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# R/C Soaring Digest

*Radio controlled*

THE JOURNAL FOR R/C SOARING ENTHUSIASTS

R/C Radio controlled SOARING DIGEST

THE JOURNAL FOR R/C SOARING ENTHUSIASTS

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*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.

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## The Soaring Site

### THE WING IS THE THING (TWITT)

Things change, and the links to world wide web pages are no exception to the rule! And, sailplane folks are always looking for detailed information specific to whatever project they have in mind.

From time to time some of these requests center around flying wing and tailless aircraft enthusiasts and we refer them to our resident experts, Bill & Bunny Kuhlman, who are also members of TWITT, the subject of this month's editorial.

In checking out the TWITT web site recently at <http:/members.cox.net/twitt> we noted that it has been changed to <http://www.twitt.org>, and quite a bit of information is available for those of you interested in primarily full size information for application in model building. Since not all of you are on line, we thought we'd share a page from their web site which explains what TWITT is all about.

"TWITT came into being in June 1986 at Gillespie Field in El Cajon, California, as the brain child of co-founders Bob Fronius, Marc de Piolenc, Richard Miller and Hernan Posnansky. They took a basic idea for a tailless, high performance sailplane and gathered around them a small group of engineers, craftsmen and pilots who shared their fascination with tailless aircraft. They envisioned achieving high performance flight with a flying wing utilizing an electro-hydraulic control stabilization system to assist the pilot in flying at the extreme aft limit of the aircraft's center of gravity. It was anticipated this, when coupled with a flying wing's low drag coefficient, would result in significantly higher L/Ds. Their initial goals were to: promote the design and construction of tailless and all-wing airplanes; provide a forum for the exchange of ideas and experience through guest speakers and a monthly newsletter; assemble a technical library devoted to tailless aircraft, and; ultimately to build at least one powered tailless airplane and one high-performance tailless sailplane.

"In the fourteen years since TWITT was first formed, it has grown to a core group of more than 140 members in the United States, Australia, France, Portugal, Scotland, Argentina, England, Belgium, Italy, Germany, Saudi Arabia and Switzerland. The membership is comprised of all types of engineers, theorists, pilots, and model aircraft enthusiasts who share TWITT's common goals, including such notables of tailless flight as Dr. Karl Nickel, Peter Selinger, Don Mitchell (deceased), Al Backstrom, Bruce Carmichael and Dr. Paul MacCready.

"In 1989, TWITT became affiliated with the Hunsaker Foundation Incorporated of San Diego, a non-profit, public benefit corporation, placing it in a Federal and State tax exempt status. This was necessary due to the growing size of the organization and to provide a shelter for accumulating future financing through donations and grants to begin realizing the ultimate goal of constructing a tailless aircraft. Although this goal is no longer a reality due to the high construction costs and legal liability issues, the other aspects of the organization still remain and are quite active. This web page is an example of TWITT's continuing efforts to its members and other interested enthusiasts.

"TWITT holds bi-monthly meetings at its headquarters in Hanger A-4, Gillespie Field, on the third Saturday of the month at 1:30 PM, beginning in January of each year. The meetings have an average attendance of about 20 - 30 members and guests from throughout southern California. Each meeting includes at least one featured speaker whose presentation provides the membership insight into some phase of tailless flight or aerodynamic phenomenon related to the develop-

**Launch**

Evan Blackstone, from Shawnee, Oklahoma, launches into slope lift over Wilson Lake, Russell County, Kansas during Midwest Slope Challenge 1999. The glider is a Dave's Aircraft Works Schewiser TG-3, made of tough EPP-foam and designed as a slope and thermal trainer. It spans 71 inches and can be built as a polyhedral or aileron trainer version. Both Evan and his dad Harlan were taught to fly by George Voss of Oklahoma City. Evan needed only a few flights before he could fly on his own; truly a fast learner. Evan is a straight-A student and plans on becoming a doctor like his father, or a scientist. Photograph taken on Fujichrome 200 slide film with Minolta SRT-201 camera using a 90-230 mm zoom lens by Dave Garwood.

**A BOY & HIS DOG**

Gordy Stahl with RnR Synergy 5 and his Catahoula Lepord dog, Bogie.

ment of tailless aircraft. Throughout the past years speakers have included: Dr. Paul MacCready, Jack Lambie, Bruce Carmichael, Karl Sanders, Kermit Van Every, Bruce Hinds (B-2 Test Pilot), Barnaby Wainfan (Facet Mobile), Al Bowers (NASA Engineer) and Irv Culver (Culver Twist). Films, slides and hands-on activities are included whenever possible.

"In addition to the meetings, a 12-page newsletter is published each month which includes extensive details of the last meeting so the entire membership can share in the information exchange. The newsletter also includes letters discussing various projects, asking for advice, or sharing other relevant information. Technical data which has come into the library is also published and members are informed of any material which may be purchased from us or vendors who specialize in tailless flight. (See the classified section for a complete listing of what is available for your library.)

"TWITT membership is open to anyone interested in pursuing the goals of developing tailless aircraft to their ultimate capabilities or who simply want to learn more about flying wings.

"Membership is $20 per year, which covers the cost of publishing and mailing the newsletter. (The fee is $30 for foreign subscriptions.) An information package, including a recent issue of the newsletter, is available for $2.50 ($3.00 foreign), and back issues can be obtained for $1.00 each, and there are multiple copy discounts available through bulk mailing. We cannot accept credit cards at this time."

If you are interested in obtaining more information or in joining TWITT, the address is:

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Telephone: (619) 596-2518 (10am-5:30pm, PST) or
(619) 224-1497 (after 7:00 PM PST) or
E-mail: twitt@pobox.com
www.twitt.org

**Happy Flying!**
**Judy Slates**

## *Jer's Workbench*

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### Designing a Workshop

*"What is an ideal workshop?"*

That's a question I was asked recently. And, frankly, I don't know that there is a simple answer to that question. It varies based on personal taste and lifestyle. One model builder may be happy to work off of a coffee table in front of the T.V., while another may require at least 1000 square feet of working space chock full with work benches and power tools.

If I had to give you my best shot at what I think an ideal set-up would look like, my focus would be geared to the average builder, whether one who only buys ARF kits, or a scratch builder.

Space! Yup, the first thing we need is space. A spare room in your house would be nice, like an unused bedroom. Don't have one? How about a garage, basement, attic, old barn, or a utility shed? Approximately 10' by 10' should be large enough to accommodate a 6' by 8' workbench or table on which you can roll out a fairly large set of plans or design a 6' wing panel without banging it into the walls. And, good lighting is a must. So, I would suggest a 4', 2 tube fluorescent light overhead.

Now is likely a good time to stop, because there are likely way too many of you that absolutely can't find the space. Or, can you? Is your garage full of stuff that you absolutely have to save, just in case you need it some day? Do you have a guest room that only gets treated to a guest once or so a year? Well, we've moved twice in the last 10 years, and it's amazing how much clutter we accumulated over our lifetime. And, when one has to figure out how to get everything into a moving van, something has to go. Let me share some ideas as to how you might find that spare room.

Let's start with the garage. What boxes haven't been opened in the last 10 years? Is there a freezer or old fridge that don't work properly? Have you considered calling Salvation Army? A local thrift shop in your area, which are listed in the yellow pages? (Don't forget that if it's a charitable organization, you can likely write off at least part of your donations income tax time. Of course, be sure to check with the tax folks, first.)

Next, let's analyze an attic or a basement if you have one. Take a good hard look at what is stored, when was the last time you used any of it, and if it's simply gathering dust and taking up valuable space. You could have a garage sale or, if you don't want to be bothered, it's likely there's a church, rest home or shelter in your area, that will accept clothes, linens, etc.

There are also places that take used computer equipment, and we've donated some older stuff to a couple of local churches, one in Texas and another here in California.

It doesn't take much to clear up a few closets so that only important stuff has a home and, once done, it's time to evaluate the furniture and the amount of space it requires. For example, the guest bed could be replaced with a small hidebed couch. And, the workbench could be a folding table. Large dressers can be replaced with heavy plastic storage units that stack nicely in a closet or under a table. Roll around storage units can be used for small tools and the like.

So, where there's a will there's a way, unless you're living out of a motel room and on the road a lot, like Gordy. However, for those of you that haven't seen his vehicle set-up, you might ask him how he makes it work for him, designing and building sailplanes, not to mention writing every month!

Assuming at least a few of you are giving this some thought, the next step is assessing what would be required, next. First, a tool rack or a couple of shelves for tools and supplies. A roll around storage unit that we mentioned earlier would be nice. Or, if you have a closet that has been emptied that's even better. There are also portable closet units that can be purchased locally.

A waste basket and a small shop vac are a must, or one could find themselves knee deep in wood chips and sawdust. If you're in the garage, that's likely no big deal, but if you're in the house, you could find yourself knee deep in something else, instead!

Believe it or not, a model builder doesn't need a huge inventory of tools in order to build a model airplane kit. A few simple tools should get the job done, even though there are a lot of tools nice to have. Simple tools include: a model knife, razor saw, small clamp, bag of "T" pins, roll of masking tape, drill, pair of long nose pliers, and some sand paper.

