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R/C Radio controlled SOARING DIGEST

THE JOURNAL FOR R/C SOARING ENTHUSIASTS

R/C *Radio controlled* Soaring Digest

THE JOURNAL FOR R/C SOARING ENTHUSIASTS

TABLE OF CONTENTS

Advertiser Index

OTHER GOOD STUFF

Special Interest Groups

Events

RCSD ON THE WEB

http://www.halcyon.com/bsquared/RCSD.html

Monthly Feature Photography & Web Version of the Printed Article (where appropriate)
Highlights & Mailing Status of the Current Issue
About RCSD
.... ***Subscription Information***
.... ***Advertising Rate Card*** (Adobe Acrobat PDF format)
.... ***RCSD Feature Columnists, Reporters, and Editors***
.... (E-mail/web addresses, plus general information about their areas of interest)
"Getting Started in RC Soaring" .... Getting started guide - Adobe Acrobat PDF format
Links to Organizations, Special Interest Groups & Clubs
On-Line Articles - Great articles originally written for the printed version of *RCSD*.
.... "Trimming Your Sailplane for Optimum Performance" by Brian Agnew
.... "Flys Faster" by Dr. Michael Selig
.... "The Square-Cube Law and Scaling for RC Sailplanes" by Dr. Michael Selig
.... "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

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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Gene Zika is the graphic artist who designs the unique ZIKA clip art.

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The Soaring Site

November Feature Article Available in PDF Format

Last month saw a flurry of activity for most of us. The holidays arrived with winter right on its heels, spreading snow, sleet and unbelievable cold weather across all your favorite flying sites, not to mention a few other places as well! But, safe behind keyboards, trying to stay warm despite the cold, the first feature article pdf file for *RCSD* was created and made available on line. For those of you that missed it, it is still available, and the photographs are in color, of course. It's called Richard Loud's flight report entitled "Dave's Aircraft Works Foamie 1-26 - 2 Meter".

"R/C Soaring Resource" Update

In addition to providing the feature article as a pdf file, the resource listings were reformatted and made available as two separate pdf documents: U.S.A. and Outside the U.S.A. Dated January 1, 2001, the 2 files were uploaded and made available on line. The updates were made prior to January 1, assuming few changes or additions would be received. And, as soon as it was accomplished, we received the first change from Nick Trubov in Arkansas. Since we receive on the average of anywhere from 1 - 3 updates a month, Nick's input, as always, was appreciated and scheduled for the next monthly update.

Nick says:

"I think about writing you every month when I get to the R/C Soaring Resource section of the magazine. And, every month I forget. This month I decided to actually DO IT RIGHT NOW and not wait until it was "more convenient".

"I have been meaning to tell you that Tom Tapp is no longer the president of the NW Arkansas Soaring Association... (Tom's in Dallas, Texas now.)

"I do not even know if there still IS a NW Arkansas Soaring Association.

"I would be happy to be a contact, here in NW Arkansas, with the understanding that I am not connected, currently, with any local soaring club or other local soaring organization. I do have three or four friends here in Fort Smith who I do fly with on occasion and I still try to make it to the few slopes we have whenever the wind is blowing in the right direction, so you can put me down. Maybe that will help us get some more people in the area interested in flying REAL toy airplanes.

"So, here are my particulars:

Nick Trubov
7112 South T Street
Fort Smith, AR 72903-4118
501.452.7806 (home)
ntrubov@ipa.net

Thanks, Nick! Your particulars have been added to the resource listing!

And, shortly before January 1, our traveling reporter, Gordy Stahl, posted a note to the soaring exchange, RCSE. Gordy's note follows:

Hi Guys,

"For years *R/C Soaring Digest* Magazine has included a page of club contact names and phone #'s. Adding e-mail addresses would be a neat addition, too. Judy is updating that page and would like all of you out there to e-mail your club's contact information to her: club name, city and state, contact names and phones and e-mail address... Web site address, too. If your state doesn't have a club, how about putting yourself in there for us traveling folks who want to fly with you when in the area?

BUTEO JAMAICNSIS?

Buteo excels in the art of soaring - shown here with designer, Dale King, who handles the controls. Jerry Slates reports on Dale's unique design in this issue.

Photography by Bill Kuhlman, Olalla, Washington.

R/C Soaring Resource Changes Submitted After 1/3/2001

(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.)

E-mail address change:
Arizona - Aerotowing, slope sites in AZ (rugged), Arizona Flying Eagles R/C Demo. Show Team, Dave Wenzlick, (480) 345-9232, dave@scalesoaring.com, or visit CASL at http://www.casl.net.

New Listing:
Illinois - Knights of the Air RC, Tim McDonough,127 S. Oaklane Road, Springfield, IL 62707, tim@mcdonough.net, http://www.mindspring.com/~tmcdonough/knights.htm.

URL Addition:
Ohio - Mid Ohio Soaring Society http://www.fortunecity.com/marina/tranquil/556/index.htm

RCSD Index/Database

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

"Thanks! Judy's address is RCSDigest@aol.com.

(signed) Gordy
"Gordy's Travels" *RC Soaring Digest*,
The Journal for Soaring Enthusiasts

Thanks, Gordy! And, for those of you following along, our e-mail went crazy!

Once the dust started to settle, the resource pdf files were updated again, dated January 3, 2001. This is a *significant* update. So, for those of you that provided information, please check it out and let me know if I have made a mistake, or if any changes need to be made. And, for those of you that use the listings, perhaps as frequently as Gordy, be sure that the current list you have is dated January 3.

In addition to updating resource listings, the club links page has also been updated. And, the number of links has more than doubled!! As you can see with the sidebar, 2 more web links are scheduled to be added.

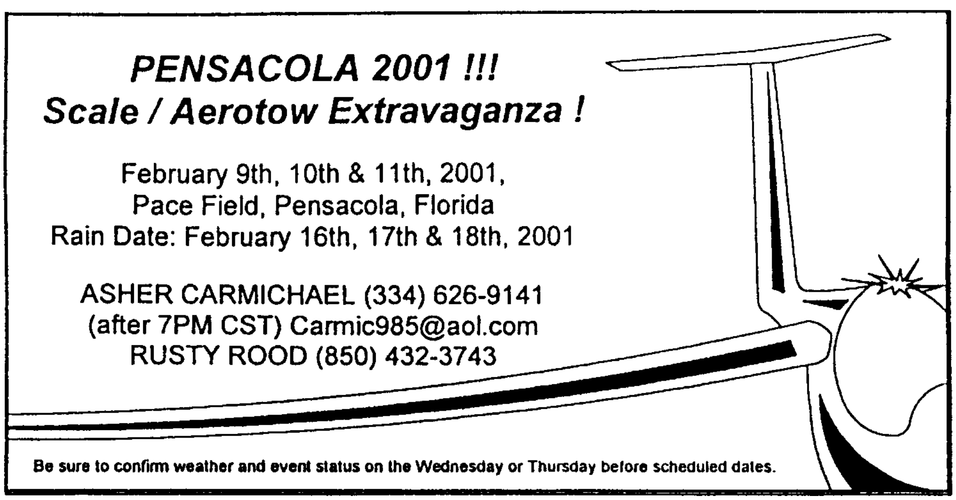
Thanks to all of you that provided information! Thanks to B^2 for doing the web weaving!

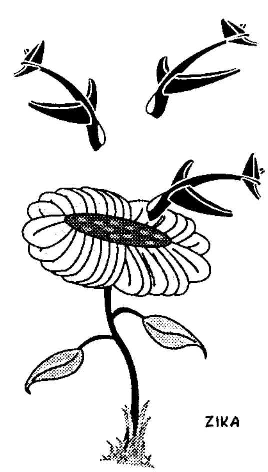
Of note, however, we do not have individual listings for the following states: Alaska, Connecticut, Idaho, Mississippi, Montana, North Dakota, Rhode Island, South Carolina, South Dakota, and Wyoming. Any volunteers?

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

Jerry Slates
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Wylie, TX 75098-2108
(972) 442-3910
RCSDigest@aol.com

Fuselage Repair Before and After...

Last month, I discussed doing end of the year's flying season annual clean up on our models. Since then I have been inspecting my models, one by one, noting that most of them only required a bit of tender loving care.

However, when I inspected my 5 year old Falcon 880, I knew a major repair job was in order.

At first glance, the plane looked pretty good. Closer inspection revealed two hair line cracks in the paint. One crack was around the leading edge wing root on the left side of the fuselage, while the other was lower down, but also on the left side.

Checking the interior of the fuselage, looking for interior damage, uncovered the need for more repair work. I checked the servo tray. Although it appeared to be in order, when I pushed down on the tray with my thumb, the glue joint was broken on the left side, as well. Since the left side of the servo tray was loose, I concluded that the fuselage cracks were caused due to lack of support. The right side of the fuselage was OK.

Overall, the damage appeared minimal, but if not repaired soon, it could become a major problem down the road. With another 5 or 6 hard landings, the whole nose could be broken off the Falcon 880, and it would likely end up in the trash can.

After a bit of time on the workbench, I felt the 880 could be around for perhaps another 9 years or so.

An easy fix, I started chipping away all of the paint around the damaged area with a modeler's knife. Note figure 3. I could see the damaged area quite clearly, now, continuing to chip away at all the small bits of broken epoxy in the cracks, both on the inside and outside of the fuselage.

Once done with that chore, I covered the cracked area on the outside of the fuselage with masking tape as shown in figure 4. The tape is used to hold everything together and, an added plus, it keeps the epoxy from running through the cracks, effectively epoxying the fuselage permanently to the workbench. A no-no, to say the least!

Once masked, I cut a piece of fiberglass, mixed some epoxy, and applied it to the damaged area on the inside of the fuselage. Once done, it was set aside and left to cure.

Once cured, the masking tape was carefully removed, and the area was wet sanded using 400 grit wet/dry sandpaper. The edges of the old (original) paint were feathered as I went along. Next, a coat of primer was applied and then wet sanded, again. It took a total of 4 coats of primer to build up the damaged area so that it would match the original paint job. Note figure 5. As shown in figure 2, the fuselage was painted with the original colors and looked almost as good as new.

Stepping back, however, I now observed a bright, shiny new paint job on the front half of the fuselage, with a five year old paint job on the back! So, using rubbing compound, I rubbed the faded color until it, once again, matched the front.

Ha! Did you think I forgot the servo tray? Nope! It was epoxied at the same time that I patched the inside of the fuselage. Enough for this month!

Happy New Year!

