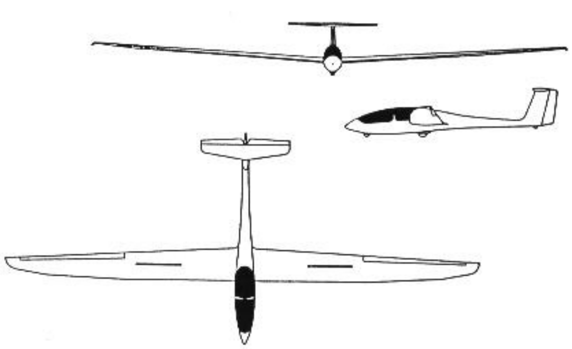
A FLIGHT TEST EVALUATION OF THE GROB 103C TWIN III

By Richard H. Johnson, Published in *Soaring* Magazine, March 1990

FIGURE 1



The Grob Werke GmbH & Co. is located in southern Germany and is increasingly well known in recent years for its production of training and club class sailplanes, as well as motorgliders, and more recently for production of light airplanes. Its factory facilities at Mattsies are large and modern, and even include a private paved airstrip. Herr Burkhart Grob is the justifiably proud owner of the factory, and likely Dr. Richard Eppler still provides aerodynamic design assistance to the Grob airplane and sailplane configurations.

Grob entered the fiberglass sailplane market about 17 years ago with coproduction of Std. 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 G103. Those low winged Twin Astirs were well designed modern sailplanes with tandem seating, excellent cockpit layout, and 17,5 meter span wings. A relatively new Eppler 603 laminar flow airfoil was featured with a measured thickness-to-chord ratio of about .20 from wing root to tip. The 1982 flight test evaluation of the Grob 103 Twin II was published in Reference A.

The newest twin model is called Grob 103 Twin III, and it began production during early 1989. The fuselage and tail surfaces are only slightly modified from the earlier Twin II, but its wing design is entirely new. The wingspan has been increased by .5 meters to 18M overall span, and its swept back leading edge outer portions are similar to those of the well-known Discus sailplane wing. See Figure 1 outline drawing.

Mike Shade, the American Grob dealer kindly delivered a new Twin III to Caddo Mills for our flight testing before it was delivered to its owner, Bruce Miller of Boulder, Colorado. N1O3LM appeared to be of excellent workmanship and well finished throughout. The wing spar caps are of strong and light carbon fibers, compared to glass for the earlier Twin II models. Chordwise wave gage measurements of the wing surfaces showed little waviness, averaging about .003 in. (.08 mm) peak-to-peak on the top surfaces and about .004 in. (.10 mm) on the flatter bottom surfaces. The wing airfoil is significantly thinner than that of the Twin II, with a measured thickness-to-chord ratio of .170 compared to .200 measured with the Twin II. Horstmann and Quast are top level young German airfoil designers, from whom we will hear more in the future. They also designed the very successful Discus airfoil.

Since no wing flaps or water ballast tanks are included, the Twin III's flight-testing was simplified. All flight-testing was performed with 2 pilots aboard, and that made the data-recording chore relatively easy. The weather was cooperating on November 19, 1989, so Mike Newgard and I made 4 high tows to measure the Twin III's smooth air sink rates. I piloted from the front seat (172 lbs. with chute) for the first two test flights while Mike (234 lbs. with chute) recorded the data in the rear seat. We traded places and duties during the second two flights.