I find that as my building skills have improved that additional tools are required. While some tools get used over and over again, other tools are only used once, tucked away in the bottom of a tool box, never to be seen again. Or, revived only on rare occasions.

Other small tools that I find useful are: screwdriver (long and short), wire cutters, tweezers, small square, scissors, soldering iron, dremel rotary tool, monokote iron, pencil sharpener, and a large tape dispenser, one that will hold a roll of masking tape.

Bench tools that are nice to have include a disk and bench sander, bench vise, bench grinder, small drill press, small table saw, and a scroll or band saw.

One thing to keep in mind, you need space to build in so, if you don't have a lot of room, take care when selecting any new tools.

When setting up a workshop, also keep in mind that things change. It may be necessary to move a workbench from one side of the shop to another, add more shelves, etc., in order to make the design more comfortable to work in. If it's comfortable, then you're sure to enjoy working there!

So, keep your workbench clean, your waste basket full, and have a great New Year!

■

The R-2, subject of a past construction article series in *RCSD*, at rest. Because of the relatively low aspect ratio and 100 inch span, it is relatively easy to see when at distance.

# on the Wing

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**Summer 2002**

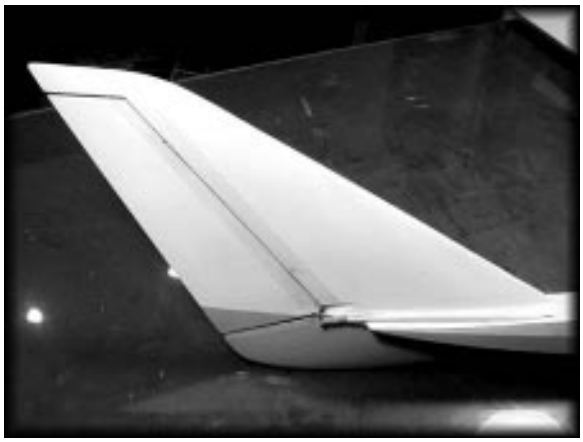
*Perfect weather from mid-May through much of October gave us an abundance of flying time this Summer. In addition to our experience with the hawk at the Howe Farm, described in the October issue, we identified a new visitor to 60 Acres. The additional flying time provided by the extended good weather was quite instrumental in getting our newly completed R-2 trimmed out and giving us the impetus to further modify our two meter Blackbirds.*

The Seattle Area Soaring Society field is located at 60 Acres, a King County park northeast and across Lake Washington from Seattle. A road divides the field into two parcels, with the north 30 acres devoted to youth soccer and the south 30 acres set aside as a multipurpose recreational facility. RC sailplanes, quiet electrics, model rockets, dog trials, and a variety of other activities are welcome there. SASS contests are scheduled for weekends, and the club has reserved Wednesdays during daylight savings time as "open field" evenings when the club winch is put out and instructors are available for flight training. Turnout on Wednesdays is always impressive and sometimes quite astounding. Despite a long drive around Puget Sound, we managed to get out and fly at the field nearly twice each week.

**The 60 Acres Harrier**

Raptors are a relatively common sight at 60 Acres. The field itself is adjacent to a small river, and the valley floor in the area is populated by various types of trees and shrubs, wild Himalayan blackberry bushes, and mowed and cut grass areas. The surrounding hillside is covered with trees and homes. With populations of snakes, insects, small birds, mice and other small rodents, it's a perfect site for hawks and other predatory birds to set up housekeeping. It's not unusual for 60 Acres RC sailplane pilots to steer their aircraft toward thermals already identified by circling hawks or fluttering swallows.

A Hitec HS-81 servo drives the rudder. It's mounted on a lightweight plywood platform so the pushrod follows a straight line back to the rudder control horn.



The right side of the completed fin and rudder assembly. The pushrod is outside the fuselage for nearly seven inches. Some time in the future a fairing will be constructed to cover nearly all of the exposed portion.

One Wednesday evening toward the end of Summer, a new arrival appeared. Rather than flying over the trees and circling in thermals, this raptor stayed very low to the ground and concentrated on the grassy area just east of the middle of the field. Instead of flying in a straight line, the bird seemed to follow a meandering course, frequently doubling back and at times hovering into the wind perhaps 25 or 30 feet above the ground. Every so often he would fold his wings upward and dash toward the ground talons first. Although we never saw him actually catch anything, it was obvious that he was searching out the visible members of the resident rodent population.

Once back home, the Audubon book in our library confirmed our initial Northern Harrier field identification. The Northern Harrier is a small falconiforme which uses a different hunting method than other members of the family. In contrast to the others, it uses its hearing more than its sight when hunting, and is known to travel up to 100 miles per day in search of food. It's one of the most agile of the raptors as well. Little wonder the McDonnell Douglas AV8-B/BAe GR3 and GR5 received the "Harrier" name.

**The R-2**

Our R-2 was completed earlier in the year, and was ready for flight testing as soon as 60 Acres dried out enough from our seasonal rains to allow cars on the field. Bill Henley, experienced RC flyer, helped us get the initial CG location and control surface throws established. The control throws were then adjusted over many test flights until we had what we considered to be the best feel. The aileron throws, for example, were set up so full deflection roll rate was as rapid as possible without producing excessive drag. The aileron to rudder mix was adjusted so nearly perfect coordinated turns could be made using the right stick only.

We had originally thought the R-2 was a floater, but that notion was dispelled as we got more experience flying in wind. It proved itself fully capable of flying upwind in stiff breezes and getting back home after going downwind in pursuit of thermals.

After final tweaking, we offered the transmitter to Sherman Knight, SASS test pilot and computer radio guru. He was ecstatic over its performance, and once on the ground talked David Beardsley, another resident expert pilot, into taking a turn at the sticks. David took over the controls immediately after launch and headed toward the southwest corner of the field where a couple of composite ships were scratching for height in a light lift thermal. Dave flew into the thermal 50 to 100 feet below the two gliders already circling and in four turns was above them by the same difference. He was more than impressed! Giving a bit of down elevator, he came across the field diagonally and found another thermal near the hillside. Tight circles, figure eights, stall turns... Dave did it all while actually gaining height. Aside from desiring some method of glide control for landing, all of Dave's comments about the flight were overtly positive.

A number of other SASS members and visitors to the field flew the R-2 over the course of the Summer. Word quickly spread that the R-2 was deceptively easy to fly and offered excellent performance for a balsa, spruce and plywood sailplane with open bay construction.

The included Table provides the final end of Summer CG

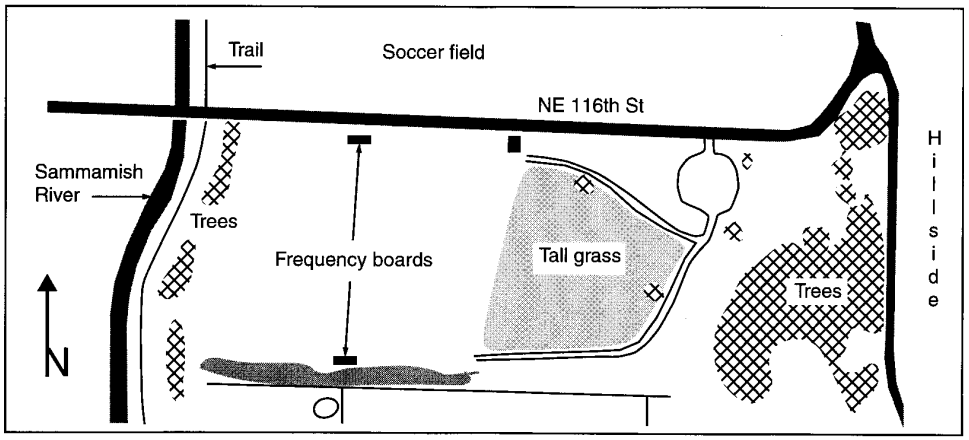
The left side of the Cebu fin after modification to install a moveable rudder. The rudder can move 45 degrees to each side. The hinge gap is sealed with mylar held in place with double sided tape.

To achieve 45 degrees of rudder deflection, portions of the fin and sub fin had to be removed for clearance of the various control system components. These cutouts are in areas of very turbulent flow, so the additional drag is probably negligible.

R-2 Control Surface Deflections

| Control Surface | Deflection |
|---|---|
| Ailerons | |
| up | 1.0 inch at root (3.25 inch chord) |
| down | 1.0 inch at root ( " ) |
| Elevator | |
| up | 1.25 inches |
| down | 1.25 inches |
| Rudder | |
| direct from Tx stick | 2.0 inches each side |
| mixed from ailerons | 1.75 inches each side |

CG at 4.5 inches behind leading edge at wing root.




and control throw schedule for the R-2.

