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R/C Radio controlled Soaring Digest

THE JOURNAL FOR R/C SOARING ENTHUSIASTS

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ABOUT *RCSD*

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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.... "Modifying & Building the MB Raven (Parts 1-4)" by Bill & Bunny Kuhlman
Bookshelf Listings - A listing of recently published books of interest to aeromodelers.
Complete RCSD Index, 1984-1999

The Soaring Site

Wyoming R/C Soaring Resource Volunteer

Last month, we were looking for volunteers to add to the RCSD 'R/C Soaring Resource' list. Thanks go to all of you that have volunteered to date!

One volunteer, this last month, is a subscriber located in Wyoming, who made an unusual offer that we wanted to share. Doug Hackett wrote the following:

"Howdy Everybody,

"Following is flight contact information for the Moran Junction, Jackson Hole, Wyoming, and the south entrance to Grand Teton National Park.

Doug Hackett
P.O. Box 330
Moran, WY 83013
Doughackett@mail.com
http://www.cowboyvillage.com
(800) 543-2847

"I am the Sales Manager at Cowboy Village @ Togwotee and I can offer *RCSD* readers a 10% discount plus breakfast for two adults each morning this coming summer for anyone visiting our area. Just ask for the "Soaring Special"!

"We are 16.5 miles east of Moran Junction on Highway 26. Moran is the east entrance to Grand Teton National Park.

"There are two OK places to fly in the summer, though I don't recommend bringing your best plane!"

Thanks for the offer, Doug!

Fatal Accident During Model Glider Towing

Safety is always be a number one priority with all of us. So, it was a heads up when the following message was forwarded to us by Bill & Bunny Kuhlman.

Nick Neve, UK delegate to the CIAM, has asked everyone in receipt of his message to alert the sailplane community of a potential problem related to launching systems, specifically staked pulleys.

"Recently, rumours from Europe reached the BMFA to the effect that a person had been killed during the towing of a model glider. Remarkably, very little information was available from official sources, so BMFA members used various contacts throughout the Continent and have managed to piece together what appears to have happened. The accident happened whilst a rocket SE8 competition was taking place but the person concerned was not flying in this event; he was relatively inexperienced and was using the site to practice glider flying.

"A pulley launch system was being used whereby the towline was anchored to the ground by stakes, the towline being passed round a hand held pulley and back to the glider. On the signal to start the two towers ran away from the fixed stake to pull in the line and launch the model. Much the same system is used competitively all over the world to launch model gliders.

"On the day in question, after "about 30 launches," the stake anchoring the pulley to the ground was pulled out by the force of the towline and struck one of the towers, a sixteen year old, in the back of the head which tragically killed him.

"Understanding the cause of the accident however is of equal if not more importance to sport glider flyers using the "pulley tow" technique than for competition flyers. It appears that the holding stake had been fixed at the start of the day's flying and had probably not been checked for security subsequently. Repeated towing had caused it to loosen until it reached the point when it was pulled from the ground by the towline at high tension. The only direction it could then take was towards the towers which it did

THE MAGIC OF SWITZERLAND

This month, Tom Nagel's "Have Sailplane Will Travel!" column takes us to Switzerland. Erich Jost reports on a beautiful slope flying site at Hahnenmoos Pass, Switzerland.

Photography courtesy of Erich Jost, Virginia.

R/C Soaring Resource Changes & Additions

(The following changes have been submitted this month and will be added to the "R/C Soaring Resource" listing(s): on-line pdf file, and periodic hard copy distribution.)

New Listing
Wyoming - Moran Junction, Jackson Hole, Wyoming, and the south entrance to Grand Teton National Park, Doug Hackett, P.O. Box 330, Moran, WY 83013, Doughackett@mail.com, http://www.cowboyvillage.com, (800) 543-2847.

Listing Change
California - Sacramento Valley Soaring Society (SVSS), Bill Rinkleib, 112 Tetworth Way, Folsom, CA 95630, (916) 983-7651, Rinkleib@AOL.com, http://www.svss.org.

Additional URL
Florida - Florida Soaring Society Add http://www.soar-fss.org

with tragic and fatal consequences.

"In competition flying in the UK, holding stakes are required to be a MINIMUM of 450 mm long and 15 mm diameter of which 350 mm must be driven into the ground. Stakes are often moved or lines re attached during competition and are therefore regularly checked by default; this is not usually done in the case of sport or practice flying.

"The lesson is very clear: any staked pulley must be regularly checked to verify its security; failing to do this could be your last mistake ever! The BMFA would advise anybody new to pulley towing to seek advice from an experienced (probably a competition) flyer. Similar risks are also presented by bungee and winch launch systems, so seek advice if you are unsure and check these stakes regularly as well.

"The BMFA believe that this potential hazard and their advice should receive a wide distribution and recipients are asked to take whatever action they believe to be appropriate within their national governing bodies to alert aeromodellers to a serious potential hazard."

Nick Neve,
UK Delegate to CIAM
Eynhallow, The Purlieu, Upper Colwall,
MALVERN, Worcs, WR14 4DJ, UK
Tel: +44 (0) 1684 561160,
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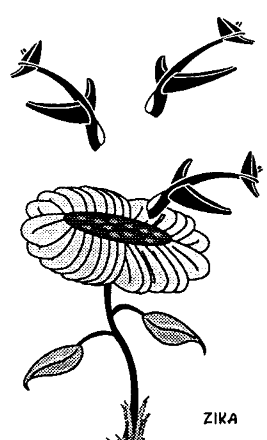
email: nickneve@clara.co.uk

Fly Safely!
Happy Flying!
Judy Slates



2001
MONTAGUE
CROSS COUNTRY CHALLENGE

Location	Siskiyou County Airport, Montague, CA
Date	June 8th - Practice and LSF Task Days June 9th & 10th - Contest Days
Time	Pilots meeting at 9 am, flying begins at 10 am
Task	Saturday - Free Distance within a prescribed course Sunday – Speed Task, 2 hour minimum, 3 hour maximum
Classes	Open, 3 Function (Rudder, Elevator, Spoiler or Rudder, Elevator, Flap)
Prizes	Plaques will be given to 3 members of the top 3 finishing teams in each class.
Entering	Entry fee is $75 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 8th, 2001. 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

Sanding an Edge

A couple of months ago, we discussed sandpaper. Before that, I talked about sanding with sanding blocks. There are times when one can simply pick up a piece of sandpaper, fold it over, and commence doing some rough sanding, like knocking off a rough edge. But, if you want to sand a straight edge, the process requires a sanding block of some kind. The use of a sanding block allows better control over the finished product. If a sanding block is not used, it is not unusual to accidentally sand a flat spot thereby ruining the project. Or, perhaps, rounding an edge that wasn't supposed to be rounded off.

A few months ago, I constructed a sanding block. And, if I say so myself, it works pretty darn good. I should have built it sooner. But, since it looks more like a 'tray', I'll call it a 'sanding tray' instead of a 'sanding block'.

The tray allows me to sand a true, straight edge on a sheeted foam wing. Having a truly straight edge makes it much easier to glue the leading edge onto the wing. No more gaps which need to be filled with extra glue or wood filler. And, it's easier to touch up the trailing edge, simply making a few passes with the wing on the sanding tray.

When balsa wood is used to sheet wings, several sheets are joined together forming a sheet large enough to completely cover the wing. As I'm sure many of you know, the balsa wood that is available from a local hobby shop does not usually come with a true straight edge making it easier to join, so most edges have to be trimmed, at least a little bit. Sometimes, the edges require trimming 2 or 3 times, in order to get them just right. However, by using a sanding tray, a true straight edge can be obtained in just a few seconds.

If you like the idea of using a sanding tray, it's quite easy to build. All you need is some plywood, five or six 2-1/2" wood screws, 80 grit sandpaper, and some glue for gluing sandpaper in place.

I would suggest, when you go shopping for materials, that you look for a piece of 3/4" plywood that has a good, smooth surface on one side. The cost of a 3/4"x2'x4' plywood at my local supply places is around $12-$15. You'll need a couple of sheets of 80 grit sandpaper, a package of 2-1/2" wood screws, a can of 3M77 glue, and a can of silicone spray.

I cut the plywood into 2 strips: 12" by 48" and 3" by 48". (I stored the left over for another project.) Using the wood screws, the 3"x48" plywood strip was screwed to the 12"x48" plywood strip as shown in figure 1. The 80 grit sandpaper was cut into 2-1/4" strips and glued onto the vertical part of the sanding tray.

For an extra smooth surface, spray the sanding tray with silicone. That's it! Now go sand something!

Until next month! Happy Flying!
■

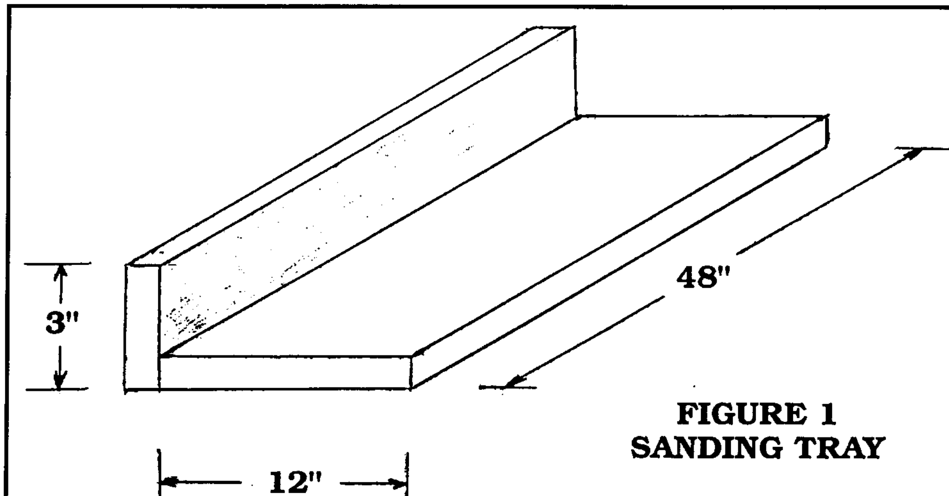

FIGURE 1
SANDING TRAY

#1 - Sanding leading edge of triple tapered wing, starting at the root.

#2 - Then, the middle...

#3 - Last part of the tip.

#4 - Flip wing over, and do the trailing edge.

#5 - Sanding edge of balsa wood sheet.

on the Wing

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Basic control systems for tailless sailplanes

Perhaps the most frequently asked questions we receive involve control systems for tailless planforms — which control surfaces are needed, where those control surfaces should be located, how large they should be, and how much deflection is required.

Because of advancements in radio control technology, it is now very easy to set up control surface deflections based on separate "rates." That is, the pilot may switch between two or more deflection parameters with the toggling of a single switch. A great percentage of pilots have come to prefer the "exponential" rate, in which control inputs near neutral have very little effect on the control surface deflection, but control surface inputs nearer the extremes have a very large effect. Some modern transmitters allow the operator to tailor the exponential curve to suit there own preferences.

Additionally, combining inputs from two functions into a single actuating system (as is required for V-tails or elevons), or separating a single function into two or more separate actuating systems (as is required for a "six flap" system where there is an aileron, elevator, and elevon on one wing panel), is now possible.

