soaring

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Coming at You: America's First World Soaring Championships!

by Bennett M. Rogers, Editor

One can drive for two days across the flat, hot plain of Texas before arriving at Marfa. Hours of driving on super new highways through a land of nodding prehistoric monsters: on all sides they sit, black and clumsy—the oil pumpers, leisurely providing for a new Cessna or junior's next car. Ninety cents a stroke, they say, and it won't run out until man gets to Mars.

Eventually mountains grow abruptly out of the plain and the road curls upwards through wild and beautiful country. There are no more black monsters, but the feeling of prehistory is strong in the vast pillared rocks and empty slopes. At 5000 feet the road opens out on to the Marfa plateau, flat but unlandable among the spiny yucca bushes, and 10 miles in from the ring of mountains is an old bomber training base — to be the home of the 1970 World Gliding Championships.

—Ann Welch

There's something exciting, almost magical, about the term "world championship." It implies dramatic, perhaps even heroic, competition at mankind's ultimate level and the human being who emerges on top is for the moment, at least, the best there is — anywhere. And if the champion is not a larger-than-life figure—a Jesse Owens, a Jean Claude Killy — who will be known for the rest of his days wherever he may go, he at least has the satisfaction of knowing that his name and accomplishment will achieve some small measure of immortality on the printed pieces of paper used to record and preserve the history of sport.

Of course, in any world championship, regardless of the particular field of endeavor, individual reputations and national prestige are on the line. But in a World Gliding Championships this is doubly true because the machines as well as the men are being measured and judged. The economic fortunes of the various sailplane companies may, to a greater or lesser extent, rise and fall on the outcome of "the Internationals." The contest may even determine the next sailplane *you* buy.

For a fun thing, a World Gliding Championships is a most serious affair.

Naturally there will be a lot of speeches and carrying on about how an international event like this increases human understanding between the nations. And it does — for, despite the differences in languages, by the time each pilot leaves for his home country he will have a crystal clear understanding of just who won and who lost and by how much. And that's what competition at the ultimate level is all about — to satisfactorily identify and honor the Overdogs. It's a challenging form of socially acceptable aggression in which people are doing something that really *matters* — and they are doing it just as hard and as well as is humanly possible — and nobody knows how it's all going to turn out. Beautiful!

There have been 11 World Gliding Championships so far. The first one, appropriately enough, took place in Germany back in 1937. It was 11 years (1948) before the pilots resumed competition of a peaceable nature, and since that time there has been a World Championships every two years (except in two instances where there was a three-year break between events). German pilots have won more individual class championships (four) than any other country; however, from 1958 until the Americans asserted themselves a decade later, the Poles were the most dominant force in international competition.

Like the Olympic Games, no official team championship is awarded; in fact, there isn't even unofficial team scoring. But it would be difficult to find any point system that would indicate that any other country did better than the U.S. at the 1968 World Championships in — of all places — Poland. And this despite the fact that none of the American pilots were flying German sailplanes, an area where Germany is pre-eminent.

And now we come to the 12th World Championships, the first one in this country, from June 21st through the Fourth of July at Marfa, Texas, where the American pilots have a golden opportunity to consolidate their precarious position at the top of the heap of international soaring. They are at home. They know the imposing terrain of Marfa; they know the weather, the landing sites, and the language. They can drink the local water without wishing they hadn't and they can go to bed at night and get up in the morning on a schedule that their bodies are accustomed to. And they are flying more competitive ships (German) than they did at Leszno, Poland, particularly in the Open Class.

The American prospects are bright.

But nothing is ever sure. So evenly matched are the world's best pilots and sailplanes that even the most moderate ill fortune can snuff out all likelihood of winning. And so there is drama . . . and tense, nerve-bending pressure. A chance to be a *world champion* — or just another top-level competitor who never quite won the big one.

All of which is going to take place in possibly the most exciting soaring locale in the world!

Let's look at the American pilots individually. Dick Johnson, the seven-time former U.S. National Soaring Champion, will captain a team consisting of (1) George Moffat, (2) Wally Scott, (3) A. J. Smith, and (4) Rudy Allemann.

George B. Moffat, Jr., a 43-year-old private school teacher from Elizabeth, New Jersey, is America's number one seeded pilot and the current National Champion. Moffat, who is married without children, is a graduate of sailboating, where he represented the U.S. on several international teams. He began soaring in 1958 and has 1300 hours in sailplanes (plus 400 in powered aircraft). He is a Diamond badge pilot and the ex-holder of the world speed records for the 100 and 300-km. triangles (the latter mark is still the U.S. national standard – 74.48 mph in the HP-8 in 1964). He was 2nd in the 1966 Nationals (SH-1), 4th in 1967 (Diamant 16.5), and his triumph at Marfa last summer was accomplished in a Cirrus B. In 1968 he

George Moffat Uveges

finished 4th in the Standard Class of the World Championships in Poland flying an Elfe S-3.

Ask people in this country who they think is the best contest pilot in the world today, and the answer consideraby more often than not is George Moffat. But ask what kind of a fellow George is, and no one seems to know. He is surrounded by an aura of aloofness that shields his inner self from casual observation. Having written countless outspoken articles about sailplanes, his opinions are well known and probably more often quoted than those of any other soaring pilot alive. However, the actual person behind the opinions is apparently known only to a close circle of friends. To the average competitor, George is simply the guy you have to lick . . . and mostly don't.

Moffat will be flying in the Open Class at Marfa in Klaus Holighaus' one-of-a-kind Nimbus, the first of the large, new superships using scads of span (72.5 feet, in this case) and aspect ratio (31). The Nimbus, which first flew early last year, is essentially an Open Cirrus with a 22-meter wing (each panel weighing approximately 200 lbs.), although the aft fuselage boom has been stretched some. Its calculated glide ratio is 51 at 56 mph, 30 at 100 mph, and 20 at 120 mph. As Paul Bikle's article elsewhere in this issue graphically points out, calculated figures tend to be a shade optimistic a large percentage of the time (like 100-110%), but Moffat reckons that in typical Marfa conditions the Nimbus should average as much as 10 mph faster than his Cirrus of last year.

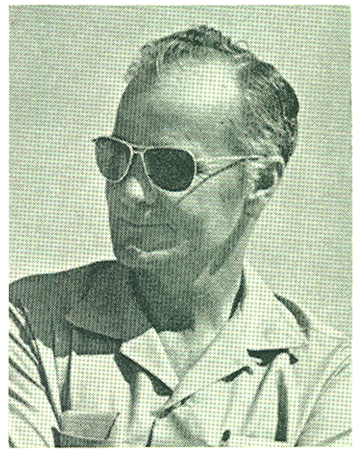
The ship uses 90-degree flaps for landing, and in the April 1969 *Soaring* Moffat stated, "Klaus feels that he could put the Nimbus in any field that would take a Ka-8, something that can hardly be said of the AS-W 12, BS-1, etc. In short, both handling and performance seem fully up to present-day ships, and the landing performance better than any but Dick Schreder's HP's." If true, George will be very hard to beat. And if not true, George will still be very hard to beat.