**The two meter Blackbirds, "Galah" and "Cebu"**

In addition to consistently flying the R-2, we and a large number of others put a lot of flight time on our two Blackbirds — the one built for our trip to Australia in 1993 ("Galah") and #7 ("Cebu"), completed last year and subject of a series of articles here in RCSD. The Blackbird was originally designed with both of the servos located within the fuselage. Long sleeved push-pull cables linked the servos to the control surfaces. The hinge line for the elevons is set back so that a contoured leading edge of the control surface is inserted downward into the air flow as the surface is deflected upward. This was done in an effort to reduce adverse yaw, as there is no rudder.

Moving the servos out into the wing eliminated the slop in the control system, but the Frise-type elevon seemed to create a large amount of unnecessary drag while thermalling with up trim, and grass and other debris always had a way of getting into the gap between the wing and the control surface. As a result, the Blackbird version taken to Australia had simple top mounted fabric hinges. Until recently we felt that adverse yaw was not much in evidence. The latest, Cebu, has bottom mounted fabric hinges, but adverse yaw was not a big problem if the control surface movements were coordinated properly. But by the middle of Summer we had established that the flight characteristics of both aircraft would be dramatically improved with the addition of a moveable rudder.

We cut into the fin area so that the rudder hinge would be at about 50% of the local chord, the sub fin would retain enough structure to be able to withstand landing abuse, and the top of the rudder would be set back from the tip of the fin. The addition of some sheet balsa and scrap plywood sealed off the open edges of the control surfaces and formed the hinge line, and standard Goldberg hinges were then mounted on the centerline to allow 45 degrees of deflection in both directions. The rudder planform and pushrod linkage can be seen in the included photos.

Although the hinge line is severely swept back, there is no discernible effect on pitch when the rudder is fully deflected. Rudder function is slaved to the aileron channel in addition to being freely controlled by the transmitter rudder stick. Once in a tight turn, rudder deflection alone can straighten out the flight path within about one and a half turns. The aircraft cannot be flown by rudder alone as there is not enough dihedral, but the rudder deflection does eliminate any remnants of adverse yaw and helps maintain heading during approach. The latter is particularly evident while making our now standard cross-wind landings. In a contest where there is a two servo limit, the rudder can be taped in its neutral position. For fun flying or AMA two meter competitions the moveable rudder makes flying a pleasure.

**On the 'boards**

Our experience with the two meter Blackbirds has been so successful we are currently performing surgery on our old XC Blackbird. Additionally, another XC 'bird which is currently under construction will have its fin contour modified to eliminate the swept hinge line of the rudder so a pull-pull cable setup can be more easily installed. This new XC 'bird, the eighth Blackbird we'll have built, will also be the first to have flaps installed. Watch for a series of articles to be printed in future issues of *RC Soaring Digest*. And now that we have all of the templates and molds necessary, it also looks like a new flapped R-2 may be in the future as well.

In all, it was an exceptionally exciting Summer. We got to see a Northern Harrier in action.There was a lot of time for flying and testing, sufficient time for some airframe modifications to be accomplished in the workshop, and enough ideas for construction projects to last the winter. The highlight of the Summer, however, was to witness so many people taking the opportunity to fly a tailless airplane for the first time and having so much fun doing it!

Suggestions for future columns can always be sent to us at either P.O. Box 975, Olalla WA 98359-0975 or <bsquared@appleisp.net>.

A full color aerial photo of 60 Acres south can be found at: <http://aol.globexplorer.com/gexservlets/gex?encrypt=aGU8MzExMTExMDIxMCdtcjwwJ2JsZTxpbGBxJ3l0bTwsMDMzLzA1NDUneHRtPDU2LzYxNjQ4ODg4ODg4ODg4OCd5bXM8LDAzMy8wMjUneG1zPDU2Lzc4OTQ4ODg4ODg4ODg4ODg4ODdodjw1ODgnaGk>

■

# Who Put the Ding in Landing?

Phil Bauer /Fremont, CA /philkaybauer@aol.com

### *There is one thing for sure. We always land.*

How we land is another thing altogether. Lets break down the possibilities (bad choice of words.) Sometimes we are in control, and sometimes it's just gravity. Since it takes people like Isaac Newton and Mr. Foster (my high school physics teacher) to understand what makes gravity work we shall limit the scope of our inquiry to stuff we more or less can understand and control. This leaves two choices: the "scale" landing in which you attempt to look like a "real" sailplane, touching down smoothly and then bouncing along on a single, tiny wheel over dirt clods and (if you're lucky) grass; and the "dork" technique. The dork was probably named after the sound a sailplane makes when it is stuck into the ground at high speed, although some people believe it is named after a personal body part.

Assuming we have a level of skill that lets us choose one of the two controlled landing options, let us examine what we can possibly be thinking of as we twiddle our sticks and shift uncomfortably while we wait for impact.

### *The Scale Landing*

People who favor this style of landing probably imagine that they are really in the toy plane. Their models tend to be scaled-down actual sailplanes, researched and built with minute attention to detail ...right down to a tiny pilot figure with a firm jaw and the eyes of an eagle, unless you couldn't locate your glasses the day you painted the eyes in which case they may be at different heights on the facial part of the figure, giving him the firm-jawed "elephant man" look. I personally believe that "scale" landings were named after the act of weighing things, such as: how much would it cost to take actual flying lessons; buy a real sailplane and get eye transplants versus buying a radio-controlled model. People who like scale landings occasionally get very upset when they think of how much it would cost to fix their plane after attempting a "dork." I can think of two reasons for their attitude: first, all the work they put into making a perfect replica of the real thing would be spoiled and second, they probably spent all their time making a perfect replica and not practicing landings (let alone flying) so they are scared stiff to begin with.

### *The Dork Landing*

"Now, now" you say. "You have written such probing, clinical insights into Scale Landings, how is it possible to be so well-balanced a person that you can explore 'The Dork Side' with equal, dispassionate intellect?" To this I say: "watch me." The "dork" is supposed to be the last phase of a competition landing. The other phases are (in order:) *timing, alignment, down-wind leg, approach, wet leg, crowing and flapping.* If you do everything just right, the nose of your plane ends up exactly where it is supposed to be at precisely the correct time with a little thump of quiet authority. Of course nobody except Joe Wurtz can do this, so over a flying season your high-precision, space-age, dream machine is systematically reduced to the equivalent of Bondo-encrusted '85 Monte Carlo ...and skillful women of the Czech Republic have ensured employment in the converted MiG factories where they construct next season's dork objects.

Hopefully, the above will cause a lot of healthy discussion about the correct way to land your sailplane. I realize that some will be offended by these blunt and penetrating facts, and their gender-specific nature. If you find yourself among this group, simply substitute "his/her/its" for any all-male reference except "dork" in which case you're on your own.

# "The Sloper's Resource"

By Greg Smith of slopeflyer.com
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http://www.slopeflyer.com

Dave Hauch and Rob Hurd, seen modeling the latest in Midwest slope gear, at an early spring flying session, Wilson Lake, Kansas.

I started off thinking this month's column would just be a review of Katie Kaufman's Mongo Transmitter Mitt but I thought cold weather flying, especially slope'n, could use a bit more coverage. (I'm still not sure about the sloping vs. slope'n debate, but Dieter at ShredAir got me thinking about it so I am going to try the slope'n version for a bit and see if it grows on me. Got an opinion? Let me know!)

On with the show!

Here in the Midwest if we don't fly in the cold weather we lose half or more of the available flying days. I hate to lose any days, let alone half the year! Here are a few items for cold weather sloping that we have found to be indispensable.

### The Mongo Transmitter Mitt

This is really simple. If you fly in the cold, you gotta get one of these.

Keep your hands warm and your transmitter dry with a mitt like this. It is made with a tough nylon shell and a polarfleece lining. Not only does the mitt cover your hands, it completely protects your transmitter too! No more worrying about those stray rain drops damaging your expensive radio. The mitt has a huge window built in so you can easily see your display and trim tabs.

During a day of flying at the Big M near Platteville, WI, Madison sloper Clayton Greaves commented on how the window on the front magnifies the sun and really heats things up in there. If you brave the cold to fly, this is a sure way to keep the fingers nimble.

Here is Milwaukee slope pilot Jeff Fremder's experience with the Mongo Mitt:

> "I've been using Katie's Mongo Mitt available for about $30 from Katie at http://www.fatlion.com/bash/mitt.html for the last two years. Our warm weather season is short here in Wisconsin and the mitt allows me to fly without gloves and maintain sensitivity on the controls. It is well made of rip stop nylon, with a soft polarfleece lining, in your choice of colors. I believe they are made to order, mine took about ten days to arrive.
>
> "Previously, I had been using light gloves with the thumb and forefingers cut out, but have found I can fly comfortably, a lot longer, with the Mongo Mitt.
>
> "I have learned that keeping your radio warm until just before use improves battery life and your comfort level holding it inside the mitt. You can either keep your radio in a warm location, or stick one of those throw-away chemical hand warmers in the mitt.
>
> "Launching requires some finesse. While the openings in the Mongo Mitt allow easy insertion of your hands, it's not something you can do in a hurry. You also have to cut out a hole for a neck strap, if you use one, and enlarge the antenna hole if you have a rubber ducky. It fits any transmitter I have tried. I have found it performs well, all the way down to zero degrees Fahrenheit."

