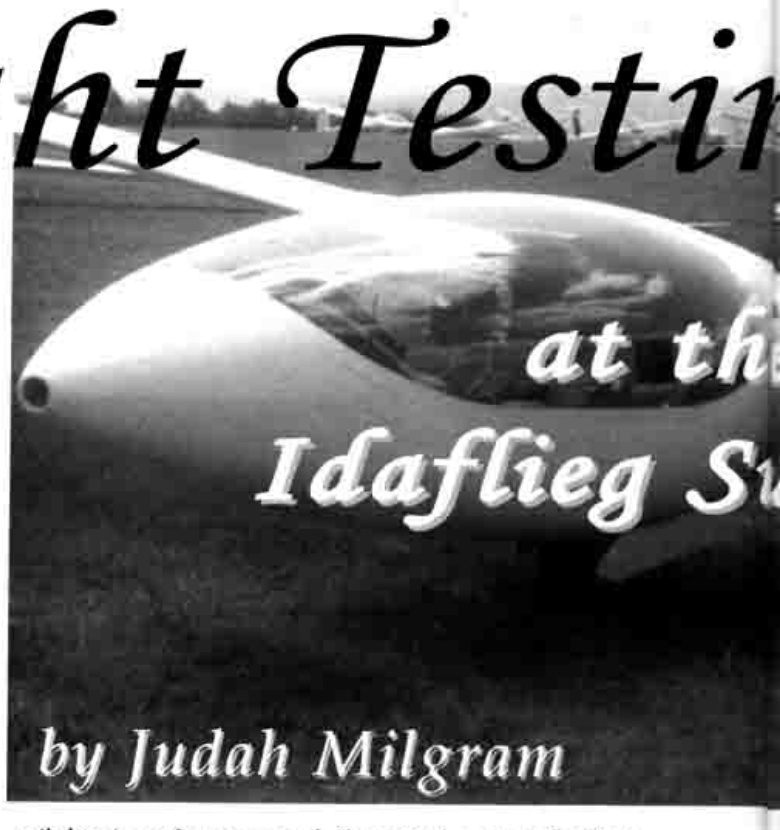
# Flight Testing at the Idaflieg Summer Meet



by Judah Milgram

During a business trip to Germany this summer, I had a chance to spend a few days at the Idaflieg summer meet in Aalen, Germany. Idaflieg (Interessengemeinschaft Deutscher Akademischer Fliegergruppen, an umbrella organization for the German Akafliegs), meets every summer for about three weeks to test new aircraft, re-test old ones, carry out various research projects, practice basic sailplane flight testing skills, and generally have a good time.

It has been over 15 years since an account of the Aalen meet last appeared in *Soaring*[1], and I thought readers would be interested in being brought up to date on some recent Idaflieg activities.

**Performance flight testing**

Idaflieg is well-known for their flight test evaluations of sailplane performance. A comparative procedure is used, with the sailplane to be measured flown in formation with a sailplane of known performance (originally, the "Holy Cirrus"; currently the "Holy DG-300"). During the comparison testing, the relative rates of descent of the two sailplanes are measured optically based on photographs taken from a third aircraft. In recent years, Idaflieg has also been evaluating a new system based on differential GPS[2].

The performance of the reference sailplane is established through a large number of timed descents: usually a minimum of 10-15 flights are required. Naturally, since a given reference sailplane can serve for many years, care must be taken to ensure that long-term changes in its performance do not affect the quality of the comparison test data. As it happens, the comparison flights themselves provide timed descent data that is used to monitor the reference sailplane's performance and, if required, correct the flight test results.

*D-41 cockpit, with spring scale for in-flight measurement of longitudinal control forces.*

Although not as sensitive to airmass motion as the timed descent method, comparison flight testing nevertheless requires still air. For this reason the Akafliegers typically get up at 6 a.m. and are ready to launch the first comparison flight at 7 a.m. No late night carousing was evident.

The Ideflieg performance results are regarded as among the most reliable available. The DLR (German Aerospace Research Institute – roughly analogous to our NASA), which participates in and, to a certain extent, oversees these tests, is generally respected as an independent and objective organization. Also, in addition to their absolute accuracy, the Idaflieg results allow for meaningful comparisons between specific sailplane designs since all measurements are made against a single reference aircraft. Consequently, the German sailplane manufacturers often send new aircraft to the Idaflieg meet for performance testing. Since Idaflieg is interested in engineering research, and not serving as the "Consumer Reports" of the sailplane world, the performance results are not released to the public until two years following type certification. This allows the manufacturers to fine-tune their designs (turbulator tape location, winglet configuration, etc.) in peace, without worrying about starting rumors among potential customers.

