May, 1999
Vol. 16, No. 5
U.S.A. $3.50

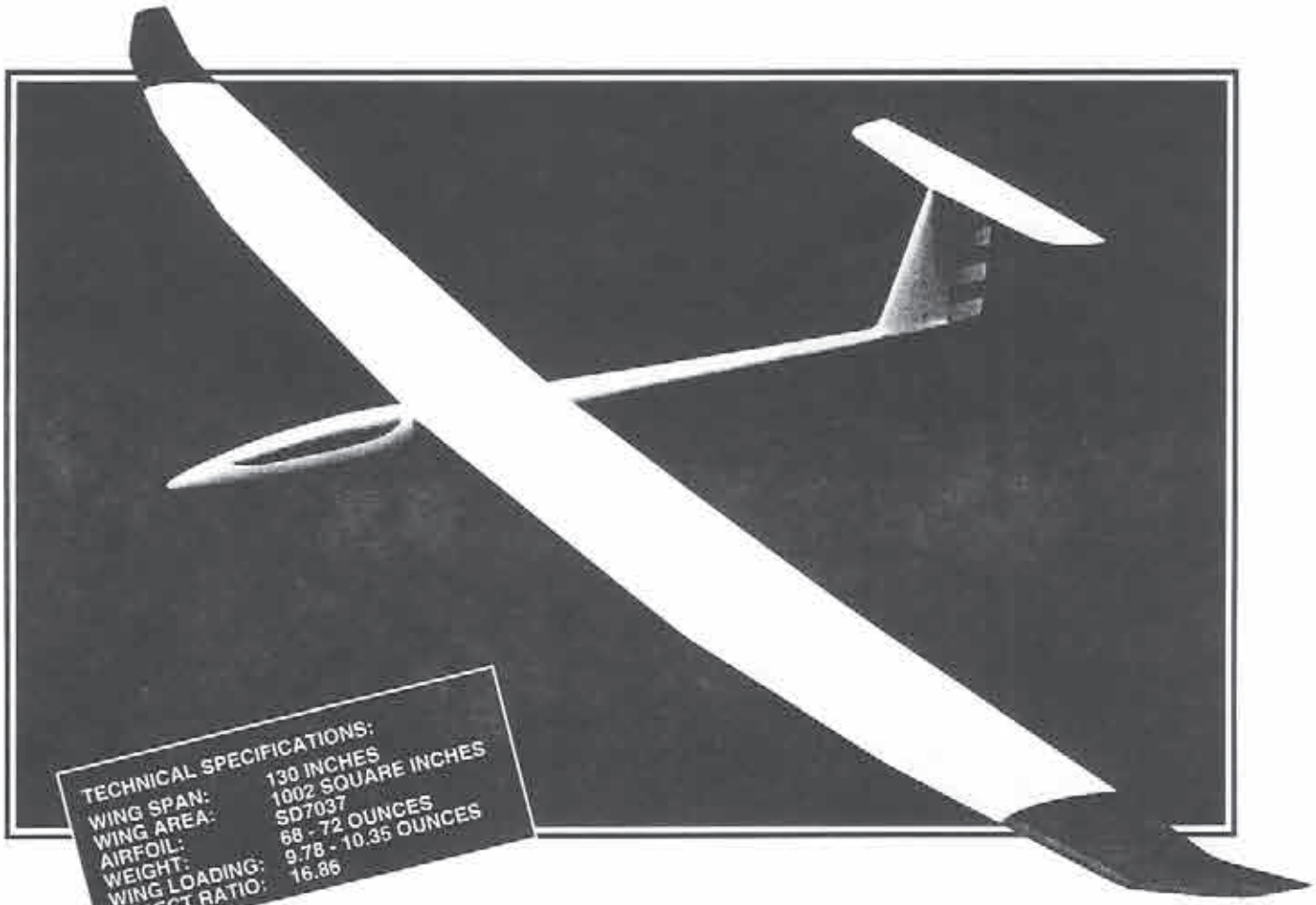
R/C SOARING DIGEST

Radio controlled

THE JOURNAL FOR R/C SOARING ENTHUSIASTS

PREDATOR XL

A WORLD CLASS ORIGINAL DESIGNED BY DAVE HILL



TECHNICAL SPECIFICATIONS:

