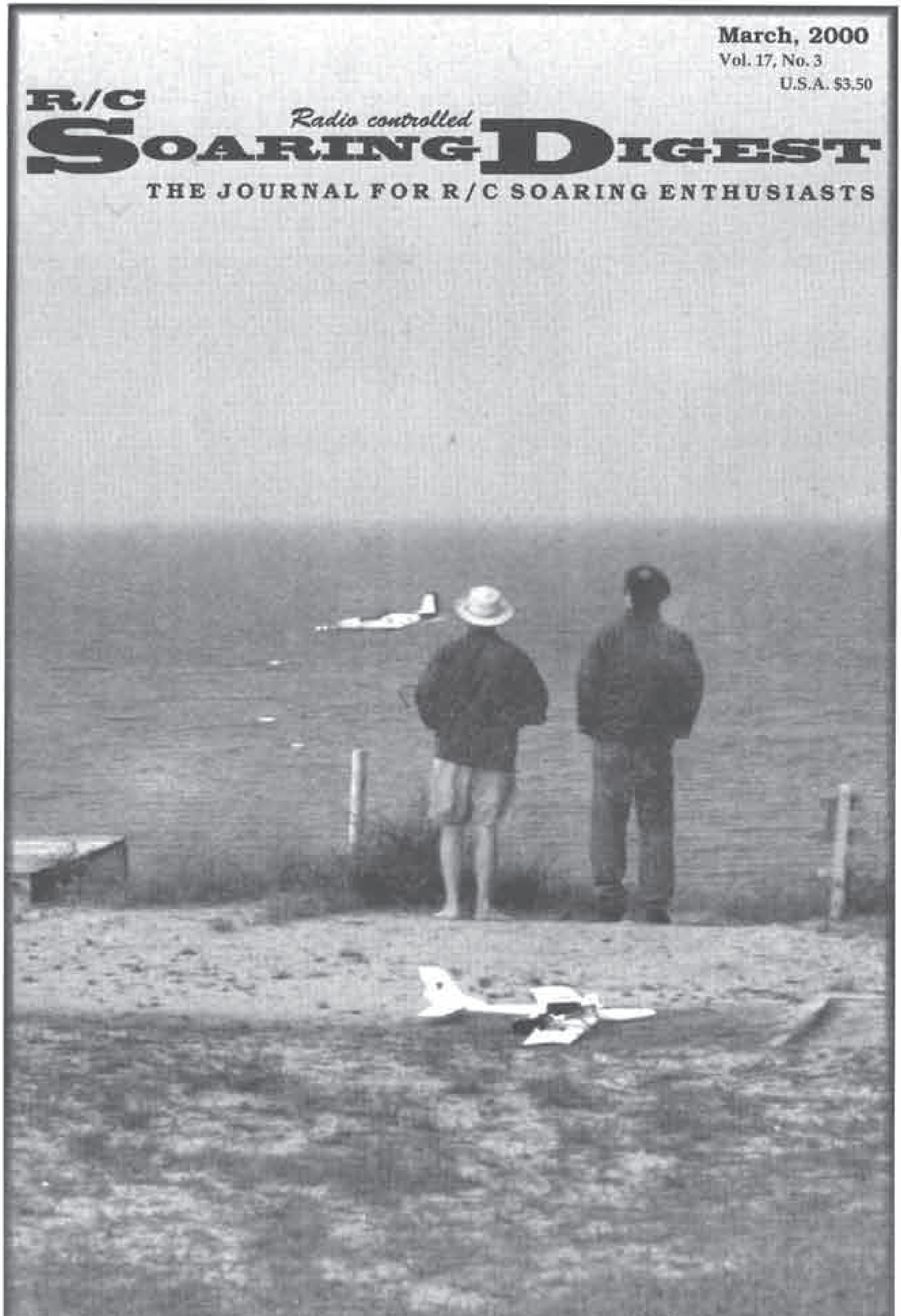
March, 2000
Vol. 17, No. 3
U.S.A. $3.50
R/C
Radio controlled
SOARING DIGEST
THE JOURNAL FOR R/C SOARING ENTHUSIASTS

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ATLANTIC FLYING

Dave Sanders (Capistrano Beach, California) and Tom Atwood (Right - Ridgefield, Connecticut) take turns flying a DAW Foam-51 over the Atlantic Ocean at Cape Cod, Massachusetts. Bob Martin Coyote in foreground.

Photography by Dave Garwood, Scotia, New York.

R/C Soaring Digest (RCSD) is a reader-written monthly publication for the R/C sailplane enthusiast and has been published since January, 1984. It is dedicated to sharing technical and educational information. All material contributed must be exclusive and original and not infringe upon the copyrights of others. It is the policy of *RCSD* to provide accurate information. Please let us know of any error that significantly affects the meaning of a story. Because we encourage new ideas, the content of all articles, model designs, press & news releases, etc. are the opinion of the author and may not necessarily reflect those of *RCSD*. We encourage anyone who wishes to obtain additional information to contact the author. *RCSD* was founded by Jim Gray, lecturer and technical consultant. He can be reached at: 210 East Chateau Circle, Payson, AZ 85541; (520) 474-5015, <gimpeg@netzone.com>.

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Bookshelf Listings - A listing of recently published books of interest to aeromodelers.
Complete RCSD Index, 1984-1998

The Soaring Site

RCSD Index Update

The *RCSD* index has been updated to include 1999, and is now available for downloading on line from the *RCSD* web pages. Lee Murray, who has been updating the index since 1984, informs us that he's working on a MAC version, as well. Our thanks to Lee for all his hard work!

A couple of you have had difficulty downloading the index this last month. Hopefully, with Lee's help, you have it in your format, by now. Should any of you have difficulty downloading the index, please let us know. We want it to continue to be a valuable reference and truly need to know if you encounter any problems.

Back Issues

For those of you new to the pages of *RCSD*, that come in the middle of a build along project, 2 part series (or longer) or whatever, and you want to get the back issues, we try to make it as easy as possible. You can start your subscription with whatever issue you like. But, ya gotta tell us with a quick snail mail note, or e-mail message. For example, if you're new to *RCSD*, received the February issue, but want January in order to obtain "Part 1, Swept Wings & Effective Dihedral" written by Bill & Bunny Kuhlman, drop us a note requesting that we send the January issue and we'll roll your subscription back one month, and put the copy in the mail. That's all there is to it.

Happy Flying!
Judy & Jerry Slates

Elmira Update

...from John Derstine
johnders@ptd.net
http://www.Geocities.com/~scalesoar

We have decided to move the Aerotow Banquet from Friday, the 9th of June, to Saturday the 10th (as in previous years). We will hold it at the soaring museum as before, but with a difference. This will be a German style, less formal, eat, drink and be merry event! Social hour will start at 6:30, and dinner around 7:30 PM, with speakers and awards to follow.

Saturday is the last day of the event this year, although anyone left standing Sunday AM may be allowed to fly until the big gliders start up. Also, we have a limited amount of camping available for those who want to stay on the hill. Tents only, no RV's, but small vans are OK.

Please tell a friend who may be planning to attend. ■

2000 Montague Cross Country Challenge

Location -	Siskiyou County Airport, Montague, CA
Date -	June 9th – Practice and LSF Task Days June 10th & 11th - Contest Days
Time -	Pilots meeting at 9am, flying begins at 10am
Task -	Saturday - Free Distance within a prescribed course Sunday – Speed Task, 2 hour minimum, 3 hour maximum
Classes -	Open, Electric, Sailair
Rules -	All sailplane pilots must be AMA members. The team will decide who and how long each pilot flies the sailplane. Sailplanes must be winch launched. There will be unlimited attempts allowed, no relaunching on course. Each sailplane must be identified with the last 3 numbers of the team captain's AMA number. The numbers must be 3" high and placed both sides of the vertical fin.
Prizes -	Plaques will be given to 3 members of the top 3 finishing teams in each class.
Entering -	Entry fee is $65 per team, each team will receive 3 event T-Shirts, and 3 tickets to a Saturday night BBQ. All entries must be received by May 9th, 2000. There will be a limit of 20 teams, so don't delay.
Lodging -	Camping is available on-site, no services available. Motels are available in Yreka, approximately 12 miles away.
Info -	For additional info please call Dean, Scott, or Randy at (541)899-8215 days, or Dean (541)899-7034 evenings, or e-mail us at dgair@cdsnet.net

Jer's Workbench

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RCSDigest@aol.com

The Baby Albatross - Part 1

I can't remember when or where I first saw a picture of the Baby Albatross, because it caught my eye many years ago. Perhaps it had to do with the mystic and romance surrounding this marvelous sailplane. Or, maybe, it was the classic lines. Or, perhaps because it was designed, built, and flown during the Golden Years of aviation. I don't know why. I just know that I have to build a scale model of one!

In September of 1975, *Model Builder* published a set of plans of the Baby Albatross by Col. Bob Thaker USAF (Retired). Thirty years later, I ordered a set of those plans from Bill Northrop's Plan Service; at the same time, I ordered a 3-view drawing and a set of photographs of the Baby from Scale Model Research.

With the plans in hand, the last couple of weeks were spent studying and reading the construction article, which was included with the plans. Armed with a great deal of information on my target subject, construction is about ready to commence. The first step is, of course, layout of the inevitable shopping list of all the building materials initially required for this project. Then a shoppin' I will go!

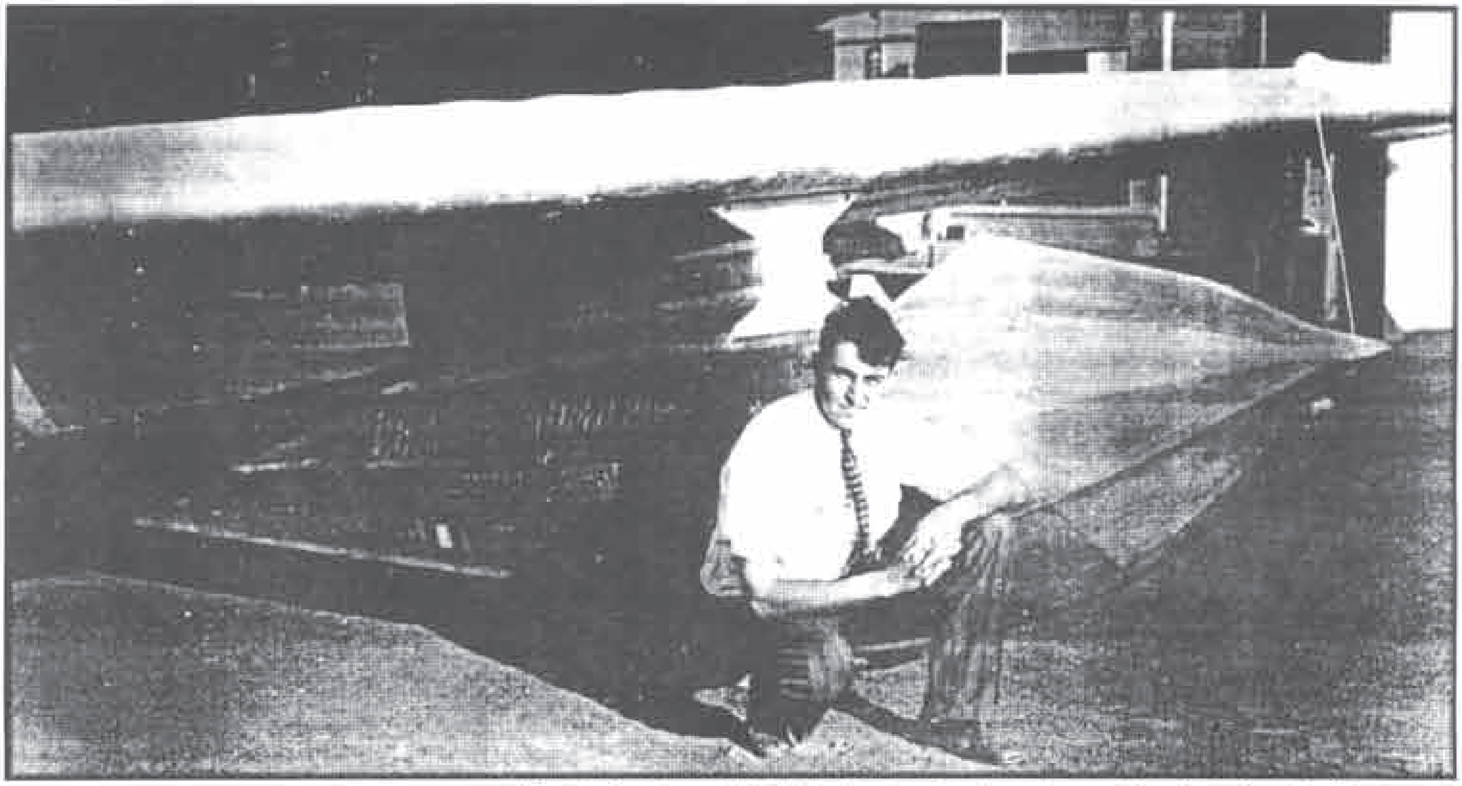
This is not going to be an easy model to build, because of its pod and boom fuselage and scale-like construction. But if I follow the plans properly, this Baby will be a real head turner at most any event!

Resources:

Bill Northrop's Plan Service
2019 Doral Court
Henderson, NV 89014

Scale Model Research
3114 Yukon Ave.
Costa Mesa, CA 92626

■



"Hawley Bowlus and #18. This ship set national soaring records and was flown by Charles and Anne Lindbergh. Probably the most important Bowlus glider." (Quote and cover from Bungee Cord, Volume 6, Number 4, Winter/December 1980. For information on how to subscribe please see end of column, or The Vintage Sailplane Association ad on page 29 of this issue.)

The Baby Albatross

About the Designer William Hawley Bowlus

May 8, 1896 - August 27, 1967

by Jerry Slates

Young Hawley Bowlus attended the "Los Angeles Aviation Meet" in 1910 and saw Curtiss, Latham, Paulham and other pioneers who have since taken their places in the history of flight. From then on, young Hawley took a real interest in flying.

He built his first monoplane hang glider in 1911; while it flew, after a 250 foot hop, it was wrecked. The next glider built was a biplane, similar to the one that the Wright brothers flew at Kitty Hawk. It flew splendidly, with several flights of 1000 feet or more in 1912.

In 1917, Hawley enlisted as a mechanic in the United States Army Air Service, serving in England and France. While in England, he continued his glider experiments, and built 2 more gliders, as well as a third in France.

After W.W. I, Hawley served as a chief flight test inspector at McCook Field (now Wright Field) in Dayton, Ohio. Later, he joined up with Claude Ryan of Ryan Aircraft in San Diego, California. Together, they designed the "Parasol", known as the Ryan M-1, a monoplane for carrying mail. The Ryan M-1 was the direct ancestor of 'The Spirit of St. Louis'. Hawley was the plant superintendent for Ryan Aircraft when the 'The Spirit of St. Louis' was built for Charles Lindbergh.

After building 'The Spirit of St. Louis', Hawley heard about German achievements at the Wasserkuppe, which turned his attention back to gliding. He built a series of single and two seat gliders, each an improvement on the last.

Around 1929, Hawley developed the auto-tow, built his 16th glider, and obtained a copyright on the word 'Sail-Plane'. During 1929-1930, he set many records along the Pacific slopes of Point Loma in California, the first being 1 hour, 21 minutes. Then, on to 9 hours, 5 minutes! During the later part of 1929, he became president of 'Bowlus Sailplane Company, Ltd.'.

Hawley taught Col. and Mrs. Charles Lindbergh the art of soaring and, on January 19, 1930, Charles Lindbergh received his soaring certificate: #9. Mrs. Lindbergh was the first woman to receive a soaring certificate.

During the early 30's saw Hawley designing and producing a number of successful sailplanes: Senior, Super and, of course, 'Baby' Albatrosses. All were manufactured in the same building as the 'The Spirit of St. Louis'.

Between 1938-1942 the Bowlus 'Baby Albatross' became internationally recognized, with hundreds built around the world. Hawley's talents were directed to the Army Air Corps. from 1942-1944, where he designed, supervised the construction, and test flew a number of diversified military gliders: XTG-12, XCG-7, XCG-8, and XCG-16.

After W.W. II in 1945, Hawley became associated with Nelson Aircraft Company, helping to develop motorized gliders.

In 1954, William Hawley Bowlus was chosen by the Soaring Society of America to be one of the first six men to be commemorated into the Soaring Hall of Fame in Elmira, New York.

On July, 1947 Hawley closed his flight book, but took one last flight on August 12, 1967. A true pioneer of American aviation, he passed away August 27, 1967.

For more information about Hawley Bowlus and the Bowlus Baby Albatross, the following references are invaluable:

Bungee Cord

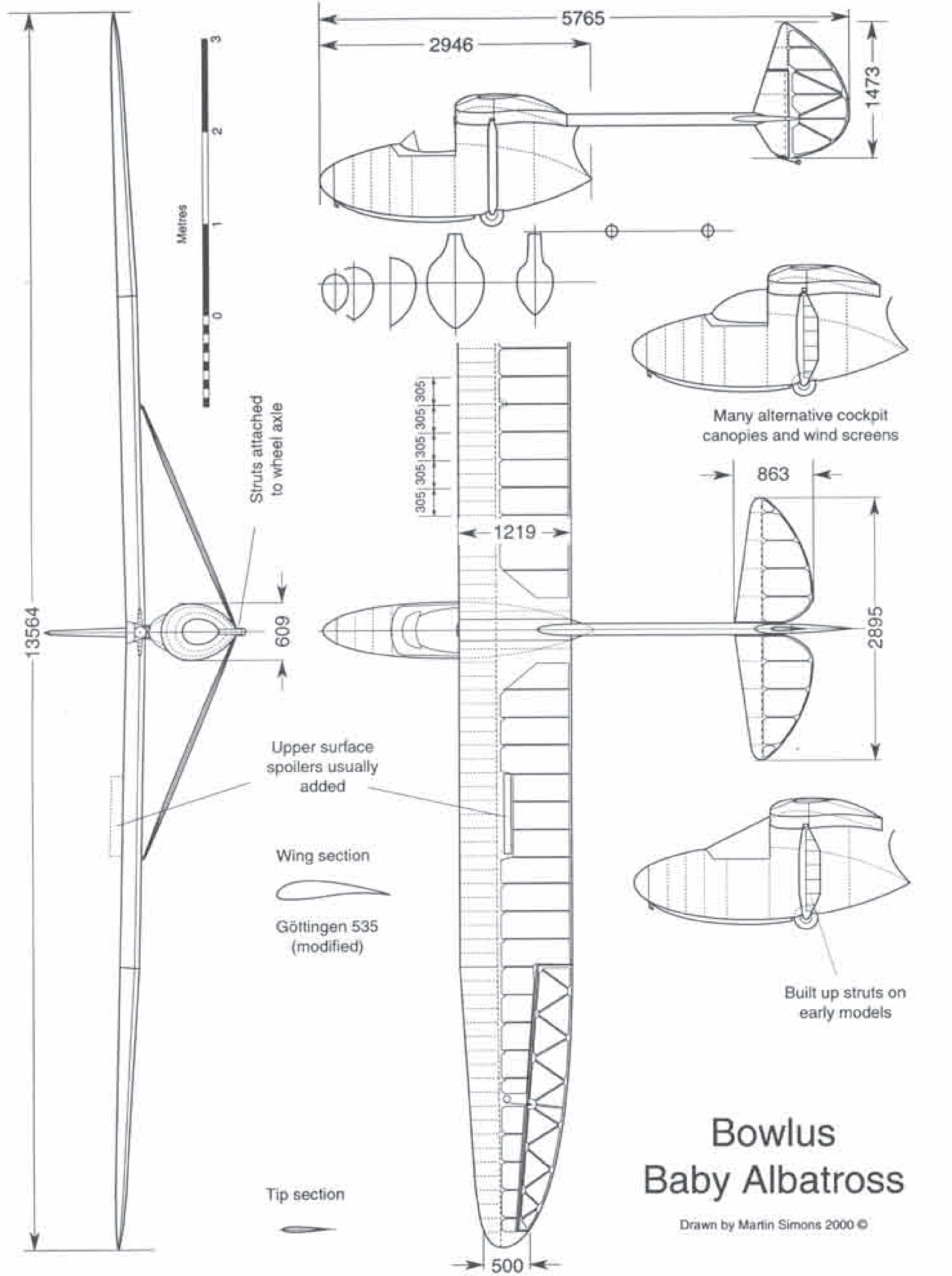
The Voice of the Vintage Sailplane Association
A Division of the Soaring Society of America
Archivist & Editor: Raul Blacksten
P.O. Box 307
Maywood, CA 90270
raulb@earthlink.net

Volume 4, Number 4
Volume 6, Number 4
Volume 7, Number 4
Volume 17, Number 2
Volume 20, Number 1
Volume 21, Number 1
Volume 21, Number 2
Volume 21, Number 4
Volume 22, Number 1
Volume 22, Number 3
Volume 23, Number 3

"The World's Vintage Sailplanes 1908-1945"
by Martin Simons
(Available from Raul Blacksten, above.)