Should the Nimbus drub the rest of the Open Class without even raising a sweat in the blazing Texas sun, it will undoubtedly encourage the design and construction of additional monsters; and the wild price tags that adorn the new heavyweights may encourage many pilots to either fly in the Standard Class or to create a new class where the present "inexpensive" Open Class ships will still be competitive. In short, the future direction of contest soaring may be strikingly affected by how this one sailplane performs.

Second in the seeding for the U.S. team was Wallace A. Scott, a 45-year-old operator of motion picture theaters in Odessa, Texas, which is just up the road a piece from Marfa. Wally Scott burst explosively on the contest soaring scene in 1964 when he finished in 2nd place in his very first Nationals, a feat not likely to be repeated. He led the U.S. team's showing at the following year's World Championships in England. And in 1969 he again finished 2nd in our Nationals, resurrecting the American reputation of the AS-W 12 in the process.

Yet Wally is perhaps even better known for his long distance record flying. In 1963 he flew a 1-26 443.5 miles, which is still the 1-26 distance "record." A year later he flew a Ka-6CR to a world goal record of 520 miles. In 1967 he went 552 miles in his Ka-6E. And last year he flew his borrowed AS-W 12 to another world goal mark, this time 605 miles, to win his third Barringer Trophy.

Wally Scott's personality reflects a sort of old-shoe warmth and friendliness. He's the kind of guy you get a Christmas card from, and if you run into somebody who just visited Odessa, chances are they stayed with Wally and his family. After an article appeared in the January *Soaring* describing Scott's most recent record flight, buddy Ben Greene sent him a letter that hilariously but unmercifully (and unprintably) kidded Wally as only Ben can do. Wally was thoroughly delighted by the ribbing.



Wally Scott Uveges

But, like the other pilots who have reached the top, Scott is deeply motivated to achieve excellence and recognition. Mention his local arch rival, Al Parker, and Wally can fly with as much blood in his eye as anyone.

Scott is married and has four children. Besides being a pilot, he is an archery enthusiast and once held a world flight record (for an *arrow*, not a sailplane) for some seven years. He started soaring in 1961 at Odessa and has over 1600 hours in sailplanes plus a full Diamond badge. He also has a commercial license and 5000 hours of power time.

Scott recently purchased the AS-W 12 prototype, which he will be flying in the Open Class at Marfa.

Our third-seeded pilot is the defending World Champion in the Standard Class, Andrew James – better known as A.J. (or Jim) – Smith, a 46-year-old bachelor and architect from Southfield, Michigan. A.J. usually has a kind of cold-fish look to him in his photographs (though not in the accompanying one); however, when you meet him in person, his features come alive and he becomes a very handsome and magnetic individual. He's

A. J. Smith

a charmer when he sets his mind to it. As you listen to him talk you are increasingly aware of an incisively dry wit being deftly imposed on some exceptionally functional mental processes; and when Smith occasionally throws away a humorous line, it has much the same cadence and inflection that comedian/political-satirist Mort Sahl uses so effectively. The guy is sharp.

But the good-guy Smith with the amusing and instructive after-dinner speeches is also the short-fused, hard and hungry contest pilot who — in his own words — "gets the people around (me) so choked up that the officials, if they could appoint a firing squad at any one point, would get them together." An exaggeration, of course, but indicative of the fact that A.J. clearly has the necessary gut feel for fierce, top-level competition of any kind. He knows instinctively that the name of the game is to win, not to make bosom buddies of his competitors nor to explore traditional democratic functions and procedures with his crew.

A former Naval carrier pilot who has also done some stock car racing, A.J. has learned to handle pressure and tension. Or as a fellow pilot once commented, "Yeah, he handles his emotions well; he just passes 'em on to everyone around him. It's like how that Green Bay football player once described Coach Vince Lombardi: 'He may not have ulcers, but he's a *carrier.*' In fact, Jim is a lot like Lombardi . . . a winner . . . the best there is at what he does . . . a highly intelligent man who prepares down to the final detail, but who — if he needs that something extra — can psych himself up for the big moment by just plain getting mad and energizing his whole system with a kind of controlled fury. That A.J. Smith is something else."

A.J. started soaring in 1957 and presently has 1700 hours in sailplanes (plus another 5000 in powered aircraft). He won his first U.S. National Championship in 1961 at Wichita in an LO-150. Like Scott, he was a member of the 1965 team that went to England. Over the past three years, no contest pilot in the world has had any better overall record than Smith. He won the '67 Nationals at Marfa in his Sisu. The following year he used a rented Elfe S-3 to become the World Champion in the Standard Class at Poland. And last summer he finished the '69 Marfa Nationals in 7th place, with only Moffat and

Scott (out of 81 competitors) beyond striking distance at the close of the contest—despite the fact that the Sisu had become a design elderly enough to have won its first Nationals *seven* years earlier. On a 2-1-0 scoring basis (2 points for each competitor beaten during a task, 1 point for each one tied, and 0 for the rest), Smith would have finished 2nd only to Moffat; and if the meet had been scored under the SSA/Mancuso handicap system, he would have been the winner.

As a minor curiosity item, Smith is the sole U.S. team pilot with less than a Diamond badge (he lacks the altitude leg). But then badges don't win contests. A.J. does.

At this year's Internationals he will compete again in the Standard Class, most likely in an LS-1.

At age 38, Rudy Allemann is the new boy on the team, the only pilot not solidly into his 40's and the only team member not to have flown previously for the U.S. Allemann, who is married with three children, is a chemical engineer who enjoys mountain climbing and skiing. He started soaring in 1957 at his present hometown of Richland in the state of Washington and now has 1900 hours in sailplanes (plus 50 in powered aircraft). He got his first taste of serious competitive soaring at the 1958 Nationals at Bishop, California, where he flew a 1-26. He subsequently came to prominence in Regionals and Nationals with a Ka-6 and later an Open Libelle. He was 7th in the '67 Nationals at Marfa,

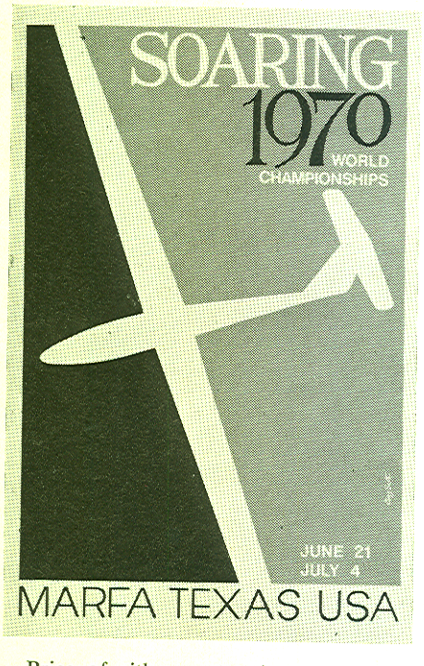
Rudy Allemann Uveges

skipped '68 at Elmira, and placed 4th at Marfa in '69 (where he was the only other pilot besides Moffat or Scott to hold the overall lead during the contest). In '69 he also managed to dominate his local Regionals to the point where he won all four contest days.