WING SPAN:	130 INCHES
WING AREA:	1002 SQUARE INCHES
AIRFOIL:	SD7037
WEIGHT:	68 - 72 OUNCES
WING LOADING:	9.78 - 10.35 OUNCES
ASPECT RATIO:	16.86

This fine kit features include:

- Finished gel-coat fuse. Requires no work except for servo tray and radio gear installation.
- Pre-installed Sullivan Carbon Push Rods.
- Bell Crank and Fin Post factory installed.
- Pre-fitted Canopy with wire hold down installed.
- Stab attachment drilled and tapped.
- Stab Tips and Leading Edge sanded and attached.
- Foam Core Rudder is pre-sheeted and ready to cover.
- Tapped and pre-installed Tow Hook Plate.
- Wing Tips and Leading Edges finished and attached.
- Wings and Stab are pre-routed.

SLEGERS INTERNATIONAL

P.O. Box 364, Long Valley, NJ 07853 U.S.A.
Shipping: 35 Hacklebarney Rd., Long Valley, NJ 07853

(908) 879-9964 - FAX (908) 879-8177
http://www.slegers.com

High Quality Electric & Non-Electric Sailplanes, Radios, and Accessories for the Sailplane Enthusiast

★ VISA ★ MASTERCARD ★ DISCOVER ★

R/C Radio controlled SOARING DIGEST
THE JOURNAL FOR R/C SOARING ENTHUSIASTS

PARK FLYER

Dave's Aircraft Works Ki-61 "Hien" mini foamie, bungee plane flies over a snow-covered soccer field in Glenville, New York.

Photo by Richard Loud.

R/C Soaring Digest (RCSD) is a reader-written monthly publication for the R/C sailplane enthusiast and has been published since January, 1984. It is dedicated to sharing technical and educational information. All material contributed must be exclusive and original and not infringe upon the copyrights of others. It is the policy of *RCSD* to provide accurate information. Please let us know of any error that significantly affects the meaning of a story. Because we encourage new ideas, the content of all articles, model designs, press & news releases, etc. are the opinion of the author and may not necessarily reflect those of *RCSD*. We encourage anyone who wishes to obtain additional information to contact the author. *RCSD* was founded by Jim Gray, lecturer and technical consultant. He can be reached at: 210 East Chateau Circle, Payson, AZ 85541. (520) 474-5935. <jampeg@netzone.com>.

RCSD should not be considered to endorse any advertised products or messages pertaining hereto. An advertising rate card is available for businesses, and clubs.

***RCSD* Staff**
Jerry Slates - Editor/Technical Editor
Judy Slates - Managing Editor, Subscriptions
Lee Murray - *RCSD* Index/Database (available on-line)
Bill & Bunny Kuhlman - *RCSD* Web Masters

Please address correspondence to:
Jerry & Judy Slates
R/C Soaring Digest
P.O. Box 2108
Wylie, TX 75098-2108 U.S.A.
(972) 442-3910, FAX (972) 442-5258
e-mail: rcsdigest@aol.com
http://www.halcyon.com/bsquared/RCSD.html

Feature Columnists
Bill & Bunny Kuhlman (B²), Robin Lehman, Lee Murray, Tom Nagel, Mark Nankivil, Dave Register, Dave Sanders, Steve Savoie, Jerry Slates, Gordy Stahl

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

TABLE OF CONTENTS

OTHER GOOD STUFF

Damaged or Improperly Bound Copy?
Please let us know, and we'll replace it. Something always slips by every month!

RCSD ON THE WEB

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

Subscription Information
Highlights & Mailing Status of the Current Issue
RCSD Feature Columnists, Reporters, and Editors ..... E-mail/web addresses, plus general information about their areas of interest.
"Building Along" Construction Aids
..... **1/5 Scale Pilatus B-4** ..... Jerry Slates
..... **1/12 Scale U-2R/TR-1** ..... Coming Soon
Links to Clubs & Organizations
Hot Topics
Event Coverage (Color Photography!)
"In the News" - A compilation of news items of interest to soaring enthusiasts.
On-Line Articles - Great articles originally written for the printed version of *RCSD*.
Bookshelf Listings - A listing of recently published books of interest to aeromodelers.
Complete RCSD Index, 1984-1998

The Soaring Site

Travel Sagas

As most of you know, each of the *RCSD* columnists have a niche. They have a specific area (or areas) of interest that they like to write about, like Tom Nagel, editor of "Have Sailplane Will Travel!", a column dedicated to travel sagas, any travel saga, and humor is most welcome. Recently, Tom said, "As HSWT evolves, it becomes clear that in addition to folks reporting on their vacation flying experiences, there is a large body of information out there from people who can write about places in their own home town area, where people SHOULD come and visit on vacation."