Because of the above mentioned capabilities, this month's column will be limited to needed control surfaces, their location and size.

For the most part, needed control surfaces are based on the type of aircraft, just as for conventional tailed aircraft. It is possible, for example, to design, construct and successfully fly anything from a very simple rudder only "plank" to a "six-flap" equipped swept wing with adjustable winglets.

In general, the control surface chord should be between 20 and 25% of the local chord. There are, however, specific situations where the local control surface chord is substantially larger or smaller. The outer area of the elevator of Jim Marske's Pioneer II-D, for example, is about one half of the expected lower limit. Because the elevator area is concentrated in an area well behind the CG, and the torque rod must be at 90 degrees to the interior drive tube, there is a jog in the trailing edge of the elevator itself. See Figure 1.

Control surface location is very dependent upon the specific planform. There are, however, some relatively simple rules which can usually be applied:

1. Ailerons should be outboard, so the roll force which they exert is maximized.

2. The elevator should be placed as far as possible from the CG so the pitch force exerted by the control surface is maximized.

3. The rudder should be placed as far as possible from the CG so the yaw force exerted by the control surface is maximized.

4. Flaps, if used, should be placed in a location such that there is not an undue pitching moment generated.

Control systems for "plank" planforms

Figure 2a: We'll start with the most simple control system, rudder only. Many modelers are unaware that very early radio control systems provided only one channel, and while some "advancements" allowed rudder, elevator, and engine control to be obtained from that single channel. In those early days the rudder was driven by a rubber band powered mechanical system, and deflection was neutral of full right or full left. Still, countless rudder-only models were flown successfully. The advent of proportional control made rudder-only control smoother, but also allowed the option of additional control surfaces, like elevator. Rudder control is sufficient for what appear to be coordinated turns if dihedral is adequate but not excessive. Any sweep of the rudder hinge line can affect the model in pitch. If the hinge line is swept back, the nose of the model will tend to pitch up. The greater the sweep angle, the greater this effect. The model must be trimmed for what we now consider excessive pitch stability. Flaps of about 5% of the wing area, if carefully placed, can be used for dethermalizing and landing control.

Figure 2b: Nearly all of us will feel some form of pitch control is necessary. The most simple elevator setup is one in which the elevator halves are inboard and connected by a torque rod extending through the fuselage. This is not a very efficient placement from an aerodynamic standpoint, but seems to work well enough that its popularity remains very high. The elevator area should be about 5% of the wing area.

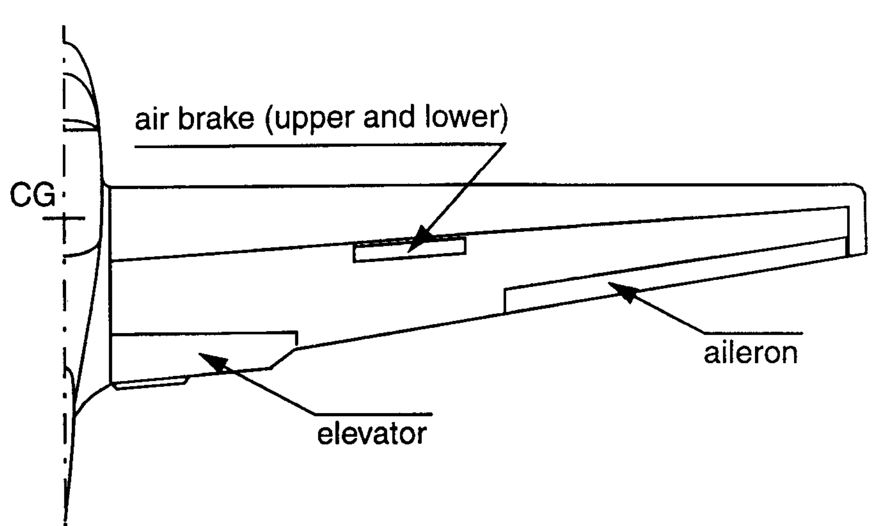

Figure 1 Pioneer II-D control surface proportions

Figure 2c: Moving the pitch control surfaces outboard raises aerodynamic efficiency, as during conditions when the wing is called on to produce maximum lift, the lift is derived from the center portion of the wing. The outer portion of the wing, with elevator deflected upward, has aerodynamic washout. Since the usual setup is to have separate servos for the two elevators, it is a very easy jump to use the transmitter in V-tail mode or combine channels to turn the elevators into elevons. (An elevon is a combination aileron and elevator, and should therefore be around 6% or 7.5% of the wing area.) Some experimentation may be needed when setting up the aileron function, as any differential will adversely affect pitch unless the centroid of the aileron is very close to the CG. Rudder control for this layout is an option which needs to be carefully weighed. If the aspect ratio is high, some form of yaw control is desirable. If you're flying on the slope and/or using a lower aspect ratio, the rudder is not necessary.

Figure 2d: This control system layout utilizes separate ailerons and elevator functions, and is similar to that used on the Pioneer II-D. As in the previous layout, 2c, aileron differential can adversely affect pitch control. 2:1 differential is used on the Pioneer, but the ailerons are very close to the CG because of wing taper, and the pitching moment imparted is negligible. The combination of separate rudder, elevator and aileron functions does have the advantage of producing flight control characteristics very close to those of a conventional tailless aircraft. The ailerons should cover the outer 40% to 50% of the wing span.

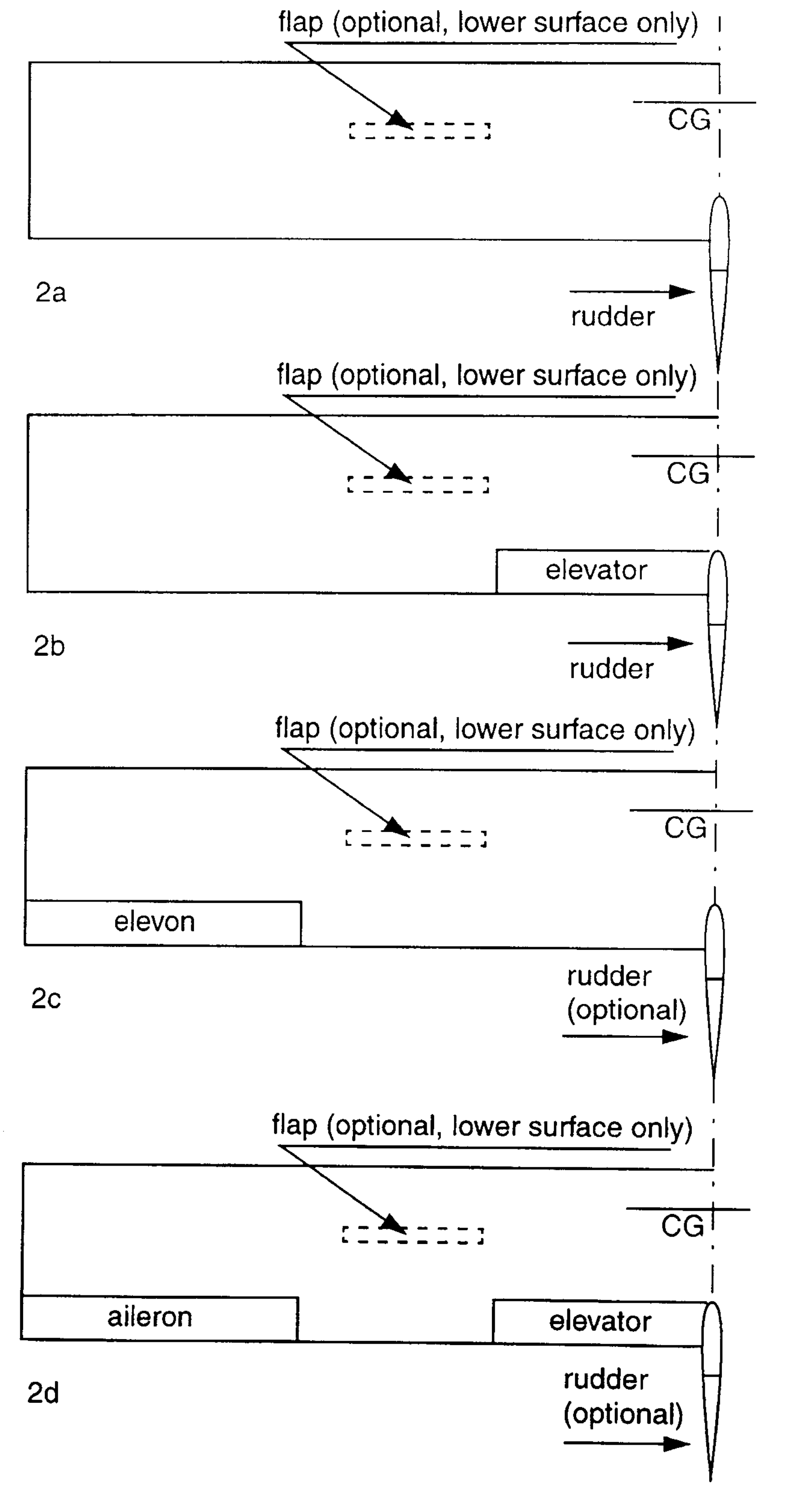

Figure 2a-d "Plank" planform control systems

Control systems for wings with sweep back

Figure 3a: The most simple control system for swept wing planforms uses elevons which cover the outer 50% of the wing span. Separate control of yaw is not usually a consideration for swept wings because the sweep of the wing provides some amount of directional stability. If yaw control is determined to be needed, it can be achieved through moveable portions of the winglets, or through a rudder attached to a single central fin. As is the case with "plank" planforms which use ailerons, the use of differential can cause problems with pitch stability.

Figure 3b: Placing the elevator inboard seems at first to be an ingenious method of obtaining greater lift through downward deflection, and negative lift through upward deflection. The major difficulty which prevents this planform from succeeding is the placement of the elevator in relation to the CG. (Remember, there must be some lever arm.) This planform requires a large sweep angle, and increasing sweep is usually detrimental to subsonic performance, but it provides a good area for experimentation.

Figure 3c: The most common placement for the elevons is outboard, with the flaps inboard. If the wing sweep and the flap size and location are carefully coordinated, it is possible to slow the aircraft to a near standstill while maintaining pitch control without excessive elevator deflection. Flaps in this case can cover 20% to 40% of the span, always close to the centerline.

Figure 3d: This is the "six flap" control system which has proven to be very popular in the German F3B environment. The span of each surface should be one third of the wing span. As most modern swept wings are built with three panels per side, each with a different twist parameter, the control surface is the same size as the corresponding wing panel. With several control surfaces across the semi-span, the lift distribution can be tailored for specific flight parameters — high speed, racing turns, thermal flight, and air brakes. If desired, a close approximation to the elliptical lift distribution can be maintained throughout all flight regimes.

Control systems for wings with sweep forward

Figure 4a: This is the most simple control system for a swept forward wing. Larry Renger's "Toucan" originally used a similar control system layout. While very easy to set up and use, its inefficiency inhibits performance. In elevator mode, a portion of the surface is well behind the CG, but a major portion is closer to the CG and may in fact be in front of it if the sweep angle is large. Additionally, the aileron is nearly full span so there is an area which is well outboard, but closer to the centerline the deflection creates quite a bit of drag and generates very little roll moment.