Katie Kaufman's Mongo Mitt is indespensible for cold weather slope'n.

Dave Hauch, Michigan sloper extraordinaire, had this tip on how to keep the Mongo Mitt open so it is easier to slip your hand in after launching:

> "I sewed completely around the cuff about a 1/4" up from the bottom, cut a slit at one end and slid a piece of hard plastic tubing in and sewed up the slit. I bought the tubing at a hardware store, like the stuff they use for compressed air, and it comes on a reel, so it has a natural circular bend to it already."

Thanks Dave and Jeff for your comments!

For more info on the Mongo Transmitter Mitt, e-mail Katie Kauffman at: katikauf@hotmail.com

**Goggles**

Blowing snow, well, blows! That kind of wet stinging feeling can reek havoc on your ability to see, the gray sky really cuts down on contrast and the bright, white snow blinds you. Fortunately we are not the only goofs out in the cold in the winter and good ski goggles can make the difference between an enjoyable day flying, or a crashed ship. I went for the copper, contrast-enhancing color and found a pair of Oakleys that fit over my glasses well. I love 'em and I'm betting if you fly slope in the cold, you will too.

**Balaclava?**

No, not Baklava, the Greek (or other Balkan state) dessert, but balaclava which is essentially a sock for your head that covers your neck and has a hole cut out for your face. Indispensable in the wind, these things really help make flying in the cold bearable. I found mine at a local bike shop.

**A Foamie**

I know, I know, but there are legitimate uses for foamies besides combat and cold weather is one of them. Glass ships seem to become more brittle in the cold and the combination of gloves or hands in a mitt means that your control may be a bit hampered so I use a DAW Mustang and a Gulp for a lot of my winter flying.

**Other tips:**

**Layer your clothes**

Polypropylene long underwear works great. Skiers use them, football players use them and warm slopers use them. If you toss in a polarfleece inner layer with a good, wind-proof shell over that you will go a long way towards being comfortable in the wind and cold. Don't forget the wind pants!

**Walk around a bit**

There is often a spot on the slope where the wind will not hit you hard or, in some cases, at all. Steeper slopes work better for this, otherwise find a bush! If you can't find a spot that is protected, at least walking around some keeps the blood flowing.

**Be careful where you land**

Foamie or Glass, sailplanes sure do slide a long way on the snow. Landing on the face of the slope here, without the summer covering of brush, can mean a long walk to get a ship that has skittered down the slippery slope. Imitating Franz Klamer, sliding down the side of a hill after a plane, is not my idea of fun!

**Talk after the flying**

Finally, we are from Wisconsin so after a cold day on the slope, we have been known to warm up at the pub where we can talk planes and look at the snow!

If I didn't mention this before, or you haven't seen it yet, the slopeflyer.com site got a major overhaul and now incorporates a content management system. The CMS allows you folks living large on the slopes to add content to the site. Post a review of a favorite slope or plane, give fellow modelers a tip or just write about slope'n. If you would like to know more about how you can post to the site anywhere you have access to a computer and an Internet connection, please contact me at greg@slopeflyer.com and I will fill you in.

There you have it, don't know what next month will bring yet, but I can assure you it will be about sloping. ■

**This month's links:**

ShredAir – http://www.shredair.com

Katie Kaufman's Mongo Mitt - http://www.fatlion.com/bash/mitt.html

Daves Aircraft Works - http://www.davesaircraftworks.com

Steve Drake's Gulp – stevedrake@aol.com

# TECH TOPICS

Dave Register
Bartlesville, Oklahoma
regdave@aol.com

**Planform Optimization for Hand Launch and Discus Launch Gliders, Continued**

Picking up from last month, we'll continue our review of planform optimization for Hand Launch and Discus Launch Gliders (HLG, DLG). The driver for this study is to get a better feel for the appropriate aspect ratio (AR: wing span/average chord) for a good DLG design.

Previous work in this column reported a value of ~ 10 as pretty good for a 2 channel HLG (javelin launch). In that case we dealt with a total glider weight of ~ 8 oz. using the SD7080 airfoil.

DLG designs require a bit more beef in the wings and fuselage to survive the launch stresses which can reach upwards of 80Gs. They also require somewhat larger vertical stabilizers for yaw correction of the spin and yaw-roll coupling at the moment of release. Additionally, we're seeing more control surface functionality (flaps, ailerons).

All of these factors add to the total weight of the sailplane. Coupling this with another trend - the move towards thinner, lower lift airfoils using laminar flow and we've got several interesting twists to the earlier problem.

Last month we developed the basic input data for the project. Using Prof. Mark Drela's X-Foil code, we calculated Cl and Cd data for the SA7035 and AG12 airfoils as a function of Reynolds number (Re - Eppler's notation). The SA7035 represents the general class of airfoils used a few years ago for HLG while the AG12 represents the newer class of airfoils used for DLG.

The Cd vs Cl curves are repeated here as Figures 1 and 2. As noted, the drag bucket is wider and the Cl is higher for the SA7035. But the AG12 is definitely better behaved in the lower Re range which is important for the cruise and thermal stage of flight. At high Re and low Cl (launch conditions) the Cd values for both sections are comparable.

Since we're going to perform a polar analysis (sink rate vs horizontal velocity over the flight profile of the sailplane), we need to make some consistent assumptions about weights, moment arms, fuselage area and empennage. That data is summarized in Table 1 for the HLG case and Table 2 for the DLG case. Three differences should be noted:

## Table 1: 2 Channel HLG Values

| | | | | |
|---|---|---|---|---|
| Aspect Ratio | 6 | 8 | 10 | 12 |
| Avg Chord (in): | 10 | 7.5 | 6 | 5 |
| Wing Area (in^2): | 600 | 450 | 360 | 300 |
| Vertical Stab (in^2): | 40 | 30 | 24 | 20 |
| Horiz Stab (in^2): | 97 | 55 | 35 | 24 |
| Empennage Weight (oz): | 1.16 | 0.72 | 0.50 | 0.38 |
| Wing Weight (oz): | 7.50 | 5.63 | 4.50 | 3.75 |
| Total Weight (oz): | 12.6 | 10.2 | 8.9 | 8.0 |

Assumptions:

| | | | |
|---|---|---|---|
| Servo (0.35 ea): | 0.7oz. | Receiver: | 0.4 oz. |
| Tail Areal Density: | 0.0085 oz/in^2 | Wing Areal Density: | 0.0125 oz/in^2 |
| VVC: | 0.055 | HVC: | 0.40 |
| Boom Length:: | 24.75 in. | Number of Servos: | 2 |
| Fuselage/Linkage): | 1.2 oz | Battery (225 NiCd) | 1.6 oz. |

## Table 2: Multi-Channel DLG Values

| | | | | |
|---|---|---|---|---|
| 2 CHANNEL: | | | | |
| Aspect Ratio | 6 | 8 | 10 | 12 |
| Avg Chord (in): | 10 | 7.5 | 6 | 5 |
| Wing Area (in^2): | 600 | 450 | 360 | 300 |
| Vertical Stab (in^2): | 40 | 30 | 24 | 20 |
| Horiz Stab (in^2): | 97 | 55 | 35 | 24 |
| Empennage Weight (oz): | 1.29 | 0.81 | 0.57 | 0.44 |
| Wing Weight (oz): | 9.72 | 7.29 | 5.83 | 4.86 |
| Total Weight (oz): | 15.9 | 13.0 | 11.3 | 10.2 |
| 4 CHANNEL (add 0.9 oz for 2 servos and linkage): | | | | |
| Total Weight (oz): | 16.8 | 13.9 | 12.2 | 11.1 |
| 6 CHANNEL (add 1.8 oz for 4 servos and linkage): | | | | |
| Total Weight (oz): | 17.7 | 14.8 | 13.1 | 12.0 |

Assumptions:

| | | | |
|---|---|---|---|
| Servo (0.35 ea): | 0.7oz. | Receiver: | 0.4 oz. |
| Tail Areal Density: | 0.0085 oz/in^2 | Wing Areal Density: | 0.0162 oz/in^2 |
| VVC: | 0.075 | HVC: | 0.40 |
| Boom Length:: | 24.75 in. | | |
| Fuselage/2 Linkage): | 1.7 oz | Battery (225 NiCd) | 1.6 oz. |
| Add'l Servo/Linkage: | 0.45 oz. | PiezoGyro: | 0.5 oz. |