Baby Albatross Model Specifications

Scale	2 3/4" - 1"
Wing Span	122"
Wing Area	1400 Sq. In.
Length	52.5"
Weight	7-8 lb.
Airfoil	Benedek B-6356b



Bowlus Baby Albatross

Drawn by Martin Simons 2000 ©

CROSS COUNTRY SOARING

Scott Gradwell
Medford, Oregon
rcpilot@cdsnet.net

If you are interested in soaring, then you need to know about Siskiyou County Airport, a military airfield that was taken over by Siskiyou County around 25 years ago.

Even though it is an active airport, the amount of full size traffic is very light. It also is an AMA flying site that is used by a local power club. But the power club is very small and you rarely see a power flyer.

The site consists of a large, inactive runway that is long enough to set up winches with room to spare, and wide enough for two winches side by side. You can also bring a motorhome and camp out on the inactive runway. The area surrounding the inactive runway is an alfalfa crop. This makes a good landing area; you just have to be mindful that it is a crop and don't do any unnecessary damage.

The closest town is Montague, which is 5 miles away. Montague is a small town and only has the basic necessities. Yreka is another 5 miles away and is much larger. You can find motels, restaurants, and hardware stores there. There aren't any hobby shops close by, so make sure to come prepared with your support gear.

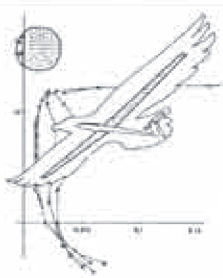
This place is a heaven on earth for sailplane pilots, full scale and modelers alike. National and Regional contests have been flown there in full scale, and we have held the last two Montague Cross Country Challenges there. Although no one has tried it yet, it would make an ideal site for aerotowing events also. It makes a great venue for r/c cross country contests or a practice site for many reasons.

First, the whole area is very open; there aren't any obstructions to get in your way while you are out on course. Second, if you have to land off field, most of the terrain is landable. Third, the traffic on the roads is pretty light and there isn't a problem pulling over to the side of the road and working a thermal for awhile. Fourth, there is a lot of lift.

I also fly full size sailplanes and have made saves of 700' directly over the airport, so you know the thermals are plenty strong enough for models. The first year of the Montague Cross Country Challenge the longest flight was just over 30 miles, the second year it was just over 40 miles. I am sure as the area is explored and people start to gain experience, even longer distances will be flown.

We will be holding the third Montague Cross Country Challenge in early June of next year, so start planning now and come join us at Siskiyou County Airport.

■



on the Wing

B²

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Swept Wings and Effective Dihedral Part 3

Last month, in Part 2, we covered the relationship between roll, yaw, and sideslip, and spent some time exploring adverse yaw. We also provided explanations of directional stability, spiral instability, and Dutch roll. The fact that the cure for spiral divergence causes a tendency toward Dutch roll, and vice versa, is important, as it forces the aircraft to be designed around what is seen as the best overall performance within these limitations. This process always includes compromise.

It is not the actual geometric dihedral which affects aircraft stability and control, but rather effective dihedral. In Part 1 we described how wing location on the fuselage - high wing, mid wing, or low wing - requires less or more geometric dihedral for the same amount of lateral stability. In Part 2 we provided graphs showing the relationship between taper ratio and effective dihedral.

This month we build upon this foundation and describe how sweep and winglets influence effective dihedral, provide a basic means of computing total effective dihedral, and offer a couple of ways of reducing excessive effective dihedral.

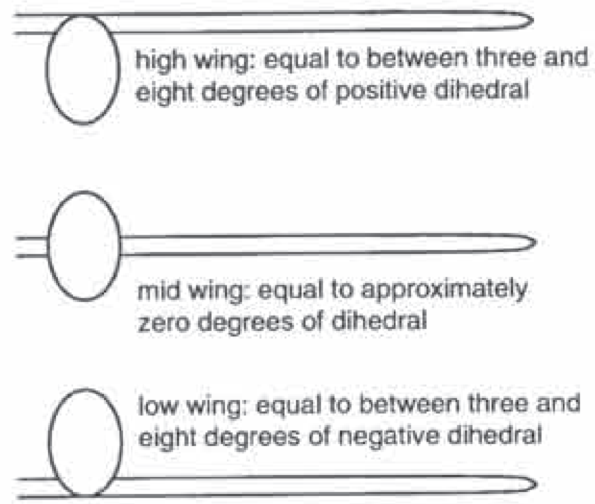


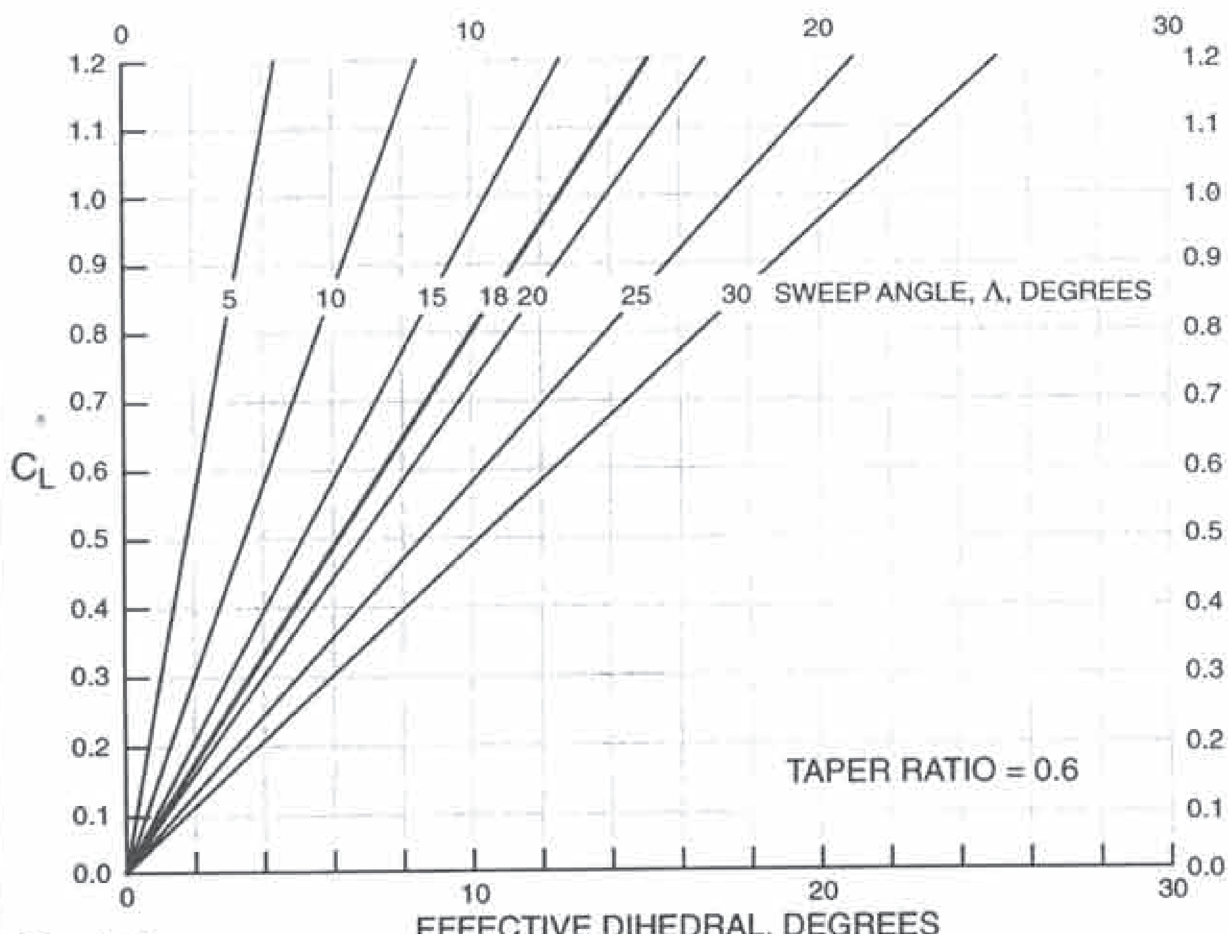
Figure 9, wing position and effective dihedral

Swept Wings and Effective Dihedral The Basics

In an ideal world, an aircraft would have adjustable vertical stabilizer size and adjustable dihedral. Dihedral would be reduced and vertical stabilizer area increased during high speed straight line flight. While thermalling, dihedral would be increased and vertical stabilizer area reduced.

Imagine for a moment that dihedral could be automatically adjusted in direct inverse proportion to speed. That is, higher speed would reduce dihedral, while slow speed would increase dihedral. If dihedral could be controlled appropriately, adjustment of vertical stabilizer size would become relatively unimportant.

We usually think of dihedral in geometric terms. That is, we actually see the dihedral when we view the aircraft from the front or rear. We block up the wing tip a certain distance during construction, or see the dihedral angle noted on outline plans in magazines.



Graph 3

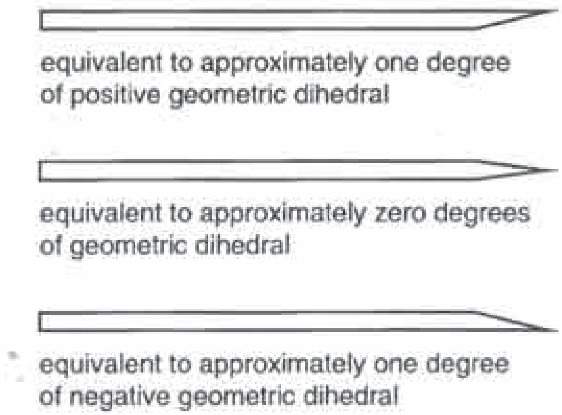


Figure 10, wing tip shape and effective dihedral

But there is also a dihedral effect resulting from certain planforms, contours and from the interactions of various components. We've already noted, for example, that a high wing location provides sufficient dihedral effect to mandate use of only a small additional positive geometric dihedral angle. A low wing location normally dictates a significant amount of positive geometric dihedral, as the position of the wing gives a large amount of negative effective dihedral. See Figure 9. Wing tip contour has a smaller, but still significant, effect. See Figure 10.

Wing sweep also provides some amount of dihedral effect. Sweep back gives positive dihedral effect, while sweep forward gives a negative dihedral effect.

From McCormick, page 547, we find that for a linearly tapered wing, the increment due to sweep angle is:

$$C_{l\beta} = -\frac{1+2\lambda}{3\,(1+\lambda)} \cdot C_L \tan\Lambda$$

where

$C_{l\beta}$ = increment due to sweep angle, and $C_{l\beta}$ -0.00021 is equivalent to one degree of positive effective dihedral;

λ = the taper ratio;

C_L = the wing lift coefficient;

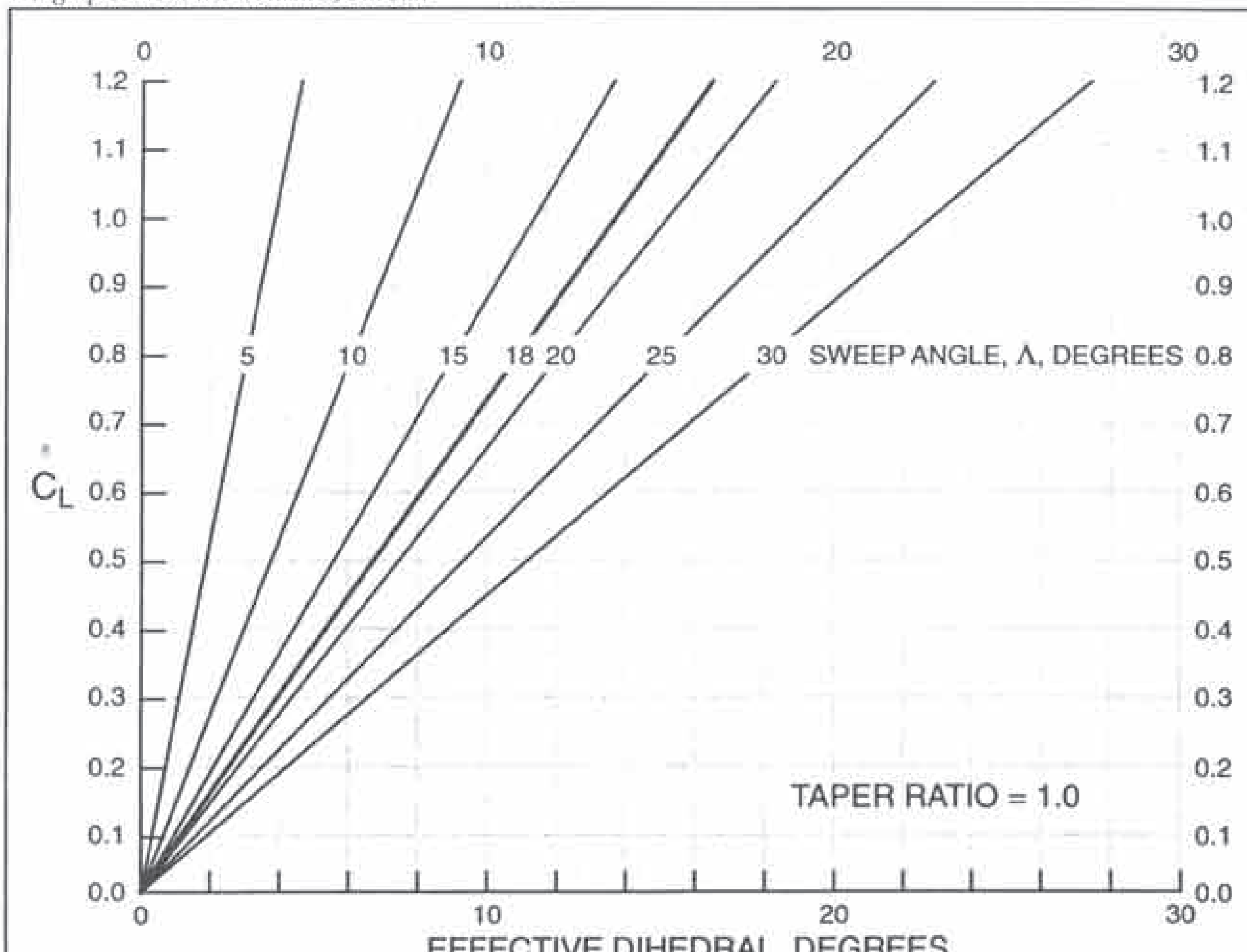
Λ = the wing sweep angle measured at half chord.

There's a tricky part to this. Note the inclusion of the coefficient of lift, C_L, in this equation. We've several times seen a "rule of thumb" stating three degrees of sweep is equivalent to one degree of geometric dihedral. Contrary to that popular notion, swept wings demonstrate a continuously variable dihedral effect. The amount of effective dihedral is directly dependent upon both the sweep angle, Λ, and the coefficient of lift, C_L. These relationships are shown in Graph 3 (taper ratio = 0.6) and Graph 4 (taper ratio = 1.0).

Several points depicted in this graph are worth noting. First, if C_L is zero, effective dihedral is zero, regardless of the sweep angle. Second, when the wing is swept back, the higher the C_L value, the greater the effective dihedral. This is an important consideration, as it relates directly to swept wing performance characteristics across the aircraft speed range. This is because velocity is directly related to C_L. As velocity decreases, C_L must increase. Effective dihedral thus decreases at higher speeds, when C_L values are low, as when flying between thermals or racing, and increases at lower speeds and higher C_L values, as while thermalling. This is exactly what we want!

Effective dihedral, as related to sweep, is directly proportional to the wing sweep angle, as measured at the half chord line. Some amount of sweep, usually no more than 25 degrees, produces an amount of effective dihedral which benefits performance across the speed range. Severe sweep angles, however, adversely affect spanwise flow and wing efficiency, and make launching via winch more difficult.

Since lateral stability (dihedral effect) increases with both the sweep angle and the coefficient of lift, there will be variations in aileron effectiveness depending on the flight regime. During



Graph 4

those periods when a swept wing is generating a very large coefficient of lift, roll response may be below acceptable levels. It is therefore imperative to have large ailerons which can produce sufficient power at minimal deflection angles.

Winglets

One final factor also influences effective dihedral — winglets. Upright winglets, as normally seen on swept wing thermal duration tailless gliders, produce a substantial amount of effective dihedral. Why this is so is examined graphically in Figure 11.

If winglets are mounted on a plank planform wing, and the wing is then yawed, the forward winglet produces some amount of lift toward the wing. The trailing winglet will produce lift away from the wing. The side of the winglet which is facing away from the oncoming flow therefore has a reduced pressure area. Adjacent areas of the wing are affected as well. The gross result is a rolling moment which is directly related to the amount of yaw. This effect is maintained when the wing is swept.

From Nickel and Wohlfahrt, page 108, the skid-roll moment for a wing with winglets is the same as that of a conventional wing with the equivalent dihedral angle, EDA (p. 108):

$$EDA = \frac{20h_W}{s}$$

where

EDA = equivalent dihedral angle;

h_W = the height of the winglet;

$s = b/2$, the semi-span.

From this formula it can be seen that taller winglets (those with greater span) produce greater amounts of effective dihedral when the wing span is held constant.

As wing sweep increases, winglet size can be reduced because of the lengthened lever arm. As reducing the height of the winglet also reduces effective dihedral, there is a trade-off of sorts to be reconciled.

Computing Total Effective Dihedral

It is important to realize that the fundamental concept to be understood with regard to lateral stability is the relationship between rolling moment and sideslip. The symbol $C_{l\beta}$ is defined as "roll due to sideslip"; a $C_{l\beta}$ value of -0.00021 is roughly equivalent to

Figure 11, yaw induced roll moment. Flight direction is toward the viewer

one degree of positive dihedral, as mentioned previously.

The total effective dihedral of an aircraft is the sum of all of the effective dihedral increments generated by the planform and its various components. Wing taper ratio, geometric dihedral and tip shape, winglets, position of the wing in relation to any fuselage, wing sweep, and coefficient of lift must all be taken into consideration. Flaps with swept hinge lines accentuate the dihedral effect even further, sometimes making controlled flight impossible.

A vertical tail, if any, also contributes to effective dihedral, as any sideslip generates a rolling moment because of side forces on the fin and rudder.

Swept wings, particularly those which use winglets, may suffer from excessive effective dihedral. Because effective dihedral is directly proportional to the coefficient of lift, roll authority may be lost while thermalling. In extreme cases, severe Dutch roll occurs at low speeds, as during landing.

Wing twist also affects the dihedral of swept wings. Excessive washout can unload the tip so much that the dihedral effect is small — or even reversed at high speeds! — and may produce a wing that can't fly well inverted.

Counteracting Excess Effective Dihedral

Luckily, negative geometric dihedral can be used to inhibit the strong dihedral effect brought on by a combination of high C_L values, severe sweep angles, and/or other factors. But computing how much anhedral is necessary for controllability across all flight regimes does pose some difficulties; there is a limit to how much anhedral (negative dihedral) can be used.

Effective dihedral may be so small at low coefficients of lift that too much geometric anhedral may cause the aircraft to invert at high speed. Or the aircraft may be susceptible to static directional divergence if too much anhedral is used and the angle of attack becomes too great.

Countering excess effective dihedral may also be accomplished by mounting the winglets such that they hang below the wing. This produces a reversed yaw-roll effect, but places the winglets in a position to be easily damaged.

So-called "diffuser tips" are sometimes used in lieu of straight anhedral or downward projecting winglets. Some sources denote this geometry with the term "Stromburg wing." See Figure 12. The wing has some amount of positive dihedral across the majority of the span, and the wing ends are then bent downward at what seems to be a severe angle. Sometimes toe-in is incorporated in the wing tip by angling the dihedral joint such that it is not parallel to the freestream, thus imparting a twist to the outer portion of the wing.