More detailed discussions of sailplane flight test methodology may be found in a number of *Soaring* articles and OSTIV publications [3, 4, 5, 6].

**Flying qualities testing**

Much of the flying at the Idaflieg meet involves evaluation of flying qualities. All participants are encouraged to

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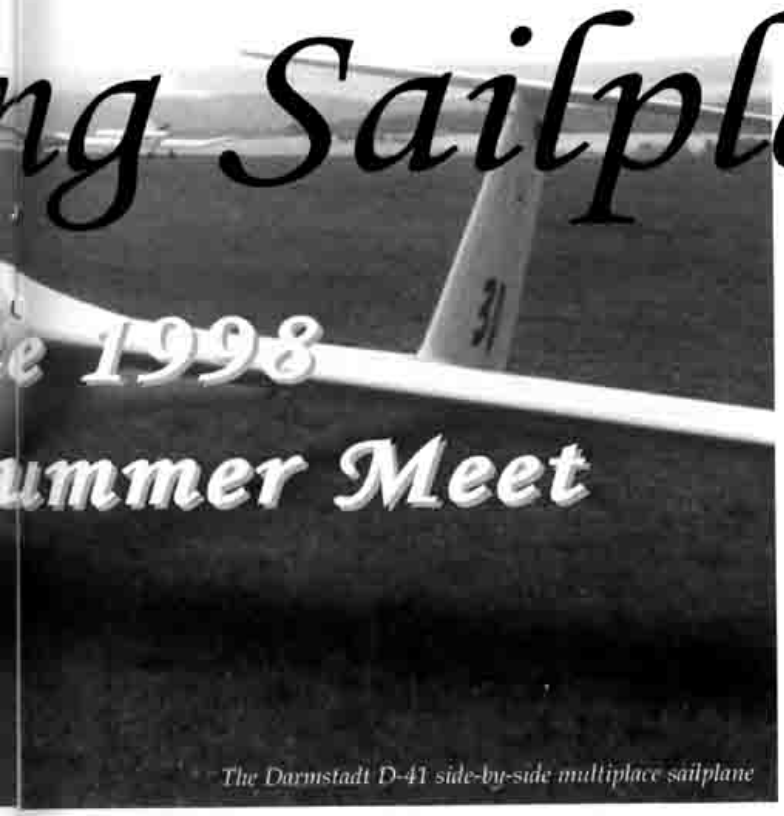


*The Darmstadt D-41 side-by-side multiplace sailplane*

take different aircraft through an extensive, systematic flight test program developed several decades ago by Hans Zacher, a well-known sailplane researcher. (A verb, Zachern, has been coined to describe the procedure.) The program includes a qualitative evaluation of the cockpit layout, take off and tow, an extensive stall series, static and dynamic longitudinal stability, stick forces, roll rate, etc. Much of the Zacher procedure has been adopted by the LBA for use in flying qualities certification flight testing.

All results are recorded on a standardized form and submitted to ldaflieg for archiving. Over the years, a large number of reports have been collected from pilots with varying degrees of experience, allowing pilots to calibrate their own observations against the general consensus.

This year, the D-41 was being used (along with a Janus) to train pilots in the flying qualities test program. The D-41 is a high performance side-by-side two-seater developed by the Akaflieg Darmstadt. The wings are based on LS-6 wings, lengthened inboard by 2.5 m on each side for a total wingspan of 20 m. The inboard extensions are fitted with camber changing flaps that replace the standard LS-6 flaps.

On the second day of my visit, Thomas Lukasczyk of the Akaflieg Darmstadt graciously offered to take me up and show me how things are done. After a short ground briefing, we launched into what turned out to be fairly good weather. The machine proved easy to thermal and quite pleasant to fly. It was so much fun, in fact, that I had trouble switching gears and getting down to the flight test work. This must be a common problem: staying aloft longer than two hours during a "Zacher" flight is listed among the minor infractions for which one is required to buy a case of beer for the party held on the last day of the meet.