■

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, write to:

International Scale Soaring Association
37545 Oak Mesa Drive
Yucaipa, CA 92399-9507
e-mail: 70773.1160@Compuserve.com
web site: www.soaringissa.org

Figure 1 - "Before"

Figure 2 - "After"

Figure 3 - Remove old paint around damaged area.

Figure 4 - Use masking tape around damaged area.

Figure 5 - Sand and prime area to be painted.

on the Wing
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http://www.halcyon.com/bsquared/

Wing Fences

(While we'll use the term "wing fence" in this article, this item may also be identified by the terms "boundary layer fence," "potential fence," or simply "fence.")

Wing fences have been used on swept wing aircraft for fifty years. The MiG-15, one of the earliest examples of their use, incorporated two fences on each wing. The F-86 used them as well. Fences can also be seen on more recent production aircraft like the Fiat G 91 and the BAe Hawk and Harrier.

Despite their use on aircraft flying at supersonic and near supersonic speeds, wing fences are also of use on low speed swept wing aircraft such as man carrying sailplanes and RC models. The Akaflieg Braunschweig SB-13 and a rendition of Hans-Jürgen Unverferth's CO8 by Glyn Fonteneau and Dave Camp serve as examples within those realms.

Wing fences have both an interesting history and an interesting effect.

A wing fence is nothing more than a flat plate which is attached perpendicular to the wing and in line with the free stream air flow. Wolfgang Liebe is credited as being the inventor of the device, for which he received a German patent in 1938, during his work on the Messerschmitt Bf 109B.

The Messerschmitt Bf 109B had a rather peculiar stall. The stall initiated at the wing root, and a cross span flow very near the leading edge then traveled outward toward the wing tip at high speed. The result of this aerodynamic behavior was that the entire wing stalled at essentially the same time, a very dangerous characteristic. Installation of a wing fence prevented the cross span flow, thus eliminating the stall problem.

That a solid plate in the path of cross span flow close to the wing surface would obstruct the flow, as was seen on the Bf 109B, may seem obvious. In actuality, however, the mechanism of operation was more covert in that the beneficial effect was provided by the initiation of a sideslip and the resulting vortex generated by the fence.

Wing fences on swept wings have been found to be very beneficial to inhibiting the nasty stall behaviors which result from severe angles of sweep, but their operation in this environment is entirely different than on a straight wing such as the Bf 109B.

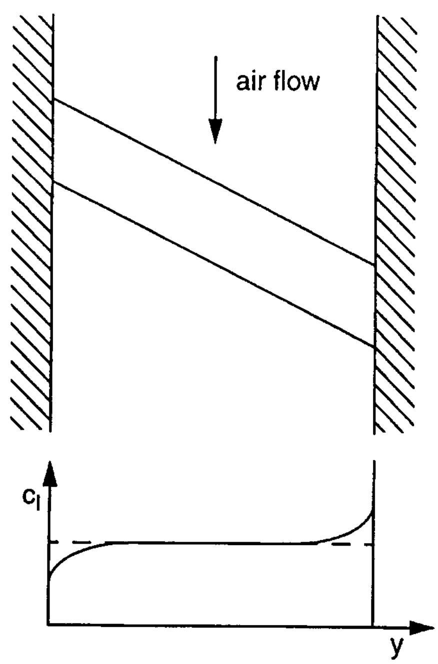

Figure 1. Schematic of swept wing in wind tunnel and associated lift distribution.

As we mentioned in the opening parenthetical paragraph, wing fences have had other terminologies applied to them. "Boundary layer fence" is the most common, so let's take a critical look at that nomenclature for a moment.

The boundary layer is that region next to the surface of a solid body where there is an appreciable loss of total pressure. That is, the velocity is a fraction of the free stream flow. The boundary layer thickness is usually defined as the distance normal to the surface in which the velocity rises to 99% of that of the main flow. The boundary layer is in reality not very thick, usually a matter of a few millimeters, even on full size aircraft.

With the above definition in mind:

- If a wing fence is constructed to be

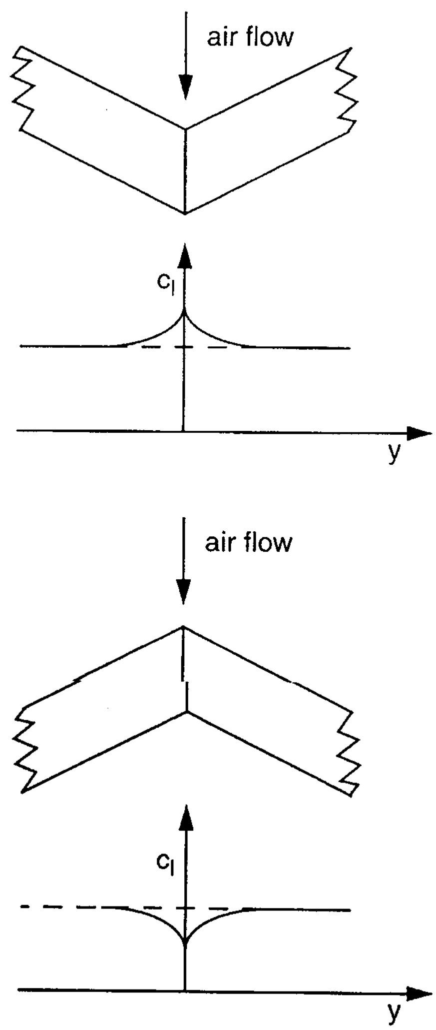

Figure 2. Swept wing segments and associated lift distributions.

the same height as the boundary layer thickness, it is not effective. In fact, fences must be quite high to have any effect at all.

- The boundary layer gets thicker toward the trailing edge of the wing, so if fence height were based on the boundary layer thickness the fence would be highest at the trailing edge of the wing. Yet extending the length of a fence much beyond 50% chord does not increase its effectiveness in the slightest.

- Wing fences are generally more effective when they wrap around the leading edge.

The term "boundary layer fence" is, as illustrated by the above points, a misnomer. Wing fences do not affect the boundary layer directly, but rather do so indirectly by having an impact on the potential flow, the flow in which the vorticity is zero. The term "potential fence" is derived from the action of the fence on the potential flow.

Wing fences on swept wings work in a very complex way, and their action is not completely understood, but we'll attempt to make the fundamental concepts easier to understand.

Begin by thinking of a swept wing panel mounted in a wind tunnel and its associated lift distribution, as shown in Figure 1. Note that if the right wall is removed we have a right wing panel for a swept back wing; if the left wall is removed we have the left wing panel of a swept forward wing.

From a slightly different perspective, by removing the walls and attaching a "mirror" wing panel to either the left or right end of the existing wing, we have a complete wing, swept either backward or forward, and an associated lift distribution as depicted in Figure 2. We can consider a wing fence to be aerodynamically equivalent to a tunnel wall. This effect is demonstrated in a more comprehensive way in Figure 3.

Installing a wing fence changes the lift distribution on a swept back wing as depicted in Figure 4. Note that on the inside of the fence the c_l is higher, while on the outside of the fence the c_l is lower. This shifting of the load to the inside of the fence is very beneficial to stall behavior.

The $c_{l_{max}}$ should be located in the area approximately 40% of the semi-span from the wing root. At a high angle of attack, this should be the area of the wing which stalls, leaving the wing root and the wing tip to continue providing lift and a slight pitch down moment.

When high angles of attack lead to separated flow, the boundary layer is directly involved at a fundamental level. Corrective measures must influence the boundary layer in such a way that flow separation is limited or controlled to some extent. As previously said, wing fences do not directly influence the boundary layer. Rather, they influence the potential flow which in turn effects the boundary layer. In general terms, the c_l load on the wing tips is reduced, the boundary layer is maintained in such a way that separation is inhibited, and the stall behavior is made more benign.

Rarely do wing fences extend farther

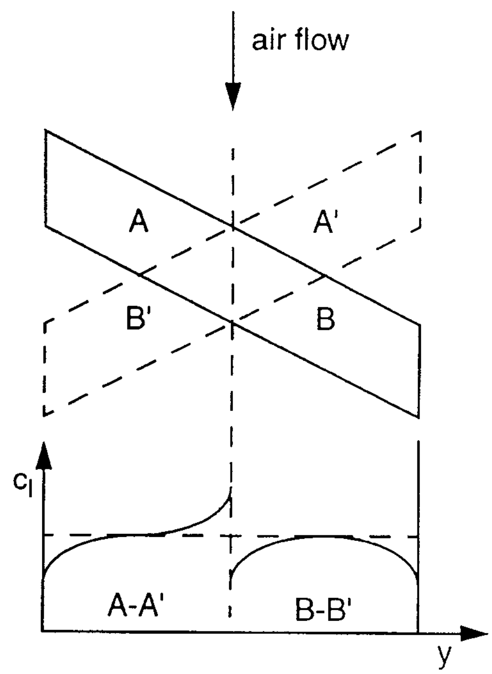

Figure 3. "Mirror" swept wings and associated lift distributions.

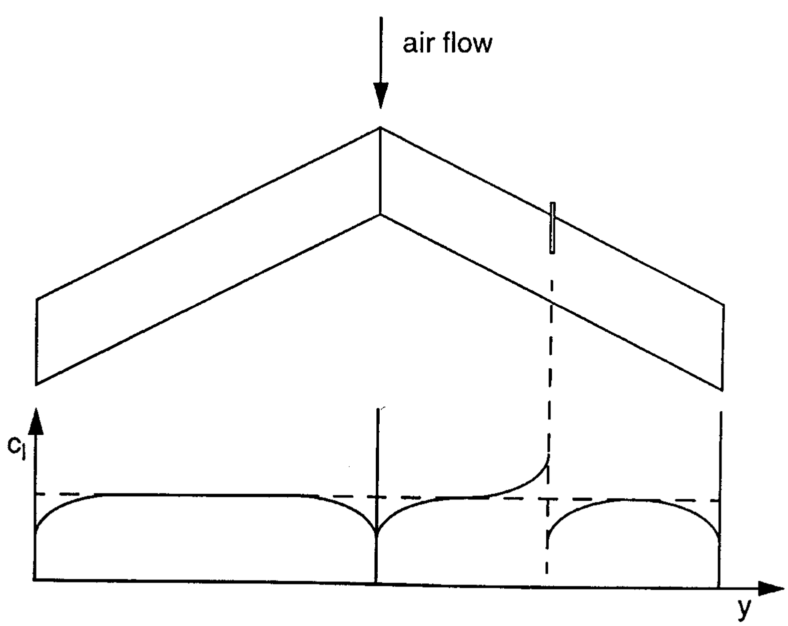

Figure 4. Complete swept wing with fence on right wing and associated lift distributions.

than 1/3 of the wing chord. The forward third of the chord is the area of greatest lift. It is also the area where the sweep effect and the "mirror" principle, described in Figures 1 through 4, are most effective.