The fourth and final installment of this series on effective dihedral will appear next month. A case study will be presented (Hans-Jürgen Unverferth's CO8 V2/3), and Eduardo Molfino will explain how he's managed to prevent terminal flat spins by using anhedral. No formulae! Should be fun!

Suggestions for future topics may be sent to us at either P.O. Box 975, Olalla, WA 98359-0975, or <bsquared@halcyon.com>.

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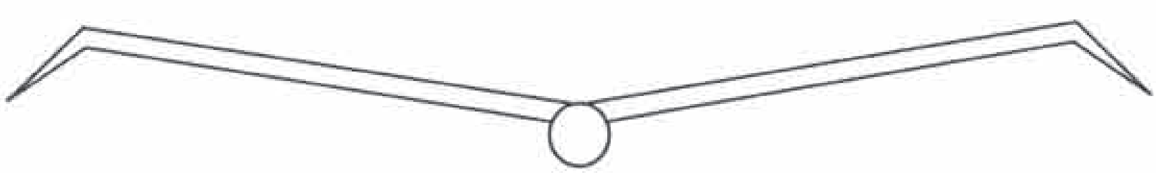

Figure 12, generic Stromburg wing

Tom H. Nagel
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Columbus, OH 43215
tomnagel@iwaynet.net

This column is dedicated to soaring vacations. This month, Tom Nagel takes a detour, sharing an unusual build along project.

The Flamingoid
A Build Along Project

I have been spouting off about the Flamingoid for so long that people have been asking me to finally get around to showing a picture of it. I decided to go them one better - a build-along article on how to hatch your very own Flamingoid.

First, a little family history. Nancy and Andrew and I live in Victorian Village, a "Renaissance Neighborhood" in Columbus, Ohio. Many of our neighbors are practitioners of various alternate sexual persuasions. We have gays, bikers, lesbians, bi-sexuals, unitarians, vegetarians, Republicans, gay vegetarian biker Republicans, and even a few heterosexual couples like Nancy and me. Her perversion is horse eventing; mine is model sailplanes.

In any event, the plastic pink flamingo became a sort of totem animal for the neighborhood. Sometimes, in the springtime, whole flocks of yard flamingos will migrate from one house to the next, moving a few doors down every night. We have a flamingo flag, a stuffed flamingo, a flamingo hat and even flamingo salt shakers.

One afternoon, at a RC show somewhere, Andrew suggested I buy some pink Monokote and build a radio controlled flamingo. The idea took hold and festered, like an insidious disease. It took a few years to incubate, but this spring, one of my planes broke out in pink Monokote - a Flamingoid.

I broke the project down into five key problem areas:

1. Selecting a model to butcher.
2. Building a flamingo prosthesis.
3. Attaching the yard flamingo neck and head to the RC sailplane.
4. Testing flight stability of the altered model.
5. Determining additional airframe modifications.
6. Sneaking out of the hobby shop with two rolls of pink Monokote.

Tom Nagel, of course! Ed.

OK, so it's six key areas. Picky, picky.

Step I - The Airframe Selection

I decided to base the Flamingoid on the venerable two meter Gnome, which Bob Sliff had just put back into production. A real live flamingo is a pretty much two meter bird. I had built a couple, and they few well. Besides, the Gnome was the club's official contest plane, and I figured a Flamingoid Gnome would either throw the other guys off stride or at least garner me some gross-out points.

Gnome kits are available from Bob Sliff's Model Service, PO Box 9, Midway City, CA 92666. E-mail : BSL140@aol.com. Bob is producing kits for Hobby Shack, and has electric conversions in the works for both 60" and 2 meter Gnomes. A 3 meter Intercontinental Bomber Gnome is available on special order for RES competition.

Step II - The Flamingo Prosthesis

Build a test flamingo neck and head out of a sacrificial yard flamingo. If you are building along, this is where you should start. The American Yard Flamingo is not a precision item. It is blow molded and made by several different manufacturers, so the internal shape of the neck/body junction area varies from bird to bird. I found out it is best to build a few head/neck combos, and then build the plane to fit the bird parts, rather than vice versa.

Cut the yard flamingo head and neck off with a hobby saw at the point where the neck has swelled out into the breast area of the bird, and the circumference (outside) is about six and a half inches. You can discard the yard flamingo legs and body, or save them for use in constructing a unique musical instrument and wine cooler. (Instructions might be in next month's issue.)

You will notice that yard flamingos come in two models: high head and low head. I used the high head version in my plane. Next, you will notice that the head and neck on a standing yard flamingo are all wrong for use on a flying flamingo. The remedy is to cut the head off about halfway out the neck, and glue it back on again looking 180 degrees the other way. Do you remember Meryl Streep in "Death Becomes Her"? You want a yard flamingo like that. I use a pinewood plug carved to fit the internal shape of the neck at the point of the cut, and epoxy it in place. It helps to roughen up the inside of the flamingo neck, to give the epoxy something to bite into.

Choose the site of your cut carefully. It helps to trace the shape of the neck onto paper, cut out the profile of the head and neck from the paper, and experiment on cutting and taping, to get the shape you want. Go for a nice sinuous curve, with the bird looking a little down and ahead.

Most off-the-shelf yard flamingos are badly finished. Paint the beak black, with a nice yellow stripe at the base, and touch up the eyes. Scale enthusiasts might add fake eyelashes from the drugstore. Hey, if you have already bought a set of yard flamingos and two rolls of pink Monokote, your reputation is already shot. Go for it.

Step IV - Flight Testing

Hey, you didn't think I was going to do this stuff in order did you?

My next step was flight testing. I asked the folks on the Radio Control Soaring Exchange what effect there might be in adding about 12" to 14" of plastic yard flamingo to the front of a model sailplane. I was told that this was very risky, that sailplanes were carefully designed, and that each part of an aircraft was built the way it was for important aerodynamic reasons.

I was told by many respected experts that adding a long neck and head would lengthen the moment arm of the forward fuselage, reducing the regenerative flux capacitance rate and destroying the subspace harmonics, thus interfering with the efficient operation of the dilithium crystal matrix. At least that is what my notes show. I had no idea what they were talking about.

Still, the B-24 Liberator always reminded me of Dumbo the Elephant, and it flew pretty well. Toucans and Pelicans can fly, and they are both extremely challenged in the fuselage department. And no known equation explains the design of a PBY Catalina. I decided to wing it.

My mentor and test pilot "Adventures With Bill" Hoelcher did several test flights with the flamingo head and neck crudely duck-taped to a standard two meter Gnome. (We couldn't find any flamingo tape.) These tests showed that the Gnome had a short nose moment to start with and didn't much care what you strapped onto the front of it.

Step III - Connection and Protection

This brings us to step three: attaching the flamingo prosthesis to the model sailplane. I obtained a block of fairly dense balsa and, by a combination of carving and gluing, cobbled together a phallic looking thing that fit inside the head and neck prosthesis. I smoothed it out with lots of model filler, and then hardened the model filler by drizzling thin CA glue onto it.

When I built the Gnome fuselage, I left the sides and bottom un-connected at the front end, where the nose block would normally go. With the head and neck stuck onto the block, I drew together the sides and bottom of the Gnome fuselage and glued them to the attachment block. I only lost about a half inch of cockpit length in the process. I used more model filler to fair in the junction between the fuselage and the attachment block, again hardening it with thin CA glue.

The head and neck prosthesis is held onto the phallic attachment block with a single small nylon bolt that taps into the block from the top.

When you cover the fuselage you are left with this obscene pink thing on the front of your sailplane. When the plane comes in for a landing, it looks like the commander in chief swooping down upon a flock of interns. If you fly the Flamingoid without the flamingo prosthesis, please be socially responsible and use some sort of latex protection, or build a special nose cone to cover the attachment block.

Step V - Additional Airframe Modifications

The cockpit covers of our planes tend to be convex, bulbous shapes. For the Flamingoid you want to go the other way, and carve a gently concave curve into the balsa cockpit cover, so that the "shoulders" of the sailplane at the wing/fuse junction taper down to the thinner neck and head prosthesis.

The battery (650 mah square pack) goes right behind the attachment block, and the two standard size servos for rudder and elevator are right behind that, pushing Sullivan cables. Since you lose a little cockpit space to the flamingo prosthesis attachment block, put the spoiler servo in the wing, and the receiver right behind the wing attachment bulkhead. I left some extra space between the battery and the diagonally mounted servos, so I could adjust the CG by shifting the battery fore and aft on its velcro mounting. The model should balance with no lead needed. The towhook goes on per the plans, as well.

However, as I completed the fuselage on the Flamingoid I became aware that the droopy flamingo neck and head created a bridging problem when the model was on the ground (or on the workbench). The beak and tail touched ground, leaving the heaviest part of the main fuse bridged up a couple of inches. Tim McCann solved this problem for me by selling me a Super Skeg, which I installed about three or four inches back from what normally would be the nose of the Gnome, where the bridging was greatest. I have had no problems landing, despite the droopy head and neck.

I did have one unfortunate crash due to launching with the receiver turned off. The flamingo prosthesis absorbed most of the impact energy, and the rest of the plane was essentially undamaged. The lesson here is that "form follows funky."

I built three more flamingo head and neck combos and, in the process, learned that yard flamingos are not interchangeable parts. Each one took a lot of fiddling to make it fit the attachment block, and each one came out looking a little different, and with varying overall lengths. Since the prosthesis sticks out front ten to twelve inches, this can be significant. What was the last time someone told you to check your CG if you change heads?

If you are building along, I suggest building at least two head and neck combos right off the bat. Yard flamingos tend to travel in twos anyway, so you will likely have a spare on hand at the start.

Step VI - Escape and Evasion

Finally the hard part, sneaking out of the hobby shop with two rolls of flaming pink Monokote. I tried to get my wife to buy it for me. She refused, on the grounds that I don't do horses and she doesn't do sailplanes.

Andrew was my next target. After all, it was his idea. A self conscious 10 years old, he likewise refused. I considered mail order, but then Tower would have my name associated forever with Pink Monokote. I could at least be anonymous if I paid cash at a hobby shop on the other side of town. I finally had to buy the stuff myself. I told the clerk it was for a friend. He said, "Yeah, sure, whatever," and snickered as I walked out. Jerk.

Flamingos actually have a lot of black coloration to them that becomes apparent only when they have their wings open. Sailplanes always have their wings spread, so I needed a pattern for the wing covering. I found some useful photos on the internet, in a shore bird book from the library, and in Roger Tory Peterson's field guide. The wing covering job went pretty smoothly, once Nancy was reassured about the kinds of pink pictures I was downloading from the internet.

The fellows at the law office got wind of this project as it neared completion. They are now after me to do totem bird for the firm: a radio controlled vulture. Does anybody know where to get a plastic yard vulture?

***

If you have a favorite sailplane saga, consider writing it down for RCSD. If you are planning a vacation that includes your plane and transmitter, consider making notes as you go, and working up an article later. Take photos. Collect maps. And send your story to Tom Nagel at tomnagel@iwaynet.net for gentle editing and suggestions. *Tom*

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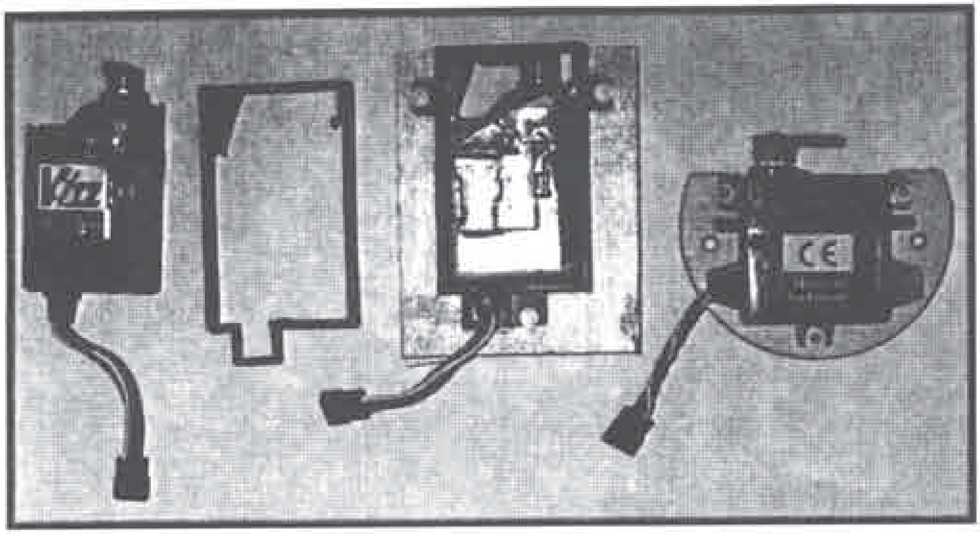

(L-R) *Wing Maxx w/o frame, orig. WM frame, Wing Maxx w/new frame & ply mount, Micro Maxx & ply mount.*

Fast Way to Mounting Servos in Hollow Wings ...Foam Core, too!

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With so many Euro-Moldies showing up in the USA lately, and all of them with molded hollow core wings, mounting servos has become a hassle.

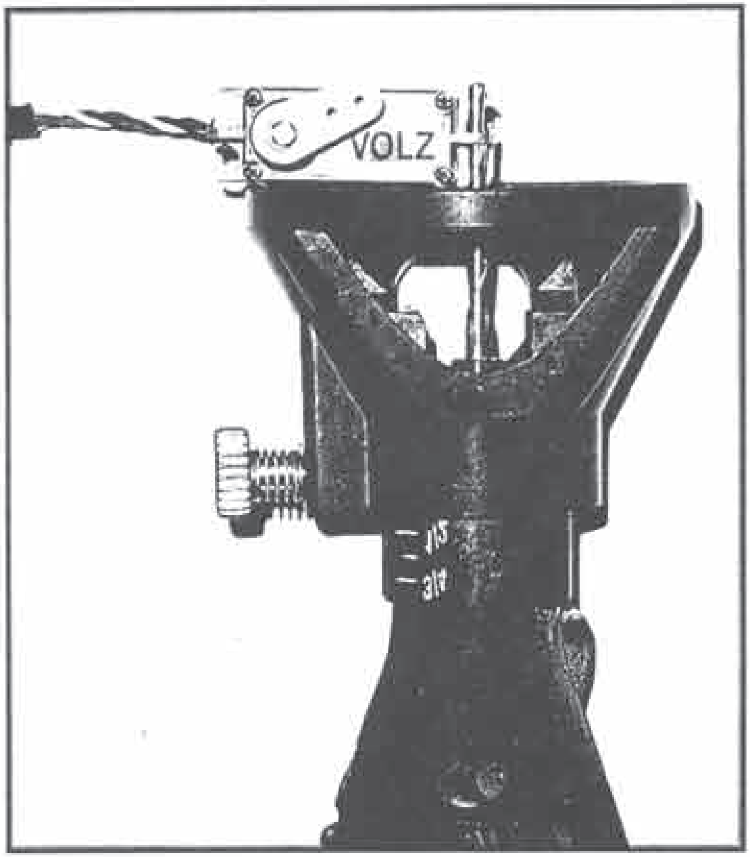
While a bunch of the European Molded ships come with molded servo pockets designed to nestle Volz servos in a snap, there are plenty that just have cavities where the servos are supposed to be mounted. The instructions never seem to explain 'how' the servos are to be mounted, it just says mount them.

Those of you familiar with Americas sailplane molder, RnR, know exactly what I mean. Recently, the Emerald has become a popular Thermal Duration ship (distributed by Skip Miller, mfg. RnR). It comes in a box with no holes in the wings or instructions as to where or how to put them. It's assumed that a modeler ordering a ship of that caliber is experienced and knowledgeable (reads *RCSD*) enough to figure it out himself.

That usually leads to heartbreak, for instance, on one molded ship I was working on for the first time. I made up a goop of 5-minute epoxy and puddled it under where the servo was to be placed. I taped a piece of wood to the top of the servo and dropped it in on top of the puddle.

I tell you, I was pretty proud of my McGyvering. The servo would end up flush with the skin, the horn in perfect position and secure, with no machining shims for under the servos! That was 'til I turned the wing over and found that the epoxy got so hot curing in that puddle that it made a huge, ugly spot on the top of the wing! Not to mention the frustration I experienced when the servo died for some unexplained reason (pre-Volz).

Well, some Volz-addicts in Europe solved the glue-in thing by CNC machining some plywood mounts so that the Volz' dropped in, secure and ready for the three tiny wood screws. While the ply mounts still had to be glued in and shimmed up to the right spot, the ply mount gave me an idea.



Dremel Router Base (Dremel #564) set to servo depth.

Since the Volz Micro Maxx servo, once screwed into the ply mount, was flush with the bottom of the ply mount, I reasoned that all I had to do in a foam core wing was to route the foam down to the exact thickness of the servo. Then, simply glue the ply mount in place! It worked super! But then came those hollow wings!

The first hollow wing I put the ply mounts into was an ICARE Hera, open class TD ship. It came with wing servo-hole indents molded into the wing skin. The 'kit' includes molded servo covers that sit into the indents, which ultimately cover the holes cut into the skins for servo access.

After opening the holes up with a Dremel Router bit, there was that cavity again. Dropping that Volz servo in, you got the sound of a stone dropping into a well. Not exactly ready for 'mounting'. So, I went to work making up little pieces of ply plates, in varying thickness, 'til the Volz ply mounts could be glued in and the servos flush with the skins. But I wasn't happy.

I thought about it a bunch and came up with a handful of ideas that would work (mine and others). One idea I really thought had merit was to turn the hollow molded wing into a foam core! Then use the process I mentioned for setting a Dremel Router to the exact depth of the servo (any servo by the way) and routing out the servo-well.

So that's what I did. I found a piece of Spyder foam deep enough to fill the cavity. I cut it so that it filled the opening and applied some 5 minute epoxy to the bottom of the foam, the inside of the wing skin, and glued it in. I chose Spyder foam for the filler since it is so dense, and I had some; actually, even white bead foam will work for mounting the Volz ply mounts. (I think that if you were to use some other servos and planned on gluing them in, I would recommend one of the extruded (colored) foams for more support base.)

So, in the case of mounting Volz servos, the new ply mount system and this 'routed' foam base system makes short work of foam core wings or the new 'popular' hollow molded wings. While there are plenty of good servos out there for our application, Volz are specifically engineered for use in sailplanes. The size, speed, torque, and mountings are being recognized by RC sailplaners around the world as sort of a 'given'.

Don't construe that statement as an advertisement; it is simply what has been going on. Like I said, there are plenty of good servos available and the routed foam system can speed up your projects.

So, let's say you glue some foam bases for some other servos; then you use some two way tape or glue to secure the servos to the foam blocks, but decide later on to pull the servos for some other use. Course then, while yanking the servos out, the foam base gets chunked out. All you have to do to mount some servos back in is to route the foam out close to the skin and glue in a new piece... Forever renewable! Take a look at the pictures and you'll see what I mean. It's so easy that I do it in motel rooms!

You can find Volz servos at Hobby Club, RC Direct, ShredAir and NSP. They'll have those cool ply mounts, too!

NOTE!!!

Dieter at ShredAir called me when I mentioned this article. He told me that virtually all of his imported molded planes come with the servo pockets molded to fit Volz servos, but for those that have just generic pockets, he found the ply mounts to be the super solution. In fact, he took it one more step and is having the ply mounts laser cut. The cost is only $10 for a set of two. When you get them, they are in the form of two pieces per servo mount. The reason is that one piece is different than the other, for fitting the servo wire exit. You simply glue the two 'layers' together and you have a ply mount!

Sometimes, Gordy's Travels are a trip in my mind to ideas rather than places. This one actually was to a place – your wings! See you on my next trip! Where's next? I was kind of thinking something electric!

Resources:

Volz Website: www.volz-servos.com

HobbyClub
www.Hobbyclub.com, (949) 240-4626

RC Direct
www.RC-Direct.com, (888) 291-2111

NSP
www.nesail.com, (802) 658-9482

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TECH TOPICS

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Cl, Cd, Cm, CP, CG - Part Deux

Last time we reviewed the definition of several important variables that capture information about airfoils. This month let's see how we can put some of them to work.

Most modelers are familiar with lift and drag coefficients. Of course, more lift with less drag is usually preferred. One way to capture the spirit of this concept is the lift to drag ratio. It's something we can plot and visualize pretty easily.