For those of you that would love to tell Tom and the readers about your home town flying experiences, his e-mail address is <tomnagel@iwaynet.net>. His postal mailing address is included with his column.

Happy Flying!
Judy & Jerry Slates

ZIKA

TMSS UNLIMITED ESL SOARING CONTEST

Dates: Saturday July 17th and Sunday July 18th, 1999.

Site: Fort Lee Drop Zone, near Petersburg, Virginia.

Pilots meeting: 9:00 am, first launch at 9:30 am both days.

C.D.: Josh Glaab, (alternate C.D. Doug Barry).

Task: International duration (T1), with times to be specified based on prevailing conditions at the pilots meeting, combined with a NATS-style 100 point graduated runway (L6) spot landing. Expect an open winch flying sequence format if conditions permit. No rounds will start after 3:30 pm on Saturday or 2:30 pm on Sunday.

Registration: $15.00 per day, only 2 competitors per frequency! Please register early and/or be prepared to switch frequencies

Launching Equip: ESL (or equivalent) 12 Volt winches with electric retrievers.

Amenities: A Greg Blazey Food-feast will be provided, for a nominal charge, facilities will also include a Porta-John.

No Fly Zone: Since there is a Bald Eagle nest in the area, there will be a no-fly zone imposed. Approximate no-fly zone dimensions are 90 degrees arc-sector starting 0.5 miles from launch/landing zone located to the south east.

Hotel Information:
There are many hotels just minutes from the site:
1) Days Inn, Hopewell Va., 4911 Oaklawn Blvd., 1(800)458-1500 or (804)458-1500

2) Comfort Inn, Hopewell Va., 5380 Oaklawn Blvd., 1(800)228-5150

Downtown Richmond area - (app. 25 minutes, completely civilized except during Harley Davidson conventions)
3) The Omni-Richmond. Many quality restaurants and the Richbrau Micro-Brewery are within easy walking distance. Phone# 1-(800) 843-6664

Directions: To the Flying Field - Take I-95 from the north or south:
To the I-295 beltway around Richmond on the east side. Use Exit 9B to Rte.36 West (Washington Street) towards Petersburg. At the third light, turn right on Rte.144 (Temple Ave). At the next light turn right on Rte. 725 (River Road) and follow 1.8 miles to McLaney Drop Zone on the right.
OR
To the Rte. 54 exit to Colonial Heights. At the first light turn right on Rte. 144 (Temple Ave). Follow for 3.2 miles to the 5th light. Turn left on Rte. 725 (River Road) and follow 1.8 miles to McLaney Drop Zone on the right.

----------detach here and mail ASAP----------

Name: _____ Phone# _____

Address: _____

Primary R/C Channel# _____ Alternate R/C Channel# _____

AMA# _____ Sportsman or Expert: _____

Please return entry form along with check payable to TMSS to: Josh Glaab, 161 Alaric Drive, Hampton VA, 23664. Phone# (757)850-3971, or (757)864-1159 during the day, e-mail ljglaab@pinn.net.

Jer's Workbench

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

Low Tech Design & Construction Rudder, Elevator, Spoiler Model RES - Part II

Since last month, the final drawing has been completed. Once I figured out what specifications I wanted, it was easy to lay out the design. I spent the best part of a week visualizing the final model, and figuring out the best way to go about building it, before the drawings were started. Then, I spent another 3 days accurately detailing the plans, which wound up taking up 3 sheets of drawings.

I began the process by detailing out the wings, as they are the easiest to do. The wing span is set at 100", with a root cord of 10" and a tip cord of 7.5". This yields 888 square inches of area, with an aspect ratio of 10.4 to 1.

Next, I tackled the stabilizer: a V-tail, with about 12% to 14% of the wing area. I arrived at these numbers based on past experience with other models that I built over the years. On paper, everything looked just about right. Once the stabilizer details were in print, the final wing area came in at 114.75 square inches, 13 % of the wing area.