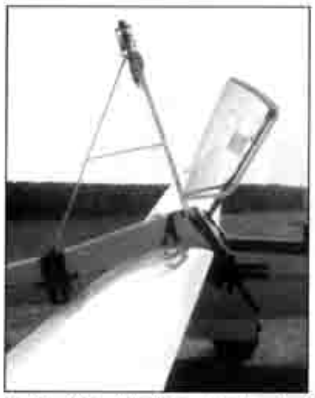
The flight was flown directly from the flight test form. We began with a series of stalls, flown in a consistent, prescribed manner in various configurations. Next, we skipped to the dynamic stability section and measured the period and damping of the phugoid mode. A few timed 45°-45° roll reversals, and it was time to land. Apparently only relatively experienced pilots are able to complete the program in a single two-hour flight. All maneuvers are flown in a very specific manner, with the results noted in space provided on the form. There's even a place for subjective comments such as "pleasant to fly."

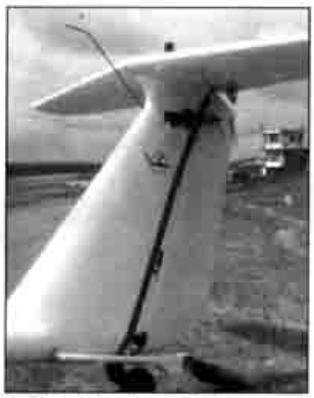
Thanks to some time spent in both an RHJ-8 and an M-200, I was already a fan of side-by-side gliders. The D-41 confirmed my opinion. Unfortunately, according to the Darmstadt Akafliegers, manufacturers have shown little interest in developing a production version of the machine. The problem may be one of image: many pilots assume that the side-by-side configuration automatically incurs an excessive drag penalty. In fact, because the side-by-side configuration allows both pilots to sit closer to the wing, the fuselage can be made shorter, with reduced wetted area. Wind tunnel comparisons between the D-41 and the fs-31 (a high performance tandem multiplace) have shown that this factor tends to offset the increased form drag due to the side-by-side cockpit. Darmstadt's follow-on project, the D-43, is a side-by-side unflapped trainer based on the D-41.

**Research projects**

In addition to the performance and flying qualities test-


*D-41 cockpit, showing tape measure used for measuring longitudinal stick position.*





***Left:*** *The Akaflieg Aachen's ASH-25. The laser displacement measurement system mounted at the top of the framework can be directed at selected reflective targets bonded to the upper wing surface.* ***Right:*** *A Dimona motorglider owned by the Akaflieg Darmstadt, used for investigation of tow plane upsets. Control surface measurement hardware are visible on both elevator and rudder. A tow rope tension measuring device is installed right at the tow plane end of the rope, wrapped in protective foam.*

ing, several research projects were being conducted during the meet. The following are just a few examples.

The Akaflieg Aachen brought an ASH-25 that they had equipped to measure wing elastic bending and (hopefully) twist in flight. A laser distance measuring device was mounted above the fuselage along with a mirror to direct the laser light onto individual reflectors bonded to the upper surface of the wing.

A new two-place from the Akaflieg Stuttgart, the fs-33, was also present. This aircraft had only been flying since June and was still in the midst of its initial flight tests. At the Idaflieg meet, these included spin tests (no problems reported) as well as the usual performance testing. In addition, Uwe Probst, the test pilot, was using the aircraft to obtain data for a research project on in-flight system identification (determination of the aircraft's stability characteristics by observing its response following various control inputs). As with most of the research projects, this work was being used by the students to satisfy academic requirements.

In recent years, motorgliders have begun to be employed in Germany as tow planes. A number of tow plane-upset accidents has led to a general ban on CG-hook being towed behind motorgliders. This is a source of concern as it prevents many sailplanes in the general fleet from being towed by motorgliders. At this year's meet, the DLR conducted a series of tests to determine the safety of the motorglider/sailplane/CG-hook towing combination with a Dimona motorglider towing an LS-8. Both aircraft were instrumented to measure tow rope tension, control surface deflections, airspeed, altitude, and so forth. Tows were conducted throughout the combined gross weight/CG envelopes of tow plane and sailplane, with various maneuvers being performed to determine the likelihood of tow upsets. This area has also been investigated by an independent team at Unterwöessen, Germany, with results (including sobering footage of simulated tow upsets) presented at the recent SSA Convention in Knoxville.

Another interesting project involved determination of airfoil drag using in-flight trailing wake measurements. Andre Jansen of the Akaflieg Karlsruhe conducted these tests using a DG-800S fitted with a movable pitot rake developed by the DLR to provide measurements over a large area of the wake (see figures).

