the airspeed indicator begins to twitch, apparently due to wing-root airflow separation vortices impinging upon the fin-mounted pitot. This is a good indicator for the pilot that a stalled condition exists.

Two sets of static sources are provided. A pair designated for use with the ASI's are located on the fuselage sides about 9 inches (230 mm) forward of the wing leading edges, and roughly 6.5 inches (165 mm) below the airfoil nose. The second static source is apparently intended for use with variometers and is located on the fuselage sides about 45 inches (1.14 m) aft of the wing trailing edges.

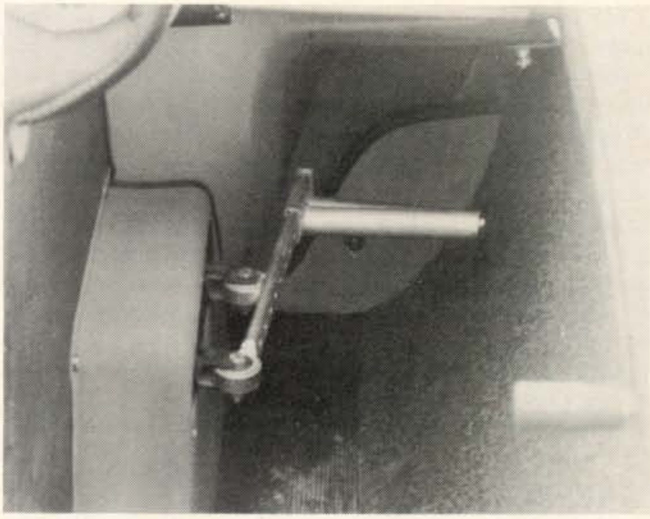
We calibrated both systems during one high-tow flight, using our standard trailing bomb and Kiel-tube measuring equipment. These data are shown in Figure 3 as airspeed system error versus indicated airspeed. Neither system is very accurate, though adequate for most purposes and con-

Figure 3
GROB 103 TWIN II
AIRSPEED SYSTEM CALIBRATIONS
N427BG, SN 3739, WEIGHT = 1237 LBS.
Nov. 14, 1982 Tests
Tail Fin Pitot



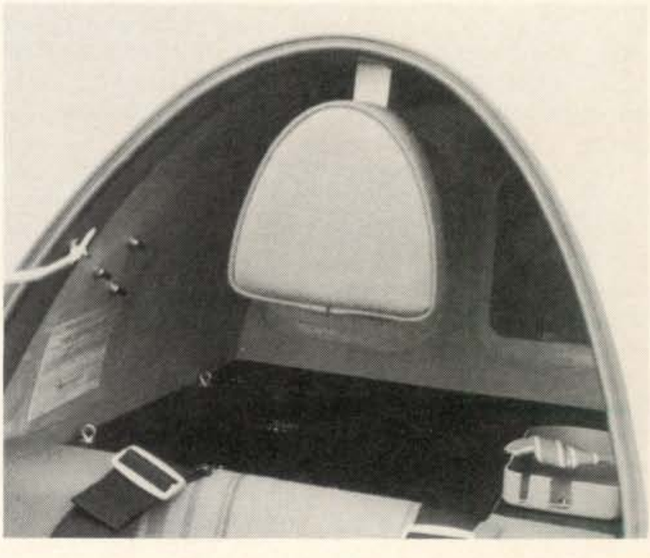


Rear cockpit, showing panel and good visibility.

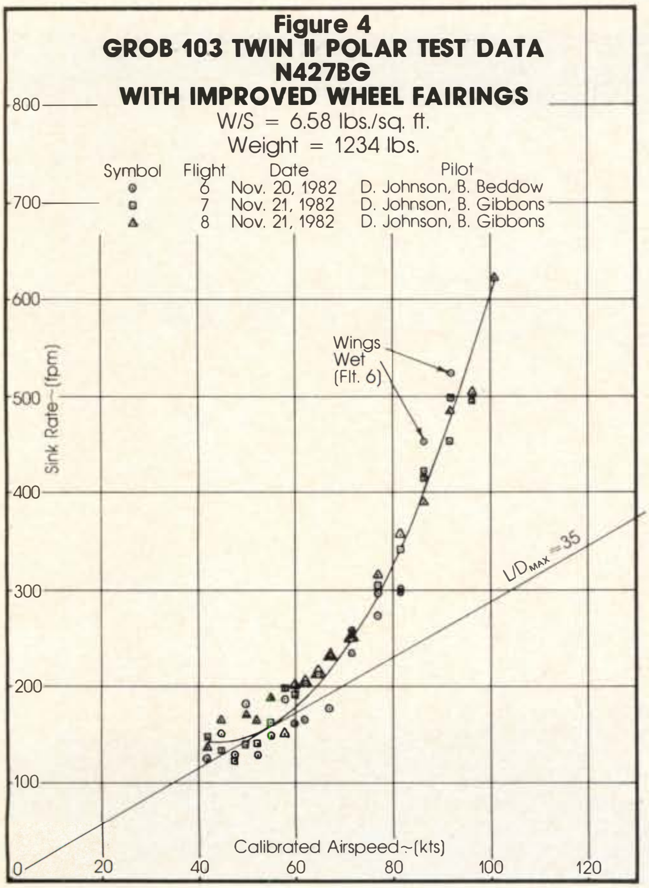


Parallelogram-linked rear cockpit rudder pedals allow passenger/instructor to stretch legs.