The fuselage design was tackled next. I found this to be the most difficult part of detailing out the plan. While a narrow, low profile fuselage is nice, it's important to give oneself plenty of room for installing the battery pack, receiver, servos, and the on/off switch.

The top view of the fuselage was completed, first. The profile, or side view, was done next. With a lot of imagination, a person can get really wild, and draw a lot of fancy, curved, and sexy lines; unfortunately, all that fancy stuff is not easy to build, so I kept the design as simple as possible. The sides of the fuselage will be flat; the bottom is flat, as is the top. Hence, the plane has been dubbed "Flat Topper". Quite appropriate, don't you think?

For those of you designing and building along with me, remember that simple is best. Next month, we hope to have the drawings of the "Flat Topper" computerized, so that you can see what the design looks like in print.

So, let's get to work, and I'll check back in next month. ■

Asher's 1/3 Frisch Wilga is powered by a King 140, swings a 32x10 prop, and has a very quiet German muffler.

Confessions of a Wilgabeast

by Asher Carmichael
Spanish Fort, Alabama

OK I admit it. My personality may be a bit convoluted and, according to some, may even be somewhat disjointed not unlike the trailing-link, articulated landing gear of my favorite aerotow tug, the PZL Wilga 35. I have always been fascinated by this "ungainly" airplane. It's sort of like having an ugly child that only a father could love. It's that way for me and the Wilga.

Designed and manufactured in Poland, this airplane is on first appearances a conglomeration of parts that looks full well like a legitimation of the Polish humor with which we are all familiar. It has spindly gear, stamped metal skin, slotted leading edge, balanced rudder and elevator and protuberances stuck on every conceivable square inch in what seems to be an attempt to induce drag commensurate with that of a paramecium in molasses.

My first look at a model Wilga was through the pages of *RCSD* and the photos that Robin Lehman had taken on his trips abroad. As I became more involved in scale aerotowing, it seemed I saw a picture or mention of a Wilga at every turn. I was convinced I was going to have one someday, somehow.

Everyone said I needed to start out with a Telemaster or a Robinhood or some other "less intense" entry into the world of aerotow tugs. I wasn't having anything to do with that; I wanted a Wilga! After all, I reasoned, I had learned the basics of flying a Telemaster in record time. Despite "fits and starts" I had soloed in one day with a 108 powered Telemaster. Wasn't I ready for a 1/4 scale Wilga?

Six months and a couple of quid later I had my Wilga and to everyone's amazement, including mine, I could actually fly and tow with this thing. The kit, manufactured by Frisch in Germany, had been a joy to build and even though the instructions were in German the supplied illustrations made construction a snap. The gelcoated fuz and obechi sheeted wings were top notch and the supplied hardware and wood parts were also high quality. I must say that I thoroughly enjoyed seeing the ugly duckling take shape and the first nudges of up elevator for takeoff rotation were just as thrilling — a proud father if there ever was one.

Those first experiences with the 1/4 scale Wilga are forever etched in my memory and most of my flying buddies know that I have an obsession with this plane. I have flown and towed with it over the course of the year and it has served well towing 1/3 scale ships with its 3w-70cc engine. I continue to fly it on occasion.

I say I fly it on occasion because there is a new object of my attention. I recently acquired the 1/4 scale's big brother, a Frisch 1/3 scale Wilga! It seems the larger 1:2.5 scale sailplanes are increasing in popularity at our local flying site. I thought that the big Wilga would be well suited for the larger gliders and that I would continue to tow the 1/3 scale sailplanes with the 1/4 scale, but the larger Wilga has proved to be the best all-around tug for my style of flying. I guess my poor eyesight is also partly to blame. It certainly is easier to see a larger towplane at altitude, which helps when towing those guys who insist, "Just a little higher."

"Gentle giant" is a description that comes to mind whenever I attempt to relate the characteristics of this airplane. Everything about it is impressive, from the smooth and quiet King 140cc engine with its German muffler, to the Kevlar fuz, waist-high stance, 30-inch prop and the expansive 12-foot wingspan. It definitely is imposing on first appearance.