His selection for the fourth spot on the team over a number of other truly exceptional pilots, including tigers like Ben Greene and Ross Briegleb, proved a popular one with the soaring fraternity in this country. Everyone seems to wish Rudy well in his first big international test, in which he will be flying a Standard Libelle (owned by Tom Page) in the Standard Class.

Additionally, designer-builder Dick Schreder of Bryan, Ohio, will be flying unofficially as a guest in the contest to demonstrate the advantages of simple flaps (as opposed to dive brakes) on Standard Class sailplanes (to be legal in FAI-sanctioned competition in 1974). We have received two reports on the ship he will fly: (1) it will be the HP-15 with a brand-new wing, and (2) the entire bird will be new, making it an HP-16. In either case, it seems likely that there may be some added flesh on the wing spar to reduce the prodigious aspect ratio.

That's about all that can be said for now. From here on, matters are strictly in the hands of the pilots themselves . . . and the gods. We suggest that those of you whose SSA memberships expire with this issue (that's about half of you) be sure and renew promptly so that you can find out how the Big Show all comes out.



WORLD CHAMPS POSTERS

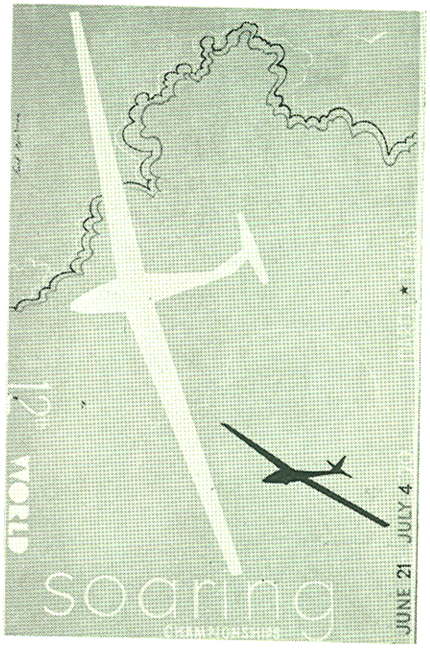
Two magnificent new posters advertising the XII World Soaring Championships at Marfa, Texas, have been issued by SSA and are now available for sale to SSA members and other interested parties.

Poster A (left), the winning design in the recent SSA poster contest, features the stylized silhouette of a high-performance sailplane. The colors are a patriotic red, white, and blue.

Poster B (right), especially commissioned from noted poster artist Earl Newman, depicts red and white sailplanes circling against the backdrop of a blue, cumulus-filled skyscape.

Both of the large (2 x 3 ft.) posters are silk-screened by hand on special heavy paper and are shipped rolled (no creases) in heavy mailing tubes.

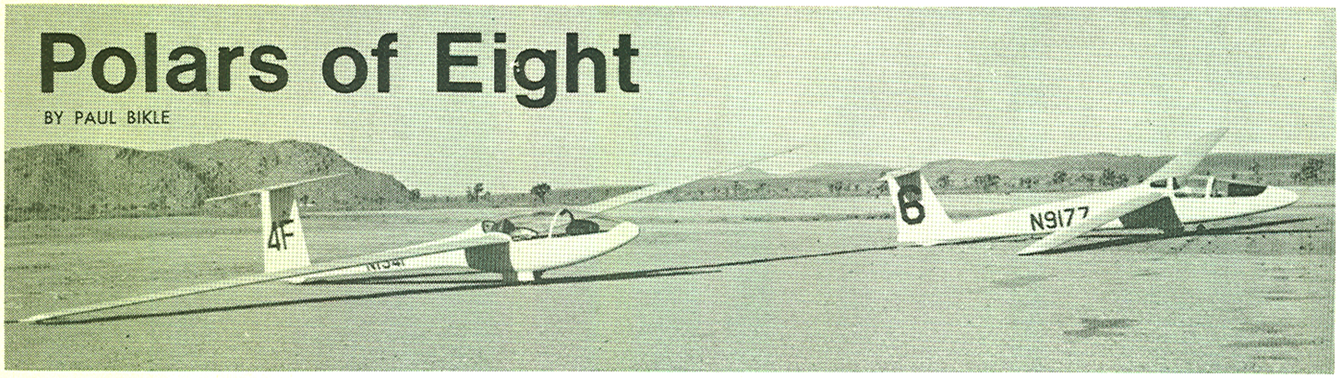
Proceeds from the sale of the posters go directly to the 1970 World Championships Fund, so that your purchase serves an eminently good cause as well as providing you with a unique memento of the Championships for future years.



Price of either poster (state whether you want A or B) is $2.50 postpaid. The posters will be available at the SSA booth at the contest site, as well as from the Soaring Society of America, P.O. Box 66071, Los Angeles, Calif. 90066 (California residents please add 5% sales tax); or from Twelfth World Soaring Championships, Box 1970, Marfa, Texas 79843.

Polars of Eight

BY PAUL BIKLE



Level flight performance polars have recently been measured on eight sailplanes as a part of a rather comprehensive flight-testing activity now under way by volunteers and individual members of the SSA Flight Test Committee. Results of this series of comparative tests were to be covered as one of the later articles in a series on flight testing planned for *Soaring*. However, the inclusion in the test program of five modern fiberglass sailplanes likely to play significant roles in the World Championships makes it timely to report these results as the first of the series.

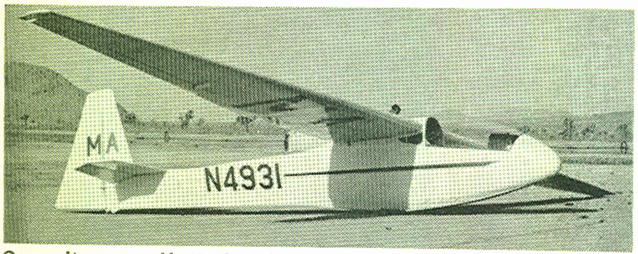
Completion of these tests at this time was as much a matter of a fortunate combination of circumstances as it was the result of good planning. Early in the fall, we had started tests to determine the level flight performance polar for the T-6, a modified HP-14T. At the same time Einar Enevoldson had started tests on his Phoebus A, concentrating on flying quality tests with particular emphasis on the P.I.O. tendencies of full-flying, slab-type horizontal tails. As the Christmas holidays approached some three months later, the T-6 polar had been measured and we had a high level of confidence in its accuracy. Work on the Phoebus A had progressed to the point where Einar needed a good airspeed system calibration and was ready for comparison tests to get both airspeed errors and level flight performance. We were both interested in using the holiday period to perfect our equipment and techniques for comparison tests, with the hope that we could organize a "workshop" later in the spring where we could obtain data for a number of sailplanes.