For use on RC sailplanes, wing fences are usually constructed using a profile similar to those shown in Figure 5 and are fabricated of stiff cardstock or plastic.

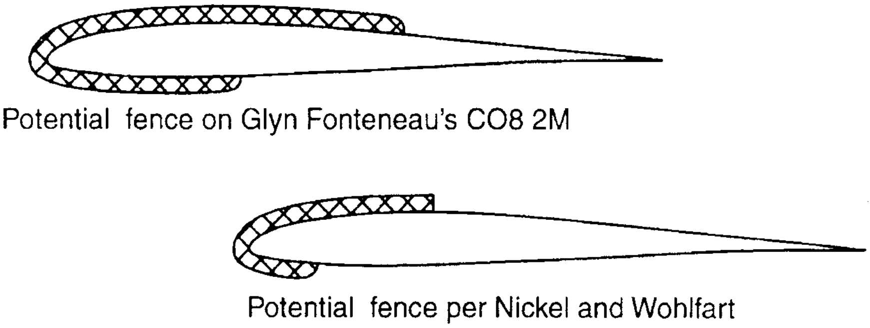

Figure 5. Examples of wing fences.

They can be conveniently attached with tape for easy removal, replacement, and/or experimentation. The most common location for wing fences is between 40% and 60% of the wing span. A location directly in front of the inner edge of the aileron or elevon has shown to be very effective at controlling adverse stall behaviors and maintaining control surface effectiveness at high angles of attack. Installing two fences on each wing panel, at 1/3 and 2/3 of the semi-span, has been found to be effective on high aspect ratio wings with steep sweep angles.

Wing fences are sometimes not easily seen. Most airliners have their engines mounted below the wing on pylons. The pylon itself serves as a fence for the lower surface, and the leading edge pylon fairing often comes over the leading edge, serving as a fence for the upper surface.

Controlling air flow to improve swept wing flight characteristics can be accomplished through a number of means - wing slots (as described in our August 1994 column), leading edge slats, and the "saw tooth" leading edge to name just a few. Wing fences are attractive, however, because they can be fabricated quickly, attached readily, and modified easily without affecting the main airframe in any way. So far as cost and ability to experiment, they are the best suited solution.

Comments, questions, and suggestions for future columns may be sent to us at either P.O. Box 975, Olalla WA 98359-0975, or <bsquared@halcyon.com>.

Resources

Kuhlman, Bill and Bunny. Slots for 'wings? *RC Soaring Digest*, August 1994, and On the 'Wing... the book, Volume 2, B^{2}Streamlines, 1997.

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Nickel, Karl and Michael Wohlfahrt. Tailless Aircraft in Theory and Practice. American Institute of Aeronautics and Astronautics, Washington D.C., 1994.

Whitford, Ray. Design for Air Combat. Jane's Information Group Ltd., Coulsdon, Surrey, 1989.

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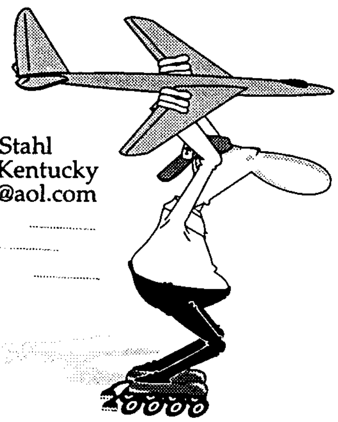

Gordy Stahl
Louisville, Kentucky
GordySoar@aol.com

During my travels, I get to meet lots of really smart guys; one of the smarty's is Bill Johns. When some of my friends and I were wondering where carbon fiber comes from and how it's made, Bill offered up this bit of information. I figured you all would like to know too! Take it away, Bill...

A Trip 'Inside' Carbon Fiber

by Bill Johns
rider@pullman.com
Pullman, Washington
(509) 332-0831 (evenings)

Most any organic matter will eventually turn into graphite if heated hot enough without oxygen. This is referred to as pyrolysis, to heat without oxygen. If there are any atoms species other than carbon, they get "burned" off. Any oxygen, nitrogen, sulfur, etc., will be eliminated as a gas during pyrolysis.

The initial fibers were made from cotton threads, but by the time you eliminate all the oxygen (lots in cellulose) the remainder wasn't that high. Current practice calls for the processing of two types of fiber. One is based on polyacrylonitrile or PAN for short. This is a synthetic polymer which is drawn into a fiber or thread. The other is based on pitch, the residue from petroleum cracking. This is a solid at room temperature, but can be drawn into a thread or fiber when drawn through a heated die. PAN is relatively easy to do but pitch, with its relatively higher carbon content, yields the better fiber.

In either case, the fiber is heated until the pyrolysis process starts. As the carbon loses its starting form, first it goes through a stage where it is not in the final graphite form (an individual molecule of graphite is called graphene); it has zones of graphene and chemically disorganized cross-linked carbon. At this point in the process, the idea is to heat and gently pull the fiber to organize the growing graphene molecules parallel to the fiber axis.

The initial carbonized fibers are relatively tough. If pyrolysis is taken up to about 1700-1800 C, you get a fiber designated as high strength or HS. Continued, careful drawing and heating as high as 2500C will yield a material that is essentially all graphite. This is stiff but not as strong, and is designated as high modulus fiber or HM.

Strength is defined as load carrying capacity at failure. Stiffness is the resistance to stretch. They are very different properties. Typically, materials are either stiff or strong, but rarely both. Graphite or carbon is in large part both. While the HS fibers are stronger, the HM fibers are still very strong relative to other materials and very stiff. (Neither are very tough, but that's where the epoxy comes in.) Folks speak of carbon fiber or graphite fiber and often don't have a clue which is which. In fact, there is a specific difference but, for all practical purposes, just calling it carbon fiber gets the idea across.

Random thoughts:

The fibers are on the order of 7-10 microns in diameter (10 microns is 0.0004 inches). Thinner is better, and this is currently the lower range of what can be manufactured in quantity. Fibers are made one at a time, each fiber in its own little glass oven. There are over 50 types of commercial fiber available from different manufactures; exactly how many I do not know. It puzzles me that when we buy fabric from our various suppliers we are not told or can't find out what we are buying: HS or HM material.

Other questions??? This is a very quick description of the process. I've left out many details, but you get the idea. If you have questions, feel free to contact me, I'll give you what I know.

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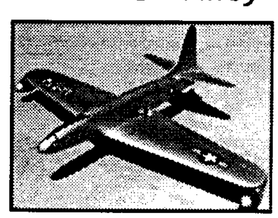

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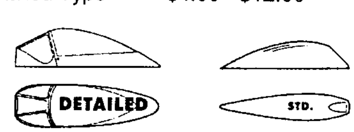

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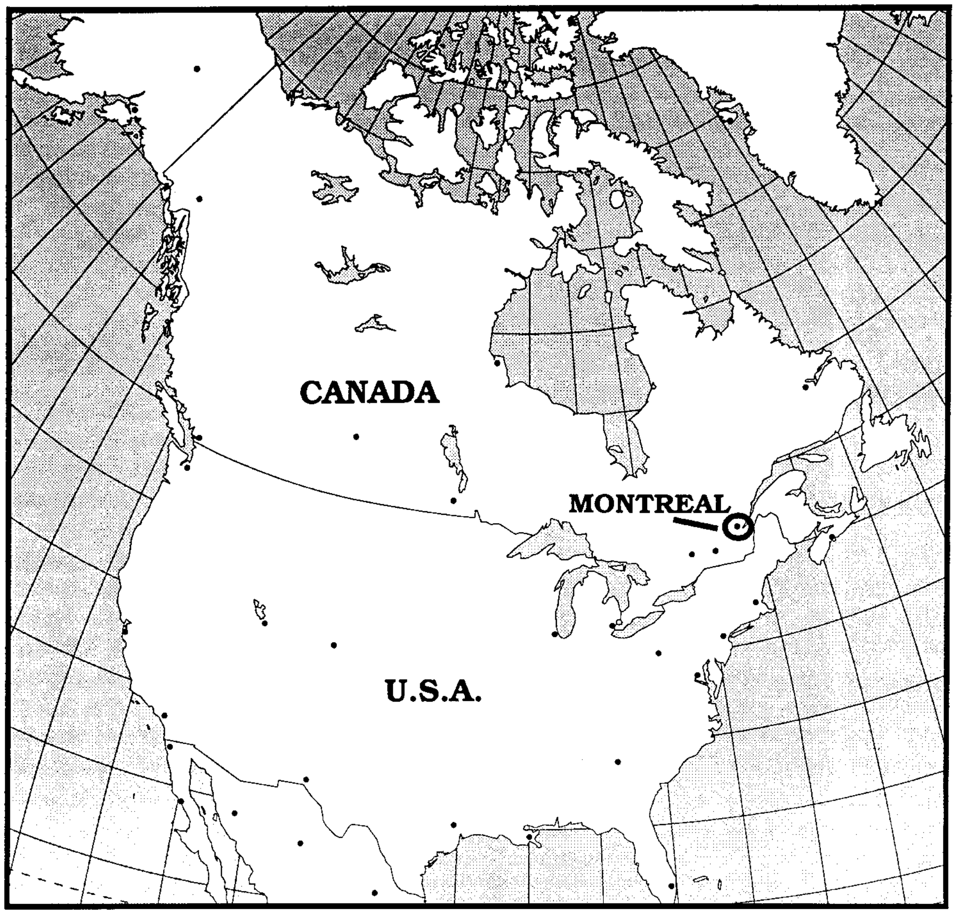


Montreal & The Canadian NATS

By Pete Carr

I've been to many Canadian NATS events, and enjoyed them all. Over the years, my sons and I would drive up to the site at Huron Park near London, Ontario and fly from the runways of the old RCAF airfield. The event was moved to the Montreal Quebec area in 1998. On reading the information on the MAAC web page I thought, "What an adventure!"

It was 700 miles from home to the contest where I decided to fly. That posed a problem since some airlines are not noted for their gentle treatment of baggage. I had resolved to take a 100 inch ship and a two meter for 2M, Standard and Unlimited. The local "Boxes Are Us" store had a box 18x18x56 inches. I grafted two of them together to house the 50 inch wing panels. The exterior of the box was plastered with the words "model sailplanes" in French and English. The issue of bag-apes ability to read in any language was not settled.

At the airport ticket counter I was asked to produce a passport. (I grew up in Buffalo, New York. We would go to Sherkston Beach on the Canadian shore of Lake Erie and never needed a passport.) It was a mild surprise to find that Canada is really a sovereign country with immigration and everything!