But first appearances are often deceiving. "Wilga" is a type of small bird in Poland and the model definitely lives up to the abilities of its namesake. This airplane is without a doubt the smoothest flying, docile, appropriate model tow plane I have flown. The King 140 runs solidly at the high and low ends translating to a wide speed range. It is powerful enough (50 lb. static thrust) to pull the largest sailplanes available and, without a tow subject behind, is capable of near vertical performance. The 45 lb. flying weight helps maintain solid flight attitude even on marginal tows. Gusty winds don't seem to phase it and 45 degrees of flap slows it to a manageable crawl on landing. It seems well balanced in all conditions and even my occasional heavy-handedness is negated by its flight characteristics. It truly appears to be and sound like a full-scale light aircraft at distances beyond your front yard.

This is the type of towplane that we all dream about. It is even fun to fly on its own though I would never admit to doing that. There's something about seeing this airplane coming almost straight down from tow release, leveling out at the last moment and flairing to what seems like a "walk-beside" speed. John Derstine's latest film shows a knife-edge climbout commencing immediately after takeoff at the Akro-Cup in Germany last year, a remarkable feat for any airplane.

Both the 1/4 and 1/3 scale Wilgas are phenomenal models from a professional kit-maker and designer. Herr Frisch has done his homework in developing these two thoroughbreds. If you have any intention of trying a Wilga in the future, I definitely recommend either of these two birds for your satisfaction.

■

P.O. Box 975
Olalla, Washington
98359-0975
E-mail: bsquared@halcyon.com
http://www.halcyon.com/bsquared/

Walter Panknin's Flying Rainbow

In 1989 we traveled to Madison, Wisconsin to attend our first MARCS Symposium. As several previous Symposiums had featured Ken Bates speaking about his numerous flying wing experiments, we were hoping that the 1989 gathering would be no different. Prior to the event, we learned that Dr. Walter Panknin was on the Symposium agenda, scheduled to speak about his Flying Rainbow design.

A brief description of Dr. Panknin's presentation at the Symposium appeared in "On the 'Wing...," and a complete transcript of Walter's presentation is available from the Madison Area Radio Control Society. Walter did not focus an any particular aspect of his Flying Rainbow, but rather provided a generalized overview of swept wing tailless design.

It took several years of friends' prodding to convince Walter to build his first "flying wing." Günther Koech, an aircraft designer employed by Lippisch during WWII, was a proponent of the idea, along with Hansjörg Ackerman, a pioneer in building tailless models. But it was a paper by Helmut Schenk, "Determination of the Longitudinal Moment for the Flying Wing Model," which served as motivation for Walter to build his first 'wing. Schenk's paper explained how the moment coefficients and zero lift angles of the airfoils worked in conjunction with wing twist, sweepback, and other variables so as to achieve a pitch stable aircraft.

A fundamental formula which Schenk provided in his paper served to integrate these important variables, and while it looks intimidating, it is actually relatively simple. A low-cost scientific calculator makes quick work of evaluating a single design, and computer programs have been written which allow iterative processes and user manipulation of one or several variables.

The Schenk formula is:

$$\alpha_{total} = \frac{(K_1 \cdot C_{Mi} + K_2 \cdot C_{Ma}) - \overline{C_L} \cdot St}{1.4 \cdot 10^{-5} \cdot \lambda^{1.43} \cdot \Lambda}$$

where

b = wing span
t_i = root chord
t_a = tip chord
t_m = $(ta + ti)/2$
l = aspect ratio, b/tm
L = angle of sweepback, measured at 25% chord
C_{Mi} = moment coefficient, root section
C_{Ma} = moment coefficient, tip section
$\overline{C_L}$ = design coefficient of lift, $C_{L\,cruise}$)
S_t = stability value (static margin)
t = taper ratio, ta/ti
K_1 = $1/4 \bullet (3 + 2t) + t^2)/(1 + t + t^2)$
K_2 = $1 - K_1$

and

$$\alpha_{geo} = \alpha_{total} - \left(\alpha_{0L_{root}} - \alpha_{0L_{tip}}\right)$$

where

α_{geo} = geometric twist, used when cutting cores
$\alpha_{0L_{root}}$ = zero lift angle, root section
$\alpha_{0L_{tip}}$ = zero lift angle, tip section
α_{total} = total wing twist, aerodynamic

To use the Schenk formula, the designer must always begin with knowledge of the pitching moment, C_{M0}, and zero lift angle, $a_{L=0}$, of the airfoil(s) used at the wing root and tip. Changing airfoils, taper ratio, aspect ratio, sweepback and static margin gives the designer wide latitude so far as final design. A comprehensive examination of the dynamics of the Schenk formula was published in *RC Soaring Digest* a few years ago.