Figure 4b: This is an ideal control surface layout for a forward swept wing, and is the recommended setup for the "Toucan." Because of the forward sweep, there is a large arm for the elevator to act upon. The ailerons are well outboard, and are therefore capable of generating large roll forces, but they are close to the CG as measured along the centerline. Aileron differential can thus be used without fear of untoward motions in pitch. A similar control surface layout was to be used on the Akaflieg Berlin B 11, a high aspect ratio sailplane with 18 degrees of forward sweep.

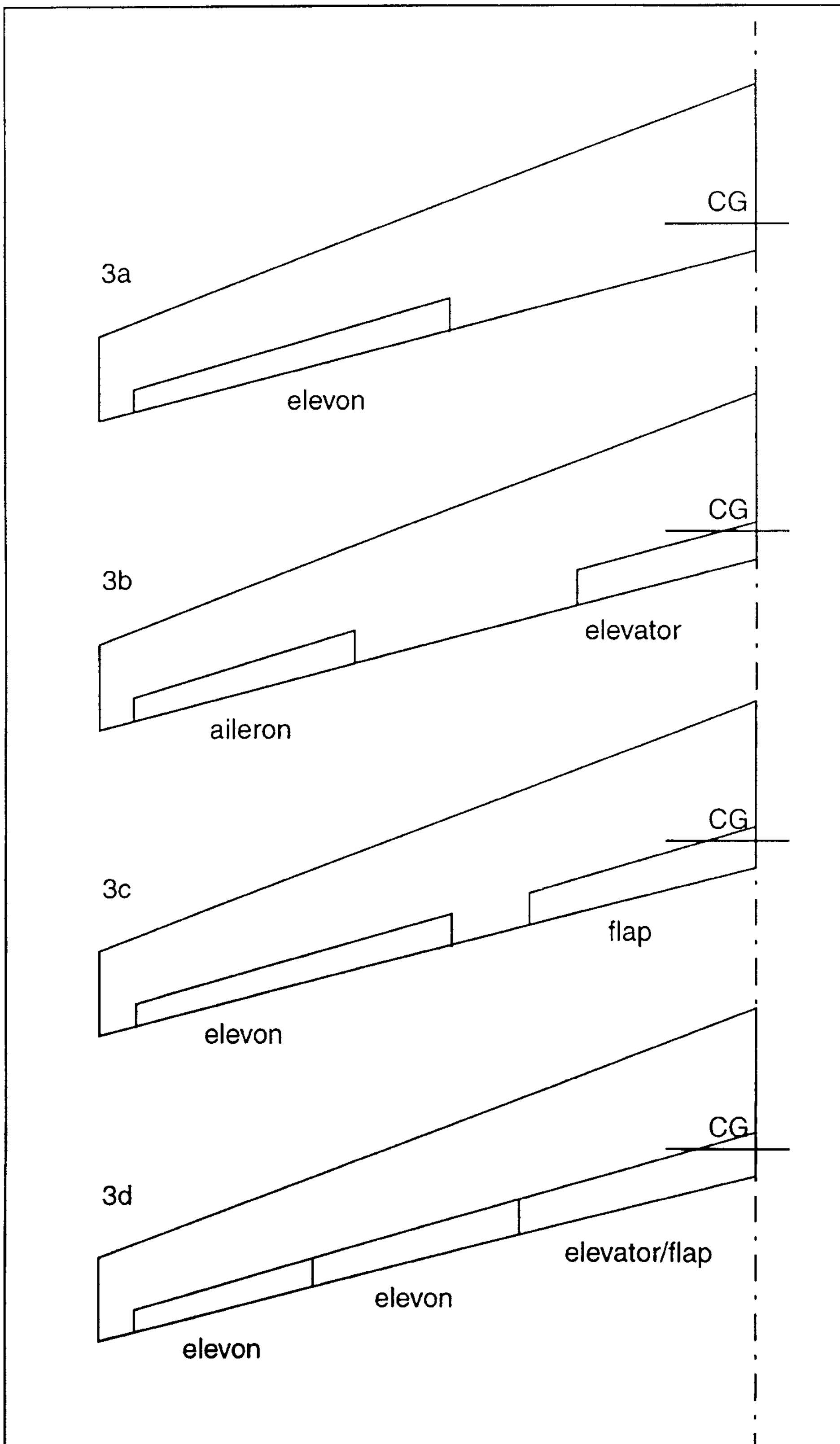

Figure 3a-d Swept wing planform control systems

Conclusion

While we often tend to choose planforms based solely on aesthetic considerations, it is best kept in mind that truly successful aircraft

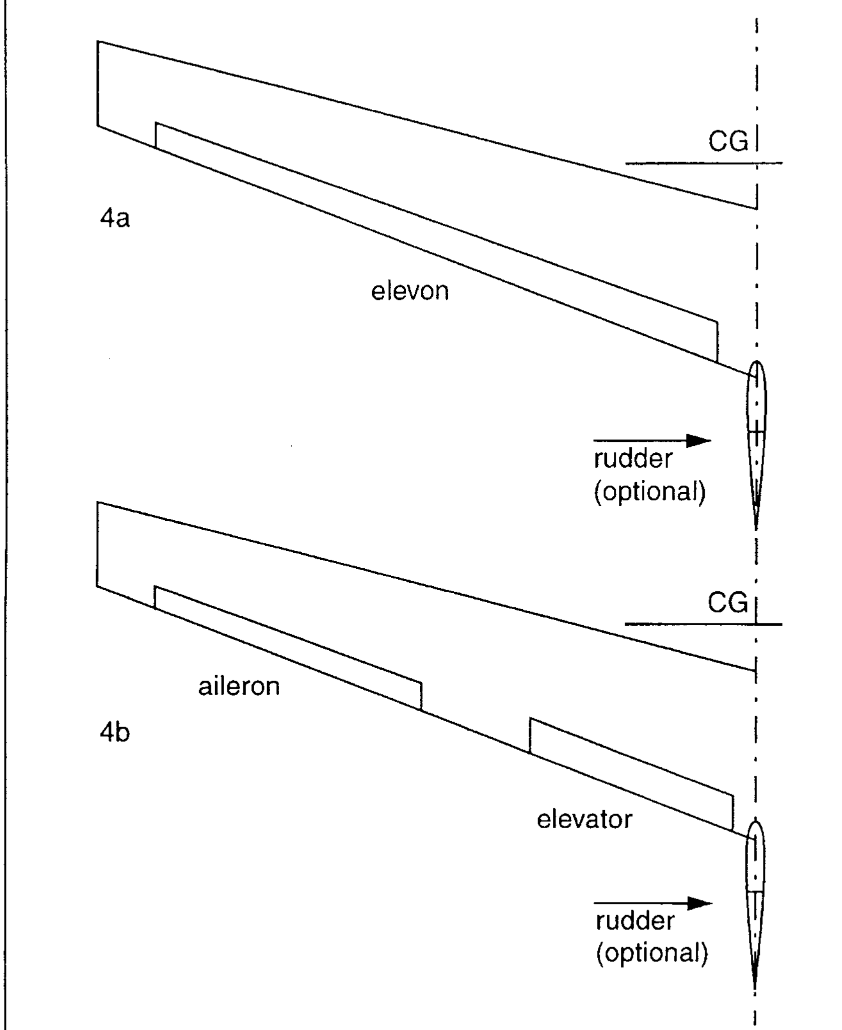

Figure 4a-b Control systems for swept forward wings

are a synthesis of stability, control, performance and structure. Hopefully we've been able to describe the most common control surface layouts and relate them to the relevant tailless planforms in a cohesive way. The resources list provided below should provide a number of starting points for further investigation.

Resources

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—. Larry Renger's "Toucan." On the 'Wing... the book, Volume 2. B²Streamlines, Olalla WA. 1997.
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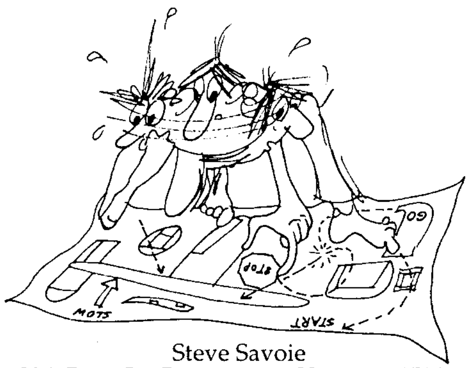
"SHORT CUTS"



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

VIKING MODELS' FENDERS

Don't you just hate stripped servo gears? Me. too. So, that's why I try to build my planes so that exposed aileron linkages are out of the way on all my slopers but, sometimes, it just can't be avoided. I also try to install servo savers where possible, but they are just not available for some of the smaller servos like the HiTec HS-81s that I used on my DAW 1-26. I could have had the linkages exit out to the top of the wing surface, but that would have killed the look of the aircraft. So, I just had them exit out the bottom and tried to make every landing smooth.

Well, the plane has been through a lot of tough landings and, to my surprise, the servos held up real well until the last landing at Petersburg Pass. This was a smooth landing, but the exposed servo arm hit a small rock and that was all it took to strip out the servo. I hate field repairs, so the plane was shelved until the servo could be repaired. But what to do when it happens next time? The only option was a protective cowling and I remembered an ad in *RCSD* by Viking Models U.S.A. picturing protective streamline cowlings called "Fenders".

I called Jerry Slates and ordered a few sets. The parts are vacuum formed from a thermal formable .015" white thermal plastic. They come in a 4 x 6 flat sheet and are extremely light and flexible. They easily conform to the curvature of either upper or lower wing surface. I used a template to mark out the cut lines and then simply cut them out with scissors. Once cut out, I just used some book binding tape and taped them onto the bottom surface of the wing over the control linkages.

They worked so well on the 1-26 that I decided to put a pair on the flap linkage of my Catalina X-C. They are sized to be cut down for the right application. While I had the Catalina out, I decided to cover the exposed rudder linkage and control horn. The improvement in airflow was not my goal in this application, but rather to reduce snags on the back end during landings, as well as hanger rash. I can't count the number of times that linkage has been snagged just by taking the 70" fuse out of the *basement*.

I did find that I needed to put a little heat on the flat mounting tabs of the fender to get a better fit onto the round fuselage. The highest temp setting on the covering iron was just right for the job. The iron was also used with low temp iron-on covering to add some matching color onto the fenders. I found this best done by taping the fender onto a small, flat working surface with double faced tape and working the material onto the plastic. It adhered quite well and the low temp setting did not disturb the surface of the plastic. Jerry tells me that they can also be painted.

Sometimes, it's taking the time to work on the little details that saves many hours of work in the future. The weight addition of the fenders is negligible; the reduced drag and increased protection for the servo linkage are worth the effort to install these fenders.