Let's compare, for instance, 3 popular airfoils (Figure 1). I've chosen the RG-15, SA 7035 and SA 7038 since these are popular sections for sailplanes. Let's also choose an average wing chord and air speed (i.e., Reynolds number) where separation of the airflow isn't a big problem. The coefficients for these airfoils are shown in Figure 2 for a Reynolds number of ~ 100,000 (UIUC database).

Experience in the field gives the following general trends (my personal opinions):

- The SA 7038 is a very good thermal duration airfoil but not a real high-speed section. It generally requires ballast to move around on windy days.
- The RG 15 is a good cross-country airfoil with reasonably good thermal duration performance.

The SA 7035 more or less splits the difference between the SA 7038 and RG 15.

Is there a way we can infer this from the coefficient data? Since we're looking for efficiency in an airfoil, it seems reasonable to plot the ratio of Cl/Cd vs angle of attack.

As we can see in Figure 3, strictly looking at the airfoil data does not provide a lot of differentiation among these airfoils. Although the SA7038 appears to have a wider angle of attack range with improved efficiency, it's not clear that the higher camber (lift) of this section will allow that to be achieved over a wide range of speeds.

We can add the effects of wing planform, parasitic drag and wing loading, and then compare the overall efficiency with that for the airfoil alone. Those estimates are the

Figure 1: Airfoil Comparison

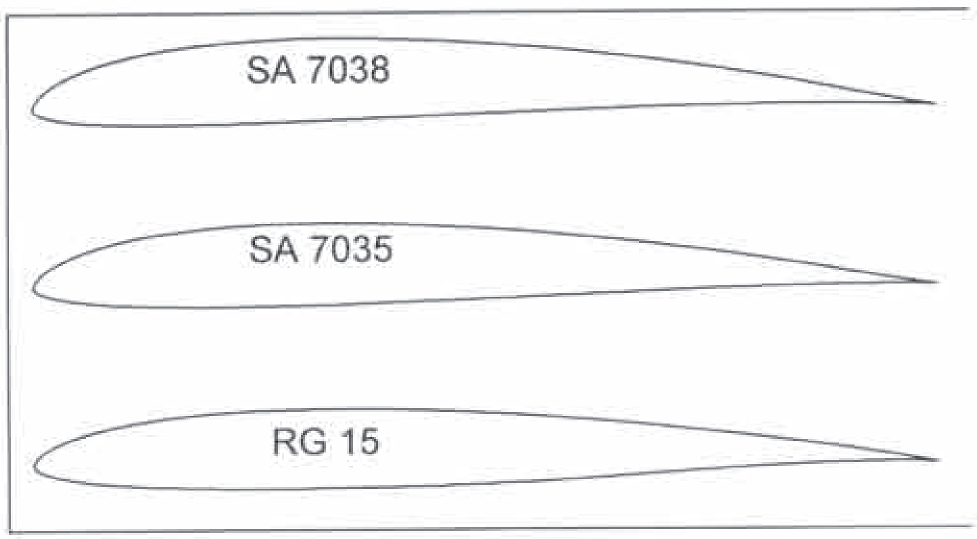
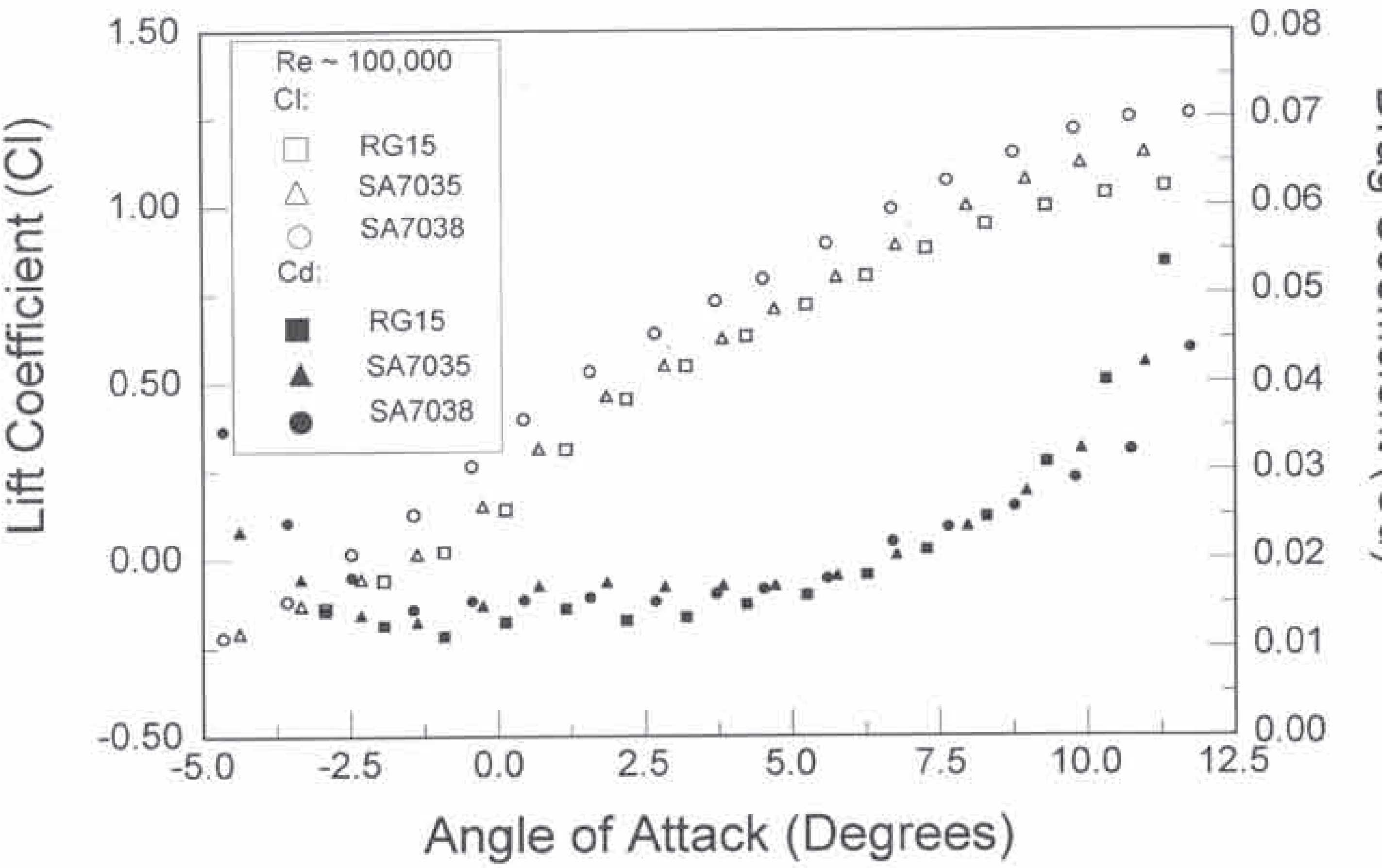


Figure 2: Lift and Drag Coefficients



solid curves in Figure 3. It's pretty apparent that the efficiency demonstrated by the airfoil is significantly degraded by the presence of the sailplane which it supports. So one point to keep in mind is that airfoil information really doesn't tell the true performance story of the sailplane.

If we look REAL close at the L/D vs angle of attack for the airfoil plus planform we might be able to convince ourselves that the RG15 looks a little better. Why would this be so? Since the SA7038 is a higher camber airfoil, the apparent efficiency of the airfoil is traded off against the induced drag from the higher overall Cl. That's one of the reasons you should try and couple higher aspect ratio planforms (lower induced drag) with higher camber sections.

So, looking at the efficiency of an airfoil by itself, or when coupled with the entire airframe, really doesn't tell the story very well. That's why I find it more instructive to look at the polar plot for a soaring design rather than simply the efficiency plot (Cl/Cd).

A polar plot for an open class sailplane using these three airfoils (Figure 4) begins to show us some differences. This type of chart shows the horizontal speed of the sailplane on the X-axis and the vertical (or sink) speed on the Y-axis. Now we're beginning to see the performance choices among these three airfoils more clearly.

In general, we see that the rank ordering noted a few paragraphs back is about right. At higher speeds, the RG 15 sinks less than either of the other sections. At low speeds, the SA 7038 is preferred. And the SA 7035 pretty much splits the difference.

So, in order to understand the design tradeoffs for an airfoil selection, we really need to look at the overall performance envelope of the airfoil AND the planform on which it will be used. A polar type graph is a good way to visual that information. The primary input to that graph is the Cl and Cd of the airfoil as a function of angle of attack and Reynolds number. But planform, wing loading and other effects contribute here as well. So we'll note for now that we've found a good home for using the Cl and Cd coefficients. In a few months we'll get back to the polar method and describe the mathematical structure used to calculate this type of information.

In the meantime, we've got a couple of more coefficients to review before we finish up this month.

Remember that we talked about the moment coefficient (Cm) as a measure of the twisting force (torque) generated by the lift distribution across the wing surface. We also mentioned that Cm would change depending on the reference point about which one measures that torque. Yet we often see airfoil data where the Cm appears to be reasonably independent of angle of attack while Cl and Cd are moving all over the place.

A long time ago in a wind tunnel far, far away, aerodynamic type folks learned that there was a special place on the wing about which the moment coefficient was essentially constant. This point is defined as the aerodynamic center of the wing. The theoretical value is 25% of the chord and, in practice, it's usually within a few percent either way.

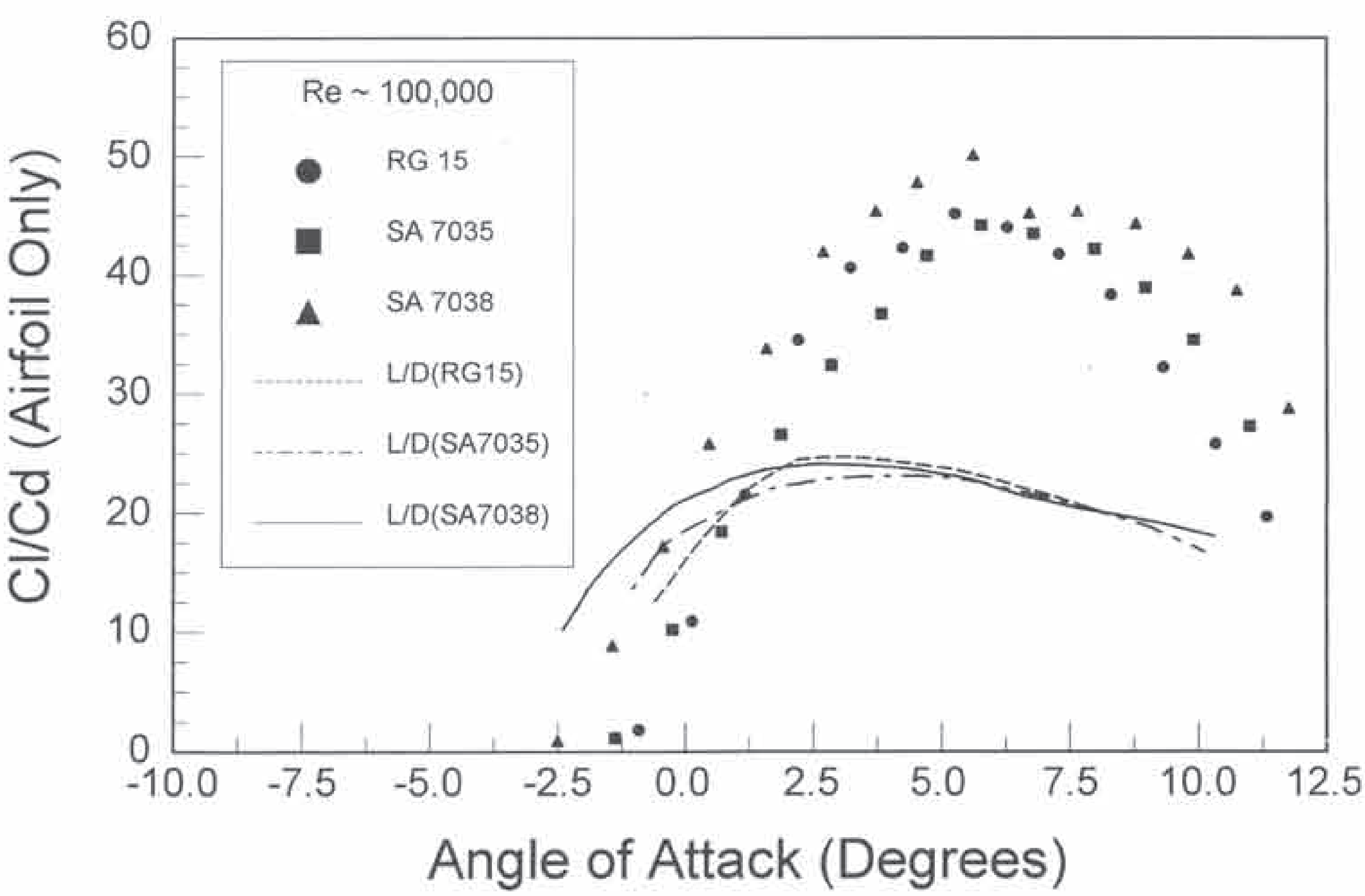
Please keep in mind that the aerodynamic center of the section is NOT the neutral point or center of pressure or many other things sometimes ascribed to this term. It's simply that point about which the moment coefficient is essentially constant as angle of attack changes.

With that term now defined, how do we use it? The answer comes along when we try and sort out the center of gravity (static balance point) for a wing.

Remember that the moment coefficient is an indication of the torque acting on the wing. That torque is simply the lift distribution multiplied by its distance from a reference point - and that reference point will now be the aerodynamic center. Although lift is distributed over the entire surface, the average force will look like it's acting through a well defined point on the chord. That point will be called the center of lift (also frequently called the center of pressure or CP).

Since Cm is the coefficient expression for the torque and Cl is the coefficient expres-

Figure 3: Airfoil Efficiency



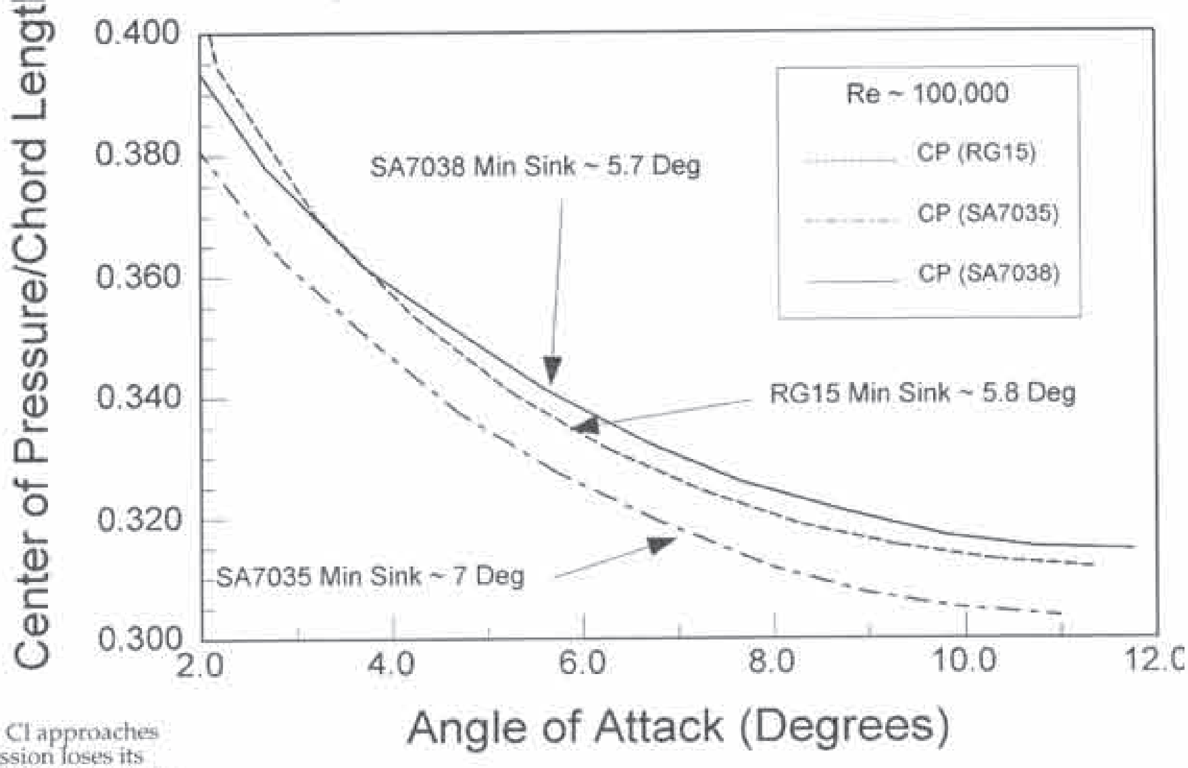
sion for the lifting force, we can find the CP to a modest degree of accuracy as:

CP AC - Cm/Cl 0.25 - Cm/Cl

where AC is the aerodynamic center and the negative sign indicates the offset distance (Cm/Cl) is behind the AC. We don't always know the exact AC for every airfoil, but we know it's usually pretty close to the quarter chord. So the second expression is probably the most generally useful for sorting out the CP.

There are a lot of caveats to this simplification. Probably the most important restriction is that the result is limited to higher angles of attack but not necessarily so high as to achieve a stall. At low to negative angles of attack, Cl approaches zero and the above expression loses its physical meaning. (CP behind the trailing edge? Nope, just a breakdown of the mathematical assumptions.)

Figure 5: Center of Pressure Travel



Let's take a look at the center of pressure location for the airfoils we've selected this month over a range of angles near the minimum sink and maximum L/D conditions. As can be seen in Figure 5, the approximate CP travel is pretty large for each airfoil. In the range of interest (somewhere between minimum sink and maximum L/D) all of these airfoils have CP positions between 30% and 38% of the average chord of the wing.

What we now know is that as angle of attack changes, the center of pressure will move around a bit. How does this help us find the center of gravity (CG, or static balance point) for the wing? Obviously, we'll never find a CG position which is dead-on the CP for all flight conditions. Matter of fact, for any position we could pick, the wing by itself is unstable and the positive feedback from a pitch change tends to drive it to an even more unstable condition.

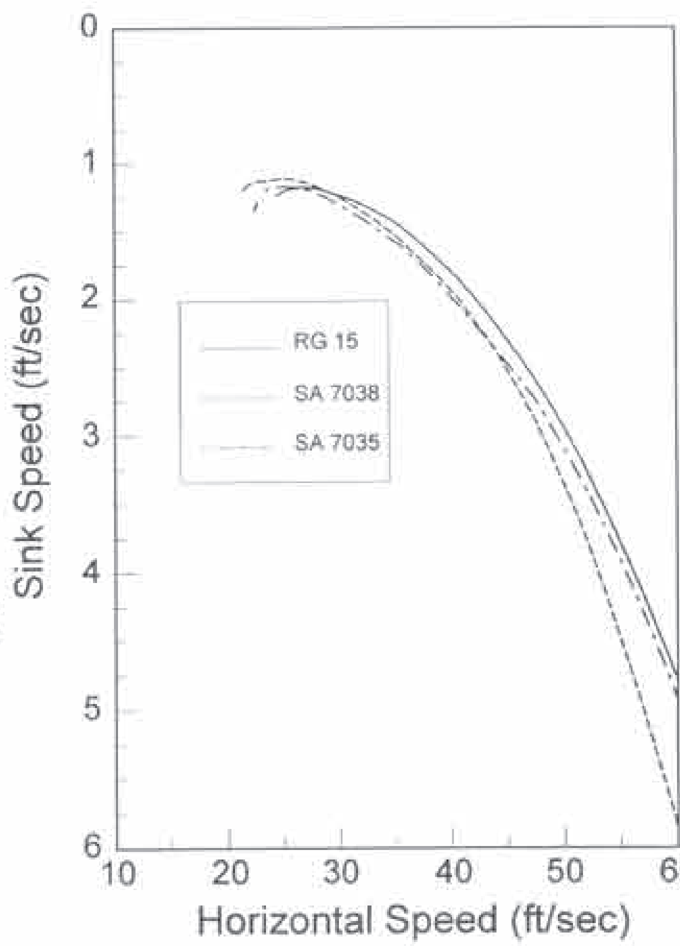
Suppose we set the CG at the CP position corresponding to a 5 degree angle of attack. Along comes a little gust of wind and picks the nose up a bit. Since the angle of attack increases, the CP moves forward. As the CP moves forward, the CG is now behind the CP and tends to increase the pitch up effect. This increases the angle of attack which moves the CP forward some more, etc., etc. You can do the same exercise with pitch down and get the opposite effect; the sailplane enters a dive and tends to tuck even harder as speed increases.