The planform of Walter's Flying Rainbow was determined using Schenk's formula. We've spent some time at the computer and have been able to work backward from the final design to determine some of the initial parameters. This Flying Rainbow uses the Eppler 222 at the root and the E 230 at the tip. The zero lift angles are $a_{0L_{root}} = -3.65$ and $a_{0L_{tip}} = +1.73$, respectively. Plugging the latter values into the second formula,

$$-2.5 = \alpha_{total} - (-3.65 - 1.73)$$

$$\alpha_{total} = -2.5 + (-3.65 - 1.73)$$

$$\alpha_{total} = -7.88 \text{degrees}$$

For Walter's Flying Rainbow, we also know the following information:

b = 3200 mm, 126.3"
t_i = 400 mm, 15.8"
t_a = 280 mm, 11.0"
t_m = (280 mm + 400 mm)/2 = 340 mm
l = 3200 mm/340 mm = 9.4
L = 19.6
C_{Mi} = -0.097
C_{Ma} = +0.025*
t = 280 mm/400 mm = 0.7
K_1 = $1/4 \bullet (3 + 1.4 + 0.49)/(1 + 0.7 + 0.49)$
= $1/4 \bullet (4.89)/(2.19) = 0.5582$
K_2 = $1.0 - 0.5582 = 0.4418$

* This value was derived by Dr. Panknin based on practical experience and a formula utilizing the camber line leading edge and trailing edge angles.

The primary formula, once appropriate values are inserted, becomes:

$$-7.88 = \frac{(0.5582 \cdot -0.097 + 0.4418 \cdot 0.025) - (\overline{C_L} \cdot St)}{1.4 \cdot 10^{-5} \cdot 9.4^{1.43} \cdot 19.6}$$

$$-7.88 = \frac{(-0.043) - (\overline{C_L} \cdot St)}{0.0068}$$

$$(-7.88 \cdot 0.0068) + 0.043 = -(\overline{C_L} \cdot St)$$

$$\overline{C_L} = \frac{0.0106}{St}$$

Based on planform geometry and actual CG location, and using the iterative abilities of our computer program, we set St = 0.075 and find:

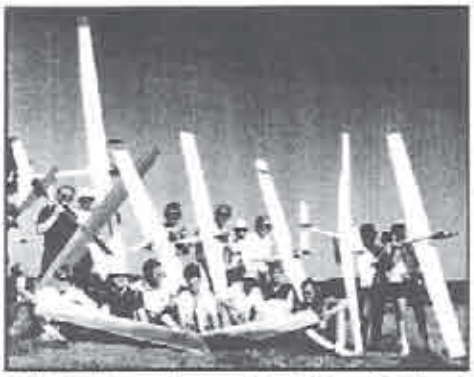
$$\overline{C_L} = \frac{0.0106}{0.075}$$

$$\overline{C_L} = 0.14$$

The elevons should be set for no deflection during cruise. That is, the elevons should be set such that they are in trail. This setting will produce the lowest drag. Additionally, when trimmed in this way, the aircraft should be operating at L/D_{max}. $\overline{C_L} = 0.14$ is, therefore, not an unreasonably low value.

From a structural point of view, Walter's Flying Rainbow included some rather unique solutions to the inherent difficulties of swept wings.

The spar, for instance, is built around a 5/8" by 5/8" O.D. square aluminum extrusion. The spar caps are made by laying 0.125" by 5/8" spruce strips on top of and under the aluminum box. To minimize the effect of the transition from the aluminum to the balsa sheer web, one of two methods have been used. (1) The sheer web between the spruce strips is balsa with 1/16" plywood sides transitioning to balsa near the end. (2) The use of carbon fiber over the spruce cap strips can be used to reduce the stress riser at the end of the aluminum tube without the use of 1/16" plywood and balsa. The spar runs to the leading edge of the cores near the end of the center panels. The joiner rod can be 0.5" steel, aluminum, fiberglass or carbon fiber rod.



Walter, his nephew, and the Flying Rainbow. Photography submitted by Lee Murray, Appleton, Wisconsin.