Viking Models, U.S.A.
2 Broadmoor Way, Wylie, TX 75098
(972) 442-3910, RCSDigest@aol.com

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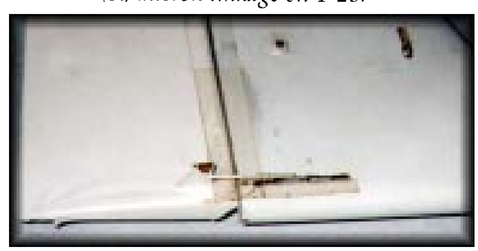
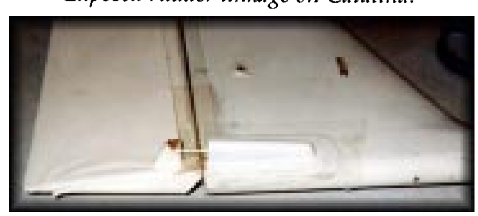
Viking "fenders" are extremely light and flexible. Simply cut them out with scissors.

Protected (L), unprotected (R) aileron linkage on 1-26.



Exposed rudder linkage on Catalina.



Protected rudder linkage on Catalina using "fender".

Iron-on film will cover fender.

Scott Gradwell
Medford, Oregon
scott@xcsoaring.com

Improving the SB-X/C: Constructing a Hatch

The premier production sailplane used for cross country soaring, I think, is the SB-X/C. If someone can think of something better, they will have to send me an e-mail, because I sure don't know about it.

There are a couple of simple modifications that I think make the SB-X/C an even better sailplane. One modification that really makes working on the sailplane a lot easier is to cut out a hatch. Some people say it weakens the fuselage, but I think the convenience is worth the chance you might break your nose.

The way I made my hatch was to first measure and outline the hatch with masking tape. Then I cut out the outline with a razor saw, framing the inside of the fuselage around the hatch opening with 1/8″ plywood about 3/8″ wide.

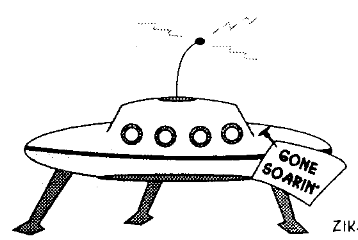
Since I constructed rounded corners on the hatch after the plywood was installed in the fuselage, I filled the corners with epoxy and microballoons. Once the saddle for the hatch was sanded smooth, I sprayed some 3M77 on a piece of mylar and laid it over the hatch saddle. I wetted out some medium fiberglass cloth and laid it over the mylar, letting it set up. When the epoxy cured, I removed the "canopy frame" from the mylar and took the mylar off the saddle. I then laid the fiberglass back down in the saddle and traced around the perimeter with a pencil, cutting the canopy frame down until only about 1/8″ excess was left. I set the canopy frame back into the saddle, sanding the hatch down to the thickness of the cloth, so it would set on top of the frame and still be flush with the fuselage. I made up some epoxy and structural filler, laying a bead around the pencil line on the canopy frame. Of course, I laid the bead on the opposite side of the pencil line; we don't want to glue our canopy frame to the fuselage. I then set the hatch back down into the saddle and into the epoxy filler, lining up the hatch with the lines of the fuselage. After the epoxy cured, I sanded the 1/8″ excess off the hatch and was left with a very rigid hatch that fit quite well.

After I finished the outside of the hatch, I traced a line of about 1/2″ around the fiberglass canopy frame and used a Dremel to cut the fiberglass out, leaving a 1/2″ lip. I then glued 1/8″ square spruce on the lip to keep the hatch from sliding side to side.

All that was left was to mount a block in the hatch with an eye hook, and one in the fuselage, and hook it up with a rubber band. After watching others struggle to get to their gear, I definitely think the hatch is worth the chance you might break your fuselage because you have weakened it.

Another modification I did was to hold down the wing with 5/16″ nylon bolts instead of the metal screws they give you. I had a radio failure and a subsequent crash. The damage to the wing was minimal and I think the wing was saved because the nylon bolts sheared off at impact instead of shredding the wing skins.

Next month, I will cover some more tips about improving the SB-X/C. ■



HAVE SAILPLANE, WILL TRAVEL!

By Tom H. Nagel
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This month's travel saga is reported by Erich Jost. To give you some background, Erich flies with the TMSS, or Tidewater Model Soaring Society, in southeast Virginia - a very active club. You can check out their web site <http://fly.to.tmss> for more information. Some TMSS members fly slope on Brown's Mountain just south of Charlottesville, Virginia, a beautiful hill flyable west, north-west, north-east and east; the place is private and one needs written permission. We are working on Erich to do a story on this site, soon.

Erich is a service engineer for rotating and reciprocating equipment, travels all over the continent and sometimes overseas, and gets to visit many places involving model airplane flying. He has lived in Canada and the US for the last 25 years, and Chesterfield, Virginia since 1995.

This month, Erich Jost takes us to Switzerland.

Slope Flying in Switzerland

by Erich Jost
Chesterfield, Virginia
Tidewater Model Soaring Society

As a lot of us "Slopeheads" know, everyone who flies slope has a favorite hill, cliff or mountain side. Model planes big, small, inexpensive, expensive, scale or not, it doesn't matter. We all have fun, especially when conditions are right. I would like to share such a story with my fellow slopers.

In August 2000, I went to Switzerland for two weeks to visit my family, who I hadn't seen for six years. I was born and raised in a small village on Lake Thun, in the beautiful Bernese Oberland near the famous tourist town of Interlaken. At a young age, I was introduced to model aviation by my father on the mountain slopes in the area, in the form of free flight. Near Interlaken, about 1.5 hours drive to another picturesque resort town of

Adelboden, is the very famous mountain flying place called "Hahnenmoos Pass", 2000 meters or about 6000 feet ASL. It was on this mountain where I had my first slope experiences about 40 years ago. Mind you, there was no such thing as RC back then. The in-thing was "magnetic nose rudder control" which, in combination with a fused de-thermalizer horizontal stab, kept the models from disappearing into the mountains most of the time. Long flights were not possible, especially in strong winds. If the de-thermalizer fuse didn't work, the model usually disappeared, never to be found again.

But back to the present day. On the weekend of August 19 and 20, the weather was absolutely beautiful, with warm moderate wind; a big, well attended two-day slope event was on the schedule at Hahnenmoos Pass. Guess where I went that weekend?

This column is dedicated to soaring vacations. 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

Arriving at this hallowed site, I found a multitude of models of every kind suitable for slope flying, especially large scale ships and fast molded slope racers.

Even though the wind was, at first, not consistently from any particular direction, this did not present a problem. It was possible to get a lot of flying done just by switching slopes. The area provides slopes in every direction, so no matter where the wind is blowing from, there is a flyable slope and, importantly so, a suitable landing area.

Additionally, massive thermals develop way down in the valleys and contribute to the excitement of magnificent slope lift. Landings are a piece of cake on the lawn-like short grass. All you have to do is be familiar with cross wind landings on sloping ground. Some landing areas are actually relatively level. It is truly a slope flyer's paradise, and the mountain scenery is spectacular. There are also very sharp crests with very steep drop-offs to one side or another, which would lend themselves to fantastic dynamic soaring (DS) which, as I found out, is not known very well among the local fliers. Some of them have heard about America's famous Joe Wurts DS exploits, though.

The local hotel, the Berghotel Hahnenmoos Pass (check out the web site), caters to model aviators, as well as mountain climbers and hikers in the summer months, and to skiers in the winter. The hotel provides a large storage room for secure safe keeping of models and equipment while staying there. Most flyers going to Hahnenmoos Pass stay there. During contests and fly-ins, the hotel is usually filled to capacity, so advanced reservations are required.

I met several famous fliers from around Europe at Hahenmoos Pass, and was able to check out the latest in airplanes. After the flying ended and the last whispers of air had been exploited with HLG's, the social affair started. We indulged in some fabulous food and drink at the hotel and, of course, engaged in a lot of hangar flying. For me, it was particularly interesting in comparing the slope flying scene to the one in the United States.

One sleeps well in the clean mountain air at that altitude. The next day, everybody was out again to enjoy themselves until, unfortunately, Sunday afternoon came along and most people had to leave. Some of the lucky ones on vacation (like me) were able to make further use of the wonderful world of slope soaring.

Unfortunately, I didn't bring my own plane to Switzerland. However, I was handed a transmitter from one of the flyers so I could do some soaring. (I left the landing up to him though.) So, if you find yourself in Switzerland and time, weather and schedule allows, visit this mountain slope paradise. You won't be sorry.

You can check out the place on the web at <www.hahnenmoos.ch>. Unfortunately it's all in German, but phone number and e-mail are universal. For those without the use of the internet, the address is:

Berghotel Hahnenmoos Pass
3715 Adelboden/Switzerland
Phone: 011 41 33 673 2121
Fax: 011 41 33 673 4841
e-mail: spori@hahnenmoos.ch

Local flying contacts are:
TUN Modellbau
Ueli Nyffenegger
Sagenfeld 3
5614 Sarmensdorf
Switzerland
Phone/Fax: 011 41 56 667 2211
e-mail: mail@tun.ch
www.tun.ch
links - Modellflugferien-Hahnenmoos

See you there!!
Fly safe and think up!!

Dave Register
Bartlesville, Oklahoma
regdave@aol.com

In the last two columns, we've discussed the basic strategy and equations needed for a performance analysis of an RC sailplane. Last time, we discussed Lift and several of the Drag terms. We'll conclude the background discussion this month with a review of parasitic drag.

Parasitic Drag

Parasitic drag sounds pretty ugly - like your sailplane has a tapeworm or something. That's because this is the component of drag that really doesn't do you any good. You can't entirely eliminate parasitic drag, but you do need to minimize it as much as possible. As with the drag terms for the wing, it can be broken down into several components, analyzed to a limited extent and then can be built into our simulation.