The contest site was a sod farm about 20 miles down the St. Lawrence River from Montreal, so the hotels and restaurants were in the same farming area as the site. Here, I found that English is not even a second language and that it was either learn a little French or risk starving.

At the Pilot's Briefing, it was announced that the houses east of the field would be a no-fly zone. I naturally assumed that the "house thermal" was located near these houses and filed the information away for reference. During the event I did "stray" over near the houses and was politely asked to fly away from there. I'd have argued the point but the official used the most polite phrases in a wonderful French accent. They are such gentlemen even when chewing you out.

Two-meter went amazingly well. The 100 inch ship did very badly and I resigned to finishing back in the pack. On "Unlimited" day the rest of the contestants brought out their F3B and F3J ships, molded and absolutely beautiful. I was left to fly the Two Meter and hoped to be "David" to the Canadian "Goliath".

The field was very flat with only distant trees and the houses to disturb the horizon. In a "big sky" like that, size matters. It was against this backdrop that I assembled the ship, checked the controls and resolved to give it my best shot.

It all came down to the last flight of the day. It was nearly 5 PM and we had flown with ballast since the second round. I was sure that the lift was long gone. The landing was a F3B tape with a hundred point bonus and I focused on making the extra points. Before

> 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*

launch I was informed that I was tied for first with a gentlemen flying a molded European F3J ship. We would launch together and last man down would be the winner. After dropping the towline we both headed up wind and did a modest thermal search. I wandered over near those houses again, just close enough to snag a small bump and chase it down wind. The F3B glass slipper had similar luck and we both wound up in the landing pattern about the same time for a max. As I came cross wind in a left-hand pattern I noted the other ship setting up to land but was focused on my ship. The two meter came upwind into the circle and made the 100 points. I was very surprised to see the other pilot walking out into the field where his model rested in the grass. I asked my timer and was told that the other ship had run out of airborne battery on final and went in. It wasn't damaged but the bonus points proved the difference and I emerged as Grand Champion.

Two things were evident. First, I was incredibly lucky. Second, a combination of good friends from the Toronto area and wonderful gentlemen from Montreal made the experience most enjoyable. In the end, the weather, the site and the sailplanes were great, but the fellows I was fortunate enough to fly with made the big difference. No matter where you go, the nicest people fly sailplanes. ■

Communication Thoughts

by Tom Nagel

Those of you inspired by Pete's article to travel to the Canadian Nats need to remember that our neighbor to the north is officially a bilingual country. (Of course, if you are a Canadian, your neighbor to the north is probably a polar bear, and there is not going to be much conversation.)

In any event, I took the opportunity to use Alta Vista's translation web site "Babel Fish" and create a handy English/French phrase book for the northbound sailplane pilot. I figure it ought to get you through most of the situations likely to come up during your average sailplane contest.

1. L'aide, mon émetteur est sur le feu!
   Help, my transmitter is on fire!

2. Vous aiment des escargots avec cela?
   Would you like snails with that?

3. Auriez-vous par hasard de la colle de cyanoacrylate?
   Would you by chance have any CYA?

4. Je ne puis pas lancer encore, mon temporisateur est dans la toilette.
   I can't launch yet, my timer is in the john.

5. Je veux un re-vol.
   I want a re-flight.

6. Aucun merci; de vrais pilotes de sailplane ne mangent pas le quiche.
   No thank you; real sailplane pilots don't eat quiche.

7. Il y a vin rouge dans ma aide de gator!
   There is red wine in my gator aid!

8. Ressemble l'heure d'obtenir une bière, hein?
   Looks like time to get a beer, eh?

Dale King's Buteo

by Jerry Slates
Wylie, Texas

Photography by Bill Kuhlman
Olalla, Washington

Wing Span:	112"
Wing Area:	874 sq. in.
Airfoil:	DS-7080 (root) SD-7084 (mid-span to tip)
Aspect Ratio:	14.47
Fuselage Length:	51.5"
Gross Weight:	61-64 oz.
Wing Loading:	10 oz./ sq. ft.

Buteos (Red Tailed Hawk, Buteo jamaicnsis) are a diverse group of medium to large hawks that excel in the art of soaring. These keen-eyed wind masters are able to tease lift from temperature troubled air and soar for long periods of time on set wings. They are often called the 'clipper ships' of the skies.

No wonder that Dale King of Wylie, Texas selected that very name for his model, which he designed and built. Because, that's what his model will do, going anywhere at any time. In fact, it has been a winner at several local contests, both here in Texas and Kansas. What more could one ask for?

Dale has spent the last few years designing his own models. He incorporates the best of each previous model, figuring out how to best make any changes and what improvements would be made as he goes along. As a result of all this work, Buteo was born.

Buteo has many features, starting with a Kevlar™ reinforced epoxy fiberglass fuselage sporting a slip-on nose cone. Dale uses a jig to drill the wing rod holes in the fuselage to ensure perfect alignment. The pins for installing the Buteo V-tail are drilled into the mold after the fuselage is laid up. There is also a micro screw adjustment block for setting the V-tail at the correct angle.

The wing is a typical obechi sheeted foam core wing with a carbon fiber rod used as a spar, and a 1/2 inch diameter aluminum wing joiner. Carbon fiber cloth has been added for that little bit of extra strength.

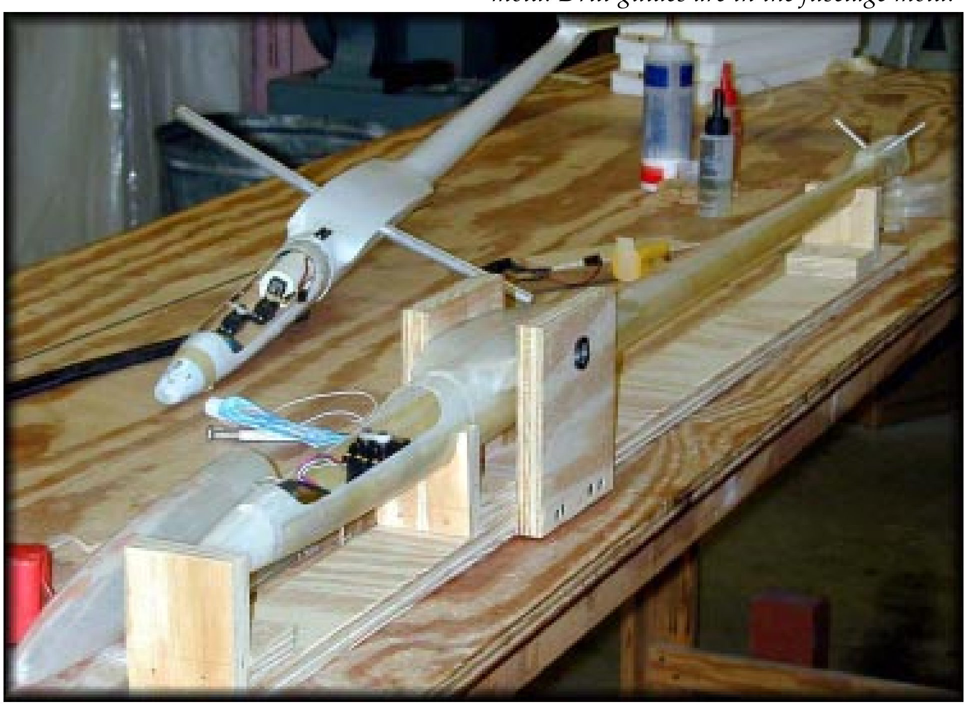
If you would like more information on Buteo, contact Dale King at:

1111 Highridge Drive
Wylie, TX 75098
(972) 475-8093
dkmkking@juno.com

Buteo, 'The Wind Master'.

There's plenty of room inside the nose for the battery pack, servos, and receiver.

Stabilizer pins - Holes are drilled in the mold. Drill guides are in the fuselage mold.



Dale's jig for drilling wing rod holes. Note the metal inserts for drill guide.

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We will have at least four tugs available, some capable of hauling up those large, heavyweight sailplanes up to 30 lb. We will limit the number of tugs flying at any one time to two.

Pilots meetings will take place at 9.30 am on Saturday and Sunday when the rules governing this Fun Fly will be covered by the CD of the day. Gold stickered narrow band radios on 72 mhz are mandatory; have your name on your transmitter and planes. Valid MAAC and AMA memberships will be required and proof will be requested at the field registration and transmitter impound tents.

Fees for the two days will be $ 20.00 Cdn. or $ 15.00 US, payable at time of registration. Tug pilots are free if they are used for towing, unless they are also flying sailplanes, in which case, the fee will be $10.00 or $6.00 US.

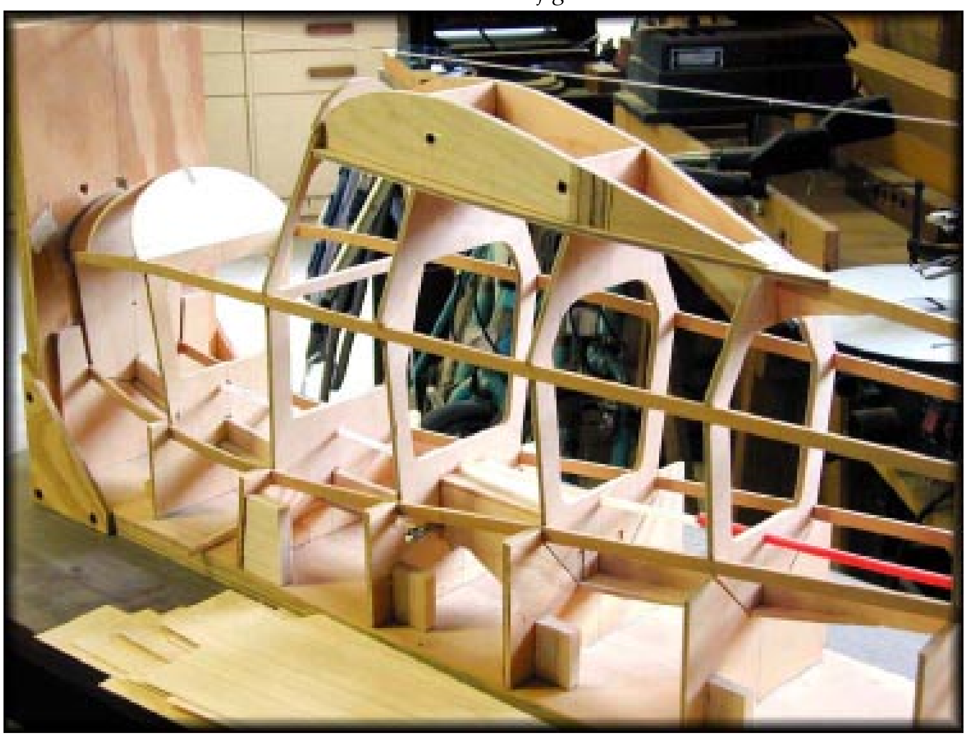
The selection of the field will be made in the spring, so interested participants please contact one of the following members after May 1st for an information package.