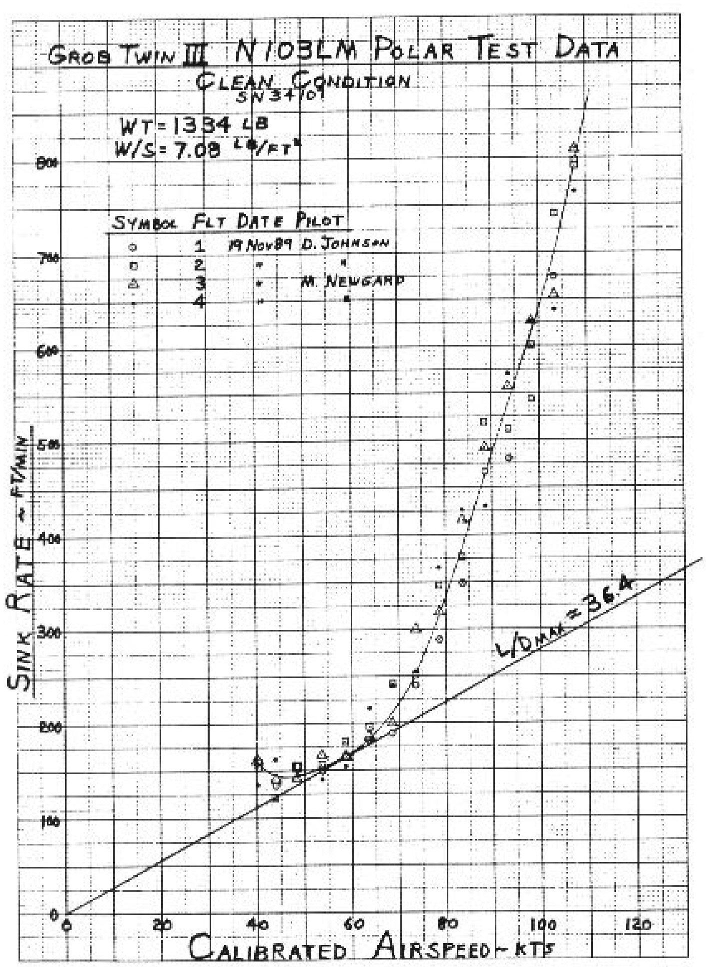
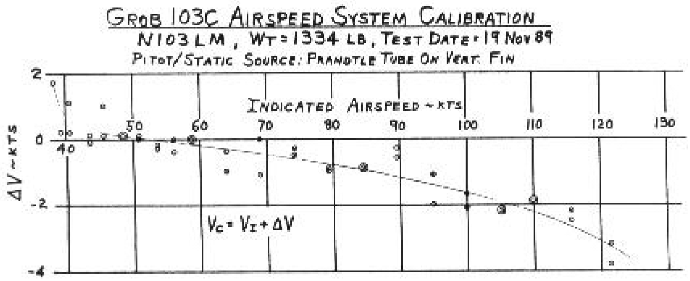


FIGURE 2

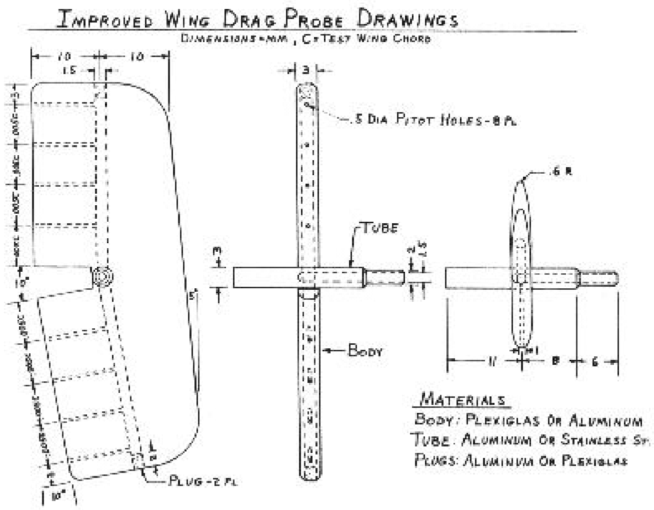
FIGURE 3



The air was relatively still that day and the data scatter was fairly modest, as shown in Figure 2. The measured polar was very good with a 36 *L/D* shown between about 55 to 62 knots. Only after exceeding 70 knots did the glide ratio diminish significantly. The airfoil appeared to perform well and no high drag regions were found.

The final test flight performed that day was the airspeed system calibration, and those data are shown in Figure 3. Relatively small airspeed errors were measured there. The airspeed system pitot and static sources are from a Prandtle tube mounted on the vertical fin. Additionally, a small total energy venturi is mounted on the top of the Prandtle tube, and that provided excellent T.E. compensation to the variometers. Minimum indicated level flight airspeed that Mike and I could achieve was about 38 knots IAS That calibrated to about 40 knots, which was close to the same minimum airspeed that we measured earlier with the somewhat smaller and lighter weight Twin II. At 41 knots IAS and slower airspeeds, buffeting was quite noticeable, as it should be.

FIGURE 4



The following weekend's testing included wing profile drag probe measurements conducted with the instrumentation described in Reference B, except that the wing trailing edge mounted probe was reconfigured to the improved design shown in Figure 4. The wing indicated relative profile drag measured data are shown as knots of drag probe system indicated airspeed versus sailplane calibrated airspeed. Low drag probe airspeeds indicate low wing profile drag, although the drag units are only relative values.