The way around this problem is to have a counter-acting force acting on a longer moment arm which overcomes the wing instability and drives the pitch change back to the original position. This is the function of the horizontal stabilizer. For the pitch up case, a properly designed horizontal stab generates a counter acting pitch down force which is neutralized when the wing gets back to the original design point. Sounds easy but it's really a pretty good trick to set up the stab and moment arms properly. That design condition was discussed in this column about two years back when we looked at tail volume coefficients and moment arms.

OK, so we've got a restoring effect from the stab that allows us to choose a particular angle of attack where we'd like to have the CG match up with the CP. Where would that be? Might you have guessed that we're getting back to that polar plot again?

If you look at the polars we graphed in Figure 4, note that there is a point at which we've got the lowest amount of sink. That's called the minimum sink

Figure 4: Polar Comparison
Open Class Design



condition. Just a little to the right of that point is the condition of maximum efficiency for the chosen planform (maximum L/D). The min. sink and max L/D points are separated by a couple of degrees in angle of attack. The specific values can be found by looking at the output from the polar calculation.

For the SA 7038 with the planform we've modeled, Figure 4 indicates that the minimum sink, as a function of angle of attack for this design, is somewhere in the 6 degree range.

At 6 degrees, Cl ~ 0.94. Since Cm ~ -0.0815, we can readily calculate an estimate for the CP (and, consequently the CG) for this condition:

$$CP = 0.25 - (-0.0815/0.94) = 0.34$$

or 34% of the wing average chord.

If we were to choose the maximum L/D point, the preferred angle of attack would be ~ 2.5 degrees. Cl at this point is ~ 0.63. So the CP for this condition would be:

$$CP = 0.25 - (-0.0815/0.63) = 0.38$$

or 38% of the wing average chord.

So if we were setting up a new sailplane with the SA7038 airfoil on a planform similar to the one used to develop this model, we'd want to spot the CG somewhere between 34% and 38% of the wing average chord. The safest place to start would be at 34% and then gradually move back a little.

Based on Figure 5, we expect to obtain about the same result with the RG15. For the SA7035, the plot indicates we'd probably need to move to the 32% to 36% range. However, as noted above, the specific locations will depend on the overall planform as well as the airfoil selected.

So how come the lowest camber section (RG15) spots the CG about the same place as the highest camber section (SA7038)? Well, the SA7038 has the highest Cm but also the highest lift coefficient. The RG15 has a lower lift coefficient but the curvature near the trailing edge of the airfoil gives it a higher Cm than the same camber value would for the SA series. VERY complicated, but those are the trade-offs you get in choosing an airfoil and planform.

Does this technique for determining the CG work? Yes. Is it really useful? Maybe. I usually set up a new plane with the CG position set for minimum sink and then change the decalage until it flies right. After getting comfortable with the flight performance, I usually pull the CG back as far as possible. The furthest back I can get things and still enjoy flying almost always works out to be the CG position determined by the max L/D calculations noted above.

Even if this isn't terribly useful in practice for most people, it gives a 'feel' for what that strange little Cm coefficient does for you. And it highlights, I hope, the need to understand polars as a key method for estimating overall design performance. We'll get back to that topic later this year.

Enough number crunching. Let's go catch a few thermals.

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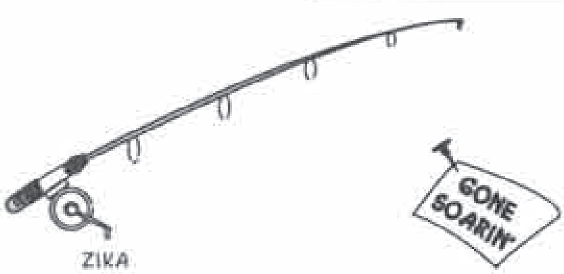

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Here we are just about in spring!

Things are starting to get cookin' all over the USA. It's now time for all of us to get out and FLY! FLY! FLY! By the time you read this, the snow cover will be gone and early spring flying will be starting. Don't forget to check those batteries, radios and all wiring! Do range checks before flying! Do battery checks before and after every flight! And above all, when everything is in good order, do good landings and have a great time!

Interest continues to build for aerobatics and scale meetings in Germany. I got the following from Frank Oeste:

> "On Saturday (in January!) we had our IGG-meeting. Thomas Schmitt and I were overwhelmed about the interest of the people. From 53 members, 40 have been there. Rheinhard Melz, Bernd Zander and Christian Albrecht came down from Hamburg. Little Markus Lange was there, as well as Richard Branderhorst and his son, Thomas, from the Netherlands. They came here by plane from Amsterdam for one day only, to attend the meeting."

How about going to your local full-sized glider field for a tow?

Frank has more:

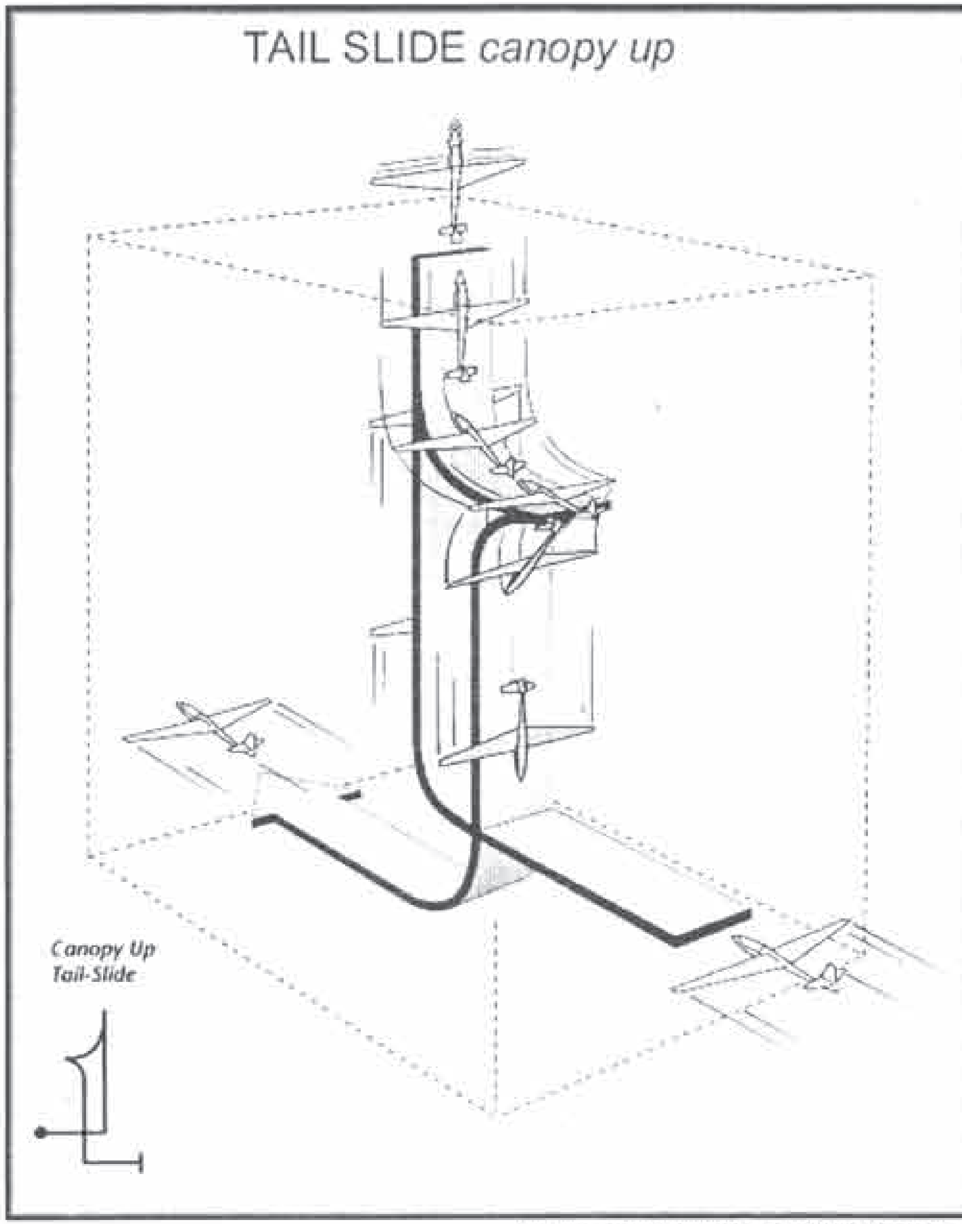
> "Marc Hauss from Strasbourg showed us a video about his first flight of his Grob G103 Twin Astir, 750 cm and 39 kilos. They towed it with an original, full size Pawnee???? You should have seen this! The airspeed during the tow was 130km/h. We started at 5:00 pm and left the pub at 1:00 am in the morning."

Obviously a good time was had by all!

Are you planning to visit Germany this year?

If so, you should check out the German IGG (translates as: those interested in large sailplanes) at <www.rc-modell.de/igg>.

We have learned a few new things about balancing Foxes for the best aerobatic performance. More on that next month. Also, a really nifty prop balancer from Germany I've recently run across. It saves lots of time and will balance any number of blades! Also, a quick and easy way to make lovely round lead ballast or nose weight – time required to make them: two minutes!



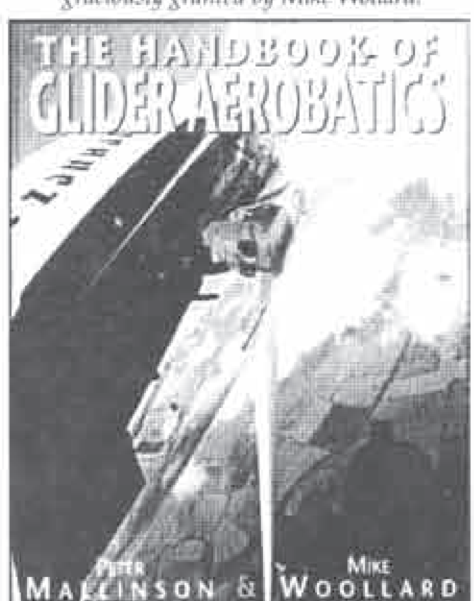
The Handbook of Glider Aerobatics

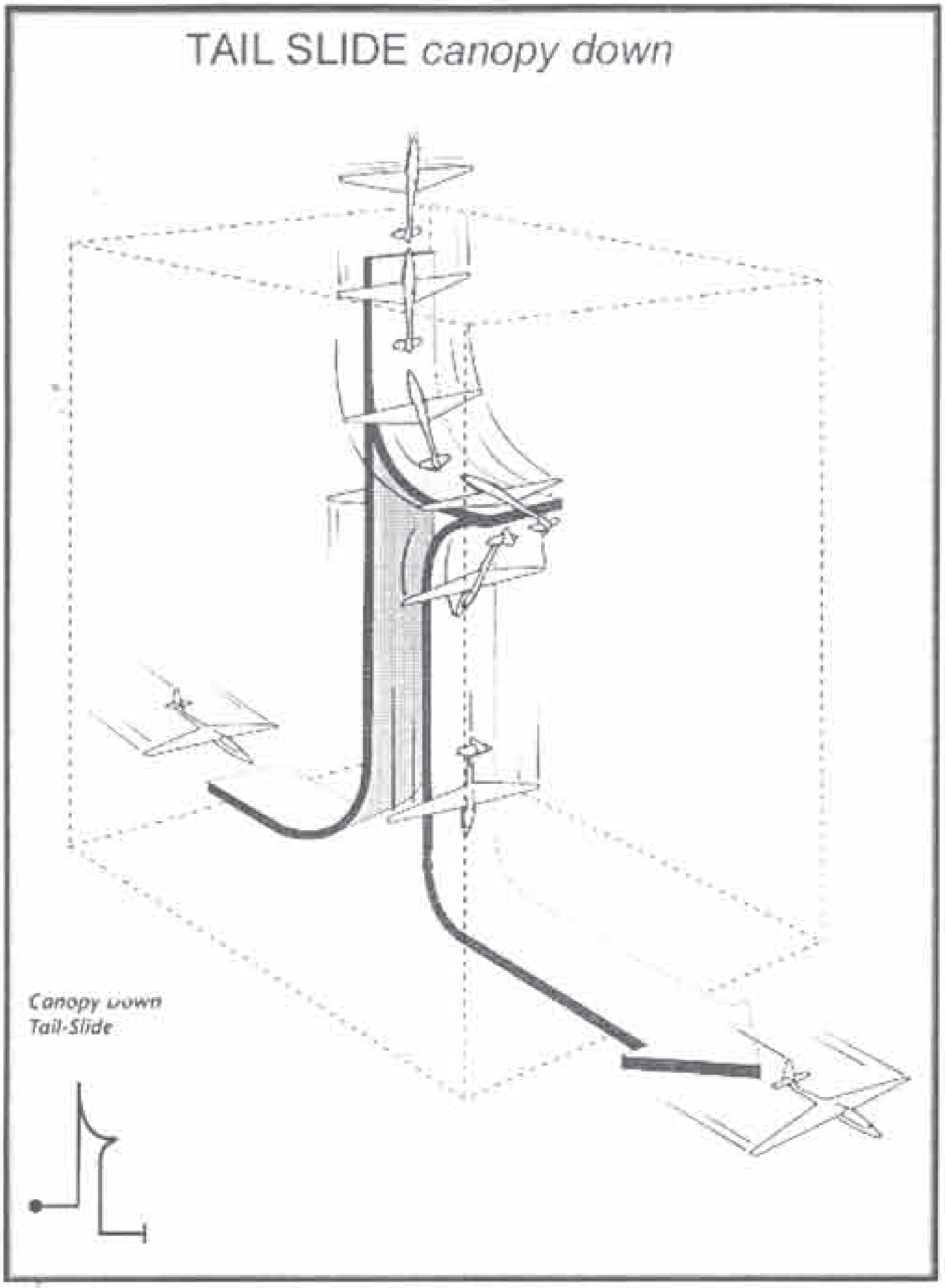
This wonderful book by Peter Mallinson and Mike Woollard covers all aspects of full-sized sailplane aerobatics. Copiously illustrated, it also happens to be an extremely useful tool for those of us interested in RC glider aerobatics. It's particularly interesting for those folks, who haven't done much and wish to try their hand at the wonderful world of stunts! Of particular interest are the many illustrations for the basic and advanced figures. These (as you can see) are very well drawn and show you exactly what the glider needs to do. There are also many excellent photographs of everything from an LO-100 and Lunak to the Swifts and Foxes – and many gliders we have not seen or spoken about.

This book is well written and will be a welcome addition to any active sailplane library!

It's available from Blanik America, Inc., P.O. Box 1124, Wenatchee, WA 98807-1124, phone (509) 884-8305, fax (509) 884-9198.

Excerpted from the "The Handbook of Glider Aerobatics". Copyright 1999. Permission graciously granted by Mike Wollard.





Excerpted from the "The Handbook of Glider Aerobatics". Copyright 1999. Permission graciously granted by Mike Wollard.

The Handbook of Glider Aerobatics

by Peter Mallinson and Mike Woollard

Imprint:	Airlife
Binding:	Laminated boards
Format:	246x189 mm
Extent:	128 pages
Illustrations:	Photographs & line drawings
ISBN:	1 84037 110 2
Publishing Date:	May 1999
Price:	$34.95
	Available through Blanik America
Phone:	509 884 8305 Fax: 509 884 9198

KEY FEATURES:

* The first instructional book on this new sport.
* Essential reading for all glider pilots.
* Excellent diagrams portray the glider's flight path through each acrobatic figure.
* Equally applicable to instructors and student pilots alike.
* Includes the latest L13 AC Blanik.

THE AUTHORS

Peter Mallinson and Mike Woollard both started flying gliders at Nymphsfield in Gloucestershire in their late 20s and their flying careers progressed along parallel paths. They both spread their wings to include powered aviation at an early stage and were soon flying a Fournier RF4D motor glider. This aeroplane with its delightful acrobatic qualities undoubtedly encouraged them in their common fascination for aerobatics. In 1989 they attended a course in glider aerobatics run by the Polish champion, Joseph Solski, and were instantly inspired by his remarkable flying and instructing skills. They went on to develop their own instructional techniques which have been used to teach many of the best acrobatic glider pilots flying in the UK today. This book is based on those techniques.

Peter Mallinson lives near Stonehouse, Gloucestershire, and Mike Woollard lives in Hitchin, Hertfordshire.

DESCRIPTION

This book provides a reference point for use in conjunction with acrobatic instruction. It aims to help provide an understanding of the important subjects that are essential for safe and successful acrobatic flying.

Section A: Theory

Deals with the following four topics:

1 Safety Considerations

2 Flight Envelopes

3 Glider Design

4 Aresti (the graphical system used to portray acrobatic figures)

Section B: Flying the Figures

Describes in general terms how to fly some of the figures most commonly encountered. There are eleven figures from the beginners or 'Standard' level, and seven from the more advanced levels.

Appendix

Includes a step-by-step guide to constructing Flight Envelopes for various gliders.

Changes in the Akro-Cup 2000 Stunt Routine

As you can see from the diagrams, Frank Oeste has made some changes to the Akro-Cup 2000 stunt routine. He has taken out two rather difficult maneuvers, substituted a much easier maneuver, and changed things around a little bit, resulting in a much easier, overall stunt routine.

The Tail Slide Deemed Too Chancy

The tail slide has been eliminated from the required stunt routine because most of the pilots found it to be a very chancy thing to execute. This is a maneuver which is either perfect or it doesn't work at all. Even the best pilots missed it from time to time.

The tail slide is not particularly difficult. The problem is that if you're just a little off one way or the other, you'll screw it up. If you don't go up exactly vertical or if the wings are not exactly level, your attempt at the tail slide will turn into a stall turn, or the glider will flop the wrong way or worse... and the judges will award you a big fat ZERO!

The Tail Slide Remembered

For those of you who have forgotten what tail slide is, let's refresh our memory. To fly the tail slide, you need to come into it with a good deal of speed. With your wings exactly level, you pull up elevator and climb exactly straight up into the vertical. As the sailplane begins to slow, you must keep the wings level and the fuselage exactly vertically. Very soon you'll lose all airspeed, and glider will fall backwards at least one fuselage length with the nose and wings still pointed straight up.

There are two ways to do it:

1. The glider then should nose over canopy up and tail up and point straight at the ground, quickly picking up speed.
2. Or, it should nose over canopy down and point straight at the ground, quickly picking up speed.

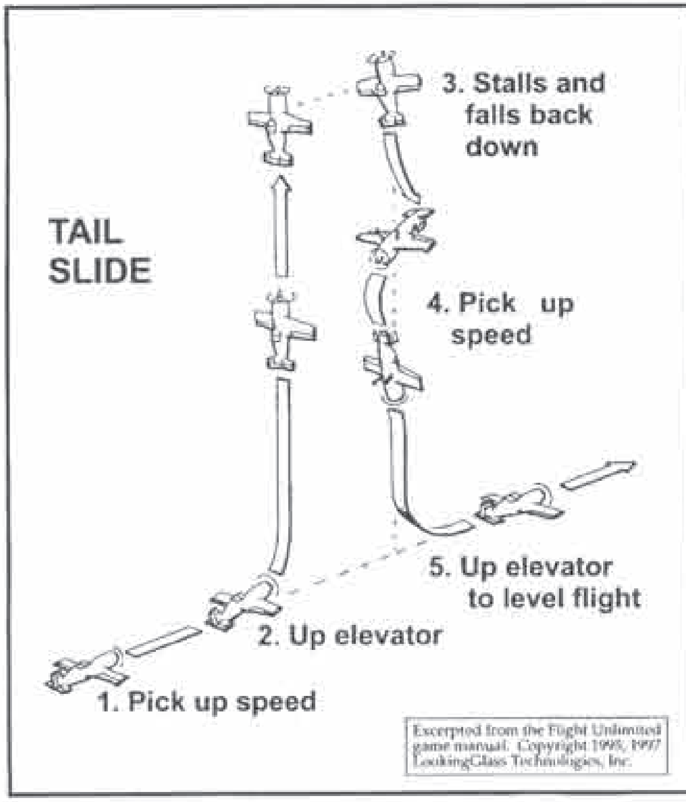
If you start the tail slide with a lot of airspeed, you have a bit of time to make small corrections until you quickly run out of airspeed, so there is some room for error.