Phil Landray
905.468.3923, linden@niagara.com

Don Smith
905.934.7415
donsmith@mergetel.com

Charlie Rader
905.563.4108

The jig.



Amazing craftsmanship!!

One of Dale King's Projects

by Jerry Slates
Wylie, Texas

Photography by Bill Kuhlman
Olalla, Washington

Like most model builders, Dale King has more than one project going on at the same time.

This is his 1/4th scale, 1931 Grunau Baby. Dale is using a jig to ensure a straight fuselage. Yes, it is a great deal of work to build a jig like this one, just as there is building this type of model. However, taking the extra time, and constructing a jig, makes the process much easier.

CANAM AEROTOW 2001
Hosted by the Canadian Model Aerotow Society (CMAS)

June 9 - 11, 2001

Since the Harris Hill L/D RC club is not holding their annual Elmira, New York Aerotow in 2001, CMAS has decided to fill the void by holding an Aerotow fun fly. The Aerotow will be close to the US/Canada border, in the Niagara Region of Ontario.

Prizes awarded for best Modern & Vintage sailplanes.
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Web site: www.alltel.net/~mwsc

CROSS COUNTRY SOARING

Scott Gradwell
Medford, Oregon
rcpilot@cdsnet.net

First, I need to issue a correction to last month's column. Obviously, you slow down in lift and speed up in sink. It was honestly not an act of sabotage to get people I might fly against to land out. Well, now that I have been caught it isn't anymore. I don't know how that got messed up. I am sure it was one of those late night, last minute problems.

Serious Cross Country Soaring Christmas Wish List

Since I am writing this column right before Christmas, although I know you will be reading it after Christmas, I decided to make up somewhat of a Christmas wish list for Cross Country Soaring. I have been interested in airborne videos for some time and have ordered a few tapes on products that are out there.

I think it would be really cool to have two pilots, one outside in the back of the truck and one inside viewing a monitor. The outside pilot would fly the sailplane while it was still easily visible. When the sailplane got high enough in the thermal, the outside pilot would ask if the inside pilot was ready to take over and, when the inside pilot was ready, he would say, "I got it."

You could hook up two transmitters via buddy cord and change the trainer switch over to a two position switch instead of a spring loaded switch so your finger wouldn't get tired. This way you could easily switch control back and forth between the two pilots. There would be several advantages of having an onboard video system. First, you could go a lot higher than what we are limited to now. Many times we have to abandon the thermal when it is getting strongest because we are starting to lose sight of the sailplane.

Second, you could view the terrain below you and fly over the terrain that you feel would give you the most lift, which you can only guess at from the ground. I am sure you are all familiar with looking out at a sailplane and trying to guess how far you are away. I have seen several sailplanes go free flight and everyone guessed they were a lot further away than they actually were.

Third, you could fly a better course. From the air, it is a lot easier to find a turnpoint on the horizon and keep a constant heading. When you are in the vehicle you are just guessing where you need to be going and, as the vehicle goes around turns, you have to make adjustments. This is where a handheld GPS with all the turnpoints pre-programmed in can come in handy, also. Just point the nose of the sailplane the same direction of the arrow on the GPS and you will be going the right direction.

Fourth, you could have a backup plan if the outside pilot's eyes start to get tired and loses sight of the sailplane. When I have been out on course for over 3 hours, the sailplane will just disappear right in front of my eyes. It can be an unsettling feeling to say the least.

Fifth, you could utilize a yaw string and be able to fly more efficiently. If you are familiar with full size soaring you will know what a yaw string is. Basically, it is a piece of yarn that will give you an accurate indication of how the sailplane is flying through the air. It let's you know if your turn is coordinated or not. With modeling, it is impossible to know if you are coordinated from the ground. If you were able to set up a yaw string visible to the camera, you would know whether you needed more rudder or aileron to fly more efficiently. Now if you could incorporate an onboard altimeter and airspeed indicator, you could really do some serious, Cross Country Soaring!

Even though this is a Christmas wish list, I think it is possible to do with the technology we have today, so one of us is going to have to try it! ■

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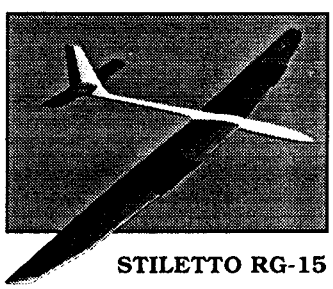
Jer



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52 1/4" fuse, nose cone	$90.00	$15.00
Contestant (148"/E205/3-4/10.5" chord)		
60" fuse, canopy, tray	$90.00	$15.00
Elf 2m (bolt-on wing mount/up to 10" chord)		
44 3/8" fuse, nose cone	$80.00	$15.00
Oden (100-130"/S3021/As Req./10.25" chord)		
51" fuse, canopy	$85.00	$15.00
Raven 3m (119"/Mod. E193/As Req./10.75" chord)		
51" fuse, plans	$90.00	$15.00
Stiletto II (100-136"/Any/As Req./10" max. chord/bolt-on wing)		
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Stiletto RG-15 (100-136"/RG-15/As Req./plug-in wing)		
49" fuse	$85.00	$15.00
Stiletto S-3021 (100-136"/S-3021/As Req./9.5" Chord/plug-in wing)		
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51" fuse, hatch	$85.00	$15.00

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TECH TOPICS

Dave Register
Bartlesville, Oklahoma
regdave@aol.com

Lift and Drag

Last month, we went over the basic conditions which must be satisfied for estimating the overall performance envelope of an RC sailplane. The equations we derived were:

Lift/Drag = Vh/Vs
and
Lift * cos(A) + Drag * sin(A) = Fg

where A is the glide slope angle, Fg is the weight of the sailplane and Vh, Vs are the horizontal and vertical components of the total velocity (V) of the ship:

Vh*Vh + Vs*Vs = V*V

We also found that a good simplifying approximation could be made:

Lift = Fg

That handles the review. What we really need to do now is figure out how to fill in the Lift and Drag forces. Let's start with Lift.

You can check this out in most introductory texts on aerodynamics. Martin Simons has covered this in his texts. You'll also find the lift equation reviewed in detail in the text by Abbott and VonDoenhoff.

In general, you might expect the total lifting force to scale with the area of the lifting surface. You'd also expect it to have some functional dependence on how fast you're moving through the air. Since the medium for flight is air, you'd expect some response to the characteristics of that medium (air). And finally, the specific lift characteristics of the airfoil must be included as well. When you roll this all up, you get the following equation which pretty well describes the lift force:

Lift = p/2 * S * Cl * V*V

where p is the local air density, S is the wing surface area, Cl is the lift coefficient of the wing's airfoil, and V is the sailplane velocity. For purposes of this analysis, we will consider that the only significant Lift component is that of the wing. Neither the fuselage nor the horizontal stabilizer contributes significantly to the overall Lift force of the aircraft. You can design with lifting bodies and lifting stabilizers but we'll not try and cover that here.

From the relationship:

Lift = Fg = weight of the plane,

we can rewrite this as:

Wl = Weight/S = p/2 * Cl * V*V

where Wl is the wing loading.

Now comes the confusing part: which set of units are we going to use? English, Metric, SI, MKS, CGS? If we choose English, which units will we use? Inches, feet, seconds, minutes, etc.? It's certainly possible to slip back and forth among all systems of units - and any good program to do these calculations should allow you to do that. Since this is a US published article, we'll stick with English units for now.

For this discussion, weight will be in pounds (convert to oz. by multiplying by 16), velocity in feet per second, and wing area in sq. ft. So, wing loading will be in lb./sq. ft., which is a pretty typical U.S. representation.

With these choices, the air density (p) will be 0.002378 slugs/cu. ft. (under conditions of standard temperature and pressure - roughly room temperature and sea level pressure). Since we are really looking to compare different design variables, doing this at a fixed air density allows an accurate comparison of the relative performance. But on