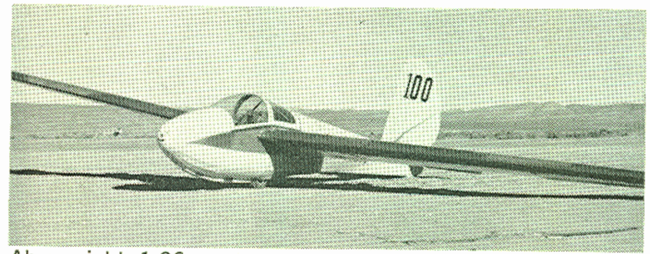
Relatively stable air and poor soaring weather had developed at El Mirage; the weather was cooperating! Earlier experiments with comparison tests had demonstrated that tests in air associated with any degree of convection yielded uncertain and generally unsatisfactory results. Interest of other pilots developed as tests progressed; Kurt Horn volunteered the use of his Phoebus C. Gus Briegleb wanted to take advantage of the opportunity to evaluate his modified BG-12, #67C. While we were at it, the Antelope Valley Soaring Club 1-26 was available, and members Floyd Finberg and Alan Bikle were willing to do the work involved. The first day of the new year found us pretty well finished with the work on these sailplanes. George Uveges then showed up with his 16.5-meter Diamant; Jack Nees came up from Laguna Beach with his Kestrel, and Dave Nees came along to fly it. Ross Briegleb persuaded Al Leffler to join in with his new Cirrus, and finally Mike Adams arrived with his standard, kit-built BG-12, which was included as being a more representative BG-12 than the modified 67C. We had the final essential ingredient with a number of volunteers with sailplanes of interest and a desire to participate to an extent which included paying for the towing. The year 1970 was certainly off to a good start as far as this part of the Flight Test Committee was concerned.

It was fortunate that only one or two sailplanes were available on any given day. The limited number of experienced flight-test people were able to give close attention to each sailplane and every detail of the testing. Pilot experience varied widely from that of Einar, a research pilot for NASA in between his soaring activities, and Ross Briegleb, with more than 6000 hours of glider time, down to the less than 200 hours of 16-year-old Alan Bikle, who flew the 1-26. Testing techniques on the comparison flights were adjusted to suit so that the less experienced pilots had nothing to do but hold their aircraft at a series of steady speeds. In addition to having a chance to fly in the tests, each participant received a copy of the test results on his sailplane including instrument calibrations, weighing, airspeed system errors, and a level flight performance polar. Results of the tests are listed in Table I and summarized as level flight performance curves in Figure 1 and Figure 2.

Each sailplane was weighed, as flown, on calibrated platform scales which we were able to place in the hangar at El Mirage to avoid any effects of wind. Most weighings were close to the weights on the A/C weight forms, but all were a few pounds heavier and one was found to be 79 pounds heavier than listed. Wing surface waviness measurements were made for the forward 50% chord at six chordwise stations on the wings of the higher-performance sailplanes; these measurements indicated wave heights in thousandths of an inch using a 2-in. gage spacing. A representative plot showing the data for the Cirrus is included as Figure 11. Maximum values for each sailplane are listed in Table I. Airspeed systems were checked and any leaks were corrected. Airspeed indicators were calibrated against the T-6 indicator and also against a standard indicator borrowed from a local government laboratory. Each sailplane was carefully sealed and checked for the tests.

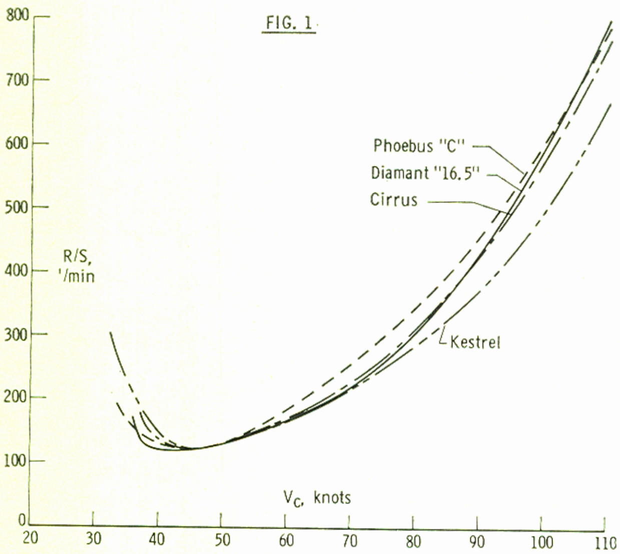
No attempt was made to standardize loadings or pilot weights. The five fiberglass sailplanes and the T-6 were all contest sailplanes with normal contest equipment and in generally excellent condition. The condition of the Phoebus C was outstanding, the Phoebus A almost as good. The wing of the Diamant had accumulated a number of small scratches and patches. The Cirrus was nearly new, with no sanding done on





Opposite page: Kestrel and T-6. Above left: BG-12.

Above right: 1-26.



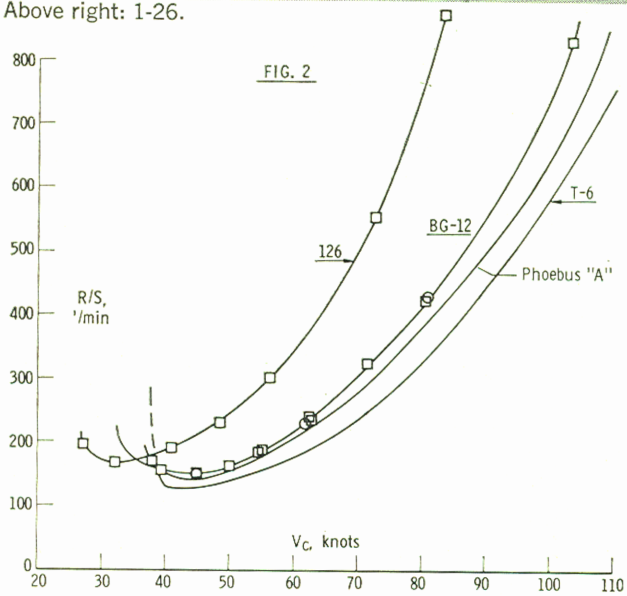
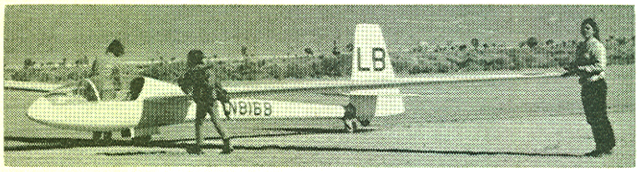
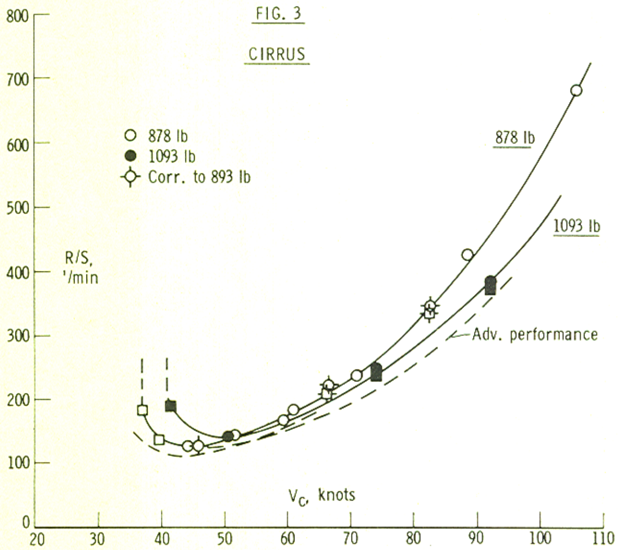