Parasitic drag arises from:

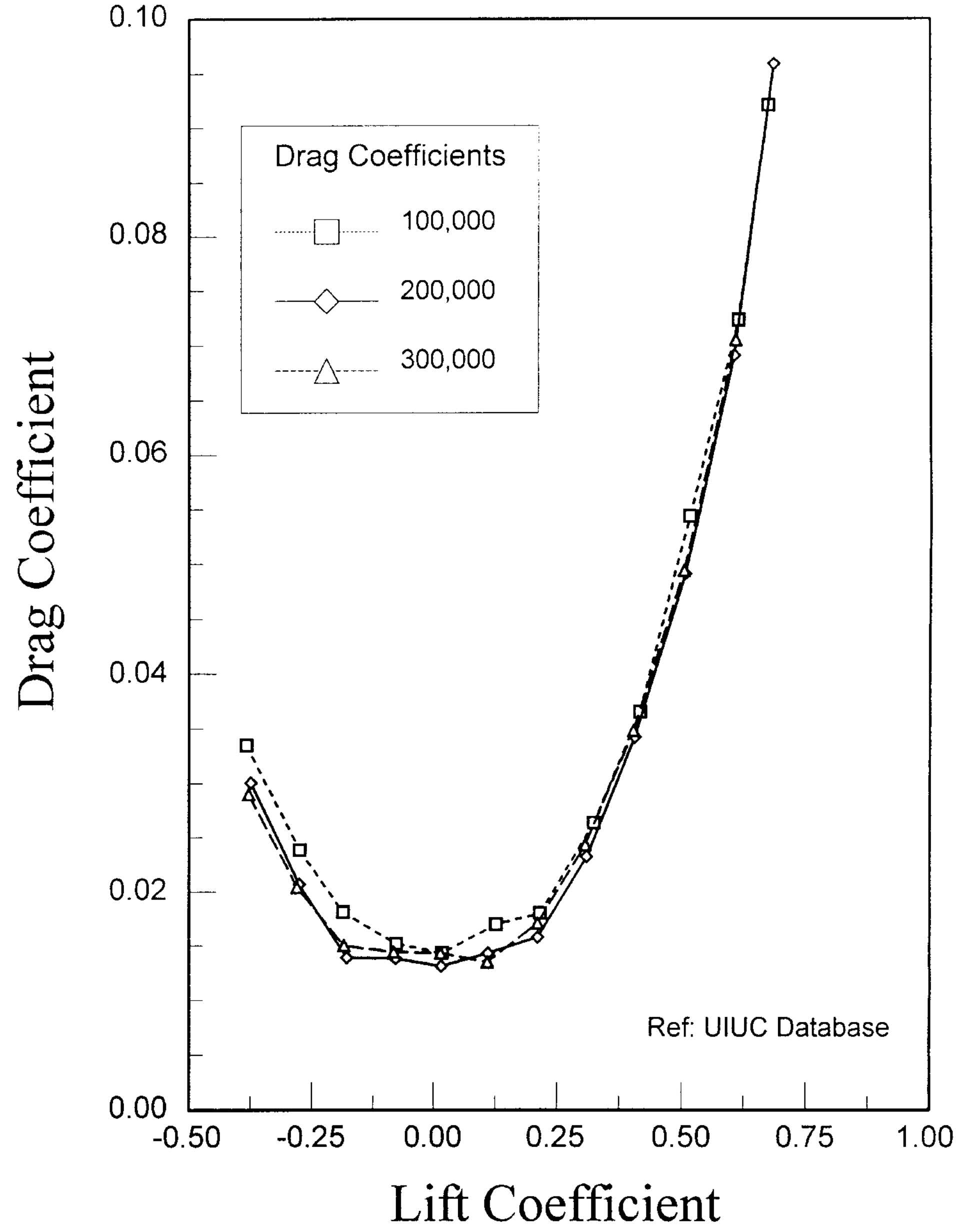
- the horizontal and vertical stabilizers, which we can analyze;
- the fuselage 'wetted' area (including intersections), which we can analyze somewhat;
- all the disturbances due to linkage, control hinge gaps, etc.

For the last category, it's very difficult to measure these effects directly. What I've resorted to doing is making an educated estimate based on fitting prior data. The reason this seems to work is that for most designs, this is a relatively small drag term. So even a modest error here won't be too offensive. But the bottom line is - the estimate for the intersection/gap effects is what we affectionately call a SWAG.

You can clean up your ship a lot and it will have a positive effect. But it's not possible to make an 'a priori' statement about the absolute effect. We'll get back to this sometime in the future but, for now, think about the RDS system for control surfaces and gap tape to clean up your hinge lines.

From what I've read over the years, the jury is still out on wing fillet radius for RC sailplanes. Same with pylons (now showing up in a number of European designs). Ol' Dave's rule of thumb is that a noisy ship is a draggy ship. I've noticed a significant reduction in wind noise from my L3MC by working on control linkage and gap seals. That's a plane with great 'legs' for covering ground anyway, so I'm not sure I've made a significant performance difference. But working through the changes and thinking that I've made a difference is half the fun. When we put the whole calculation together, we'll run fuselage parasitic drag as a variable and see how much difference it makes in our simulation results.

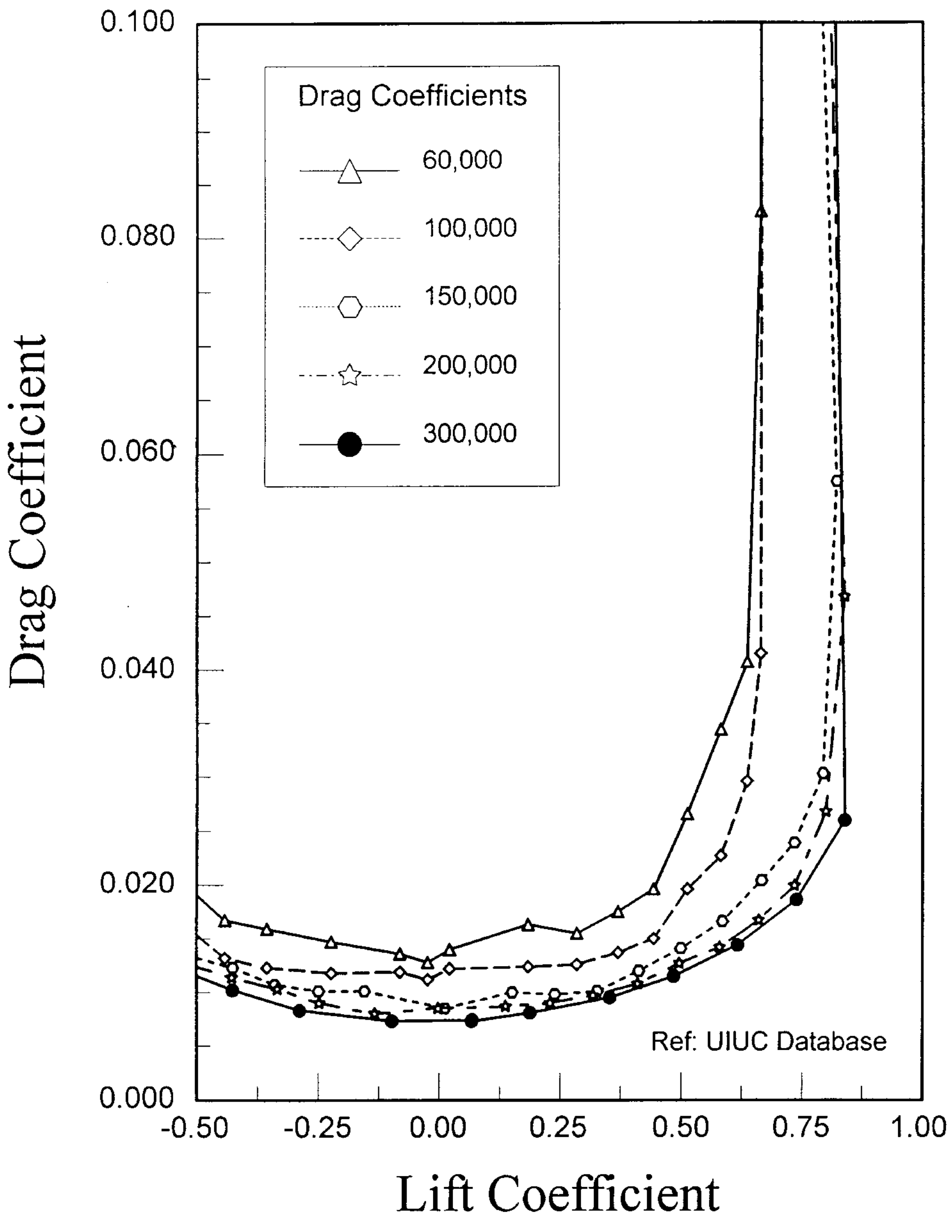
Figure 1: Flat Plate Drag Bucket



STABILIZER CONTRIBUTION:

Some part of parasitic drag arises from the stabilizer surfaces. For this component, we know the total areas of the horizontal and vertical stabs. Also, recall that one of my earlier assumptions is that these surfaces are not typically generating lift but act simply as restoring forces around a low, or zero, lift coefficient condition. Consequently, the induced drag term that applies to the wing (the 'price of lift') will be negligible for the stabilizers. Therefore, we don't have to worry about the aspect ratios of these surfaces.

Figure 2: SD8020 Drag Bucket



However, we DO still have to worry about profile drag and Reynolds number effects. For the conditions noted, we can concentrate primarily on profile drag response to Reynolds number near Cl=0. For a symmetric tail section, this should be in the middle of the drag bucket and relatively easy to analyze.

Figures 1 and 2 show the drag buckets for the flat plate and the SD8020. Both of which are popular stabilizer sections. The NACA0009 is also used for this application, but the SD8020 is a better choice if you're going to use a true airfoil.

Although it's tough to guess how the curves are going to trend below 60,000, we can do a simple fit to the data near Cl=0 for both cases and come up with equations that will provide useful extrapolations over the range where the data is available. You can do this in Excel if you want to give it a try. Just generate a trend line to the plotted data and you should get results like Figure 3. In this case, I've averaged the drag coefficient over roughly +/- 2 degrees around Cl=0.

Cd (SD8020) = 0.06152 - 0.00431*Ln(Rn)

Cd (FlatPlate) = 0.04133-0.00216*Ln(Rn)

Please note that under the assumptions used here there is a modest drag coefficient advantage to the SD8020. However, given that the surface areas of the stabilizers are usually small when compared to the wing, using the simpler flat plate 'airfoil' doesn't introduce a large drag penalty to the overall design. Prof. Selig has noted other conditions to consider in the lift curves of these sections and you are referred to that work for further discussion (1).

The remaining issue for stabilizer drag is estimating the Reynolds number. One can do this in several ways:

- Calculate the average chord for the horizontal and vertical stabilizers separately. Use the sailplane's velocity to calculate the average Reynolds number for each surface and then add up the separate contributions. Or,

- For most designs, the average chord of the stabilizers is about 1/2 the chord of the wing. So take 1/2 the Reynolds number of the wing to figure the stabilizer drag coefficient and use the total stab area to do the calculation. Simpler and almost as accurate.

FUSELAGE CONTRIBUTION:

Here's where it starts to get a bit more 'iffy'. We can figure total areas for drag contribution but surface roughness, area distribution, round or sharp edges, radius and size of the intersections, and entry angle with respect to the average airflow can make a huge difference. Fuselage design for low drag is tricky in the absence of wind tunnel data. So what we'll do here is concentrate on the total 'wetted' area of the fuselage and then make some very conservative extrapolations so we won't get results that are too optimistic.