Figure 1: Lift Coefficient for SD7037

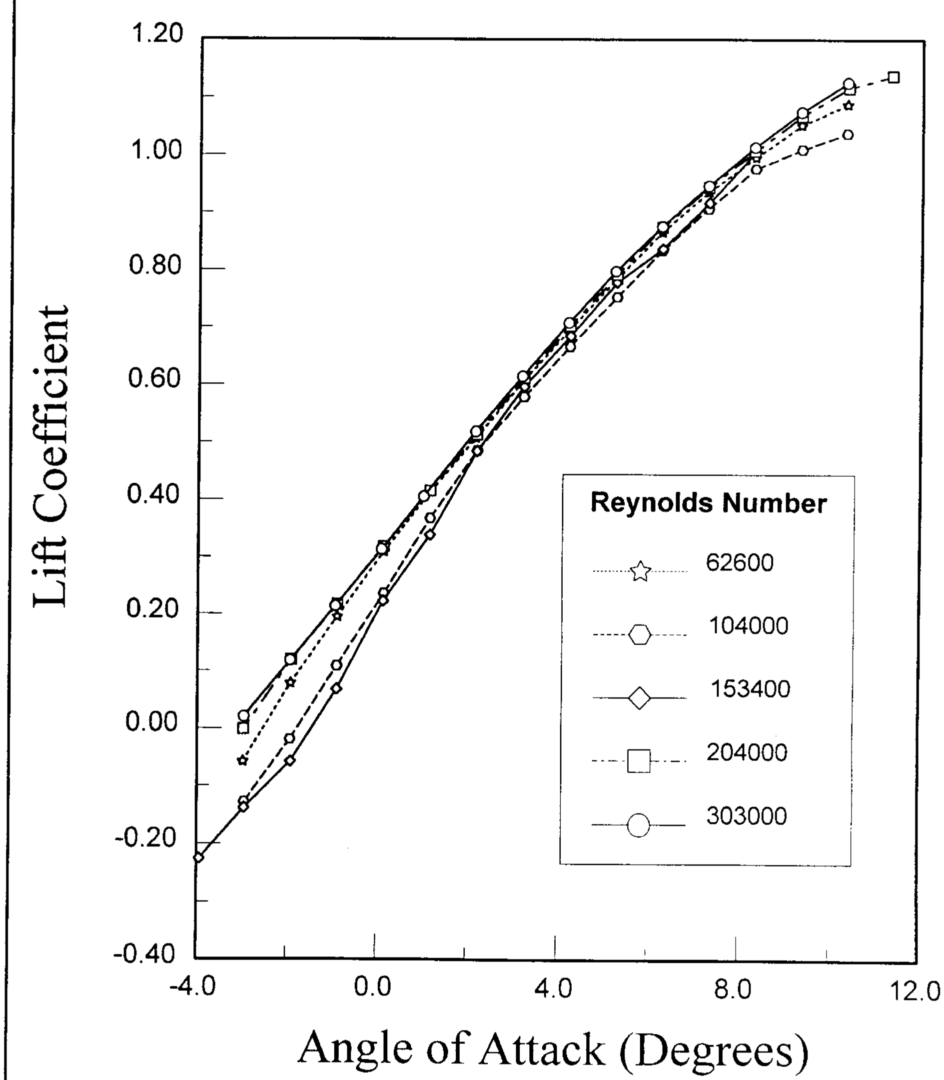
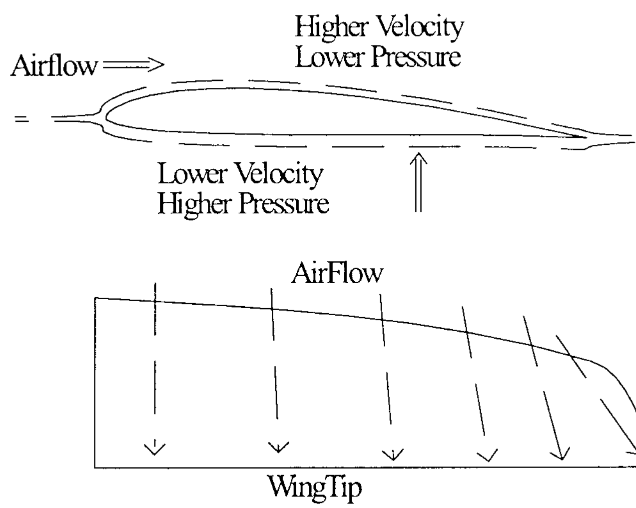


Figure 2: Flow Conditions For Tip Vortices



next time.

Since we've talked about lift a bit, let's tackle induced drag first. This is sometimes called 'the price of lift' because it arises from the interaction of lift forces on the wing and the specific planform for the wing. It's due to the spanwise component of the airflow over the wing. Yup, that's right. Some of the airflow leaks out around the wingtips.

The physical reason for this is straightforward. Consider the conditions of Figure 2. Airflow over the wing section produces lift with the lower surface experiencing a slightly higher pressure than the upper surface. Since a pressure imbalance exists, the air flow from the bottom of the section will try and

an absolute basis, the same plane will handle differently at Pike's Peak or Pensacola.

For conventional airfoils, the lift coefficient increases as the angle of attack increases. However, at some point, the airfoil stalls and no additional lift can be produced. Consequently, a typical lift coefficient data set will look something like the curves in Figure 1 (UIUC database). Note that the lift coefficient changes a bit as we vary Reynolds number. That's an important scaling effect for both airfoil chord and velocity which we'll discuss a little later in this series.

When we look at the drag terms for an aircraft, it's a bit more complicated since there are multiple contributions which arise from different sources:

Total Drag = Profile Drag + Induced Drag + Parasitic Drag

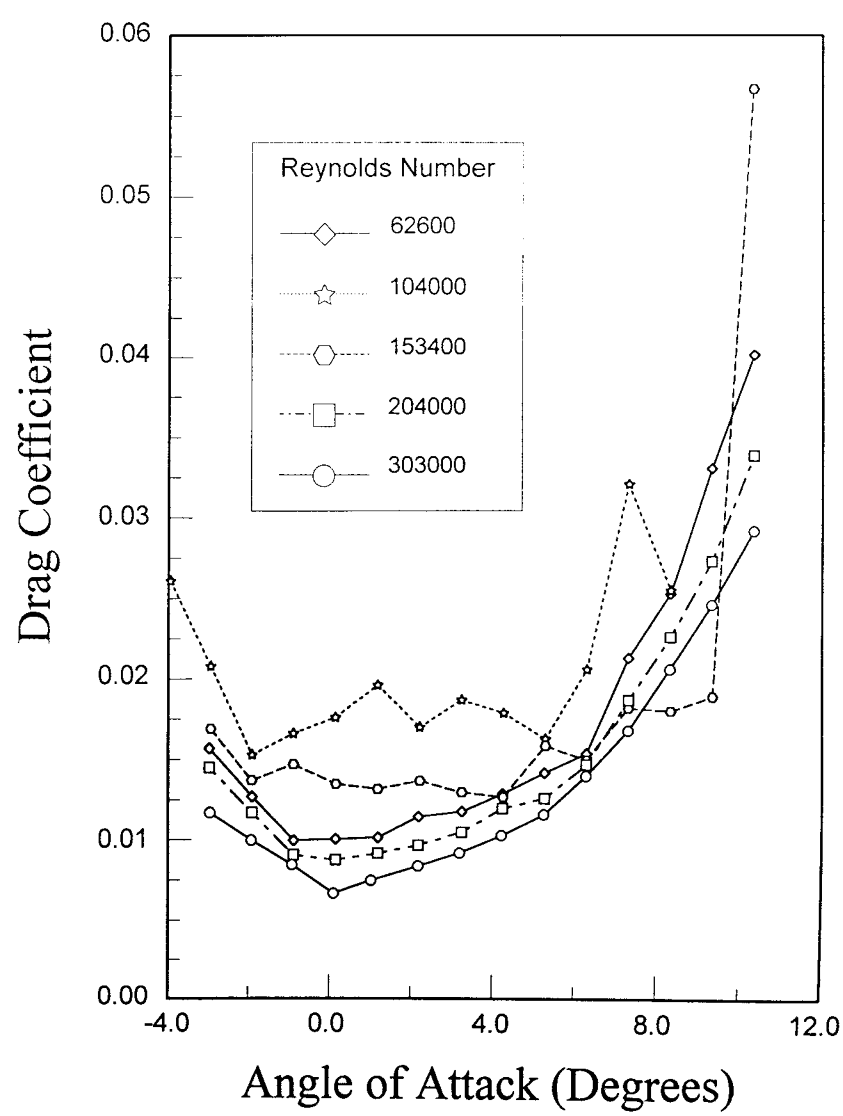
where Profile Drag arises from the airfoil, Induced drag comes from the wing planform, and Parasitic drag is all the stuff that's left over (fuselage, tailplanes, intersections, hinge gaps, linkage hanging in the breeze, etc.).

For both the Profile and Induced drag, we can write down an equation analogous to lift:

Drag = p/2 * S * (Cdp + Cdi) * V*V

where Cdp is the profile drag coefficient and Cdi is the induced drag coefficient. We'll sort out these two terms this month and tackle parasitic

Figure 3: Drag Coefficient for SD7037



re-connect with the top any way that it can. Most of it connects at the trailing edge. However, at the wingtips, it can also flow around the tip along the span direction. This type of flow creates wing-tip vortices. These vortices dissipate energy and therefore act as drag terms.

Tip vortices in large aircraft can be very energetic and persistent. Tip vortices from large aircraft, such as a 747, can create turbulence which can create problems for lighter aircraft for up to a minute or more after landing.

It seems reasonable that if the wingtips are far apart compared to the chord of the wing, this should be less of a problem. It also seems reasonable to expect a stronger effect as the wing produces more lift. Many years of airfoil testing has shown that the induced drag coefficient can be well represented by the expression:

$Cdi = Cl*Cl / (e * Pi * AR)$

where Pi ~ 3.1416, AR is the Aspect Ratio (wing span divided by the wing average chord) and 'e' is a correction factor for non-elliptical lift distributions. For simplification, we'll assume e = 1.0 for the remainder of this discussion. Many current high performance sailplane designs approach this approximation, especially those using the Schuemann-Ellipse planform discussed in this column last year.

Now let's turn to profile drag. We can usually think of this term as simply the resistance to airflow by the airfoil we've selected.

Sometimes profile drag is associated with the thickness of the airfoil section. Although this is a contributing factor, for the speeds at which we fly it's more important that the airflow over the wing stay attached to the wing surface. If flow separation occurs, this can contribute far more to profile drag than simply the overall thickness of the section. We'll use Figure 3 as an example.

For modest angles of attack, the airflow over the wing is well attached and we have a smooth drag response over a reasonable range of angles. As the angle of attack is increased, the airflow over the upper wing may separate and then re-attach (the