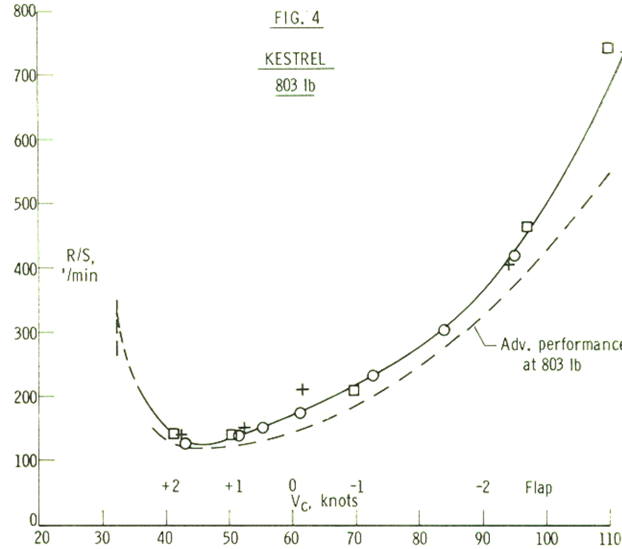
TABLE I

A/C	Kestrel	16.5 Diamant	Phoebus C	Cirrus	Cirrus	T-6	Phoebus A	BG-12	1-26
Factory No.	Apr. '68	042	833	65	Same but with 215 lb of water	6	41	113	100
Span, ft	55.7	54.2	55.8	58.2		57	49.2	50	40
Area, ft^2	123.7	143	151.2	135.6		142.5	139.7	141	160
Aspect ratio	25.1	20.5	20.6	25		22.8	17.3	17.7	10
Flap	As spec.	As spec.	None	None		0°	None	0°	None
Gear	Up	Up	Up	Up		Up	Fixed	Fixed	Fixed
Gross wt., lb	803	864	769	878	1093	810	711	828	593
Pilot wt., lb	165	175	165	218	218	200	200	155	160
W/S, lb/ft^2	6.5	6.04	5.08	6.5	8.06	5.7	5.08	5.9	3.7
Airfoil	-----	-----	E403	-----	-----	Mod-FX 61-163	E403	4415R 4406R	-----
Wave factor*	6	8	3	6	6	10	2.5	10^+	Very
Min. V_c, kt	32	36	33	37	41	37.5	32.5	37	27
At R/S, '/min	-----	170	200	180	200	-----	200	190	220
Min. R/S, '/min	124	120	124	127	140	125	139	151	165
At V_c, kt	45	43	43.5	44	49	43	45	43	32.5
Best L/D	38	38.5	37.5	37	37	36.3	34	31	21.5
V_c at best L/D, kt	52	51	49	50	55	48	48	50	42
V_c, 394 '/min, kt	92	87	84	87	93	86	81	78	64
'/min at 35 kt	N/A	N/A	170	N/A	N/A	N/A	177	N/A	171
'/min at 40 kt	148	122	134	138	N/A	130	151	154	186
'/min at 50 kt	132	131	134	136	141	140	152	162	243
'/min at 60 kt	168	168	184	173	168	179	207	217	343
'/min at 70 kt	219	219	257	230	213	236	282	307	500
'/min at 80 kt	287	307	347	319	278	326	380	419	760
'/min at 90 kt	372	435	458	430	362	450	497	562	-----
'/min at 100 kt	495	598	609	577	472	590	655	746	-----
'/min at 110 kt	672	803	790	766	624	758	890	-----	-----

*Wave factor is the maximum wave height in thousandths of an inch measured on the forward 50 percent of the wing surface with a 2 inch gage at six chordwise stations.







the factory wing finish. Condition of the Kestrel was outstanding except for a leaking forward canopy seal which was not discovered until the tests were completed. Except for an inherent waviness in the metal wing surface greater than the fiberglass sailplanes, the T-6 was in first-class condition. The BG-12 was in generally good condition, while the 1-26 was representative of the average club trainer which it was. Obviously the results of the tests pertain to these eight individual sailplanes as flown and should be applied to other sailplanes of the same type with some degree of caution.

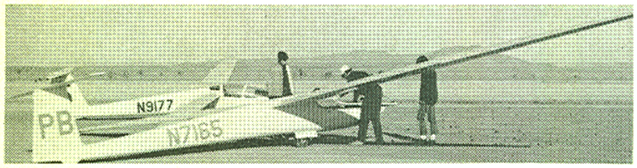
Testing of individual sailplanes involved one flight with either the swivel-head wing boom, as shown in the photograph of the Phoebus A, or a trailing static cone, as shown in the flight photo of the T-6, to obtain a complete airspeed error calibration. A cross-check on this calibration was also obtained from the T-6 airspeed readings during side-by-side comparative sink tests made on later flights. Airspeed system correction curves and data points are plotted in Figure 9. Errors for the Kestrel, Diamant, and T-6 were found to be negligible. On the other hand, neglect of these corrections in the case of the Phoebus C, Phoebus A, and BG-12 would result in serious errors in the high-speed performance measurements. There is a tendency to lose sight of the fact that a polar represents both rate of sink and speed. One knot may not seem like much, but it is equivalent to about 15 or 20 feet per minute in R/C at 100 knots; at 50 knots, one knot is equivalent to 2% in L/D or nearly 1 point in L/D on the higher performance sailplanes.