**Interesting aircraft**

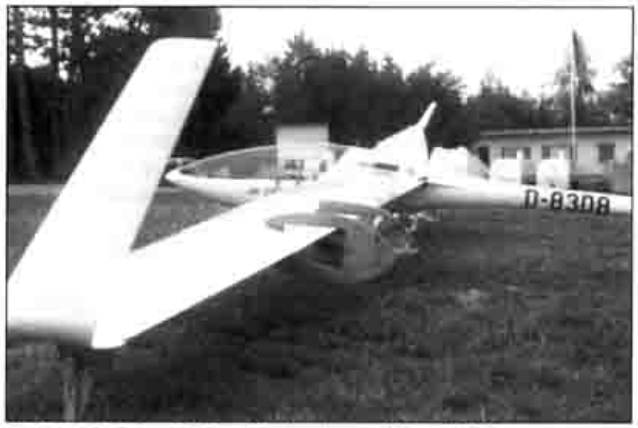
In addition to those already mentioned, several interesting and unusual aircraft were present. These included:

1. The new "Carat" motorglider by Technoflug, GmbH. This is a single-seat motorglider with Discus wings, a 45hp Sauer engine (air-cooled, VW based), and retractable landing gear. Ralf Boehler, the test pilot, brought the machine to work on the certification testing and to allow other pilots to evaluate it. Everyone I spoke to who flew it raved about how much fun it was to fly.
2. The SB 13 flying wing from the Akaflieg Braunschweig. This has actually been around for many years, but was impressive to look at "in the flesh."
3. The Darmstadt D-38, an early fiberglass standard class sailplane that provided the design basis for the DG-100. The D-38 is still flown regularly by the Darmstadt Akaflieg.
4. A beautiful "Rhonsperber," a pre-war wood and fabric Hans Jacobs design newly built from original plans.

**General Comments**

Many of those present commented that changes to the German system of higher education were creating difficulties for the Akafliegs. Some reported a decline in direct support from the universities (financial, workshop space etc.). Other changes affect the Akaflieg members themselves. Participation in an Akaflieg represents a serious commitment. Most Akafliegs require members to work at least 3-400 hours per year on Akaflieg projects. As a result, many Akafliegers extend their studies even beyond the nominal seven years required for a Diplom. (As a side effect, this helps maintain continuity in personnel during multi-year projects.) Recently, however, there has been increased pressure placed on students to finish their studies in a timely manner. For example, some universities have begun charging increased tuition after a certain number of years. (university students in Germany usually pay little or no tuition). Pressures of this sort have always been present at American universities, which may help explain the relative lack of development of Akafliegs in the United States.

One pilot pointed out that the halcyon days, when Akaflieg designs routinely set the standard for high performance, are gone. Currently, it is difficult for Akafliegs to build sailplanes that perform better than those in series




*DG-800S of the Akaflieg Karlsruhe used for airfoil drag measurements. A pitot rake is mounted near the midspan point of the left wing. A transducer unit is mounted near the wing root.*

*DLR pitot rake mounted on DG-800S. The rake is oriented in the spanwise direction. An electric motor drives the rake vertically through the depth of the wake while the pitot pressures are recorded automatically (this installation is known to some as the "mouse elevator").*

production. As a consequence, increased emphasis is being placed on unusual configurations, improved structural design, aerodynamic details, safety and crashworthiness, and general engineering research. Such work is no less important than pushing the performance envelope. Certainly, the Akafliegs will continue to play an important role in sailplane development in the future.

**Acknowledgments**

Many thanks to my hosts at Idaflieg: Jens Kammer, of the Akaflieg Aachen and Idaflieg president; Andre Jansen of Akaflieg Karlsruhe; and Gerd Stich and Dietmar Schmerwitz of the DLR. All the Akafliegers in attendance were quite gracious and happily took the time to explain their work.

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***About the author:*** *Judah Milgram, an aeronautical engineer and sailplane pilot, took his first glider ride in 1972. Though specializing in rotorcraft, sailplanes remain his first love. He is currently translating and updating a well-known German text on sailplane design, "Grundlagen füer den Entwurf von Segelflugzeugen" (Fundamentals of Sailplane Design) by Fred Thomas, due for publication this summer by the College Park Press (http://www.cgpp.com)*