Figure 1: Cd vs Cl: SA7035 - X-Foil Data

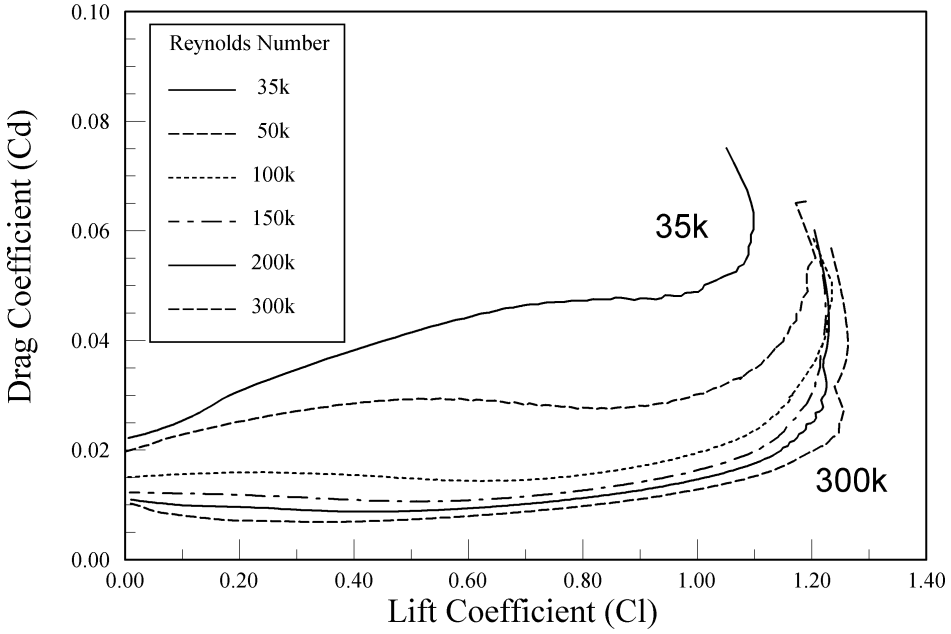
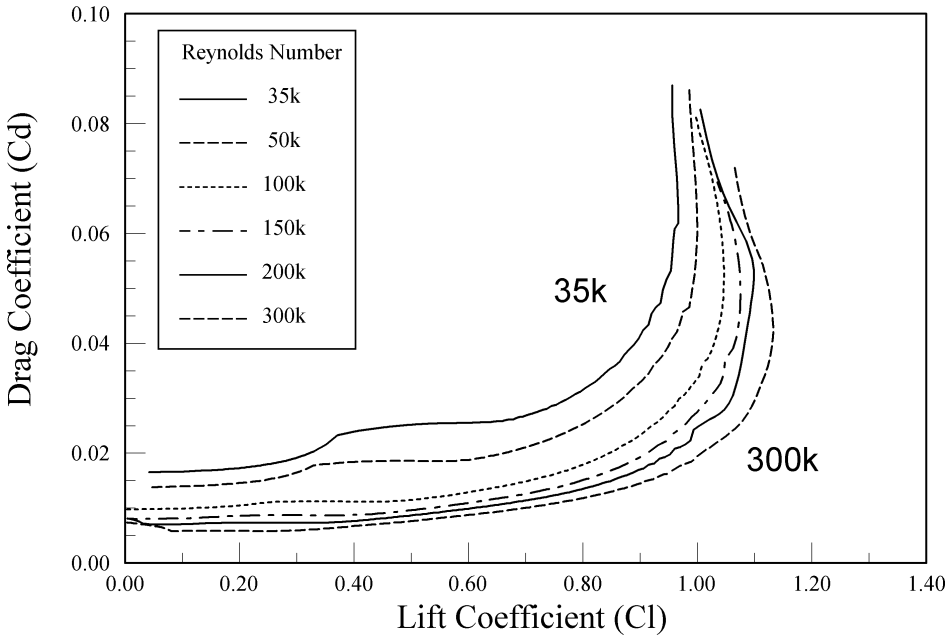



Figure 2: Cd vs Cl: AG12 - X-Foil Data




1) The wing area density is higher for the DLG. This represents the stronger construction needed for this case,

2) The vertical (rudder) volume coefficient (VVC) is larger for the DLG. This represents the sub-rudder contribution needed to maintain good initial launch trajectory, and

3) The fuselage weight is higher for the DLG. This is the added structure needed to withstand high G launches as well as the piezoelectric gyroscopic stabilizer circuit (lingua franca: piezo or gyro) used for launch control.

Please note that my definition of VVC is:

VVC = (Av * Dm) / (Aw * S/2)

where Av is the vertical stabilizer area, Dm is the moment arm (º chord wing to º chord stabilizer), Aw is the wing area and S/2 is Ω the total span (30 inches in this case). Some definitions for this volume coefficient may use S rather than S/2 so be sure you know which is being used by the particular author.

The numbers are taken from a series of HLG designs I've built over the past several years. That basic design was converted to DLG. Some trial and error (Umm, that really means wreckage!) resulted in the extra structures that I needed to add to keep things in one piece. You may be able to build lighter and stronger so we'll guesstimate from this work what the likely trends could be as a function of weight.

In Table 2 we've done the SA7035 DLG only for a 2 channel ship. Since the AG12 works well in this example, we've added estimated weights for 4 servo and 6 servo cases to see how wing loading affects things with this airfoil.

Comparing polars for the simple HLG case, we've plotted the results (Figures 3 and 4) for AR of 6, 8, 10 and 12. Although this may seem an extreme range, some craft have been made at the 7 end while a few have been flown at 11 or slightly higher. So we're bracketing the wing planform values actually used at the field.

For HLG, good minimum sink is very important. But it's also important to achieve that at a relatively low speed so you can linger longer in a light thermal. Additionally, you'd like to be as efficient as possible when you're cruising around so a good Lift to Drag (L/D) ratio is also desired.

In the earlier work with the SD7080, the UIUC database was used for Re dependence. Since this data ended at 60k, and the higher aspect ratios require values down to ~ 35k, a linear extrapolation of that data was made to the lower range. As can be seen in Figure 1, below 50k a linear extrapolation of Cd with Re is not appropriate. Consequently, the poorer performance of the SA7035 at AR = 10 and 12 is likely due to the high drag at low Re exhibited by this section.

For the AG12, an aspect ratio of around 10 appears to be a reasonably good optimum. However, anywhere in the 8 to 10 range is probably indistinguishable in practice. So I would conclude that using the older large

plane airfoils should tend towards the low end of this range to avoid poor Re performance. The more recently designed laminar flow sections can still perform well at the upper end of this aspect ratio range.

What's interesting to note is that the polars all become broader as an inverse function of Re at higher speeds. Although not shown here, this is the opposite of the tendencies for this same type of calculation for open class ships. For the HLG/DLG wingspan, a high aspect ratio apparently produces poor performance in the intermediate speed range due to Re scaling. For open class ships it appears you are above a critical Re value for these problems and higher aspect ratios are generally favored over the entire speed range.

If we look at an expanded speed range for the AG12, we find that the curves indeed cross over to the expected tendency at speeds in excess of 65 ft/sec. This is shown in Figure 5 only for AR 6 and 12 to keep the graph from being too cluttered. I hope this emphasizes the need for careful consideration of Re effects at the scales encountered with HLG and DLG designs. This factor is not nearly as critical for open class ships.

Turning our attention to the DLG weight class, for the two channel configuration, the polar is shown in Figures 6 for the AG12. Although the increase in weight is only a few ounces, it tends to shift the optimum performance to a slightly lower aspect ratio. This trend favors both Re and wing loading and suggests that a value of ~ 9 may be a good choice.

For the DLG case we can now add two more parameters for evaluation - the estimated launch height and the estimated flight time at minimum sink. These numbers are derived from a launch height calculation which is coupled to the polar program and uses the calculated drag coefficients derived from the polar evaluation. To arrive at these numbers, an estimated release velocity and launch angle is assumed to calculate the launch height. The flight time is then the sum of the launch time and the value for the height divided by the minimum sink rate.