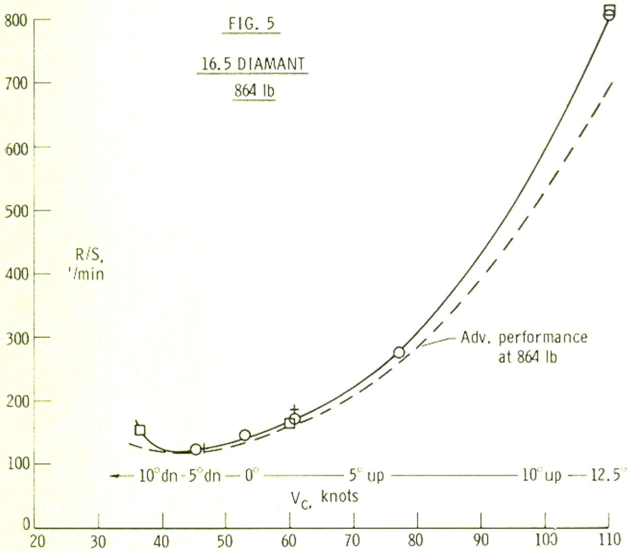
At least two flights, and in some cases three or four flights, were then made on each sailplane for comparison tests with the T-6. All flights in this series were made from tows to the neighborhood of 10,000 feet, with the first flights each day made at about nine in the morning. Temperature data was taken in the climb and tests were discontinued if the lapse rate was not stable. On several of the flights the air was smooth enough for absolute, timed rate-of-sink measurements, and these were made when the opportunity presented itself. However, the bulk of the data was obtained when the air was not completely smooth and not suitable for absolute measurements. Tests were discontinued at lower altitudes whenever convection was encountered.

Basic comparisons were made in 5-minute, side-by-side glides. For each point, the lead sailplane would establish a steady glide at a constant indicated airspeed; the second sailplane would then take a position about 200 to 300 feet out from the wing tip of the lead sailplane. When both pilots were ready, the run would start, both pilots noting the altimeter and airspeed readings and estimating the difference in height between the sailplanes at this point. At the end of five minutes, the pilots took the same readings and the run was terminated. Where the performance of the two sailplanes was about the same, change in the relative heights of the two ships was determined most accurately from the estimates made by the pilots. For height differences in the neighborhood of 50 feet or less, the accuracy appeared to be about ±5 feet; when divided by five minutes, this would give an incremental rate of sink within about ±1 foot per minute.

Greater differences in performance resulted in relative height changes considerably in excess of 50 feet over a period of five minutes. In these cases, estimates were augmented with the use of transparent grids which could be used to gauge height differences in fuselage lengths, and the relative altimeter increments were also used as a source of data. For height differences approaching 150 feet, relative height differences were only accurate to about ±15 feet, and this would give an uncertainty of about ±3 feet per minute to measurements of difference in rate of sink. The differences were corrected to sea-level standard condition by the same methods used for reducing absolute rate-of-sink data to sea level. Corrected increments were then added to the standard rate of sink already determined for the T-6 at the specific calibrated airspeed at which the test was flown.

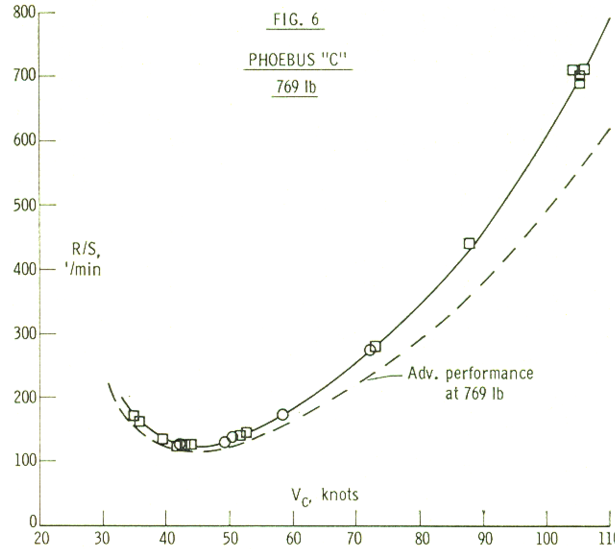
In cases where the difference in sink exceeded 30 feet per minute, comparisons were made by having the second sailplane start behind and to one side of the

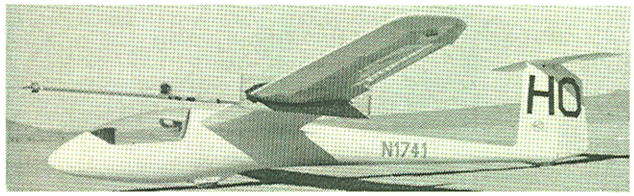




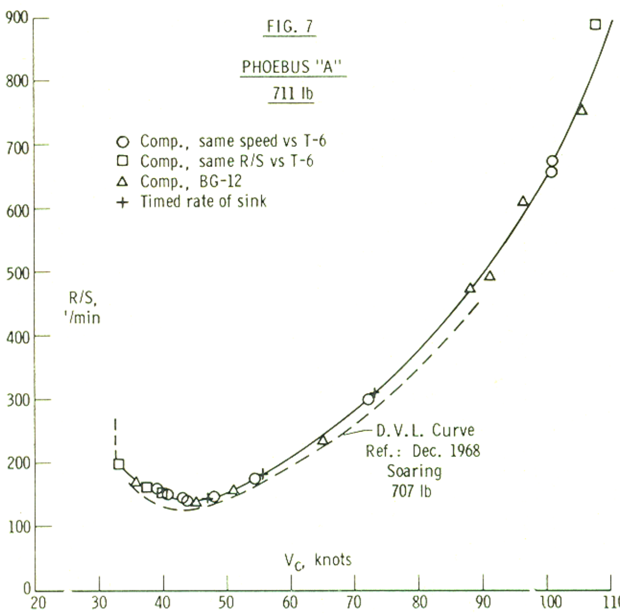
lead sailplane, maintaining the same rate of sink by keeping the lead sailplane on an appropriate line of sight to the horizon, and noting the difference in calibrated airspeeds. The same technique was also used for points where the speed of the test airplane was outside the speed range of the T-6. This procedure required stable air, clear visibility, and a far-off horizon for reference, as well as a good understanding of the factors which might lead to a slight inclination of the line of sight; generally, any effect of an inclined line of sight can be minimized by selecting diverging flight paths so that the relative distance between the sailplanes remains about the same. The technique has been developed to a point where good results were obtained, and a number of points were checked using both techniques. It was then only necessary to read the rate of sink for both sailplanes from the standard-day, sea-level T-6 polar at the T-6 calibrated speed and to plot it at the calibrated speed of the test sailplane during the run.

Test points for the 1-26 and BG-12 are plotted with the summary curves in Figure 2. Curves for the Cirrus, both with and without 215 pounds of water ballast, are shown in Figure 3 along with the test points for both conditions. The heavy weight points have also been corrected to the lighter weight and plotted on the light weight curve, showing full agreement with the theoretical effect of weight. Kestrel, Diamant, Phoebus C, and Phoebus A test data are shown in Figures 4, 5, 6, and 7. The points represented by circles are side-by-side comparisons, points portrayed by squares are from comparisons at the same rate of sink, while crosses indicate timed rate-of-sink measurements made in completely smooth air. Figure 8 is the reference curve for the T-6, with timed rate-of-sink points (crosses) obtained during the comparison tests plotted along with earlier test points (black dots) on which the curve was based. All data have been plotted in nondimensional form as lift coefficient squared vs. sailplane drag coefficient in Figure 10.