Further reinforcement is required if balsa sheeting is to be used as the wing skin. For purposes of torsional stiffness, some glass cloth should be placed on the core at a 45 degree angle. An alternative would be to use carbon fiber veil to increase the torsional stiffness.

Winglets are made from blue foam with a balsa base. The installation of wood blocks for mounting the winglets should be considered before sheeting. The objective is to keep them light. Walter used pressure sensitive plastic film (vinyl shelf lining paper) to cover them, and this worked out very nicely. The weight of the winglet should not exceed 35 grams or 1.2 ounces. This weight requirement can also be met by using blue foam with 2 oz. cloth vacuumed bagged onto it.

Walter used a third servo mounted in the wing root to control a flap which was hinged at about 50% of the 3" flap chord. The flaps were about 10" long on each side. This setup serves as more of a speed brake than a flap, and no pitching results from its use.

The Flying Rainbow is an extremely successful design. It builds rapidly, can be winch launched, is stable, and performs well both over flat land and on the slope. Interestingly, it seems to do better in turbulent conditions.

Walter's presentation at the MARCS Symposium was not only exciting, it provided the motivation for us to begin construction of our own series of swept wing tailless sailplanes — Project Penumbra. Walter visited us in April 1991, and we spent a day at 60 Acres testing and trimming one of the later versions. His death in November 1992 affected us deeply, and we dedicated "On the 'Wing... the book" to his memory.

References:

Dr. Walter Panknin at the MARCS Symposium. "On the 'Wing...," *RC Soaring Digest*, September 1990, and "On the 'Wing... the book," pp. 106 - 107.

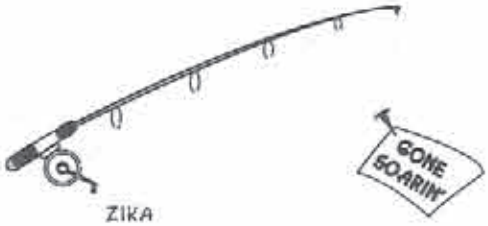
"Flying Rainbows." Proceedings of the 1989 National Sailplane Symposium. Al Scidmore, Editor.

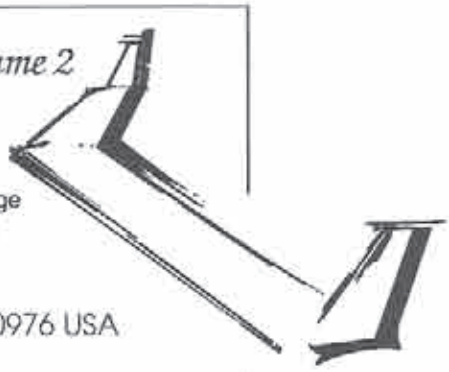
Four Basic Concepts. *RC Soaring Digest* October 1994 through January 1995, and "On the 'Wing... the book, Volume 2," pp. 73 - 93.