Figure 4: Drag Bucket for SD7037

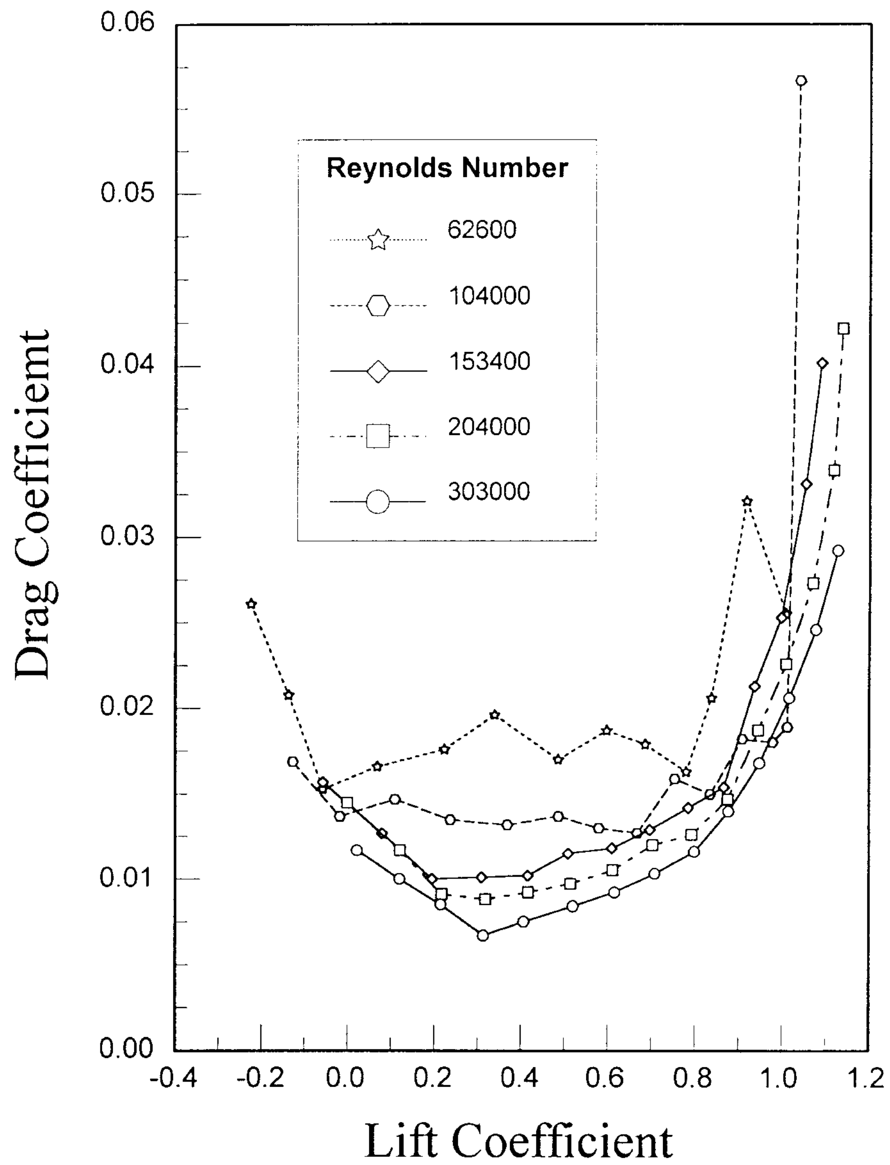
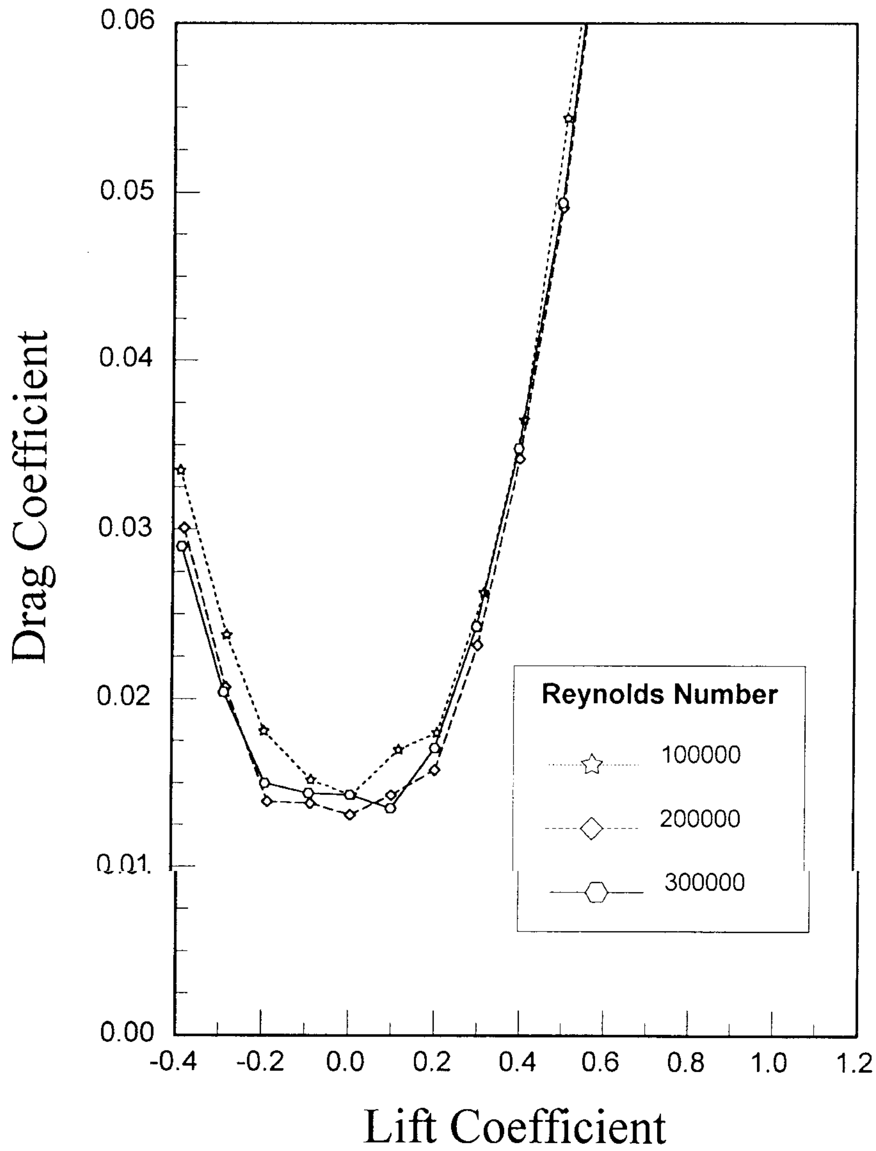


Figure 5: Drag Bucket For Flat Plate



'separation bubble'). As this effect increases, drag increases. Finally, when the airflow completely separates and cannot re-attach, we have a stall.

At extremely low angles of attack, the same effects are observed but with separation now being most likely on the lower surface. Normally we don't worry about that operating regime since the extreme case of lower surface separation usually corresponds to negative lift coefficients. About the only time this situation might practically occur is if you're flying inverted.

This is all OK for the higher Reynolds number plots. But at lower values (usually less than 100,000), we sometimes see a high drag coefficient in the middle of the (normally) low drag region. At low speeds and with unfavorable airfoil designs, there simply isn't enough energy in the surface layer of flowing air to enable the air stream to re-attach to the surface. So this looks a bit like an early onset of a stall.

Normally when a stall is approached, increasing the angle of attack only makes separation worse. However, in this case, increasing the angle of attack will move the separation point a bit more towards the leading edge. The pressure gradient is then usually more favorable for re-attachment and the drag coefficient drops again until the onset of the true stall at a higher angle of attack.

The really tricky part about all of this is that these effects become more pronounced at low speeds and small chords. There are two areas of concern for sailplane folks - small airplanes (HLG, MHLG) and wing tips. In both cases, careful design and selection of the airfoil becomes crucial for good low speed flight and wing tip stability. Unfortunately, this really tricky regime (< 60,000 Reynolds number) is about where the data runs out so you have to use design tools with caution under these conditions.

Before leaving the profile drag term, let's look at the airfoil data in a slightly different way. Instead of looking at Cl and Cdp as a function of angle of attack, let's plot Cdp vs Cl. I'm not real fond of this approach as it loses the connection with incidence angle but it is a compact way to compare different

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24" x 36"	$17.50	24" x 36"	$35.00
36" x 48"	$35.00	36" x 48"	$70.00

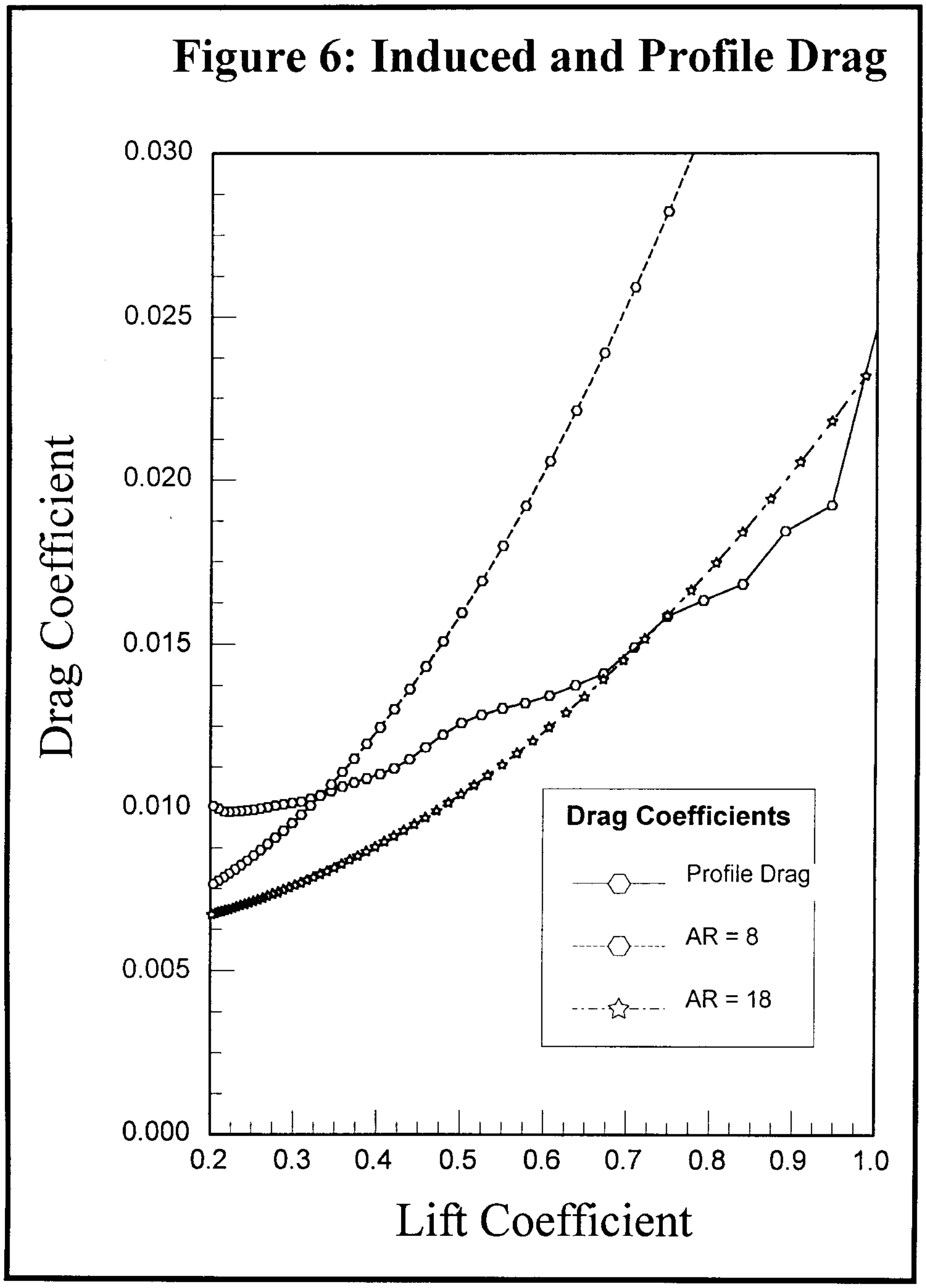


Figure 6: Induced and Profile Drag

sections. In Figure 4 we've combined the data from Figure 1 and Figure 3 for the SD7037. The shape of this plot looks somewhat like a pail and is sometimes called the 'drag bucket'. In general, the lower and wider the bottom of the bucket the better.