Figure 3: HLG Summary - SA7035 Airfoil

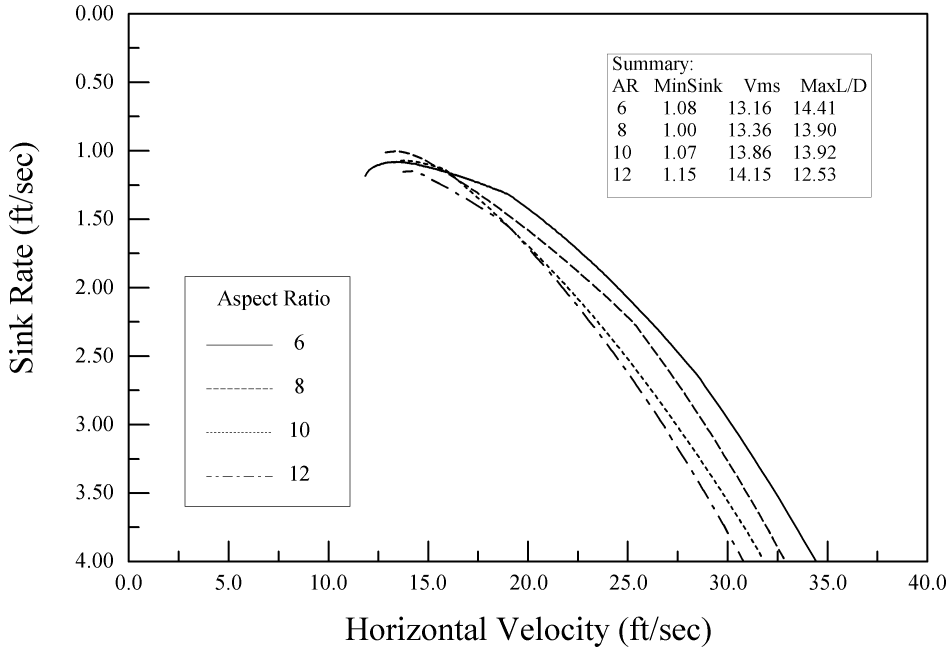
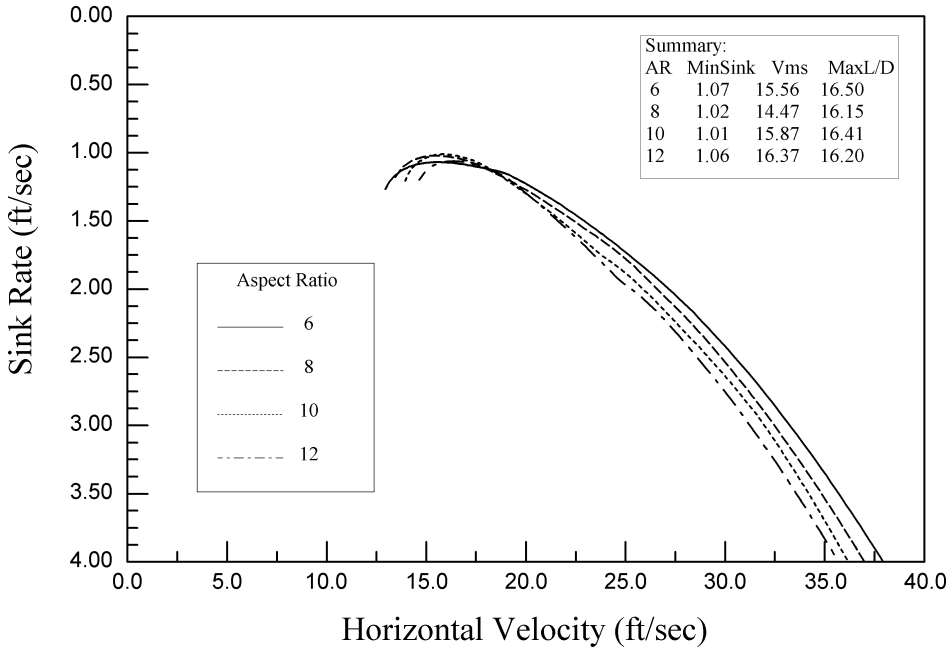



Figure 4: HLG Summary - AG12 Airfoil




For this study, the launch angle is 70 degrees and the release velocity is 65 ft/sec. The results will roughly scale with initial launch velocity. The launch height for a given velocity is not much changed for angles > 60 degrees. So these are conservative, but practical numbers for sport flying.

It is notable that the launch heights are all comparable for most cases but the flight time varies somewhat more widely. This is mostly in response to the change in minimum sink. Comparing these values with the minimum sink and max L/D terms we also find an optimization somewhere between 8-10 for the aspect ratio.

In Figures 7 and 8, the polars for the AG12 for a 4 servo and 6 servo estimated ship are also shown. There are subtle differences as the weight is increased. The minimum sink, max L/

Figure 5: Re And AR Effects - AG12 Airfoil

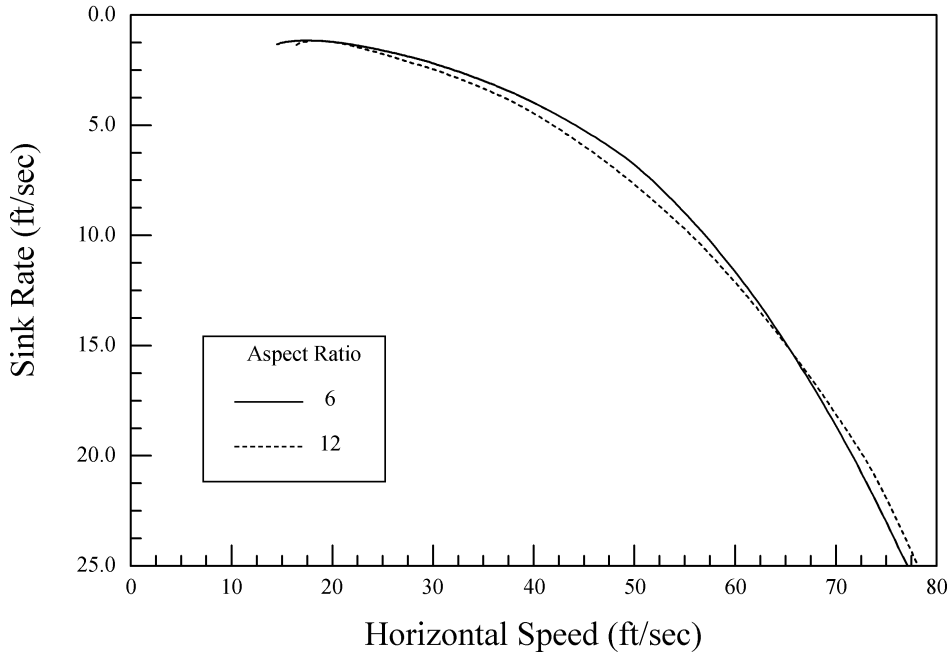
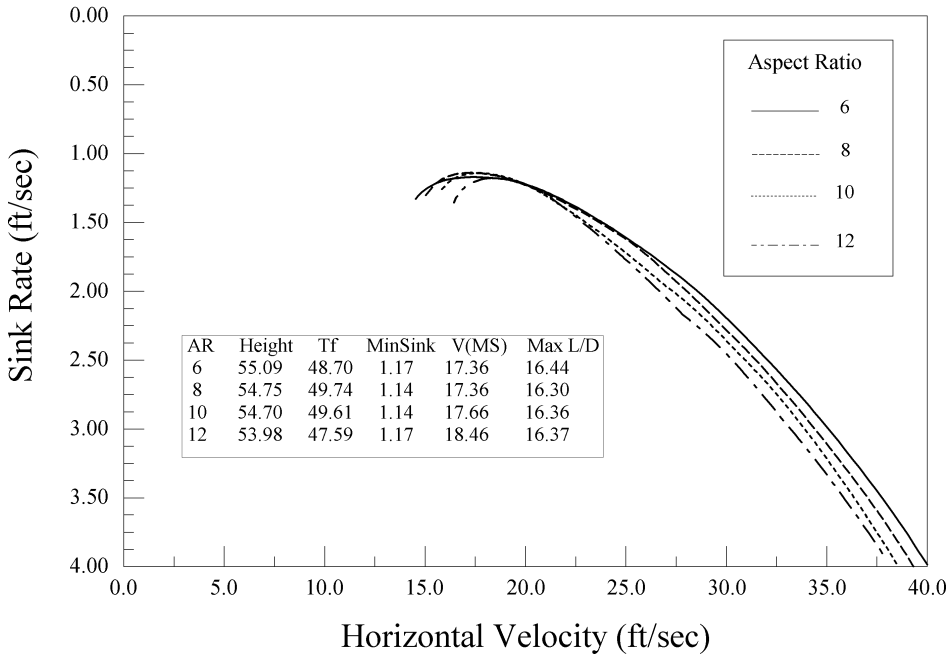



Figure 6: 2 Channel DLG - AG12 Airfoil




D and flight time values optimize around an aspect ratio of 8 at the higher weight. So we can conclude that a heavier plane probably favors a somewhat lower aspect ratio. However going much below 8 does not seem to offer any significant advantage - unless you build somewhat heavier than I do.

Although the changes appear subtle, a final comparison of a subset of this data is shown in Figure 9. This plot compares the polar and associated key flight parameters, for the 2 channel and 6 channel DLG. Here we see that the 2 channel DLG in straight flight will generally outperform the 6 channel estimation for minimum sink, total flight time and efficiency as seen in the max L/D value.

In the heat of battle (contests) the added functionality of the multi-function ship very likely has the advantage by increasing effective camber for light air conditions and using reflex for launch and moving around in the wind. But for the simple pleasures of sport flying, there is no disadvantage (and maybe even an advantage!) to keeping it real simple. The case of flaperons may be a very nice compromise for contest conditions (4 servos).

As a reality check on the overall results, an AR of 8 converts to about 450 sq.in. wing area while an AR of 10 gives 360 sq.in. In prowling the web for present day designs, I find that most ships bracket the 350 sq.in. to 420 sq.in. range. One could claim Q.E.D. and leave it at that. But why should one celebrate about predicting the obvious?

Well, if these calculations had said that an AR of 16 is great for a 4 channel DLG, they wouldn't have much credibility. Since the results do seem to match with reality, we can continue to use this as a tool to simulate performance for conditions we haven't yet tried (different airfoils, details of wing layout, etc.). Ultimately, the proof is at the flying field, but studies like this can provide some confidence in the expected performance of untested configurations.

I also like knowing that for just messing around, a properly designed two channel ship with a real light sport type radio (Hitec III, for instance) is probably going to give me just about as much performance as a top end multi-function sailplane. Now I wonder what would happen if I change the base airfoil to increase camber for the higher wing loading? Do I get back to a somewhat higher aspect ratio? Sounds like another study is developing here. Let's look at that next time.