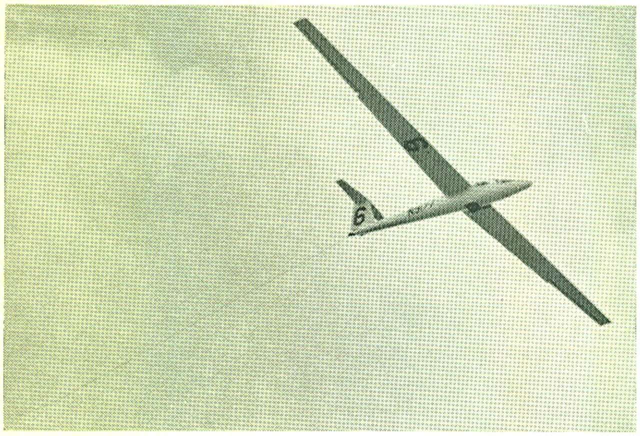




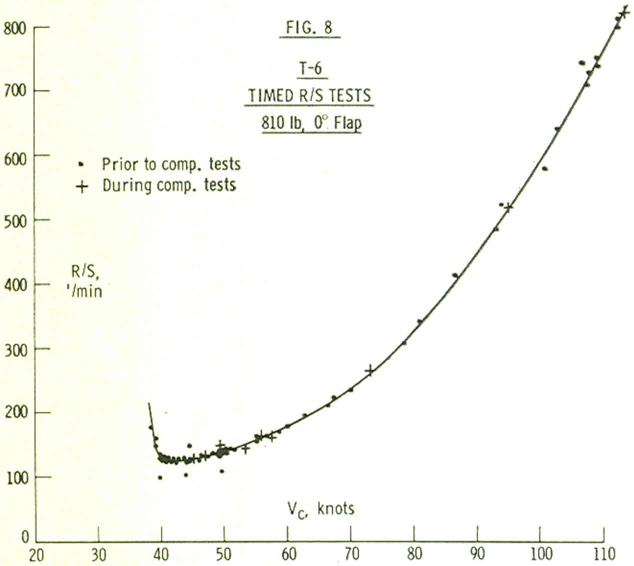
The Phoebus A wearing the swivel airspeed head.



Of course, the absolute level of the performances obtained for all eight sailplanes is entirely dependent on the validity of the reference T-6 data, which consist of 47 individual rate-of-sink measurements at various speeds. These were all timed runs at constant speed for a minimum of at least five minutes or 1000 feet; some were continued for as long as 15 minutes, and some for as much as 5000 feet of altitude. All were made on very early morning flights to altitudes in the neighborhood of 12,000 to 13,000 feet on days when the lapse rate was stable and wind velocities and wind shear was at a minimum. Temperatures were measured in flight; the aircraft had been weighed on several occasions during the flights; instruments were calibrated; and the configuration was carefully controlled



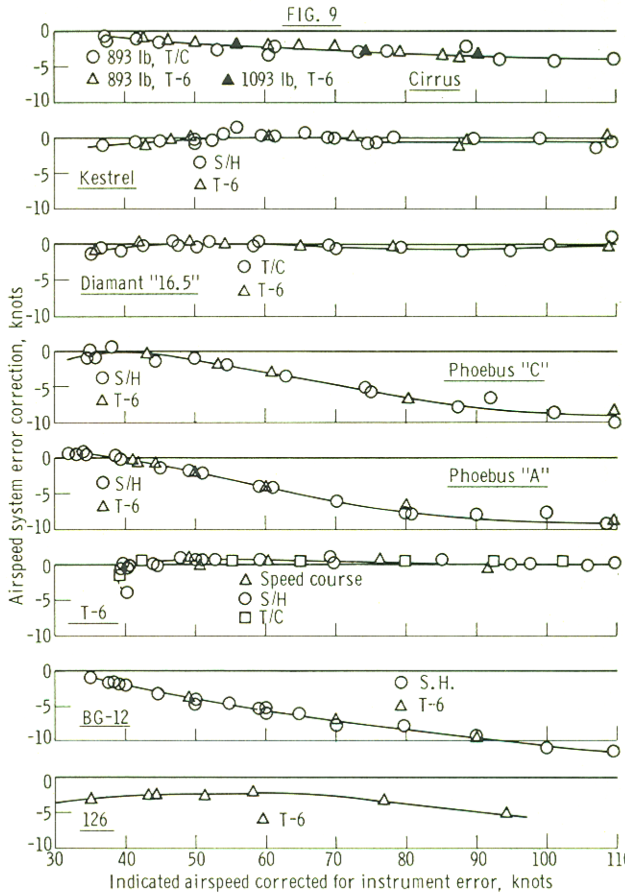
The T-6 trailing a static cone in order to calibrate the airspeed system.



during the period of the tests. A rate-of-sink vs. speed polar has been determined for sea-level standard conditions using techniques essentially the same as those described by Dick Johnson in "Sailplane Flight Test Performance Measurement," published in the April 1968 issue of *Soaring* Magazine.

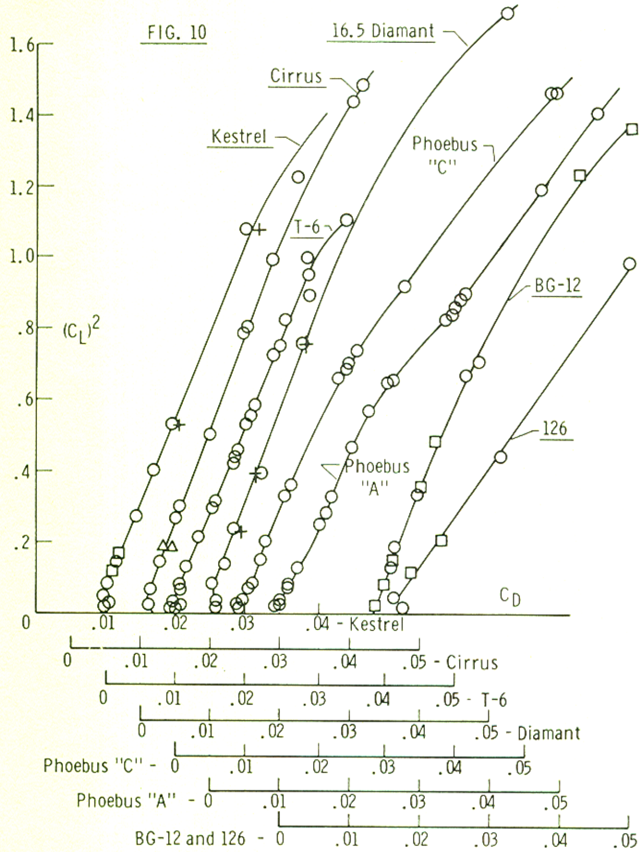
A great deal of attention had been given to the determination of the airspeed system errors to insure accurate calibrated airspeeds. Calibration flights were made on nine occasions; these included two series of runs with airplanes calibrated over a ground speed course, calibration against a separate airspeed system connected to a swivel airspeed head mounted 2.3 chord lengths ahead of the wing, calibration against a trailing static cone, and calibration against a previously calibrated SHK. All gave consistent results with a scatter of less than ± 1 knot. Check calibrations were also made during the comparison tests, and the agreement with earlier calibrations was excellent. This agreement, along with the consistent rate-of-sink data points obtained at this time, served to maintain our confidence in the accuracy of the reference polar.