Generous rear cockpit baggage space.



Cockpits have separate canopies with improved latches. Mike Newgard (rear cockpit) assisted with airspeed calibration tests. 6'3" test assistant Bruce Beddow fits easily in the front cockpit.



siderably better than the below-wing static systems provided with a number of the current racing sailplanes such as the *Ventus, Nimbus 3, Mosquito,* and *Mini-Nimbus.* At stall, the Twin II indicated about 36.5 knots (with passenger aboard) with the ASI connected to the handbook-specified forward static sources. The Figure 3 calibration indicates that about 3.5 knots must be added to the 36.5 knots indicated value to arrive at a 40-knot calibrated airspeed level-flight stall ($C_L \approx 1.22$).

During the above testing, a light but gradually increasing noise and buffeting of the airframe was noted at airspeeds above 50 knots; so much so that above 80 knots it was not really necessary to use the flight test electric instrument vibrator to keep the calibrated test altimeter free. This buffeting seemed to originate on the bottom fuselage surface. Although no tuft testing of the airflow was performed, it was surmised that one or both of the forward wheel fairings was not functioning properly and that the airflow there was separating. For that reason we removed the factory-designed fiberglass wheel fairings and installed a somewhat crude but more aerodynamically shaped pair of our own, fabricated from cardboard and tape (see photo).

Three additional high tows were made to measure the *Twin Astir's* sink rates with the modified wheel fairings installed. These data are shown in Figure 4. Again the air was not as still as I should have liked, but the curve faired through the data did indicate that improvement was achieved. The L/D max increased by 6 percent to about 35, and the sink rate at 80 knots also decreased by about 6 percent. Airframe buffeting and noise was still noticeable but diminished in magnitude. It is likely that a more carefully made set of improved wheel fairings would result in even larger performance and noise improvements.

During test flight 6, the sailplane's wings became covered with a heavy layer of dew just prior to the 86- and 92-knot data runs. This condition was apparently caused by the cold sailplane's descent into a moist low-altitude air layer just prior to the flight's final two data runs. The measured sink rates there were about 9 percent larger than those measured during the following flights (7 and 8) with the wings clean and dry.

The Twin's airbrakes are large Schempp-Hirth type of flat-plate devices that protrude out of the wing top surfaces only. Their effectiveness is just about ideal for this type of sailplane — quite adequate for good glide-path control, but not so powerful that a relatively low-time pilot would be apt to get into difficulty. The Twin sideslips well, and if a really steep approach is needed, it can be easily achieved by combining sideslip with full airbrake. The wheel brake is a powerful hydraulically-actuated disc device which functions when the airbrake handle is pulled fully aft. For that reason one should be careful not to force the airbrakes fully open at touchdown or the wheel brake will be operating too early.

The controls all worked efficiently and freely, making the Twin II both comfortable and pleasant to fly. I have been told that earlier Grob Twins suffered somewhat from excessive friction in the aileron and rudder control systems, but that certainly was not present with our new test sailplane. The cockpit noise level is moderate, especially in the rear seat area at all but low airspeeds. This could easily be quieted appreciably by installing air seals at the elevator and rudder gaps as well as at the wheel-well openings. Fiberglass fuselages act like acoustic sounding boards to amplify noises originating anywhere there.

The empty weight of our test Twin was roughly 850 lbs. (385 kg) which included basic instruments in each cockpit. Each wing panel weighed about 208 lbs. (94 kg), which can be handled easily by three people in assembly. The overall assembly and control attachments are similar to typical current sailplanes. Good, but nothing is automatically connected, which is quite satisfactory for this type because it is normally left assembled in most operational situations.

Overall, the Grob Twin II must be rated as a really first-class two-place sailplane for primary-to-advanced training and for pleasure flying. Its moderately high L/D and thermaling performance give it good soarability and a high probability of remaining airborne during cross-country flights. This sailplane design appears to be well-suited to the 1980's training tasks, and it will likely be very popular throughout the world for both that purpose as well as general pleasure flying.

Thanks go to Jim and Charlie for kindly providing the Dallas Gliding Association with the use of N427BG for test evaluation, to DGA and SSA donors who provided the towing funds, and to the patient tow pilots who performed the high tow chores.

The reader of flight test evaluations should recognize the data are subject to uncertainties regardless of the method used. The data presented are those measured and experienced, but they do not purport to be absolute or always repeatable and comparable to other data. Hence they should be used with appropriate consideration of the implications and uncertainties involved. —Ed.

Cardboard and tape were used for temporary test fairings as on forward wheel shown here.