A perfectly executed tail slide can be flown in two ways, one with the sailplane flopping over onto its back, and the other with the sailplane falling onto its nose (as described above). The latter tail slide is what was called for in the Akro-Cup. Should you be unlucky enough to fly the wrong tail slide, you will get ZERO points awarded for all your efforts! As I said, it's not a hard maneuver to fly, but it's most difficult to execute perfectly.

A Tale of Two Tail Slides

If you want to fly it with the sailplane flopping onto its back (canopy down), you need to add full down elevator at the point when the glider hangs in the air and starts to descend tail first. The air coming backwards over the down elevator will cause the model to flop onto its back and point straight down.

The other tail slide is the maneuver, which was called for in last year's aerobatic event. This time the glider is supposed to fall backwards, then flop straight down onto its nose (canopy up). In order to be absolutely certain that this what happens, this version of the tail slide is best flown conservatively. Some points awarded are better than no points at all! If you push down elevator while the glider still has a little vertical momentum, the nose will start to rotate forwards just enough to cause the glider to flop nose down (canopy up) after it slides backwards towards the ground. If this is done in a very subtle manner, perhaps the tail slide will look quite good, if not perfect. If you fly the tail slide in this manner, you will almost certainly have points deducted, but on the other hand the nose will fall in the correct direction and you won't get graded a big fat ZERO for all your efforts.



To execute a perfect tail slide with the nose flopping forward, you need to go straight up, and when all airspeed has been lost and just when the sailplane starts to fall backwards (but while still pointed straight up), you need to pull full up elevator. With the air coming backwards over the full up elevator, this will cause the tail to come up and the nose to flop down pointing straight to ground. Doing it this way, you will be awarded highest marks.

A Good Tail Slide Starts Before You Do It!

If your entry into the vertical is perfect (wings level, fuselage perfectly perpendicular), your tail slide will very probably go well.

If you were to fly the tail slide going directly away from you, then the maneuver would be a great deal easier because you can see what you're doing!

In short, although the execution of the tail slide is not particularly difficult in theory, it turns out to be a very chancy maneuver at best. In over a hundred attempts, I saw only one or two perfectly executed tail slides last year. You need a lot of luck to fly it perfectly, and that's the problem: skill rather than luck should decide the winner of an aerobatic. This year, skill will decide. There will be no tail slide required!

The Inverted Slow Roll Was Also Removed

The other maneuver, which Frank subtracted from this year's Akro 2000 was the inverted slow roll. This is quite a difficult maneuver to do properly because you need to fly it with a lot of airspeed. You also must input top rudder where and when you need it. Not only is this maneuver very easy to screw up on, but you need a lot of energy to perform it correctly, meaning you lose a lot of height. As you know, airspeed = energy = height loss.

One of the interesting things I found watching the airtowing for the Akro-Cup last year was that even the huge 1:3 Wilgas were being forced to fly so high that they sometimes flew out of sight! The towpilots started to complain. Can you imagine how high you have to be to make such an enormous tug disappear into the wild blue yonder? I would guess that these guys were sometimes well above 2000 and perhaps even higher than 2500 feet!

At any rate, it was deemed that the Akro routine forced the sailplane pilots to fly too high and so the inverted slow was removed to help alleviate this problem.

If you look at the diagram of the new required Akro-Cup stunt routine as it now stands, not only is it easier and more forgiving to fly, it can be flown much lower. This means among other things, that it'll be much easier for the towpilots to see and the airtows won't take so long. Perhaps even more importantly, the sailplane pilots will be able to start lower and see much better what they're trying to do, and so the new and improved stunt routine 2000 is better for everyone!

Just in case the pilots find this new Akro routine too easy, Frank added a new twist.

An "Unknown" Routine Added

Taking a feather out of the full-sized aerobatic sailplane competitions' hat, there's another new and very important change in this year's competition. An "unknown" stunt routine is going to be added, which every pilot will be required to fly. No practice flights will be allowed. "Here it is, now show us your stuff!" I rather imagine that this will level the playing field!

This "unknown" routine will be put together in secret from fifteen possible maneuvers. If you take a look at the list of these maneuvers, taken individually, they're not all that difficult, but put together into the "unknown" stunt routine, they're most certainly going to be a challenge to fly well!

The Akro-Cup is sure to be a most interesting event. Anyone want to go? If so, mark September 1-3 in your calendar, and while you're at it, why not visit Rödermark the weekend after (September 9-10) and see some magnificent state-of-the-art giant scale sailplanes and tugs do their thing? Both these events will be held near to Frankfurt, so you won't have to drive all that far. You can even take in some full-sized gliding and visit the Wasserkuppe in between. How much better can it get?

If you're interested, you should contact Frank Oeste for details. He speaks excellent English. You can reach him by E-mail at <Frank.Oeste@t-online.de> or by phone/fax: 011 49 6103 81801.

So long for now, see you there!

■

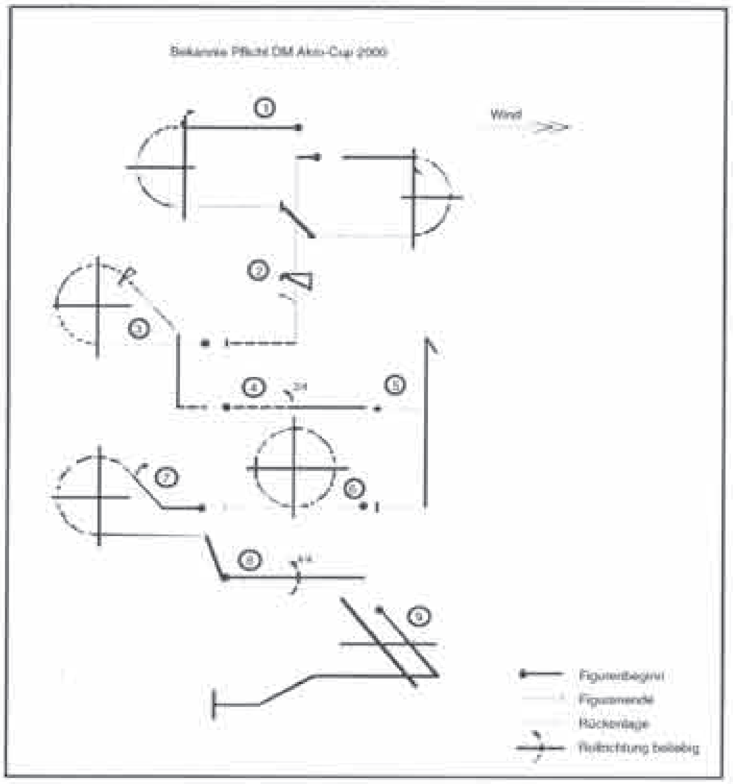
3rd. International German Championship for Akro-Semi-Scale-Gliders 2000

This competition took place for the first time 1997. Cup-Cup for Semi-Scale-Gliders at Dreieich/Frankfurt and has its origin in the full-size glider aerobatic scene. The enthusiasm of the 19 participants and the resonance to the reports in the R/C magazines caused a huge interest resulting in the International German Championship of the DMFV for Gliders-Semi-Scale-Gliders 1998. In 1999 still more pilots participated.

Because of our experiences last year, "Known Routine for the next competition this year (2000) has been changed. Changes have been made so that the gliders won't have to start the routine so high and the stunt figures will be able to be flown more easily.

The Akro-Cup 2000 will now have a "Known Routine" and an "Unknown Routine". The "Unknown" will be flown this year the first time. It will be created out of the catalogue by a neutral person and will be published at the beginning of the competition.

As in the former years, the scale model sailplane must be a model of an aerobatic type (the full-size original glider must be licensed for aerobatics). The size and wingspan is not limited but the weight must be less than 20 kilograms.



1. „Known Routine"
1.1 Figures and Coefficients

		K-Factor	max. Points
Program			
1.	Double Split-S: Split-S	12 (6+6)	120
	Immelman	12 (6+6)	120
2.	1 1/2 spin to inverted flight	17	170
3.	Inverted 5/8 loop, 1/2 snap roll 45° downwards	26 (14+12)	260
4.	2/4 roll	10 (2+8)	100
5.	Stall turn	17	170
6.	Inside loop	10	100
7.	1/2 upwards Cuban eight	19 (10+9)	190
8.	4/4 roll	19 (2+17)	190
9.	Landing	5	50
	Total fig. Max. Points	147	1470
Impressions			
1.	Placement of maneuvers	10	100
2.	Harmony	15	150

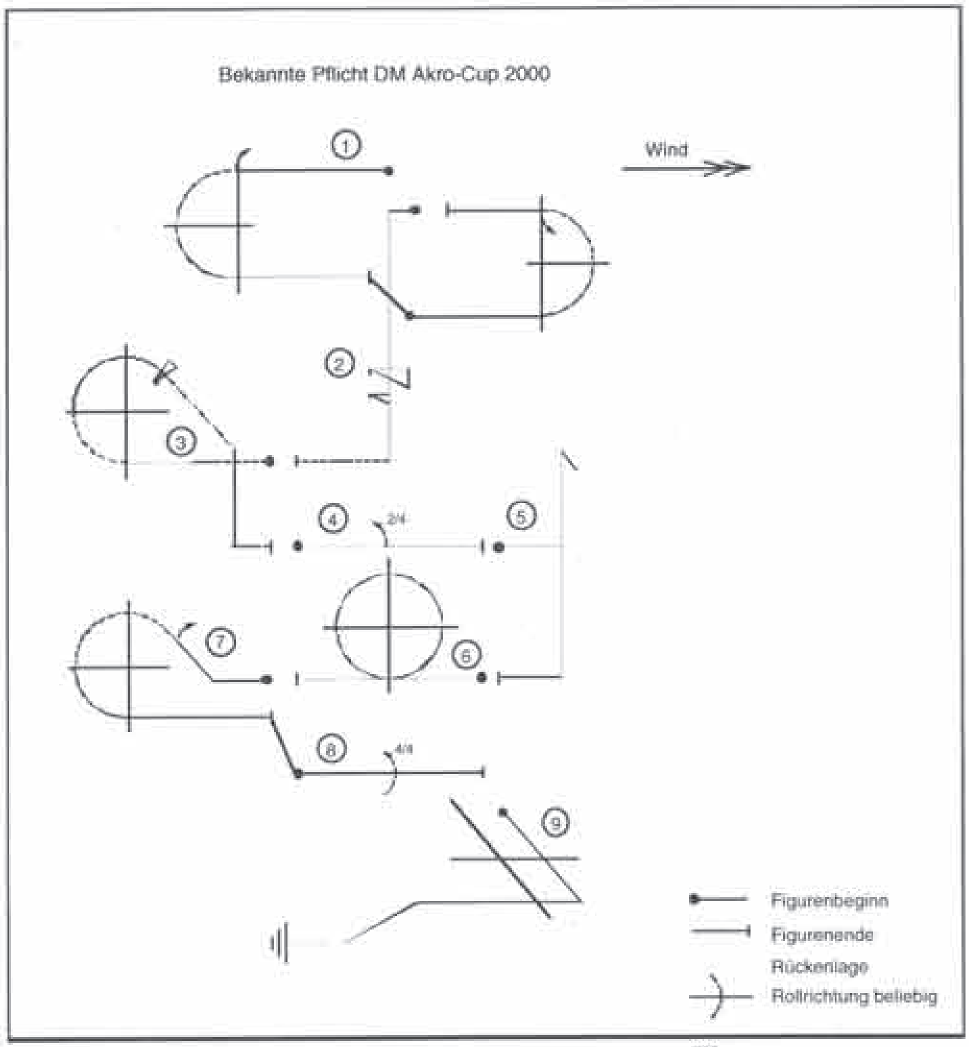
Max. Possible points: 1720.

Points are given in 0.5 steps from 0 till 10.

All coefficients are taken out of the FAI catalogue from the full-size glider aerobatics. The landing is the only exception. It will be assessed in this competition, but is not in full-size aerobatics.

1.2 „Known Routine 2000"

1. Split-S followed by an Immelmen
2. 1 1/2 pos. spin, into inverted flight
3. Inverted 5/8 loop,
   1/2 snap roll 45° downwards
4. 2/4 roll
5. Stall turn
6. Inside loop
7. 1/2 upwards Cuban Eight
8. 4 point roll
9. Landing



2. Unknown Routine

The "Unknown Routine" will only be created out of the passage 2.1 "Possible figures for the Unknown Routine" and will be announced 60 min. before the "Unknown" will be flown. The number of figures will be between 6 and maximal 8 (without landing).

2.1 Possible figures for the "Unknown Routine"

- Loop
- Stall turn
- Roll or parts of it
- 2/4 Roll
- 4/4 Roll
- Spin (1, 1-1/2, 2 rotations)
- 4/8 loop up
- 4/8 loop down
- Cuban Eight
- 1/2 Cuban Eight
- 1/2 Inverted Cuban Eight
- Split-S
- Inverted flight
- 360° turns or parts thereof
- Standing Nine

Explanation of the figures for the "Known Routine" and the "Unknown Routine"

2.2 Roll (steered-/ slow roll)

K10

360° turning of the a/c around its longitudinal axis. The roll has to be flown on a straight line. The turning speed must be constant and the CG should remain on a straight line.

2.3 1/2 roll (steered-/ slow 1/2 roll)

K10

Like figure roll, but the turning around the longitudinal axis has to be stopped after 180°.

2.4 2/4 roll from inverted

K10

1/2 roll from inverted with a stop in turning after 90°. The stopping must be well recognizable. The CG should remain on a straight line.

2.5 4/4 roll

K19

Interrupted full 360° roll. After each 90° well recognizable stop of turning. Roll stops should last exactly the same time and the turning speed should be the same in every segment. The CG should remain on a straight line.

2.6 Inverted flight - straight & level

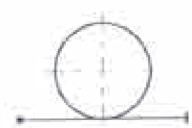
K3

Inverted flight - straight and level (min 5 sec.).

Combinations with 1/2 rolls are possible +K5.

2.7 Loop

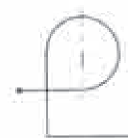
K10



Constant radius. The points of beginning and ending of the loop must not be at the same horizontal level.

2.8 Standing Nine

K11 bzw. K12

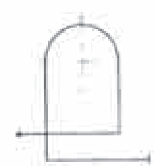


3/4 positive loop with well-shown vertical downwards line, followed by a transition into horizontal flight (positive or inverted).

Combinations with 1/2 rolls are possible. +K5

2.9 Humpty Bump

K13



The figure starts with a 1/4 loop into a vertical flight upwards, followed by a 1/2 loop into vertical flight upwards. The radius of the transition into the upward and downward flight should be identical.

Combinations with 1/2 rolls are possible. +K5

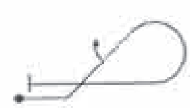
2.10 1/2 Cuban Eight

K16

From horizontal flight 5/8 loop, straight line 45° downwards, with 1/2 roll in the middle of the line, thereafter transition into level flight.

2.11 1/2 Cuban Eight vice versa

K16

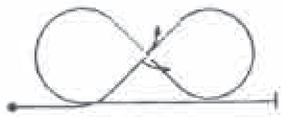


From horizontal flight 45° upwards, straight line with 1/2 roll in the middle of the line, thereafter 5/8 Looping and transition into horizontal flight.

2.12 Cuban Eight

The Cuban Eight consists out of two 5/8 loops, one followed after the other, with a 1/2 roll in the middle of the 45° line downwards. The beginning and the end of the figure must not be at the same horizontal level.

K29

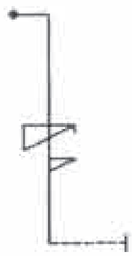


2.13 Spin with 1 1/2 rotations into inverted

The spin has to be started with minimum flying speed, so that the aircraft rotates from the start on a steep and vertical trajectory. The aircraft may not be forced or pulled into the spin. The vertical trajectory has to be reached at least after one half rotation, otherwise the beginning of the figure will be considered as a snap roll and the spin will be graded with zero.

At the end of the spin the aircraft has to remain a short period of time in the vertical trajectory. Transition into inverted flight with a normal radius.

K17



2.14 Inverted 5/8 loop upwards, 1/2 snap roll

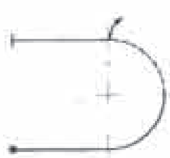
The 5/8 loop will be flown with constant radius. When reaching the 45° line upwards, the aircraft will be steered with a 1/2 snap roll into inverted flight. The aircraft should not show a line of flight like a corkscrew and the rotation should have a constant speed.

K26

2.15 4/8 loop with 1/2 roll - upwards

From horizontal flight into a 4/8 loop with immediately 1/2 roll after the loop into horizontal flight.

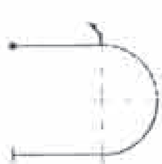
K12



2.16 1/2 roll with 4/8 loop-downwards

The aircraft will be steered with a 1/2 roll into inverted flight, followed immediately by a 4/8 loop downwards into horizontal flight.

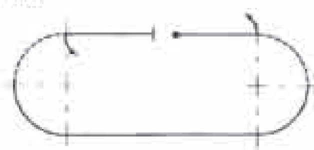
K12



2.17 Split-S

The aircraft will be steered with a 1/2 roll into inverted flight, followed immediately by a 4/8 loop downwards into horizontal flight. After a few seconds in horizontal flight a 4/8 loop will be flown, followed immediately by a 1/2 roll into horizontal flight.

K26

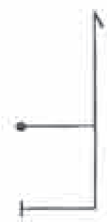


2.18 Stall Turn

The transition from horizontal flight into the vertical part upwards and out of the vertical part downwards into horizontal flight has to be flown with a constant and adequate radius. The turn in the highest position has to be fan-shaped and has to start already when the aircraft is still going upwards and has to be finished when on a vertical line downwards. The turn at the peak of the figure has to be only a turning around the vertical axis of the aircraft with constant turning speed.

Combinations with 1/2 rolls are possible. +K5

K17

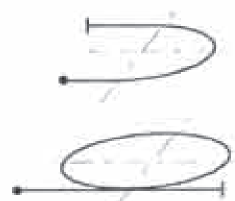


2.19 360° turns or parts of them

360° turns or parts of them, in horizontal or inverted flight. Constant bank angle, transition into bank or into normal flight with the same turning speed.

Combinations with 1/2 rolls are possible. +K5

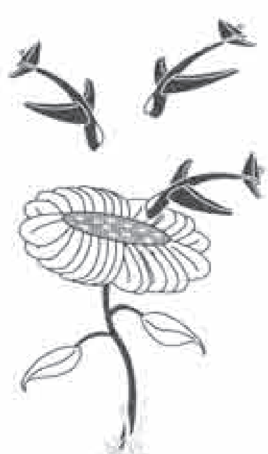
K3 bis K8



2.20 Landing

Between the landing and fig. 7.10 no more aerobatics should be performed. The aircraft will perform a traffic pattern followed by the landing. Base and final approach have to be separated by a well recognizable 90°- turn. The rate of descent has to be constant during landing. There must be a recognizable flaring and a smooth touchdown of the aircraft. The landing is finished, when the aircraft has stopped.

K5



ZIKA

"SHORT CUTS"

Steve Savoie
926 Gage St., Bennington, Vermont 05201
(802) 442-6959

X-4 Part 2
Design Issues

The construction of the X-4 has had some minor slippage due to a lack of available time to work on the project. Some design issues have been worked out, so not all is lost. The first hurdle to overcome was how to control the glide-path for landing, especially for slope landings. I read a very extensive documentation package sent to me by B Squared which mentioned difficulty controlling pitching moments when the split flaps are used (the lower sections) on the full size aircraft in just flap mode. The problem was so significant that flap mode was removed from the aircraft configuration leaving only the split flap dive break configuration. Because of this, I think it's best not to go down that road for a scale model.

The split flap dive brake system presented some design problems until I saw a nicely constructed Corsair which had a recessed control horn that fit neatly into the hinge line. That was when I got the idea to use two offset control horns operated from just one servo, one for each surface (upper/lower). Both will recess into the fairly thick hinge line and will be driven by a standard servo via a servo saver arm. This design will require the use of sturdy pin hinges as well some local reinforcement of the control surfaces.