For comparison, Figure 5 shows a similar presentation for a flat plate (drawn to the same scale). Even though the flat plate is a much lower thickness than the SD7037, the drag bucket is far less favorable which should reinforce the idea that thickness isn't always the most important point for low drag, high efficiency airfoils.

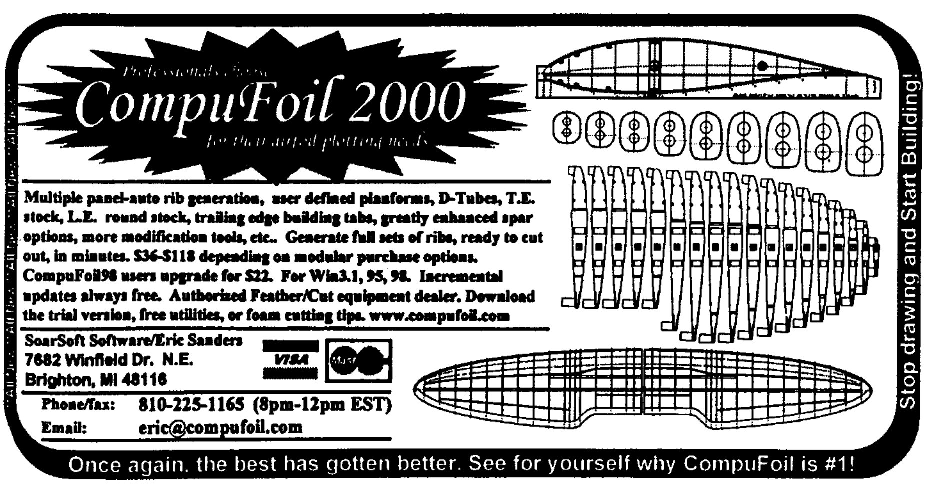
A final point that I'd like to illustrate this month is the comparison of profile and induced drag. In Figure 6 we've compared the "drag buckets" of two designs using the same airfoil (the SD7037) for aspect ratios of 8 and 18. This is generated from my polar analysis program and illustrates the importance of including planform effects when looking at performance.

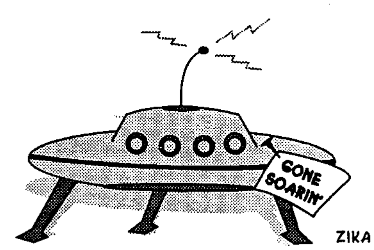
For AR ~ 8 the induced drag dominates for Cl > 0.4. For AR ~ 18, induced drag dominates for Cl > 0.8. Clearly the higher aspect ratio ship has a wider range of efficient operation. In this case, induced drag overshadows profile effects.

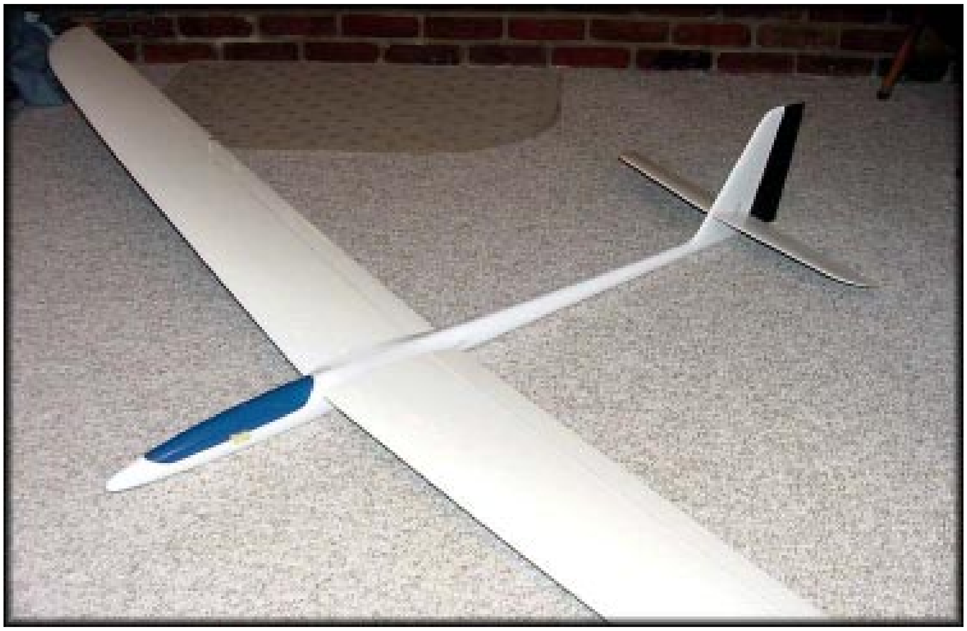
But what we're missing here is the speed range due to the higher wing loading at the higher aspect ratio. What we'll find when we investigate a little further is that the high AR ship is very efficient with a broad cruise range but won't slow down very well for light thermal work. This may be the difference between a 'floater' and an F3B ship, for instance.

That probably wears us all out for this month. Next time let's wrap up the parasitic drag considerations and then build our polar analysis. Hang in there. The ugly stuff is almost over.

■







Molded Condor – Part 1

by Edwin Wilson
Louisville, Kentucky

Ed Slegers has been producing and distributing models and accessories for many years now. One of Ed's longest running kits has been his Condor. This unlimited class, full house plane has gone through several changes over time. I have an early kit that has the Selig 3021 airfoil and a straight 3/8 inch diameter wing joiner rod. Newer versions had the Eppler 7035 airfoil. Wing construction in all the previous kits was the usual obechi over white foam. The fuselage has always been fiberglass with Kevlar™ reinforcement in the required places. Nothing fancy, just solid construction with predicable performance and no bad habits.

Ed flew at the Mid-South Soaring Championships in Louisville this past June with a prototype of his newest version of the Condor. This new plane and Ed flew well enough to take the overall two-day championship in some tough flying conditions. Since I was already shopping around for a new unlimited class plane, I ordered myself a new Condor right at the contest. I have since found out that a molded Condor, flown by Scott Meader, took 4th at Visalia this year.

This new 2000 incarnation of the Condor is an all new molded model. Brian Agnew manufactures the fuselage for Ed and it is finished in white gel-coat. Ed then installs the pre-

finished rudder, the pushrods, and the elevator bellcrank. You are left to install the servo tray and tow hook block to complete the fuselage. The elevators are in a conventional mid-tail format and are hollow molded and pre-finished.

The wing profile is a straight taper with a sweeping low drag wing tip. The airfoil is an Eppler 7035. Like the stab, the wing is hollow molded and is pre-finished in white on top and your choice of colors on the bottom. My set of Condor wings are black on the bottom. The guys at RnR Products mold the Condor wing and their quality is superb. Ed cuts out the flaps, and ailerons in the wings, pre-installing gap seals/wipers. Finally, the surfaces are hinged and an alignment pin is installed into the wing root. The wing rod is upgraded now to a 3/8x5/8" high modulus, square carbon beam that will be capable of withstanding any F3B/F3J launch you can throw at it. In fact, it is the same spar and wing rod that RnR's Millennium uses. You are left to install your servos and wires to complete the wing.

The molded Condor's wingspan is 114 inches, which is slightly smaller than many of the more recent molded kit releases. Ed has tried to balance a plane size that can launch like a rocket, is still big enough to be seen way out, but has improved agility for those last minute corrections around the landing tape. A bonus is that a shorter wing can be made stiffer without excess weight being added for strength. When I picked up my plane, I was impressed by how light it feels. My plane weighs 44 oz. straight from the box. The lighter weight combined with the 7035 should make for a great thermaling plane.

In part two, I intend to install my radio gear and cover some minor additions I will be doing to the kit for competitive reasons, and the all-important first flights. ■

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Airfoil: SD7037
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Asher Carmichael, (334) 626-9141
Carmic985@aol.com
Rusty Rood, (850) 432-374

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

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Montague XC Challenge — Montague, CA
Dean/Scott/Randy, (541) 899-8215 Days
Dean Gradwell, (541) 899-7034 eve.
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Gerry Knight Memorial Scale Aerotow Rally Y2001 — Ontario, Canada
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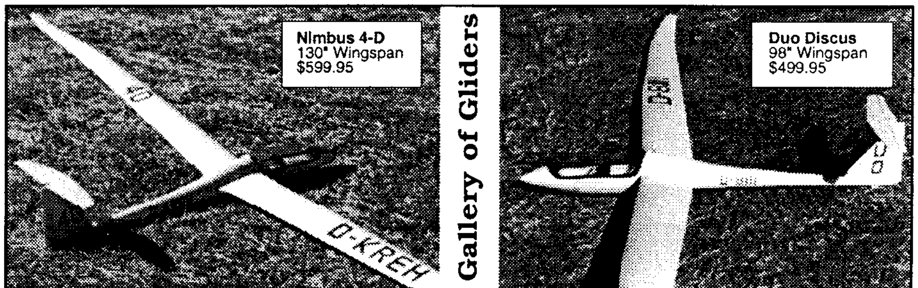

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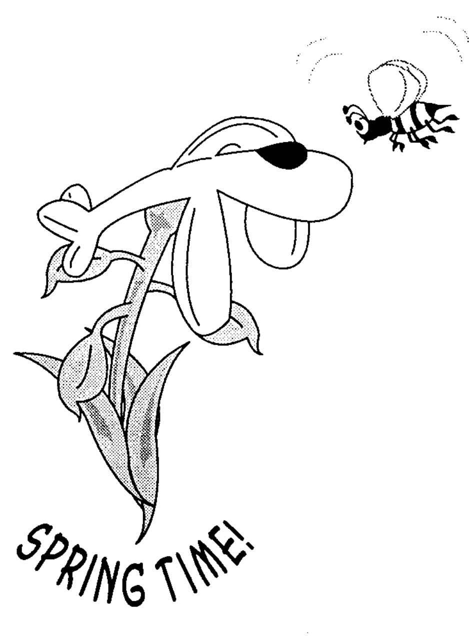

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Reference Material

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>.

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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.

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

The Great Midwest Oc-Tow-Berfest 2000

Submitted by Pete George and Mark Nankivil.
Photography by Mark Nankivil.

Nick Schell's Roke 1/3.75 scale ASK-18 lifting off for one of Nick's many flights over the weekend. Nick made it down from Michigan for the event.

(This event was held near Alton, Illinois. Additional details in upcoming issue. Oc-Tow-Berfest will be back again in 2001, so keep watch for further information in *R/C Soaring Digest.*)