Until then, hope you've had a happy holiday. Remember that flying something is a whole lot better than flying nothing so have fun and don't sweat the details too much!

(Figures 7-9 are on the next page! Ed.)

■

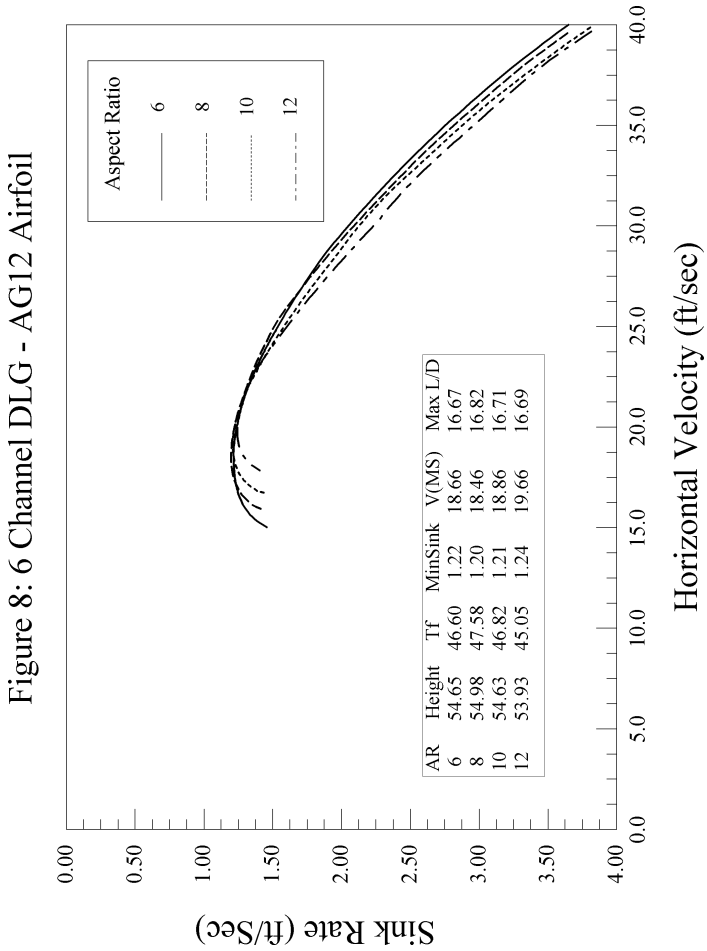



Figure 8: 6 Channel DLG - AG12 Airfoil

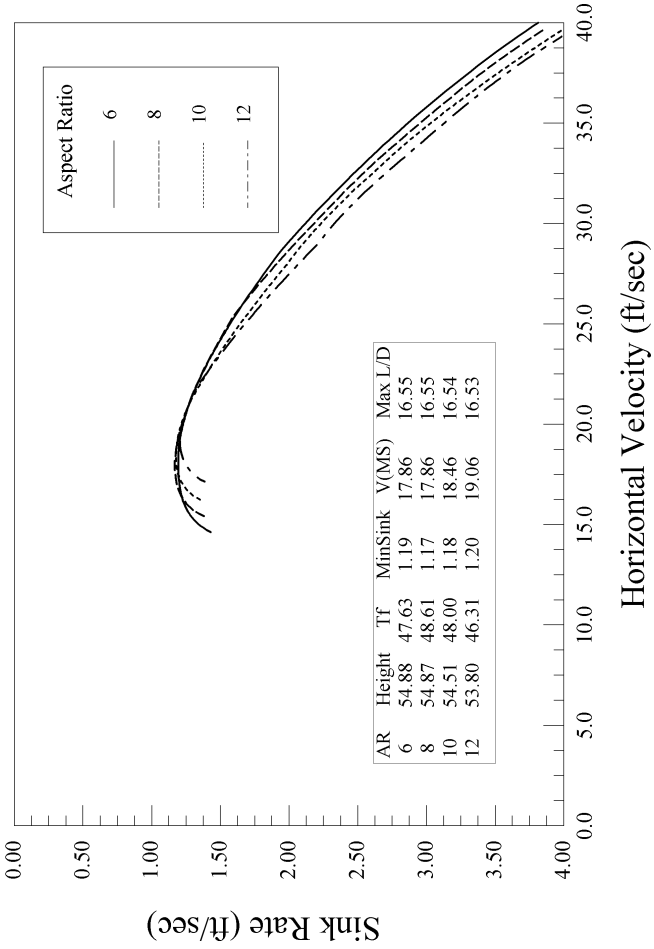



Figure 7: 4 Channel DLG - AG12 Airfoil

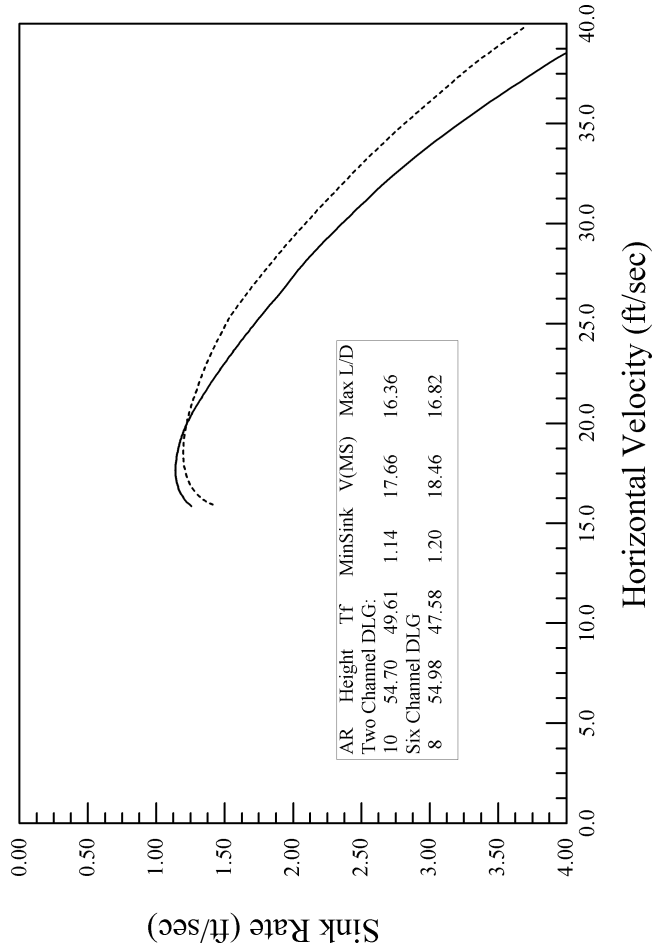



Figure 9: Optimized Planform Results - AG12 AIrfoil

## SCHEDULE OF SPECIAL EVENTS

**February 1-2, 2003**
Southwest Classic Phoenix, AZ

**March 15-16, 2003**
The Classic Mid-Winter Southern California
Torrey Pines Vintage Sailplane Regatta
http://www.agcsc.org

**May 15-18, 2003**
Midwest Slope Challenge Wilson Lake, KS
www.alltel.net/~mwsc

**May 24-25, 2003**
So. California PSS Festival Cajon Summit, CA
Brian Laird, Slope_Scale@compuserve.com
<ourworld.compuserve.com/homepages/slope_scale>

**October 10-11, 2003**
Texas National Tournament (TNT) Dallas, TX
www.SLNT.org

**For Sale - Personal**

| | |
|---|---|
| Dodgson Camano 100 with E205 | $120.00 |
| Eismann Jet | $175.00 |
| JM Glasscraft Songbird 78 | $75.00 |
| JM Glasscraft Songbird 100 | $75.00 |
| Sailplanes Intermatal RacerCS | $150.00 |
| Sailplanes Intermatal Axle | $150.00 |

Craig Christensen, 3261 45th Street, Webster, MN 55088; 952-652-5483 after 4:00 PM.

# THE NATURAL SIDE OF THERMAL SOARING

by Lee Murray
Appleton, Wisconsin
lmurray@athenet.net

| Time | Deg F | Dew Point | %RH | Event |
|---|---|---|---|---|
| 8:45 | 59.0 | 57.2 | 0.94 | Scattered Clouds |
| 9:45 | 60.8 | 51.8 | 0.72 | Scattered Clouds |
| 10:45 | 64.4 | 46.4 | 0.52 | Scattered Clouds |
| 11:45 | 64.4 | 44.6 | 0.49 | Scattered Clouds |
| 12:45 | 66.2 | 42.8 | 0.43 | Scattered Clouds |
| 13:45 | 66.2 | 39.2 | 0.37 | Mostly Cloudy |
| 14:45 | 66.2 | 39.2 | 0.37 | Mostly Cloudy |
| 15:45 | 64.4 | 35.6 | 0.34 | Mostly Cloudy |
| 16:45 | 62.6 | 39.2 | 0.42 | Overcast |
| 18:45 | 59.0 | 42.8 | 0.55 | Overcast |

Temperature history for September 21st, 2002 in Appleton, WI.