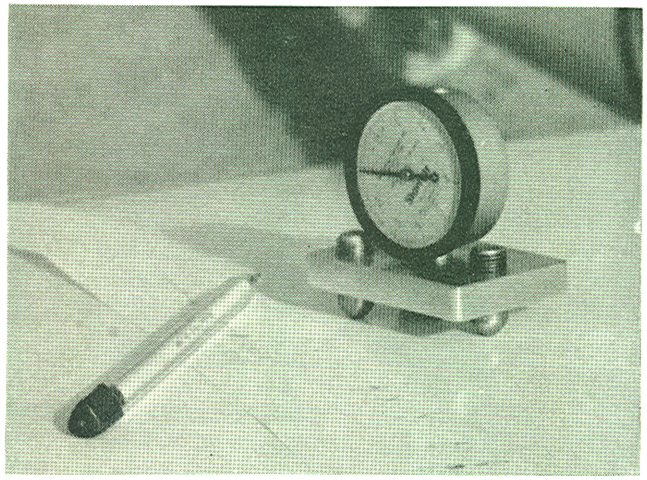
There is always the possibility of some systematic error in procedure which has not been detected or the possibility that the average smooth air in the El Mirage area has some residual subsidence. The fact that the measured data presented here for the T-6 are almost



identical to the data obtained by Dick Johnson in the flat lands of Texas with his quite similar HP-13 tends to indicate that this is not the case. What about the overall accuracy of the comparison tests? We ran additional tests on the Phoebus A flying with the BG-12; points obtained from comparisons with the BG-12 (represented by triangles) are plotted with the points from the T-6 in Figure 7 for the Phoebus A, with excellent agreement between the two sets of data. As a further check on the overall consistency of the test results, the BG-12 data of Figure 2 were compared with data obtained on the original BG-12 in 1956, with quite close agreement. The 1-26 points plotted in Figure 2 fell so close to the curve for a different 1-26 tested in 1960 that the curve drawn through the points is the same 1960 curve.

Plots 3, 4, 5, and 6 also show dashed curves taken from the manufacturers' advertised curves. It is not too surprising that these range from 5% to 15% better performance than obtained in the tests. It is interesting to note that the Diamant performance curves almost agree at slow speed. Curves for other sailplanes are displaced about the same amount throughout the speed range, while some others differ more at slow speed than at high speed. Use of such advertised data for comparison purposes between sailplanes may introduce more differences than actually exist between the sailplanes tested. In several instances it was noted that maximum L/D, for example, was quoted as something like 44 in the tabulated performance, the curve in the same brochure showed 42, and the test results for the airplane tested showed something like 37 or 38. For another sailplane, the published L/D curve was 15% better than





The gage above measures the smoothness of wing surfaces.

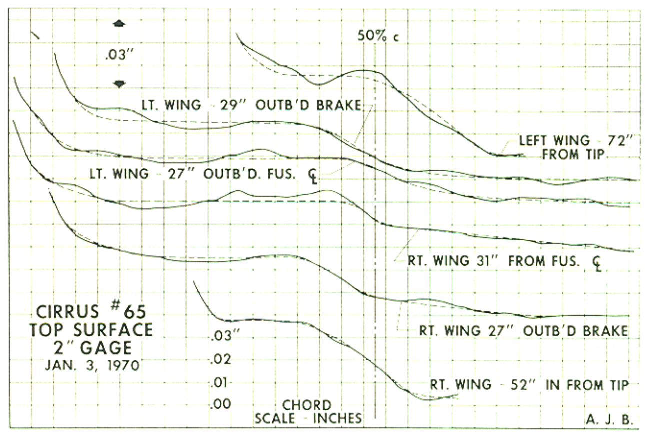


FIGURE 11

the rate-of-sink curve published on the same plot, in this case the rate-of-sink data agreeing with that obtained in these tests.

Of greater concern was the difference shown by the dashed curve in Figure 7 for the Phoebus A. This is the D.V.L. polar for the Phoebus A from the article by Hans Zacher which was reprinted in the December 1968 *Soaring*. The original data in the D.V.L. report have been checked and certainly appear to be correct. Earlier D.V.L. data obtained on a Ka-6CR was very close to the data obtained on a similar Ka-6CR in this country in 1961. We have been unable to account for this difference in Phoebus A performance except for a possible difference in the sailplanes.

Certainly the relative difference in performance for the eight sailplanes tested are valid within fairly close limits. The extent to which these sailplanes represent other sailplanes of the same type and the extent to which they represent the best of each type is, of course, unknown. It would be reasonable to assume that the performance of the sailplanes tested does indicate the general level of factory-built planes in the hands of the customer. Wing waviness measurements would indicate that the extent of laminar flow might be considerably less than claimed. Comparison of the lift-coefficient-squared vs. drag-coefficient plots, Figure 10, with claimed polars also indicates an incremental drag which could very easily be explained by a difference in the extent of laminar flow. This leaves open a very real question as to what extent laminar flow can be achieved in flight.

Closely examining the performance obtained and comparing it with experience in contests emphasizes a very real but hard to analyze and too often neglected consideration of the low-speed performance in comparing sailplanes. It would certainly appear that a combination of good performance and agility in maneuvering at very low speeds and rapid roll accelerations could combine to make up for a considerable difficiency in high-speed performance under many soaring conditions. At best, level flight polar data of the type reported here is only one piece of the puzzle of what makes a good sailplane. Even so, people do seem to be interested in such data and should benefit from a realistic assessment of its value.

No attempt has been made to explain in detail much of what has been covered in this report. Future reports will address themselves to many aspects of interest. These will include new techniques, airspeed system error as related to type and design of airspeed systems, complete results of the T-6 tests, data obtained with simple hinged flaps including loads and hinge moments as well as lift and drag effectiveness, flight-test performance of 10 more sailplanes, profile drag measured on several airfoils in flight, and several articles devoted to stability and control testing.

In the coming months we plan to obtain data on the AS-W 12; preliminary data indicate that the AS-W 12 may well have a maximum L/D of about 44. Of great interest would be the opportunity to fly comparison tests with the new family of Standard Class sailplanes, but these will not be available until next fall for tests of this type.