The first drag probe flight was flown with the wings smooth and clean, and those data are shown in Figure 5. A well-defined classical low drag "bucket" is shown by those data between 41 and 75 knots CAS. Above 75 knots the indicated drag is much larger because the airfoil slips out of its laminar bucket at those airspeeds.

The next three flights were flown with a 2 foot (.61 M) long strip of standard German zig-zag turbulator tape attached to the wing lower surface ahead of the probe, and located at .80, .70, and .60 chord, respectively, during the test flights. The plan was to determine if a turbulator could reduce the airfoil drag even further by eliminating any separation bubbles that possibly existed there, as they do with many modern low drag sailplane airfoils.

With the turbulator strip at .80 c the drag probe showed only a .1 to .4 knots increase in wing drag and no decreases at any airspeed. At .70 c turbulator location the drag increases were larger, amounting to about .5 to 1.0 knots over the sailplane airspeeds. At .60 c turbulator location, the drag increased even further to about .8 to 1.6 knots, and those data are shown in Figure 5. It appears that the Twin III airfoil functions optimally without a lower surface turbulator.

The final four test flights were flown with the Twin III's wing

FIGURE 5

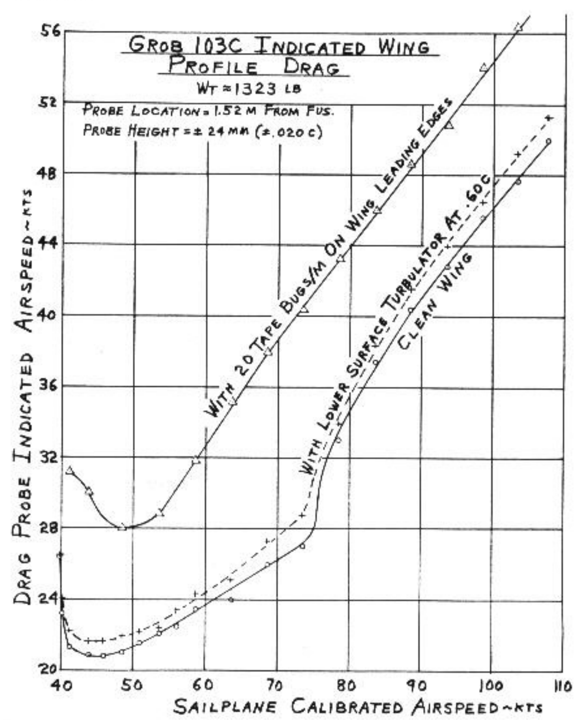
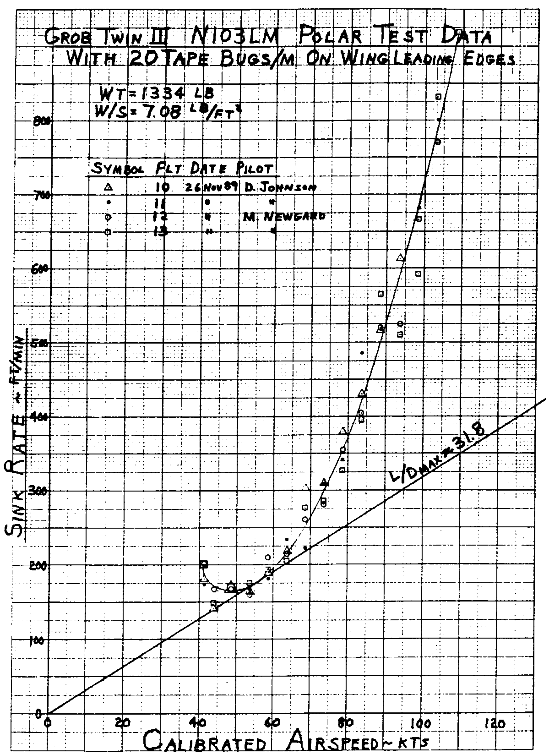


FIGURE 6



leading edges roughened with our standard pattern of 20 duct tape “bugs” per meter of wingspan. The wing drag probe data for that configuration are included in Figure 5, where large 8 to 12 knot drag increases are shown, compared to clean wing readings. It is quite apparent that even modern training sailplanes need to have their wings cleaned frequently for optimum performance.