In a recent column, I wrote about a frontal system coming through during a local thermal duration contest and how it affected the flight times. The lift was neutral to certain point then became good as the ground level air temperatures reached a trigger level allowing the height of the mixed boundary layer to go much higher[1].

During a recent fun flying experience, a point was reached when the lift changed from neutral to wide-areas and long in duration[2]. The Soarcast* indicated that it should have been a good day. However, flight times had been about 3-5 minutes until about 3 PM when they were 20+ minutes for several of us. Was it just some fluke in the stability of the atmosphere not predicted by lapse rate and ground level air temperature or did it have something to do with the approaching cold front? This is the topic of this article.

The book Aviation Weather describes what can happen with frontal weather when masses of air with different temperatures mix[3].

*Weather occurring with a front depends on (1) the amount of moisture available, (2) the degree of stability of the air that is forced upward, (3) the slope of the front, (4) the speed of frontal movement, and (5) the upper wind flow.*

*Sufficient moisture must be available for clouds to form, or there will be no clouds. The degree of stability of the lifted air determines whether cloudiness will be predominately stratiform (stretched horizontally) or cumuliform (stacked vertically).*

In chapter 5 of his book[4], Dennis Pagen talks about the weather fronts, wind direction and lift. A comparison is made to cooler sea breezes that displace and run under warmer air. On a larger scale, the situation of cold fronts converging with warm, moist air often involves thunderstorms, a condition not recommended for full size soaring.

On the day I mentioned, a cold front arrived from the northwest, and with it, a distinct line of dark clouds with increasing elevation into the distance. The cold air was coming in from Canada with a North West direction. The ground level warm breeze was out of the West. You can see the wind directions on the left side of the Soarcast Plot in Figure 2. The angled lines show wind direction (going straight up indicating wind out of the north). A line extending from the left edge of the plot to the right is a graph of the wind velocity.

The confluence, or the frontal line, where the air was mixing was advancing slowly to the east as the afternoon went on. According to one theory, the colder air was slipping underneath the warmer air as shown in Figure 1. Models in the air were gaining altitude as the air they were in was generally being forced up. As we flew the sky became darker, we packed up and left. A few hours later it was raining.

Weather front theory has to get a little more complex to explain some limited areas where the air was not going up. I found two possible explanations for

this, either one or both of which may have existed.

Explanation 1: The ground was now warmer than the air filling in under the rising warmer air. This gave the possibility of convective cooling and sinking air mixed in with the general rising air.

Explanation 2: There was turbulence along the interface of the two air masses that would cause areas where the model would be sinking.

Weather information was downloaded from the Internet: The temperature, dew point, wind, RH and conditions history was recovered from:

http://www.wunderground.com/history/airport/KATW/2002/9/21/DailyHistory.html

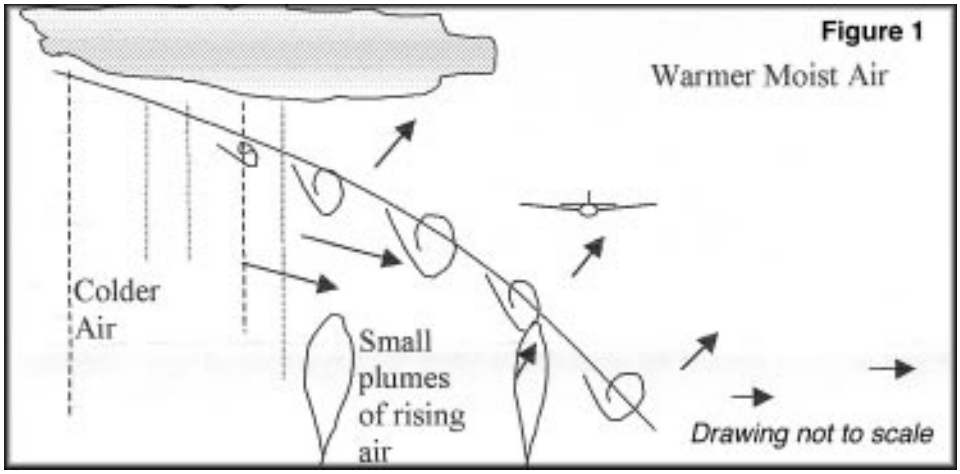
KATW is the abbreviation for Appletons Outagamie County Airport just a few miles from the flying field.

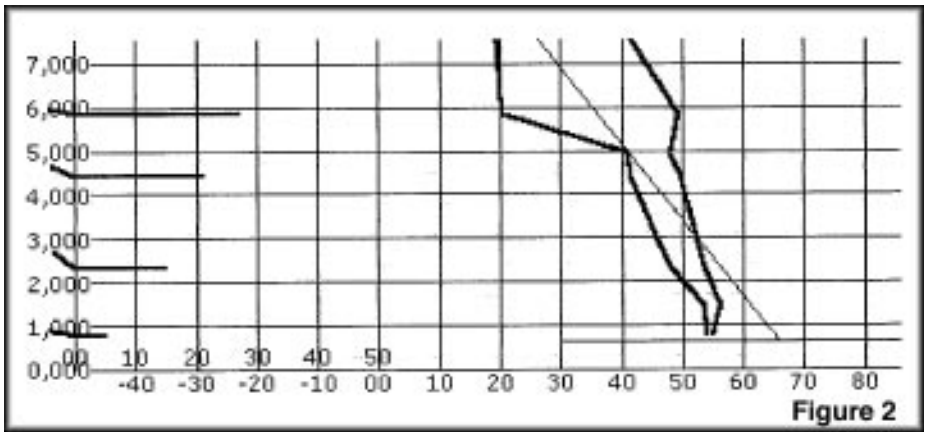
**Wind Speed, mph/Temperature, F**

The conventional theory for why we had good conditions so late in the day would rely on the temperature history for the day and the lapse rate. The lapse rate data from Green Bay (about 25 miles away) suggests that the temperature exceeded the trigger temperature by noon. The good thermals didn't happen when expected, perhaps because of some special condition imposed by the weather font. Or perhaps the very local conditions had too much evaporative cooling to participate in the convective cooling (thermal processes) until more instability took place. The scattered clouds in the weather history earlier in the day suggest this may have been the case.

The exercise of looking at weather information should be useful to you in being able to analyze your local weather conditions. I believe the more 'in-tune' an RC or full size sailplane pilot is to his local atmospheric conditions, the better thermal flyer he can be.

I'm closing with a photo of a line of cumulus clouds seen in late October in SW Florida shown on page 17. This is the result of converging coastal front of cooler coastal breezes running under




warmer interior air with enough moisture to form clouds. Why there isn't more full size thermal soaring in Southern Florida? Perhaps the air is too unstable. I bet some readers have some answers.


1 *RCSD*: Jan 99 pg10, May 99 pg 24, Sep 99 pg 22, Apr 00 pg 22 and Jul 00 pg 14.

2 A method developed by Pearson predicts when thermals will lift sailplanes to specific altitudes when a temperature is reached.

3 Soarcast Version 1.0.4 was provided as a free download from the web page of the Soaring Society of America. Newer versions are currently available.

4 US Depts. of Transportation and Commerce, Aviation Weather for Pilots and Flight Operations Personnel Reprinted by ASA Publications, 1975 ed.

5 Pagen, Dennis, Understanding the Sky, p. 185, Dennis Pagen Publisher.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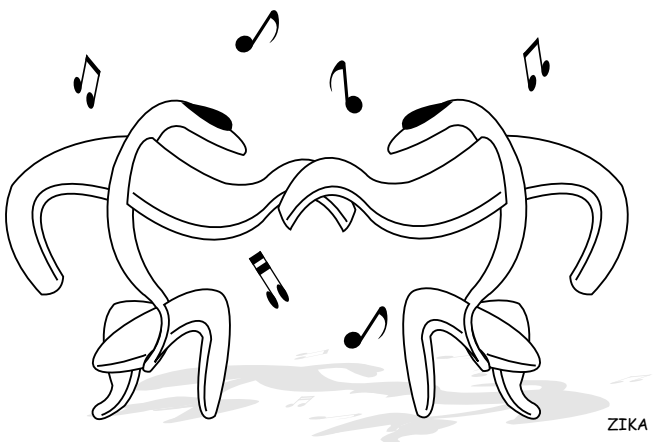

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### For Sale - Business

**PARACHUTES: $12.50** (includes S&H U.S.A.) Send check or money order to Dale King, 1111 Highridge Drive, Wylie, TX 75098; (972) 475-8093.

### 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>.

### 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.

## International Scale Soaring Association

There is a growing interest in scale soaring in the U.S. We are dedicated to all aspects of scale soaring. Scale soaring festivals and competitions all year. Source for information on plans, kits, accessories and other people interested in scale. For more information:

web site: www.soaringissa.org

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

## 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 $30.00 (Foreign) per year for 12 issues.

T.W.I.T.T., P.O. Box 20430
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www.twitt.org

## 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 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.

http://www.silentflight.org

## 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**
**1709 Baron Court**
**Daytona, FL 32124 USA**

## ESL

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.e-s-l.org