Another issue to contend with is how to make upper and lower control surfaces that mate up well and center up close in alignment to the rest of the wing. To make the upper and lower control surfaces I'll just cut the surface free from the sheeted wing, hot wire the foam core down the trailing edge, and cut through with a razor saw. The inner faces will be capped over with 1/64" ply. An internal stop made from stiff carbon fiber will center the surfaces at the aileron break. Another stop will be position at the root into the split flap area. When the surfaces close down, the stops will hold them neutral when the servo "cams over" to lock the surfaces.

Hope to get more to you for the next month's installation.

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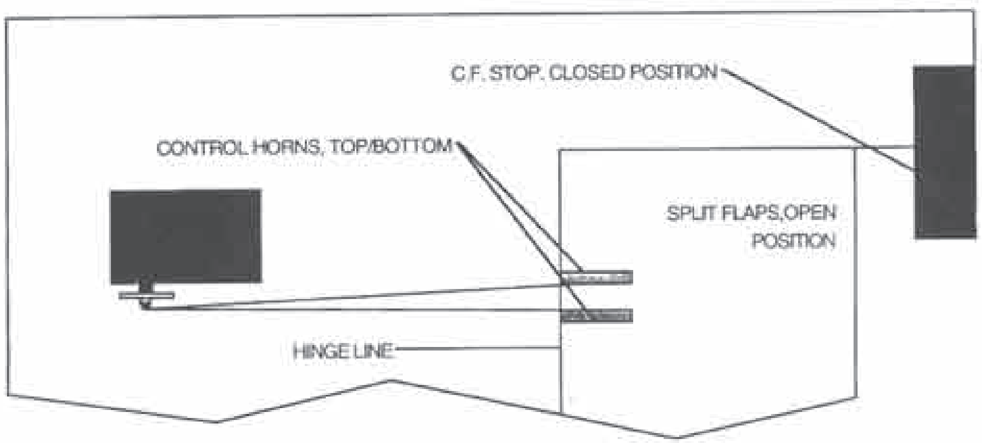

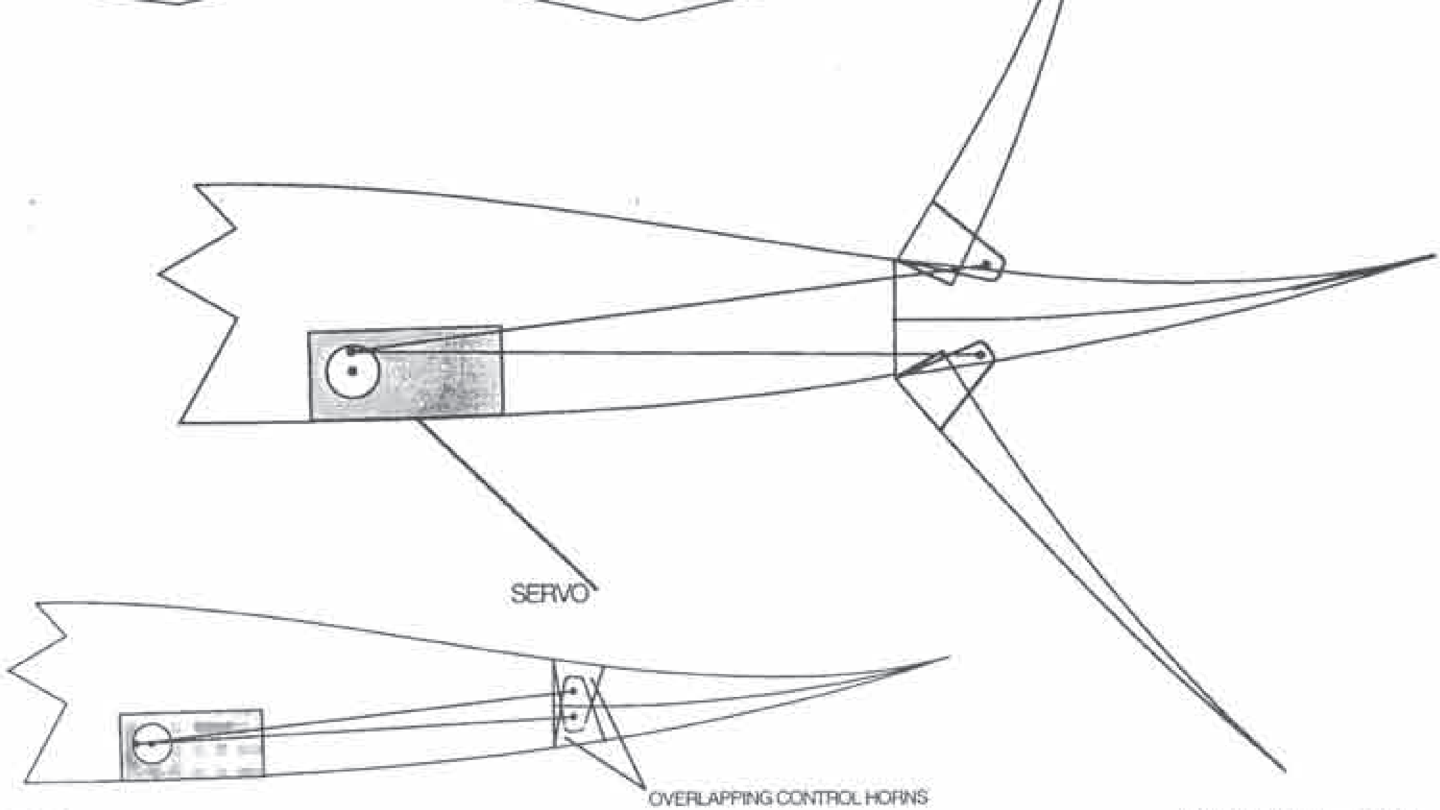

SCHEDULE OF SPECIAL EVENTS

May 5-7
Texas National Tournament — Dallas, TX
Jay Schultz, jkschul@juno.com
Henry Bostick, (972) 279-8337

May 6-7
MVSA Gateway Soaring Open 2000 — O'Fallon, MO
Mark Nankivil, (314) 781-9175
Nankmc@QuixNet.net
Alden Shipp, (217) 223-3052
alden@adams.net

May 6-7
International Slope Race — Davenport, CA
Gavin Botha, (408) 270-1471
gbotha@arc.nasa.gov

May 6-7
East Coast HL Classic — Frederick, MD
John Appling, (410) 374-2463
JAppling@qis.net

May 19-21
Midwest Slope Challenge — Lake Wilson, KS
Loren Blinde, (402) 467-4765
mwsc@alltel.net, www.alltel.net/~mwsc

May 20-21
Los Banos Scale 2000 — Los Banos, CA
Bruce DeVisser, (408) 286-7396
ohmktg@aol.com

June 7-10
Elmira Scale Aerotow 2000 — Elmira, NY
John Derstine, (570) 596-4392
johnders@postoffice.ptd.net
http://www.Geocities.com/~scalesoar

June 10
Cross Country Challenge 2000 — Lancaster, CA
Merrill Brady, mmglidert@keyway.net
Gary Fogel, gliderrc@aol.com

June 9-11
Montague Cross Country Challenge — Montague, CA
3rd Annual, Practice June 9th
DG Airparts, Inc., dgair@cdsnet.net
(541) 899-8215

June 23-25
MSSC 2000 — Louisville, KY
Ed Wilson, (502) 239-3150
ewilson1@bellsouth.net

June 24-25
Spring Fling 2000 — Sacramento, CA
Dudley Dufort, (916) 448-1266
www.svss.org

July 1-2
CRRC 3rd Annual RES - 2m & UNL — Sudbury, MA
Info. & Map: http://www.charlesriverrc.org
Dick Williamson, (781) 981-7857
Williamson@ll.mit.edu
Pete Young, (617) 484-0640
pwyoung@ix.netcom.com

July 29-30
GNATS Aerotow 2000 — Ontario, Canada
Phil Landray, (905) 468-3923
linden@niagara.com
Gerry Knight, (905) 934-7451
Lou Kleiman, (905) 688-4092
Mistral@niagara.com

August 3-6
International Electric Flight Festival — San Diego, CA
Ron Scharck, (858) 454-4900
Scharck@aol.com

August 6-12
F5 World Championships — San Diego, CA
Ron Scharck, (858) 454-4900
Scharck@aol.com

August 12-13
CRRC Soar-In Contest — Sudbury, MA
Anker Berg-Sonne, (978) 897-1750
anker@ultranet.com
John Nilsson, (978) 368-7136
nilssonj@rd.simplexnet.com
Info. & map: http://www.charlesriverrc.org/

August 26-27
Washington Scale Aerotow Fun Fly — Yakima, WA
Gene Cope, (509) 457-9017, gcope@ixpnet.com
Frank Smith, (509) 924-8440

For detailed information on events outside of the U.S.A., please view www.sailplanes.com event schedule.

Classified Advertising Policy

Classified ads are free of charge to subscribers provided the ad is personal in nature and does not refer to a business enterprise. Classified ads that refer to a business enterprise are charged $5.00 per month and are limited to a maximum of 40 words. The deadline for receiving advertising material is the 15th day of the month. (Example: If you wish to place an ad in the March issue, it must be received by February 15.) *RCSD* has neither the facilities or the staff to investigate advertising claims. However, please notify *RCSD* if any misrepresentation occurs. Market Place Listings are $5 a month. Personal ads are run for one month and are then deleted automatically. However, if you have items that might be hard to sell, you may run the ad for two months consecutively.

For Sale - Business

PC-Soar Version 3.7 Sailplane Performance Evaluation Program with Airfoil and Sailplane Library expanded to 60 models including Chrysalis, Anthem, Genesis, Peregrine, Probe, Thermal Eagle, and Spectrum. Airfoil library includes 322 polars with 56 UIUC polars. PC-Soar with Libraries of Sailplanes and Airfoil Polars plus a new Excel utility for working with multi taper wing areas and aerodynamic centers. Reduced Cost: $50 + $3 P&H. PC-Soar library and software Upgrade to Ver. 3.7: $10 + $3 P&H. LJM Associates, 1300 Bay Ridge Rd., Appleton, WI 54915; ph: (920) 731-4848 after 5:30 p.m. weekdays or on weekends. E-mail: lmurray@athenet.net. PC-Soar Web Page: <http://www.athenet.net/~atkron95/pcsoar.htm>.

PARACHUTES: $10. Dale King, 1111 Highridge Drive, Wylie, TX 75098; (972) 475-8093.

DesignAire: EASY TO USE AIRCRAFT DESIGN SOFTWARE (PC). 3-D sketch, performance, Wt/Bal, inertias, color graphs, panel analysis, static stability, airfoils, envelope, FAR 23A loads and envelope. Runs "airfoil ii". $119. JammAero POBox 236, Horntown VA 23395. www.jammaero.com.

For Sale - Personal

1/4 Roedel Super Cub (towplane), 2.687 meter span, wing profile Clark Y mod. (suitable motors are 160 T, 300 T, OS BGX-1, Brison 3.2 or similar), NIB... $385.00. Contact Robin Lehman, 63 E. 82nd St., New York, NY 10028; (212) 879-1634.

Soaring Products Thermic Sniffler, Audio Rate of Climb/Descent Sensor Serial Number LF555, frequency 49.830 MHZ, voltage 9v, BI-Pole antenna, mfg. in U.S.A. Companion Receiver, Lafayette Model HA-240, 49.830 MHZ. Substantial belt hook, ear plug & 30" antenna. Price... $125 + $10 S&H, money order only. Dale Willoughby, 370 E. Fourth St., Benson, AZ 85602-6614, (520) 586-8756.

Hobby Shops that Carry RCSD

Gunnings Hobbies
538 San Anselmo Ave.
San Anselmo, CA 94960
(415) 454-3087

Gyro Hobbies
23052 Lake Forrest Dr.
Unit C2
Laguna Hills, CA
(714) 583-1775

Gyro Hobbies 2
17431 Brookhurst Unit H
Fountain Valley, CA 92708
(714) 378-8924

Hobbies "N Stuff
9577-L Osuna Rd. NE
Albuquerque, NM 87111
(505) 293-1217

Hobby Town U.S.A.
8060 S. 84th St.
La Vista, NE 68128
(402) 597-1888

Hobby Warehouse
4105 South Street
Lakewood, CA 90712
(562) 531-8383

King R/C
Five Forks Village
King, NC 27021

Tim's Bike & Hobby
2507 Broadway
Everett, WA 98201
(206) 259-0912

Please send in your scheduled events as they become available!

R/C Soaring Resources

These contacts have volunteered to answer questions on soaring sites or contests in their area.

Contacts & Soaring Groups - U.S.A.

Alabama - North Alabama Silent Flyers (NASF), Ron Swinehart, (256) 722-4311, <ron.swinehart @lmco.com>, or Rob Glover at AMA3655@aol.com, http://sh1.ro.com/~samfara/

Alabama - Central Alabama Soaring Society, Ron Richardson (Tres.), 141 Broadmoor Ln., Alabaster, AL 35007, <ron_mail@bellsouth.net>.

Alabama - Southern Alabama & NW Florida Aerotow, Asher Carmichael, (334) 626-9141, or Rusty Rood, (904) 432-3743.

Arizona - Aerotowing, slopesites in AZ (rugged), Arizona Flying Eagles R/C Demo. Show Team, Dave Wenzlick, (602) 345-9232, <azdw@uswest.net, or visit CASL at <http://www.public.asu.edu/~vansanfo/casl>.

Arizona - Central Arizona Soaring League, Iain Glithero, (602) 839-1733.

Arizona - Southern Arizona Glider & Electric (Tucson area), Philip Brister (contact), (520) 394-2121, pbrister@juno.com. SAGE welcomes all level of flyers!

Arkansas - Northwest Arkansas Soaring Society, Tom Tapp (President), RT 2 Box 306, Huntsville, AR 72740, (501) 665-2201, eve.

California - DUST, Buzz Waltz, 68-320 Concepcion, Cathedral City, CA 92234, (760) 327-1775, <buzzwaltzrc@excelonline.com>.

California - High Desert Dust Devils, Stan Sadorf, 14483 Camrose Ct., Victorville, CA 92392; (760) 245-6630, <Soareyes@aol.com>.

California - Inland Soaring Society, Robert Cavazos, 12901 Forman Ave., Moreno Valley, CA 92553, RCAV@aol.com.

California - Northern California Soaring League, Mike Clancy, 2018 El Dorado Ct, Novato, CA 94947; (415) 897-2917.

California - Sacramento Valley Soaring Society, Dudley Dufort, 225 30th St., Suite 301, Sacramento, CA 95816, (916) 448-1266, <www.svss.org>.

California - Soaring Union of Los Angeles, John Bruce, 908 W 245th St., Harbor City, CA 90710, (310) 534-0948, <rcflyinman@aol.com>.

California - South Bay Soaring Society, Mike Gervais, P.O. Box 2012, Sunnyvale, CA 94087; (408) 683-4140 (H), (650) 354-5469 (W).

California - Southern Calif. Electric Flyers, John Raley (President), 1375 Logan Ave., Costa Mesa, CA 92626; (714) 641-1776 (D), (714) 962-4961 (E), e-mail: E-Flyer@ix.netcom.com.

California - Torrey Pines Gulls, Ron Scharck, 7319 Olivetas Ave., La Jolla, CA 92037; (619) 454-4900.

Colorado - Rocky Mountain Soaring Assn., Phil Weigle, 1290 Salem St., Aurora, CO 80011; (303) 341-9256 eve.

Eastern Soaring League (VA, MD, DE, PA, NJ, NY, CT, RI, MA), Tom Keisling (Pres./Editor), (814) 255-7418, kiesling@ctc.com; Ben Lawless (Sec./Tres.), LawlessB@ang.af.mil; Anker Berg-Sonne (Scorekeeper), (508) 897-1750, anker@ultranet.com; Josh Glaab (Contest Coordinator), (757) 850-3971, ljglaab@pinn.net; <http://www.eclipse.net/~mikel/esl/esl.htm>.

Florida - Florida Soaring Society, Mark Atzel (President), 1810 SW Terrace, Ft. Lauderdale, FL 33312, (954) 792-4918.

Florida (Central) - Orlando Buzzards Soaring Society (www.specs-usa.com/~ingo/OrlandoBuzzards), Jerre K Ferguson (Pres.), 4511 Pageant Way, Orlando, FL 32808, (407) 295-0956, <jerre@bellsouth.net>.

Georgia - North Atlanta Soaring Association, Tim Foster, (770) 446-5938 or Tom Long, (770) 449-1968 (anytime).

Hawaii - Maui Island Slope Soaring Operation (MISO), Duane A.K. Asami, 262 Kamila St., Kula, HI 96790, pgr. (888) 932-6247, <dasami@mauigateway.com>.

Illinois (Chicago Area) - Silent Order of Aeromodeling by Radio, Jim McIntyre, 23546 W. Fern St., Plainfield, IL 60544-2324; (815) 436-2744. Bill Christian, 1604 N. Chestnut Ave., Arlington Heights, IL 60004; (847) 259-4617.

Illinois (Northwest) - Valley Hawks R/C Soaring Club, Jeff Kennedy (President), 414 Webster St., Algonquin, IL 60102, (708) 658-0755, eve. or msg.

Indiana (NE Indiana and NW Ohio) - League Of Flight by Thermal (LOFT), Ft. Wayne, Marc Gellart, (419) 229-3384, <isoar2@wcoil.com>, <www.rc-aero.com/LOFT>.

Indiana - Bob Steele, 10173 ST Joe Rd., Fort Wayne, IN 46835, (219) 485-1145.

Iowa - Eastern Iowa Soaring Society (IA, IL, IN, KS, NE, WI), Ed Harris (editor), 2000 NW 84th Ave., Ankeny, IA 50021; (515) 965-5942, <harris.edwin@mcleodusa.net>, <http://eiss.cnde.iastate.edu>.

Kansas - Kansas Soaring Society, Pat McCleave (Contact), 11621 Nantucket, Wichita, KS 67212; (316) 721-5647.

Kansas - Aerotowing, Jim Frickey, (913) 585-3714.

Kentucky - Bluegrass Soaring Society, Frank Foster (President), 4939 Hartland Pkwy., Lexington, KY 40515; (606) 273-1817.

Kentucky - Louisville Area Soaring Society, Ed Wilson (Contact), 5308 Sprucewood Dr., Louisville, KY 40291; (502) 239-3150 (eve), e-mail <ewilson1@bellsouth.net>.

Louisiana - Capitol of Louisiana Soaring Society (CLASS), Leonard Guthrie (contact), 12464 Fair Hope Way, Baton Rouge, LA 70816, (225) 275-2122, flyguts@aol.com.

Maine - DownEast Soaring Club (New England area), <Jamesiii@blazenetme.net>.

Maryland - Baltimore Area Soaring Society, Erich Schlitzkus (President), 52 North Main St., Stewartstown, PA 17363; (717) 993-3950.

Maryland & Northern Virginia - Capital Area Soaring Association (MD, DC, & Northern VA), Chris Bovais, 12504 Circle Drive, Rockville, MD 20850; (703) 643-5513.

Massachusetts - Charles River Radio Controllers, Dick Williamson (past president), 21 Pendleton Road, Sudbury, MA 01776; (781) 981-7857 (W), <williamson@ll.mit.edu>, <http://www.charlesriverrc.org>.

Michigan - Greater Detroit Soaring & Hiking Society, Greg Nilsen (Sec.), 260 Rosario Ln., White Lake, MI 48386-3464; (248) 698-9714, GNilsen624@aol.com.

Michigan - Great Lakes 1.5m R/C Soaring League & "Wings" Flight Achievement Program & Instruction. Ray Hayes, 58030 Cyrenus Lane, Washington, MI 48094; (810) 781-7018.

Minnesota - Minnesota R/C Soaring Society, Tom Rent (Contact), 17540 Kodiak Ave., Lakeville, MN 55044; (612) 435-2792.

Missouri - Independence Soaring Club (Kansas City area, Western Missouri), Edwin Ley (Contact), 12904 E 36 Terrace, Independence, MO 64055, (816) 833-1553, eve.

Missouri - Mississippi Valley Soaring Assoc. (St. Louis area), Peter George, 2127 Arsenal St., St. Louis, MO 63118; (314) 664-6613. Mark Nankivil, nankmc@quixnet.net, (314) 781-9175.