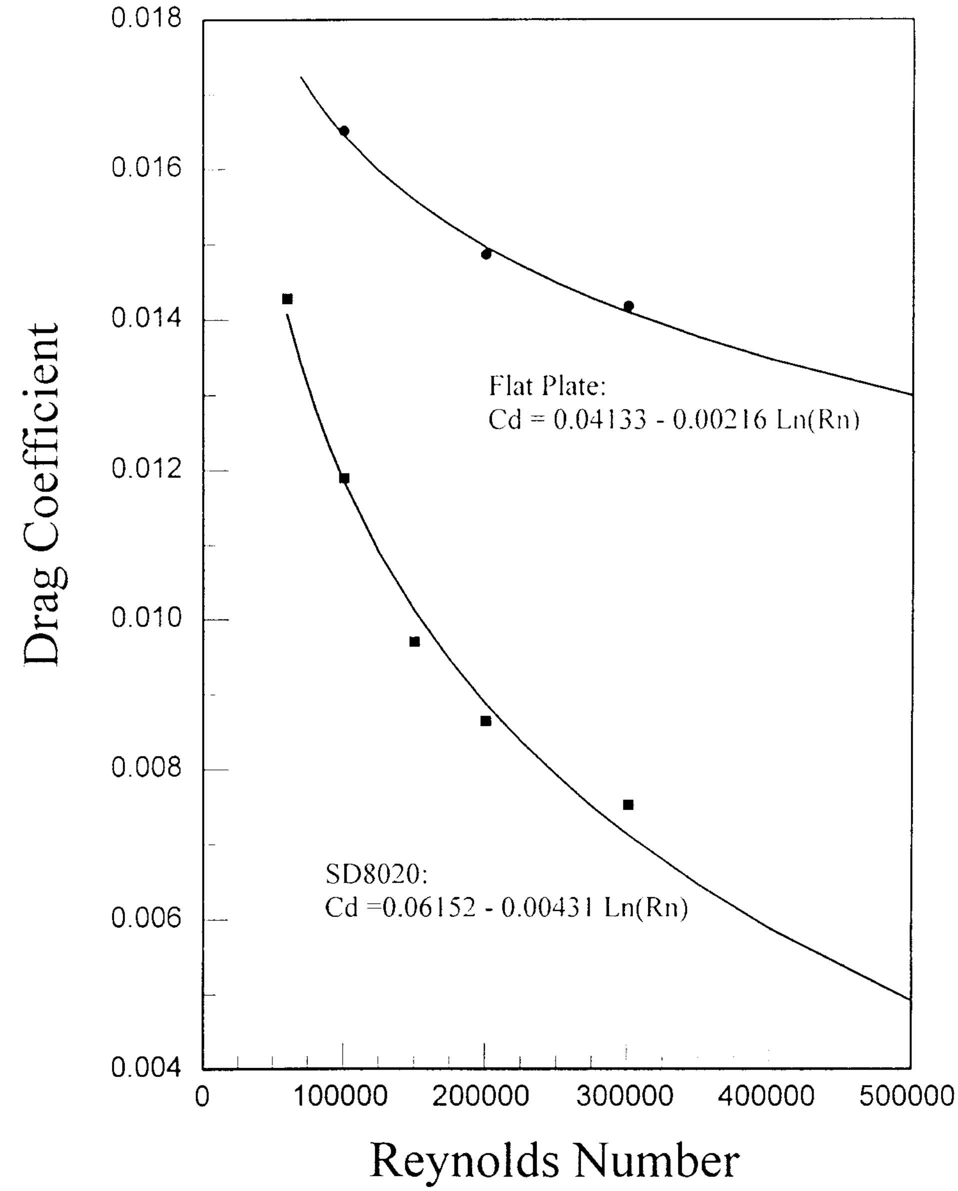
If you've got a box type fuselage with not too many taper breaks, simple geometry calculations can get you a good value of the total surface area. I'll refer to this as the 'wetted' area - that is the entire surface that's exposed to the airflow (top, bottom, left and right sides). This is different than the area used for calculating drag coefficients for wing surfaces - which is just the average chord times the span. That's about 50% of the total area that's exposed to the airflow.

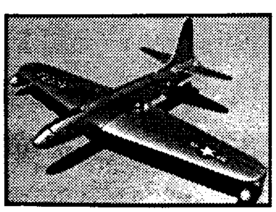
For more complex cross sections, you may need to do a little more work. Let's use as an example my Laser 3MC (essentially identical to the Psyko 3 fuselage). For the most part, any place along the fuselage looks a bit like an elliptical cross section. A very simple way to get the wetted area is to pick a number of stations along the fuselage and wrap a piece of string around the body at each location. Measure the length of the string to get the circumference. Then use the distance between each station and the average circumference between each pair of stations to calculate the area.

Using this method, I come up with a total 'wetted' area for the L3MC fuselage of ~ 190 square inches. The surface area of the horizontal and vertical stabilizer for this design is ~ 200 square inches so on an area basis, the fuselage drag should be comparable to that from the stabs. But we also have to consider Reynolds number effects.

For the fuselage, consider that the airflow will be primarily along the axis of the ship. We also note that the fuselage is typically 6 or more times the average chord of the wing. So the Reynolds number for the fuselage should be at least 5 times the value for the wing (allowing for some vertical flow). If the wing is flying at 60,000 then the fuselage will be at least 300,000.

Figure 3: Drag Coefficient Reynolds Number Dependence





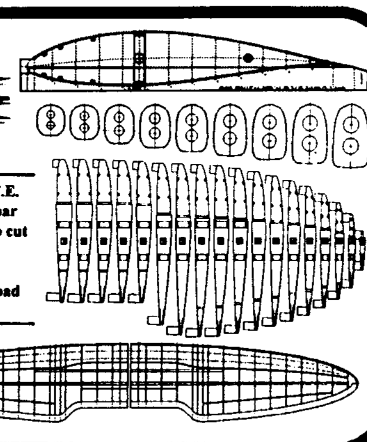
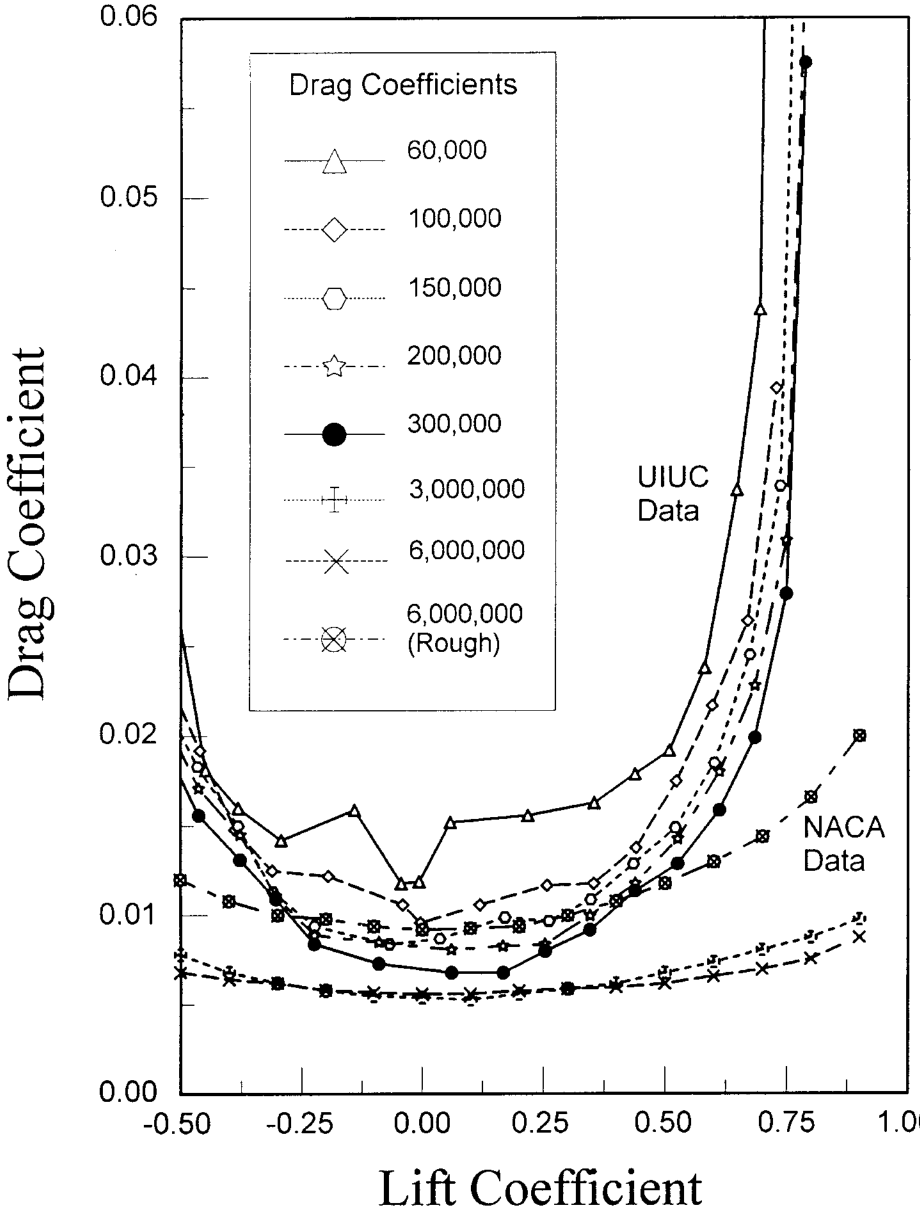


Figure 4: NACA0009 Drag Coefficients



In Figure 4 we've blended recent data from the UIUC database with older NACA data reported in Abbott and Von Doenhoff (2) for the NACA0009 airfoil. For Rn > 300,000 we've only plotted two values (3,000,000 and 6,000,000) since the data is pretty asymptotic beyond 3,000,000 (i.e., Cd near Cl=0 has a pretty flat response to Reynolds number). Since the fuselage Rn will be at least 300,000 we can use a constant value for the drag coefficient. The trouble is, which value do we use?

Again, I'll have to fall back on making a reasonable guess (Spock, where are you?). Referring to the Abott and Von Doenhoff reports, the Cd dependence on thickness of a symmetric profile (assuming turbulent flow) is relatively insensitive to thickness in the 8% to 12% range. Since most fuselages will fall in this range of thickness (maximum height or width as a percentage of fuselage length), the Cd near Cl=0 for a symmetric NACA 4-digit section in this thickness range is probably a reasonable estimate for the drag coefficient of the fuselage.

One other consideration should be used in this 'guesstimate'. Again, refer to Figure 4 for the case of Rn=6,000,000. In this example, two conditions are given - one for a normal surface finish and one for a roughened surface. The latter case exhibits a drag coefficient about 50% greater than the former. Although data does not exist for the rough surface at Rn ~ 300,000, fully developed turbulent flow from the roughened surface should be achieved since this is well above the Rn for which laminar to turbulent transition can be expected. To be conservative, I'll choose the drag coefficient for a roughened surface for our estimate of fuselage parasitic drag. Final result: we wind up with a fuselage parasitic drag coefficient of:

Cd(fuse) ~ 0.012

To be even more conservative, in my calculation I'll use the total 'wetted' area of the fuselage for considering fuselage parasitic drag. This should capture most of the 'effective' area generated by the intersections (wing to fuselage, stabilizers to fuselage). Although this derivation leaves a lot of uncertainty in the final number, the fuselage parasitic drag will not normally be the dominant drag term so some uncertainty here will not greatly affect the final result, except at very high speeds. For the purposes of this simulation, the fuselage contributions will usually be held constant while the wing and stab area, airfoil, aspect ratio and wing loading will be varied.

LINKAGE AND HINGE GAP CONTRIBUTIONS:

This is the least known term and the estimate becomes consequently less certain. If we could stick a few wings and components in a wind tunnel we could sort this out pretty quickly for a specific design. But even then, slight differences in construction and linkage setup could change the result appreciably - see the reference in Dave Garton's recent *Model Aviation* column as an example (3). What I've done in my program is simply let the designer use a low, medium or high drag coefficient estimate here. The estimate is used as a scaling factor on the fuselage drag coefficient and increases it by 25%, 50% and 100% respectively. This isn't a good answer but it is based on some experience.