The sink rate data measured with the 20 tape bugs per meter on the wing leading edges are shown in Figure 6. There an L/D max of about 32 is shown at 55 knots, and a minimum sink rate of about 165 ft/mm (.84 m/s) is indicated at 48 knots. The sailplane stall speed increased by about 1 to 1.5 knots with the roughened wing leading edges.

With the older Twin II Grob we noted that as stall was approached, the sailplane airspeed indicators would begin to twitch, apparently due to wing root airflow separation vortices impinging upon the tail fin mounted pitot. That was a good warning to the pilot that apparently did not carry over into the Twin III for some reason.

The Twin III’s airbrakes are large 67-inch (1.70 m) long Schempp-Hirth type of single flat plate devices that protrude from the wing top surfaces. They each are 12 in. (.30 m) larger in span than those of the Twin II, although not quite as high. 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. Sideslips are easy to perform, and combined with airbrakes really steep approaches can be made, if needed. The main wheel is 6 X 6 inch and the wheel brake is a powerful hydraulically actuated disc unit, which functions when the airbrake handle is pulled fully aft. For that reason one needs to be careful not to force the airbrakes fully open at touchdown or the wheel brake will be actuated too early.

The controls all worked efficiently and freely, making the Twin III both comfortable and pleasant to fly. The stall characteristics appeared to be similar to those of the Twin II, gentle but quickly spinable if pro-spin rudder is applied.

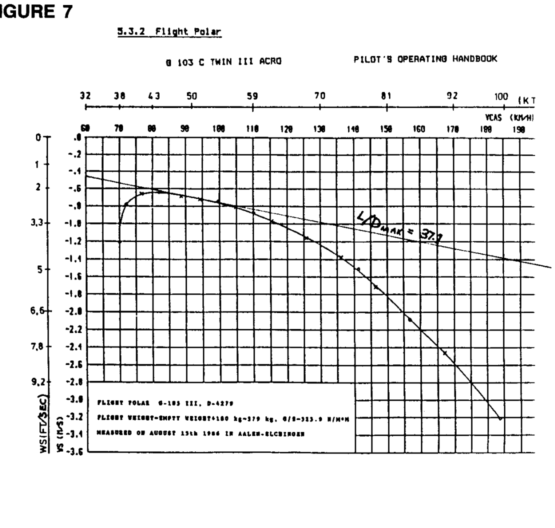
The empty weight of our test Acro Twin III was 928 lbs. (421 kg.) which is about 78 lbs. (35 kg.) heavier than the non-Acro Twin II that we tested 7 years earlier (Reference A). Since the Twin III’s maximum allowable gross weight is 1,323 lbs. (600 kg.), its maximum total payload is 395 lbs. (179 kg.). With two heavy pilots, or added equipment such as oxygen, barographs, etc., it would be quite easy to exceed the 1,323-pound (600 kg.) allowable gross weight limit. Each wing panel weighs about 228 lbs. (103kg.), and that is only about 20 lbs. (9 kg.) heavier than those of the Reference A Twin II.

The overall assembly and control attachments are the same as for the earlier Twin II. Good, but only the elevator control is connected automatically. That is generally quite satisfactory for this type of sailplane because it is normally left assembled at most operations. Overall, the Grob Twin III is really a first class two-place sailplane for primary to advanced training, and still is excellent for pleasure flying. It will likely be very popular throughout the world for those purposes in the coming years.

The Twin III’s handbook includes the flight polar that was measured with that model’s prototype in Germany about 3 years earlier, likely by a comparison method. That polar is shown in Figure 7. It indicates that D-4279 measured about

371 L/D max. No special sealing was included in our test sailplane, and we did note a cockpit pressure change when the airbrakes were opened. Additional air sealing would likely

FIGURE 7



provide some additional performance increase to our flight test sailplane.

Thanks are due to Mike Shade of Grob of America for bringing the new Twin III to Caddo Mills for our testing, and to its new owner, Bruce Miller of Cloud Base, Inc., for his kind agreement to let us test his fine new sailplane. The Dallas Gliding Association provided the towing funds and its members performed the testing.

REFERENCES

A. Johnson, R.H., “A Flight Test Evaluation of the Grob 103 Twin II Sailplane,” *Soaring,* February, 1983.
B. Johnson, R.H., ‘At Last an Instrument that Reads Drag,” *Soaring,* October, 1983.