Nebraska - B.F.P.L. Slopers, Steve Loudon (contact), RR2 Box 149 E1, Lexington, NE 68850, (308) 324-3451/5139.

Nebraska - Lincoln Area Soaring Society (Wilson Slope Races), Jim Baker, 920 Eldon Dr., Lincoln, NE 68510, (402) 483-7596, jcbaker@inebraska.com, <http://www.geocities.com/CapeCanaveral/Hangar/1671/lass-2.html>.

Nebraska - SWIFT, Christopher Knowles (Contact), 12821 Jackson St., Omaha, NE 68154-2934, (402) 330-5335.

Nebraska - Ken Bergstrom, R.R. #1, Box 69 B, Merna, NE 68856; (308) 643-2524, <abergst@neb-sandhills.net>.

Nevada - Las Vegas Soaring Club, Ray Dinoble, 10812 Hollow Creek Lane, Las Vegas, NV 89144, (702) 254-7911, <dinobler@juno.com>>.

Nevada - Sierra Silent Soarers (Reno/Sparks/Carson City/Minden area), Chris Adams, (775) 345-1660, chris@scrollsander.com, <http://www.scrollsander.com/SierraSilentSoarers.htm>.

New Jersey - Vintage Sailplane R/C Association, Richard G. Tanis (President/Founder), 391 Central Ave., Hawthorne, NJ 07506; (201) 427-4773.

New Mexico - Albuquerque Soaring Association (all soaring & electrics), Jim Simpson (contact), 604 San Juan de Rio, Rio Rancho, NM 87124; (505) 891-1336, <jimbonee@aol.com>, <http://www.abqsoaring.com>.

New York, aerotowing Rochester area, Jim Blum and Robin Lehman, (716) 335-6515.

New York - Elmira - Harris Hill L/D R/C, aerotowing & slope, John Derstine, (717) 596-2392, e-mail johnders@postoffice.ptd.net.

New York, aerotowing Long Island Area, Robin Lehman, (212) 744-0405.

New York - (Buffalo/Niagara Falls area) - Clarence Sailplane Society: www.paradox.net/homepages/mtimm/css.html or Lyn Perry, President (716-655-0775; perryl@ecc.edu); Jim Roller, Competition Coordinator (716-937-6427; Rolj98@aol.com).

New York - Long Island Silent Flyers, Stillwell Nature Preserve, Syosset, NY, Ze'ev Alabaster (President), (718) 224-0585, or Peter DeStefano (VP), (516) 586-1731.

New York - Syracuse area, Central NY Sailplane Group, Dave Zinteck, Minoa, NY, (315) 656-7103, e-mail Zinteck@aol.com.

North Carolina - Aerotowing, Wayne Parrish, (919) 362-7150.

Northwest Soaring Society (Oregon, Washington, Idaho, Montana, Alaska, British Columbia, Alberta), Sandie Pugh (Editor - NWSS Eagle), 1119 SW 333rd St., Federal Way, WA 98023, e-mail: parrot2luv@aol.com, (253) 874-2429 (H), (206) 655-1167 (W).

Ohio - Cincinnati Soaring Society, Ed Franz, 7362 Ironwood Way, Burlington, KY 41005; (606) 586-0177, <ejfranz@fuse.net>.

Ohio - Dayton Area Thermal Soarers (D.A.R.T.S.), Walt Schmoll, 3513 Pobst Dr., Kettering, OH 45420, (513) 299-1758.

Ohio - Mid Ohio Soaring Society (MOSS), Hugh Rogers, 888 Kennet Ct., Columbus, OH 43220; (614) 451-5189, e-mail <tomnagel@iwaynet.net>.

Ohio, Kentucky & Indiana - Ohio Valley Soaring Series, Marc Gellart, (419) 229-3384, <isoar2@wcoil.com>, <www.dma.org/DARTS/ovss/ovss.html>.

Oklahoma - Central Oklahoma Soaring, George Voss, (405) 692-1122.

Oklahoma - Tulsa R/C Soaring Club (TULSOAR), http://www.mccserv.com/tulsoar

Oregon - Bay Area R/C Fliers, Mike Shaw, <grizzy2@gte.net, (541) 269-2423.

Oregon - Portland Area Soaring Society (PASS), Pat Chewning (Secretary), 16766 NW Yorktown Dr., Beaverton, OR 97006, (503) 645-0323, e-mail: patch@sequent.com, www.europa.com/~patch/

Oregon - Salem Soaring Society, Al Szymanski, CD, (503) 585-0461, http://home.att.net/~aszy/sss/.

Oregon - Southern Oregon Soaring Society, Jerry Miller, 3431 S. Pacific Hwy. TRLR 64, Medford, OR 97501, e-mail Milljer@aol.com, ph/fax (541) 535-4410.

Tennessee - Memphis Area Soaring Society, Bob Sowder, 1610 Saddle Glen Cove, Cordova, TN 38018, (901) 751-7252, FAX (901) 758-1842.

Tennessee - Tullahoma (South Central), Coffee Airfoilers, Brian Smith, 317 Crestwood Dr., Tullahoma, TN 37388, (931) 393-4876, <bismith@midtnn.net>.

Tennessee - Soaring Union of Nashville, Terry Silberman, PO Box 17946, Nashville, TN 37217-0946, (615) 399-0846.

Texas - aerotowing, Dallas area, Andrew Jamieson, 6931 Desco Dr., Dallas, TX 75225, (214) 369-6118, AJamieson@Sleepmed.com. Larry Sengbush, (972) 291-4840.

Utah - Intermountain Silent Flyers, Tom Hoopes, (801) 571-3702 (eve). "Come Fly With Us!"

Vermont - Steve Savoie, 926 Gage St., Bennington, VT 05201, (802) 442-6959.

Virginia - Blue Ridge Area Soaring Society (Central Virginia - Waynesboro), Tom Broeski, (540) 943-3356, <tjb@rica.net>.

Virginia - Tidewater Model Soaring Society, Herk Stokely, (757) 428-8064, herkstok@aol.com.

Virginia - Appalachian Soaring Association, Bristol VA & TN area, Daniel E. Didgeon, Apt A, 721 Meadowview Rd., Bristol, TN 37620; (423) 844-0518: voice mail (423) 914-4290, <ddijun2@aol.com>.

West Virginia & Pennsylvania - Tri-State Soaring, Chip Vignolini, 2784 Mill St., Aliquippa, PA 15001; (724) 857-0186, Voice mail (412) 560-8922, <ydne30a@prodigy.com>.

Washington - Seattle Area Soaring Society, Waid Reynolds (Editor), 12448 83rd Avenue South, Seattle, WA 98178; (206) 772-0291.

Wisconsin - Valley Aero Modelers, Lee Murray, 1300 Bay Ridge Rd., Appleton, WI 54915; (920) 731-4848, <lmurray@athenet.net>.

T.W.I.T.T.
(The Wing Is The Thing)

T.W.I.T.T. is a non-profit organization whose membership seeks to promote the research and development of flying wings and other tailless aircraft by providing a forum for the exchange of ideas and experiences on an international basis. T.W.I.T.T. is affiliated with The Hunsaker Foundation which is dedicated to furthering education and research in a variety of disciplines. Full information package including one back issue of newsletter is $2.50 US ($3.00 foreign). Subscription rates are $20.00 (US) or $25.00 (Foreign) per year for 12 issues.

T.W.I.T.T., P.O. Box 20430
El Cajon, CA 92021

Outside U.S.A.

Australia - Southern Soaring League, Inc., Mike O'Reilly, Model Flight, 42 Maple Ave., Keswick SA 5035, Australia. Phones: ISD+(08) 8 293-3674, ISD+(08) 8 297-7349, ISD+(018) 8 082-156 (Mobile). FAX: ISD+(08) 8 371-0659.

Canada - Calgary R/C Soaring Society (Alberta), thermal duration & slope soaring, Chris Gregg (Pres.), (403) 226-1019, cgregg@cadvision.com; Eric Weder (Sec.), (403) 289-8844, eaweder@telusplanet.net.

Canada - Montreal Area - C2VM Glider Club, Jacques Blain (President), days (514) 443-5335, eve. (514) 652-6167.

Canada - Greater Niagara Area Thermal Soarers (GNATS), Flat Field Soaring & Aerotowing, Gerry Knight, (905) 934-7451 or Don Smith, (905)934-3815.

Canada - MAAC Men Gliding Club, Jim Holland, 168 Verona Dr., Winnipeg, Manitoba, Canada R2P 2R8, (204) 697-1297.

Canada - Southern Ontario Glider Group, "Wings" Programme, dedicated instructors, Fred Freeman, (905) 627-9090, or Bill Woodward, (516) 653-4251.

England (CIAM Flyer), Jack Sile (Editor), 21 Bures Close, Stowmarket, Suffolk, IP14 2PL, England; Tele. # 0449-675190.

England (southwest) - Sean Walbank, Woolcombe Hays, Melbury Bubb, Dorchester, Dorset, DT2 0NJ, phone 01935-83316.

Hong Kong - Robert Yan, 90 Robinson Road, 4th Floor, Hong Kong, (852) 25228083, fax (852) 28450497, yanr@asiaonline.net.

Japan - Dr. Paul "Sky Pilot" Clark, 2 - 35 Suikoen Cho, Hirakata Shi 573, Osaka Fu, Japan; IAC+(81) 720-41-2934, <pclark@osk3.3web.ne.jp> http://www3.osk.3web.ne.jp/~pclark/skypilot/

Scotland - Ron Russell, 25 Napier Place, South Parks, Glenrothes, Fife, Scotland KY6 1DX, ph. 01592 753689.

RCSD Index/Database

Available from: <http://www.athenet.net/~atkron95/pcsoar.htm>. Or, send 3.5" high density disks & SASE with stamps for 2 oz. Lee Murray, 1300 Bay Ridge Rd., Appleton, WI 54915; (920) 731-4848 after 5:30 pm weekdays or on weekends, <lmurray@athenet.net>.

Reference Material

Summary of Low-Speed Airfoil Data - Volume 3 is really two volumes in one book. Michael Selig and his students couldn't complete the book on series 3 before series 4 was well along, so decided to combine the two series in a single volume of 444 pages. This issue contains much that is new and interesting. The wind tunnel has been improved significantly and pitching moment measurement was added to its capability. 37 airfoils were tested. Many had multiple tests with flaps or turbulation of various configurations. All now have the tested pitching moment data included. Vol 3 is available for $35. Shipping in the USA add $6 for the postage and packaging costs. The international postal surcharge is $8 for surface mail to anywhere, air mail to Europe $20, Asia/Africa $25, and the Pacific Rim $27. Volumes 1 (1995) and 2 (1996) are also available, as are computer disks containing the tabulated data from each test series. For more information contact: SoarTech, Herk Stokely, 1504 N. Horseshoe Circle, Virginia Beach, VA 23451 U.S.A., phone (757) 428-8064, e-mail <herkstok@aol.com>.

"Ultimate Scale Soaring" video taken at the 1998 Northeast Aerotowing Fly-in, New York, U.S.A. - international flyers & interviews. From Germany: The Akro Cup and The Scale Seglerschlepp. Check or money order, $24.95 plus $3.20 S&H (U.S.), payable to John Derstine, RD 3# Box 336, Gillett, PA 16925; (570) 596-4392, <johnders@postoffice.ptd.net>. S&H foreign: $6 Canada/Mexico, $7 Europe, $8 Asia/Africa, $8.50 Pacific Rim. VHS format, NTSC standard. PAL format $40 + applicable shipping.

Books by Martin Simons: "World's Vintage Sailplanes, 1908-45", "Slingsby Sailplanes", "German Air Attaché", "Sailplanes by Schweizer". Send inquiries to: Raul Blacksten, P.O. Box 307, Maywood, CA 90270, <raulb@earthlink.net>. To view summary of book info.: http://home.earthlink.net/~raulb

Seminars & Workshops

Free instruction for beginners on construction & flight techniques, week-ends (excl. contest days), "AJ" Angelo, South Bay Soaring Society (San Jose area), (415) 321-8583.

BBS/Internet

Internet soaring mailing listserve linking hundreds of soaring pilots worldwide. Send msg. containing the word "subscribe" to soaring-request@airage.com. The "digestified" version that combines all msgs. each day into one msg. is recommended for dial-up users on the Internet, AOL, CIS, etc. Subscribe using soaring-digest-request@airage.com. Post msgs. to soaring@airage.com. For more info., contact Michael Lachowski at mikel@airage.com.

The League of Silent Flight (LSF) is an international fraternity of RC Soaring pilots who have earned the right to become members by achieving specific goals in soaring flight. There are no dues. Once you qualify for membership you are in for life.

The LSF program consists of five "Achievement Levels". These levels contain specific soaring tasks to be completed prior to advancement to the next level.

Send for your aspirant form, today:

League of Silent Flight
c/o AMA
P.O. Box 3028
Muncie, IN 47302-1028 U.S.A.

Sailplane Homebuilders Association (SHA)

A Division of the Soaring Society of America

The purpose of the Sailplane Homebuilders Association is to stimulate interest in full-size sailplane design and construction by homebuilders. To establish classes, standards, categories, where applicable. To desiminate information relating to construction techniques, materials, theory and related topics. To give recognition for noteworthy designs and accomplishments.

SHA publishes the bi-monthly ***Sailplane Builder*** newsletter. Membership cost: $15 U.S. Student (3rd Class Mail), $21 U.S. Regular Membership (3rd Class Mail), $30 U.S. Regular Membership (1st Class Mail), $29 for All Other Countries (Surface Mail).

Sailplane Homebuilders Association
Dan Armstrong, Sec./Treas.
21100 Angel Street
Tehachapi, CA 93561 U.S.A.

The Vintage Sailplane Association

Soaring from the past into the future! The VSA is dedicated to the preservation and flying of vintage and classic sailplanes. Members include modelers, historians, collectors, soaring veterans, and enthusiasts from around the world. Vintage sailplane meets are held each year. The VSA publishes the quarterly BUNGEE CORD newsletter. Sample issues are $2.00. Membership is $15 per year. For more information, write to the:

Vintage Sailplane Association
13312 Scotsmore Way
Herndon, VA 22071 USA

The Eastern Soaring League (ESL) is a confederation of Soaring Clubs, spread across the Mid-Atlantic and New England areas, committed to high-quality R/C Soaring competition.

AMA Sanctioned soaring competitions provide the basis for ESL contests. Further guidelines are continuously developed and applied in a drive to achieve the highest quality competitions possible.

Typical ESL competition weekends feature 7, or more, rounds per day with separate contests on Saturday and Sunday. Year-end champions are crowned in a two-class pilot skill structure providing competition opportunities for a large spectrum of pilots. Additionally, the ESL offers a Rookie Of The Year program for introduction of new flyers to the joys of R/C Soaring competition.

Continuing with the 20+ year tradition of extremely enjoyable flying, the 1999 season will include 14 weekend competitions in HLG, 2-M, F3J, F3B, and Unlimited soaring events. Come on out and try the ESL, make some new friends and enjoy camaraderie that can only be found amongst R/C Soaring enthusiasts!

ESL Web Site: http://www.eclipse.net/~mikel/esl/esl.htm

ESL President (99-00): Tom Kiesling (814) 255-7418 or kiesling@ctc.com

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Hurricane- 31 1/2" W.S.
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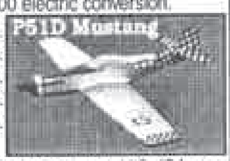

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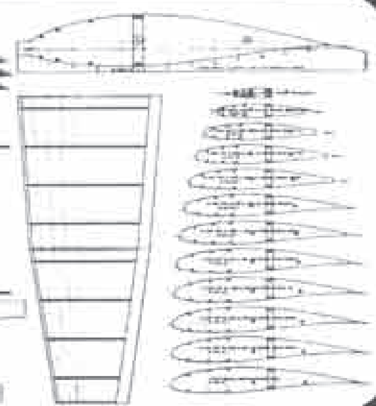

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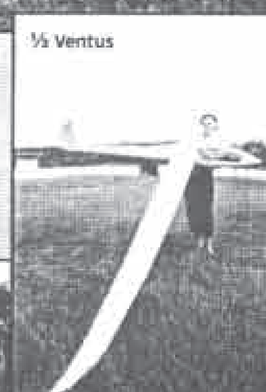
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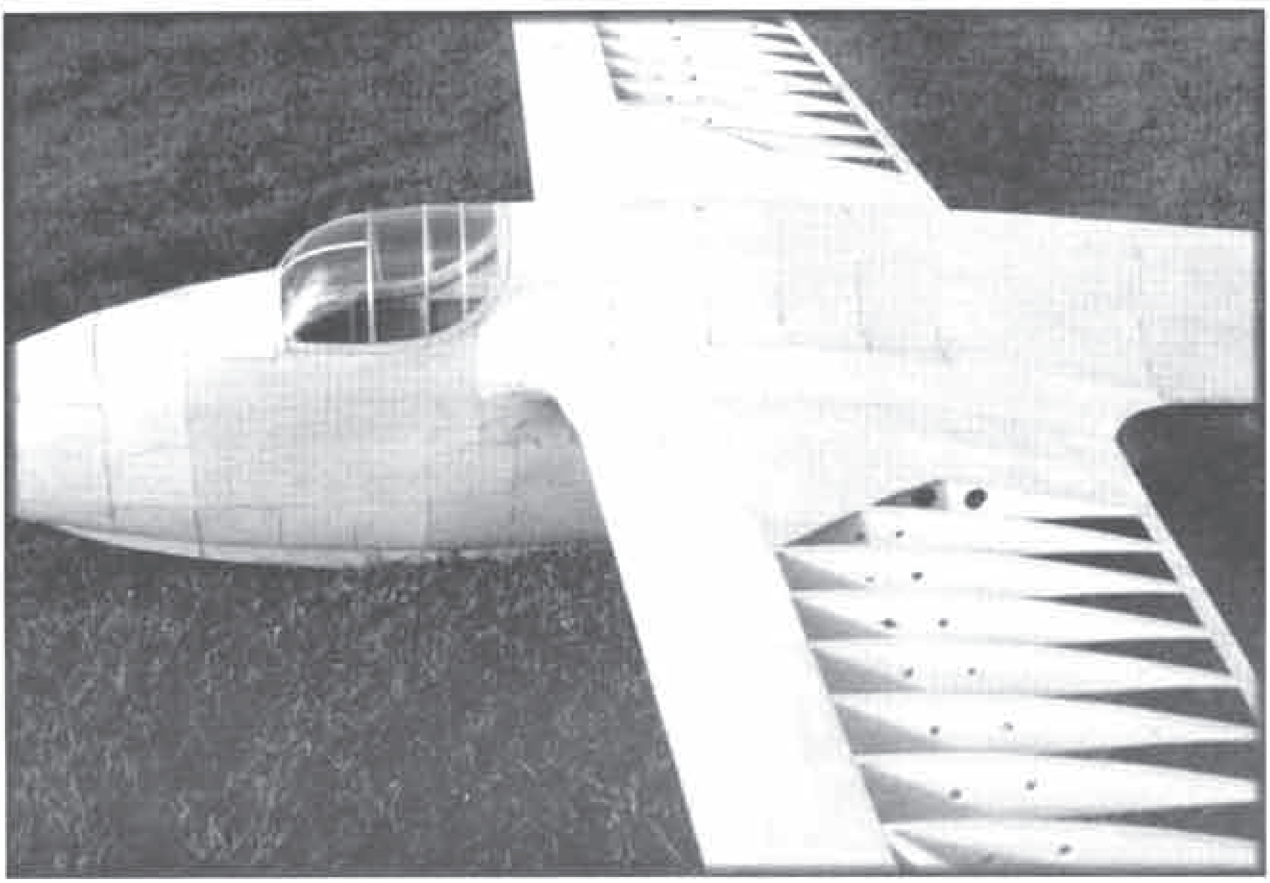
SCRATCH BUILT FAFNIR

...by Frank Oeste
Provided courtesy of Robin Lehman



The Fafnir was organized from plans by Hans-Jürgen Fischer, the guy doing all that wonderful aircraft documentation, from the magazine *MFI*.

The size is 1:4, 8 kilograms, 475 cm wingspan, all made out of balsa and plywood. The skin from the fuselage is 0.4 mm plywood. It was ironed with wood glue on the "spanten". Now, it is painted with clear color; then the electric has to be soldered and, in about 3 weeks, it will fly for the first time.