First of all, it's hard to imagine that linkage drag could be more than the drag contribution of the fuselage. So 100% is an upper limit. Next, there are some reports that total linkage drag may be comparable to stabilizer drag for the case of no shrouds around the linkage. With shrouds the value can be appreciably reduced. So a 25% increase is reasonable for a well streamlined base case.

But the real bottom line is that many years ago, we used the techniques described above to fit the polar data from the San Fernando Valley Silent Flyer's polar experiments headed up by Blaine Beron-Rowden. Once induced and profile drag were taken into account (based on the airfoil data we had at the time), there was always a small drag contribution needed to make the model fit the data properly. Once the stabilizer contributions were considered, the residual drag is about what can be determined from the fuselage and linkage terms we've discussed.

One plane stood out as having the lowest parasitic drag contribution. It was an original design known as the 'Goose'. This establishes the lowest drag condition (low fuselage area, clean linkages). Paragons and such provided the upper bound (large area, boxy fuselages with nyrods out in the breeze). So in a sense I've cheated by having an answer (at least in general) before solving the problem. But I don't count it as cheating since all that's been done here is use measured data to be sure that the estimates are at least realistic.

That's about as far as we can go on the background work. There is more detail available, especially in the European F3B design forums. But I'm not sure that adding more detailed analyses will lead to a more accurate result at this point. The terms we've discussed capture the major elements and use reasonable estimates for the less well defined terms. So let's use what we've got to look at design trends and refine it more later on if that's needed.

Next time we'll put it together and run some sample cases to see how changes in assumptions change the results of the calculation. Then we'll look at optimizing different design classes to address the question "Does Bigger Fly Better?"

Resources

(1) MS Selig, CA Lyon, P Giguere, CP Ninham and JJ Guglielmo, "Summary of Low-Speed Airfoil Data, Volume 2", SoarTech Publications, 1504 N. Horseshoe Circle, Virginia Beach, VA 23451 (April, 1996). E-mail: herkstok@aol.com

(2) IH Abbott and AE VonDoenhoff, "Theory of Wing Sections" Dover Publications, NY (June, 1959), ISBN 0-486-60586-8

(3) Original reference from Mike Garton, *Model Aviation*, March 2001: http://beadec1.ea.bs.dlr.de/Airfoils.linkage.htm

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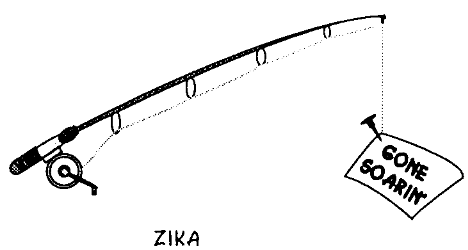

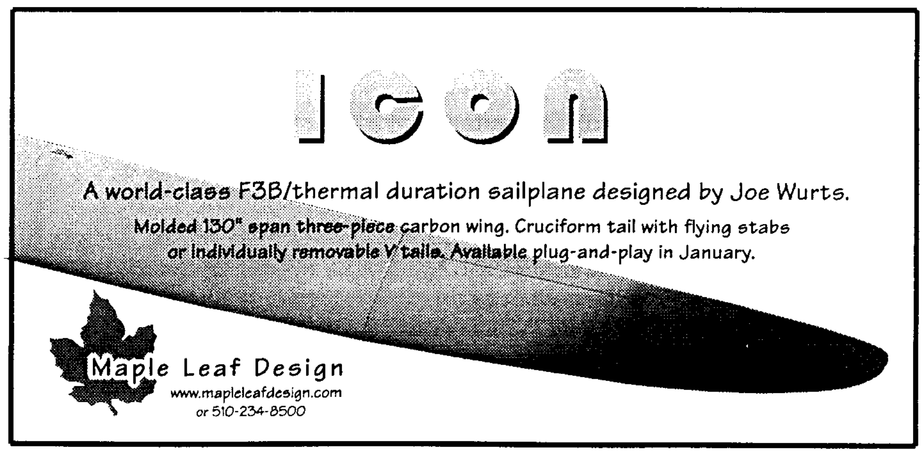

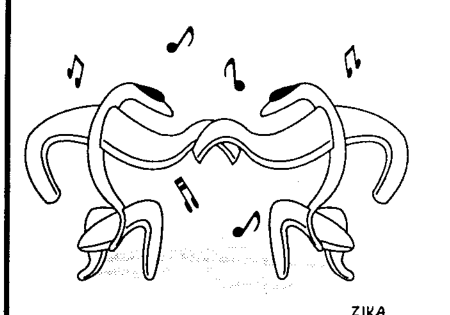

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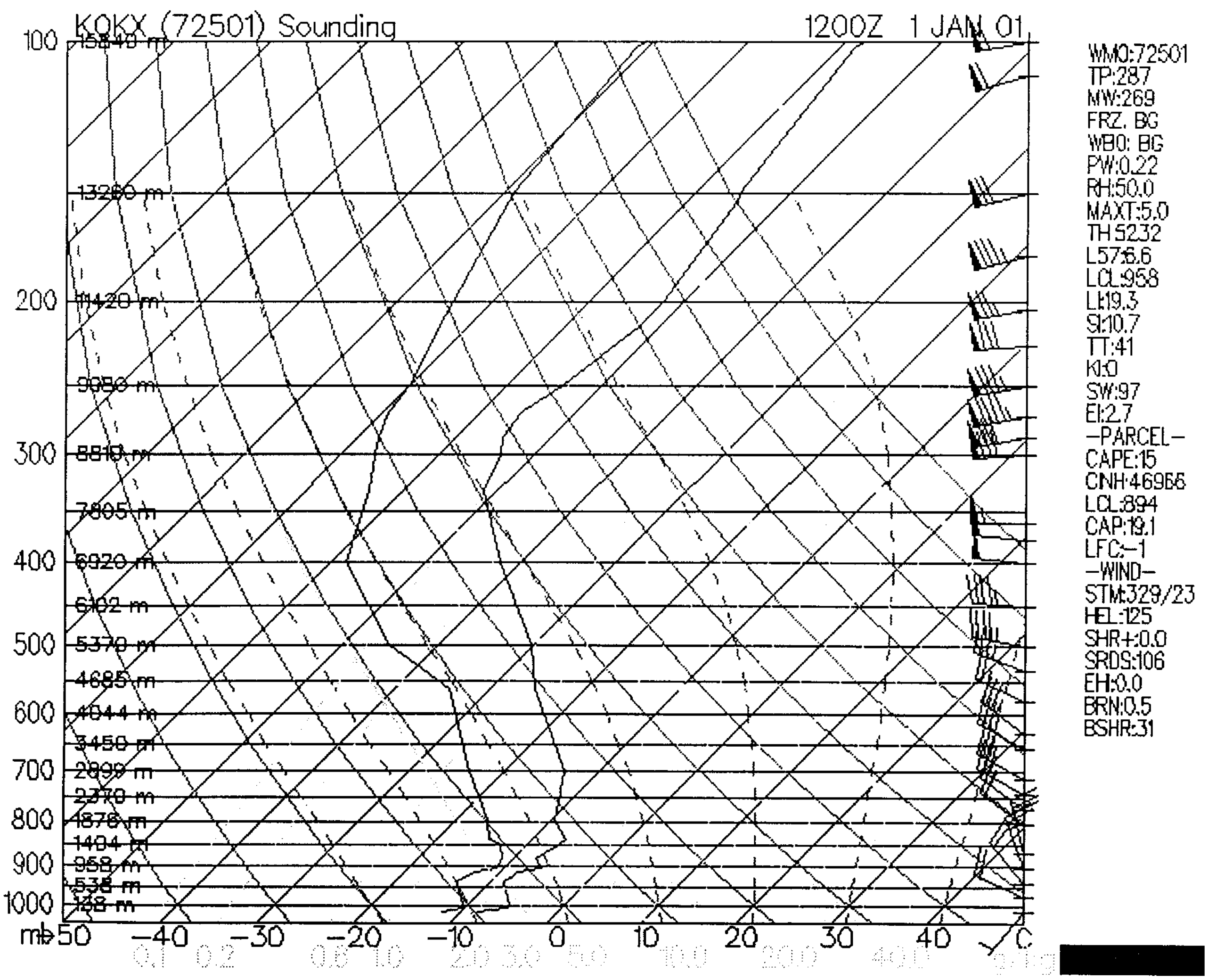

- For questions and information on this server, NOAAPORT and WXP, contact Dan Vietor at *devo@ks.unisys.com*
- For sales information on Unisys weather solutions, contact Mike Porreca at *michael.porreca@unisys.com*
- *Last modified October 10, 1999*

FIGURE 1

THE NATURAL SIDE OF THERMAL SOARING

By Lee Murray
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Ground Temperature Corrected Lapse Rate Plots and SkewT Plots

Flying Models Vs. Full Size Sailplanes

People have made the point to me that, for the most part, you don't need to predict what days will have thermals sufficient to soar full size sailplanes. Thermals for modeling purposes only, sometimes referred to in this column as plumes, can provide the lift needed to max out the tasks during a contest if you are skillful enough to find and use light lift. Yes, this is true, but there are other good reasons for learning this information.

1. For an unskilled modeler, the thrill of getting in strong lift can be very motivating.

2. Knowing how strong thermals can be brings you to other realizations. Would you want to fly a Gentle Lady that has no spoilers when you might have to deal with a 1,000 fpm thermal?

3. Just knowing that strong lift conditions exist tells one that you should have spoilers or flaps on your model for the safe descent when the "hat sucker" threatens to take a model out of sight.

4. If you needed to accomplish a one or two hour LSF thermal duration task, you would like to know on which day to take out your biggest model, so you can climb to the edges of visibility. From that great height, you can float through a down cycle to find the next lift cycle.

5. For those of us who pursue US and world records, this information can make or break an attempt.

In previous articles[1] I have described a process that utilizes the atmospheric sounding information available from the Internet for cities with airports or weather bureaus around the country and the world. By examining a plot of air temperature vs. altitude, one can predict just how warm the ground air has to be to reach a certain altitude. This would be the trigger temperature.

Full-scale glider pilots sometimes use a preprinted graph paper with a family of adiabatic lines to plot the sounding (altitude vs. temperature) information[2]. This chart is confusing for those who first see it, including myself. Actual air temperature is compared to theoretical air temperature for a packet of air rising from the ground using the dry adiabatic lapse rate (DARL)[3], -5.4° F/ 1000 feet or -9.8°C/ Km. If the air packet temperature is higher than the actual air temperature, the packet will continue to rise. Plots shown in earlier articles had one adiabatic line plotted from a specific altitude and temperature down to 0 Ft AGL (above ground level). That intersection of the adiabatic line with the temperature axis defines the trigger temperature, less a few degrees, for the altitude of interest.

SkewT Plots

I know that what I have described thus far sounds difficult — The data gathering, the plotting, the projections — but I have good news for you. Plots similar to what I am talking about, called the SkewT Plot can be obtained directly through the Internet for a number of weather stations. A plot for Brookhaven, NJ can be obtained using the URL:

http://weather.unisys.com/
upper_air/skew/
skew_KOKX_inv.html

(Note: The editor may have trouble getting all the detail onto a black and white figure for the RCSD hard copy. Punch in this URL and see for yourself what I'm talking about.)

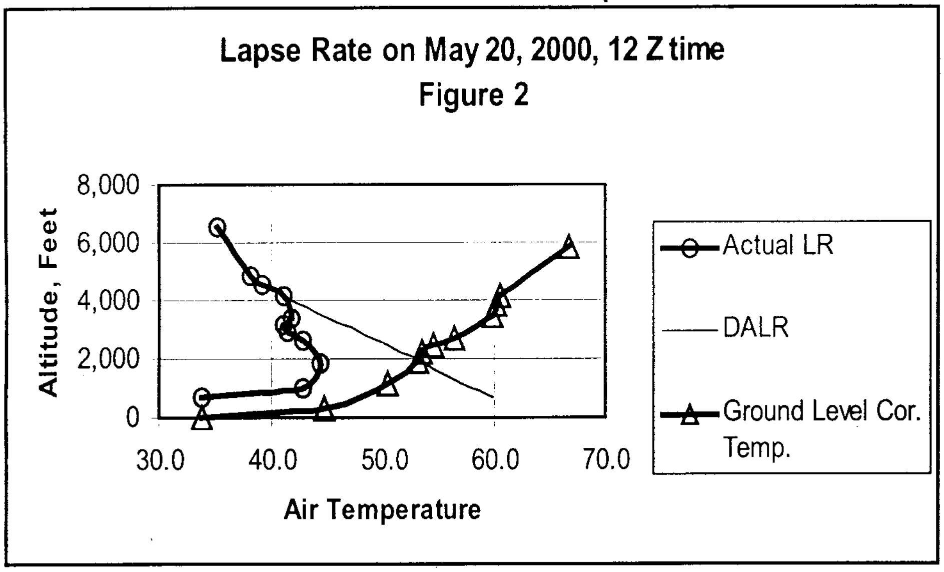
A January 1, 2001 plot is shown as Figure 1. Note that it also has wind speed, wind direction, moisture content and other information. The irregular, mostly vertical, black line to the right is the lapse rate plot and the one to the left is the dew point plot. The major Y axis is altitude and the Major X axis is skewed temperature. These are metric plots, meters and deg C. Families of adiabatic lines (dry and moist) are plotted. This is best seen in color on a computer screen or color printer. The Unisys page has a description of their SkewT plots on their page. Its main purpose is for weather prediction, and part of that is to understand the stability of the atmosphere. (See Figure 1.)

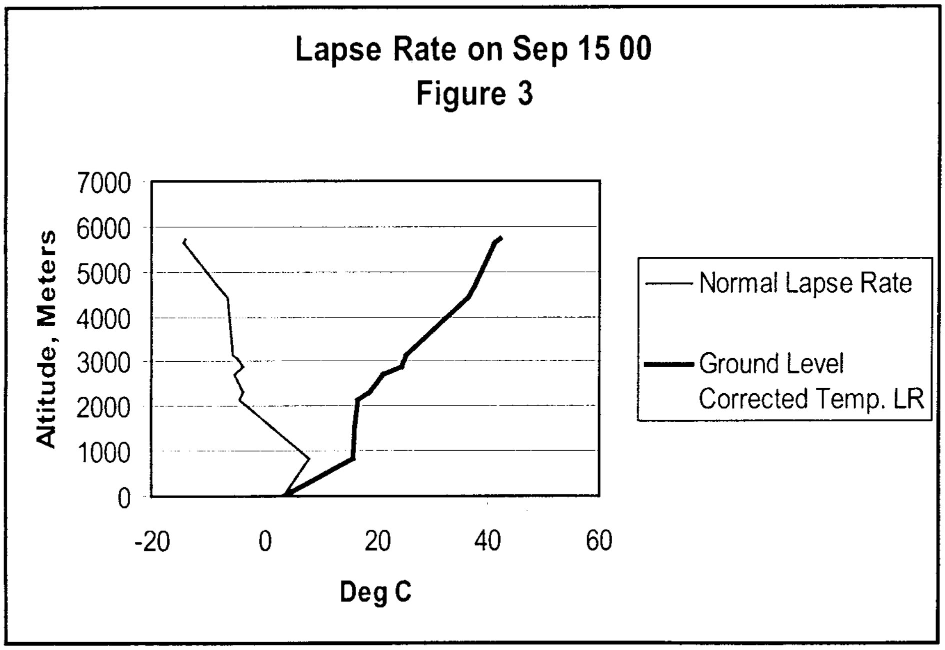
Ground Temperature Adjusted Air Temperature Lapse Rate Plots

The lapse rate plot becomes easy to interpret using a plotting method whereby air temperatures at altitude are corrected to ground level temperatures using the dry adiabatic lapse rate of - 5.4°F / 1000 ft. A line that slopes to the left (a negative slope) predicts that an instability where a thermal will continue to rise. (See Figure 1.) One which slopes right (a positive slope) predicts that an air packet of a particular temperature will stop rising at a specific altitude. One only has to project a line vertically from a given ground level air temperature to the "ground level corrected lapse rate" line to determine how high a thermal will rise.

Figure 2 contrasts the conventional trigger temperature plot (line labeled Actual LR and DALR) to the plot of Ground Level Air Temperature vs. Altitude (AGL). Temperatures on May 20 reached 64 degrees; great thermal activity was seen with thermals going to 4,000 feet.

The other part of the picture is to know the predicted max temperature and when in the day your trigger temperature will be reached. Common weather reports indicate the expected high temperature of the day. Many times the temperature profile will be like the day before, if the weather system isn't changing. If you wanted to have the temperature history for a particular day, you can access that information from a government weather service webpage. To find the weather station near you, use the URL: http://iwin.nws.noaa.gov/iwin/##/##.html but substituting your state abbreviation for the ## signs above. The process will allow you to identify the stations near you. For Appleton Wisconsin's Outagamie County Airport, I end up linked to http://weather.noaa.gov/





weather/current/KATW.html. The ATW relates to this airport (the symbol ATW that show up on our baggage if you fly here).

Unusual Weather Observation

I observed an unusual atmospheric phenomenon on a trip back from Green Bay on September 15th. What I saw was a series of funnel shaped clouds that descended from a common higher altitude to a common lower altitude. My wife held the camera out the window and took some photos. When I got home I downloaded the sounding information. The sounding showed an inversion and an unstable temperature profile that is shown in Figure 3. I suspect that warm thermal generators produced packets of moist air warm that rose to the inversion at 2,000 meters. A condensation occurred causing a cloud to form at about 1,500 meters rising to 2,000 meters where it encountered another inversion above which it could not rise. I don't have an explanation for the cyclonic appearance. Perhaps one of the experts can supply that information. (Photograph on page 20.)

References:

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

2 Simons, Martin, *RCSD* V 16, #1, pg. 10

3 Values differ depending on the source. Dennis Pagen in Understanding the Sky gives a value of 5.5 for DALR and 2 to 5 deg F/1,000 ft given for moist adiabatic lapse rate (MARL). ■

Please send in your scheduled 2001 events as they become available!

SCHEDULE OF SPECIAL EVENTS

April 7-8, 2001
Deep South Championships — Houston, TX
Mike Kovacs, j_m_kovacs@yahoo.com
http://www.geocities.com/j_m_kovacs/hawks/dsc2001.html

May 4-6, 2001
Texas National Tournament — Segoville, TX
Pancho Morris, (972) 681-1098
Lynn Williams, (214) 321-3005
tooth@hawkpci.net

May 18-20, 2001
Midwest Slope Challenge — Wilson Lake, KS
Loren Blinde, mwsc@alltel.net
http://www.alltel.net/~mwsc

June 9-10, 2001
Montague XC Challenge — Montague, CA
Dean/Scott/Randy, (541) 899-8215 Days
Dean Gradwell, (541) 899-7034 eve.
dgair@cdsnet.net

June 9-11, 2001
CANAM Aerotow — Ontario, Canada
Bill Woodward, (519) 653-4251
woodwab@mail.mohawkc.on.ca

July 7-8, 2001
CRRC RES Contest — Sudbury, MA
http://www.charlesriverrc.org
Pete Young, (617) 484-0640
pwyoung@ix.netcom.com
Dick Williamson, (781) 981-7857
williamson@LL.mit.edu

July 21-22, 2001
Gerry Knight Memorial Scale Aerotow Rally Y2001 — Ontario, Canada
Phil Landray, (905) 468-3923,
linden@niagara.com
Don Smith, (905) 934-7415,
donsmith@mergetel.com
Charlie Rader, (905) 563-4108

August 11-12, 2001
Pacific Northwest HL Regional — Redmond, WA
SASS R/C HLG
Adam Weston, (206) 766-9804
red@tgworks.com
http://www.reddata.com/SASS

August 11-12, 2001
CRRC Soar-In Contest — Sudbury, MA
http://www.charlesriverrc.org
Dave Walter, (978) 562-5400
dwalter@ultranet.com
John Nilsson, (978) 368-7136
nilssonj@rd.simplexnet.com

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.

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

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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/month and are limited to a maximum of 40 words. *RCSD* has neither the facilities or the staff to investigate advertising claims. However, please notify *RCSD* if any misrepresentation occurs. Personal ads are run for one month and are then deleted automatically. If you have items that might be hard to sell, you may run the ad for 2-3 months.

For Sale - Business

PARACHUTES: $15 (includes S&H U.S.A.) Send check or money order to Dale King, 1111 Highridge Drive, Wylie, TX 75098; (972) 475-8093.

FENDERS! Cover your aileron and flap pushrods with a set of fenders, to help protect bottom of wings & control horns. Price (check or money order): $5.95 (set of 4) + $3.50 S&H USA. (Texas residents add 7.250% sales tax.) Viking Models, U.S.A., 2 Broadmoor Way, Wylie, TX 75098; (972) 442-3910.

DesignAire: EASY TO USE AIRCRAFT DESIGN SOFTWARE (PC). 3-D sketch, performance, Wt/Bal, inertias, color graphs, panel analysis, static stability, airfoils, FAR 23A loads and envelope. Runs "airfoil ii". $119. JammAero POBox 69, Wallops Island VA 23395. www.jammaero.com.

SAILPLANE PLANS: Copies of ORIGINAL, SOAR BIRDY & BIG BIRDY plans as originally kitted by Bridi Hobby. $12.00 per set, shipping included. BUZZ WALTZ, 68-320 Concepcion Rd., Cathedral City, CA 92234, 760-327-1775 or e-mail, <buzzwaltzrc@excelonline.com>.

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

LSF

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

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
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.eclipse.net/~mikel/esl/esl.htm
ESL President (99-00): Tom Kiesling (814) 255-7418 or kiesling@ctc.com

BORDERTOWN, AUSTRALIA

Martin Simons poses with his absolutely gorgeous Condor III at a November scale aerotow event held 'Down Under'.

Photography by Don Howie.