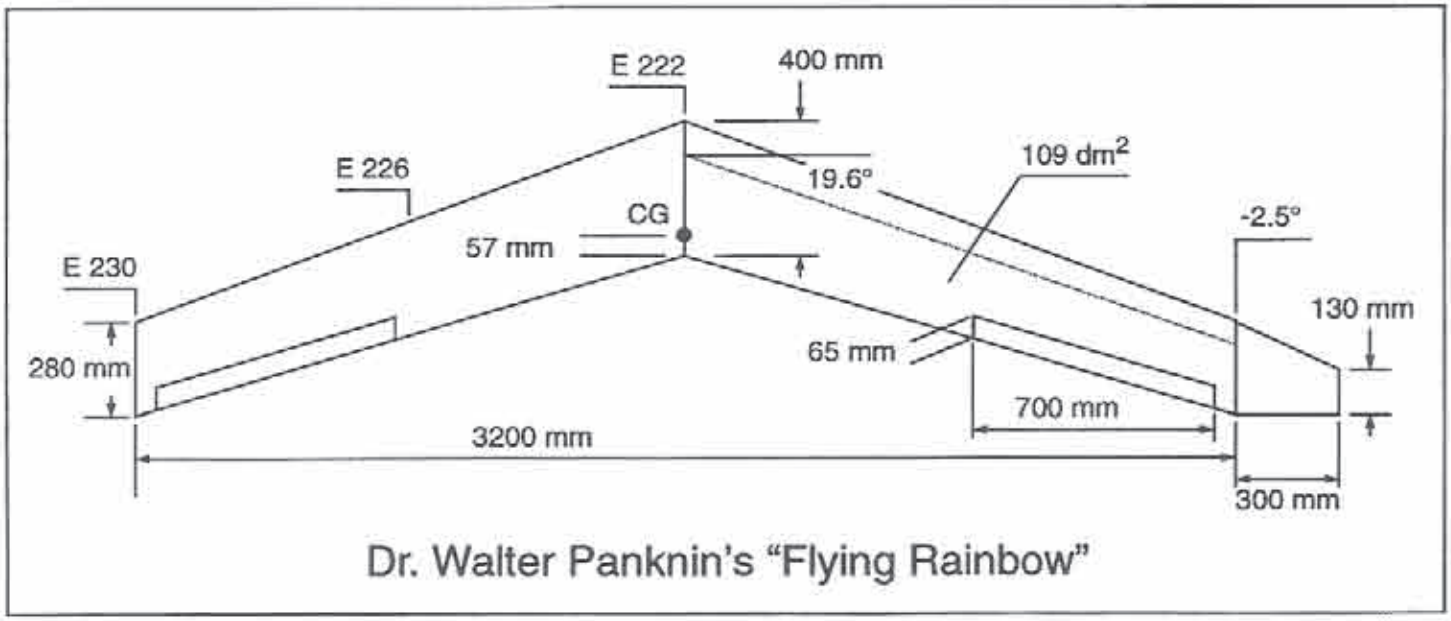
Panknin.bas is available in Applesoft BASIC, and in QuickBASIC for both IBM-compatibles and the Macintosh platform. Alan Halleck's Razer1 and Dr. Panknin's Twist Formulae, "On the 'Wing... the book," pp. 132 - 141, and <http://www.halcyon.com/bsquared/Panknin.html>.

Schenk, Helmut. Laengsmomentum-Rechnung Beim Nurflugel-Modell. Self-published, Pforzheim Germany.

■







Dr. Walter Panknin's "Flying Rainbow"

FIGHTING FOAM & HEAVY IRON

Volume 3, Number 3

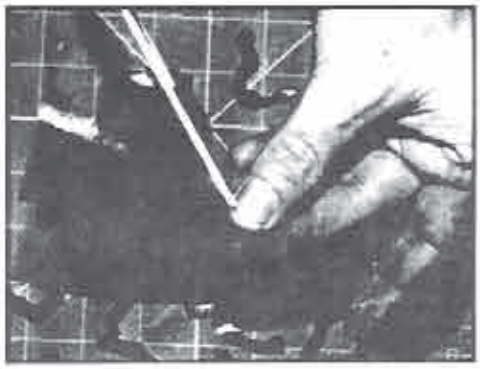
David M. Sanders
4455 Camino El Molino
Capistrano Beach, CA 92624
(949) 248-2773
daw1@access1.net

CRAZY CAMOUFLAGE...

As many of you know, I'm a staunch advocate of the Ultracote finishing method for EPP airframes, which leads folks to frequently ask me how myself and other ambitious builders come up with the intricate color schemes on some of our military models. Top of the list is usually the Japanese planes, like the Ki61 Hien or A6M5 Zero in the mind-boggling New Guinea/Solomon Islands mottled schemes. Observers will see the planes, examine them closely and see that indeed each piece of the camouflage color is a separate piece of covering film laid over a base color, and the follow-up question is, "Are you insane?!" Well, maybe just a little, but not totally! You can do these schemes quite easily and with very little concentration if you know just a few cute tricks. Wanna' see? Take a look at this...

The first thing to note is that these planes were usually camouflage painted in the field, over a factory fresh (or later, perhaps not so fresh) natural metal or overall light sea gray base color scheme. Many times, particularly late in the war, good masking materials were not available to far flung units on the outer edges of the Empire, so the camouflage was painted very obviously around national insignias and serial numbers. The result is that the camouflage components were pretty random, with large variation in scale, spacing and length; even over the finish of a single aircraft. These factors combine to make your life a lot easier as a scale modeler, particularly if you're going for a semi-scale finish and just trying to convey the 'main idea'. Granted, these schemes were applied using spray guns, and had fade-out, unmasked edges which of course will be impossible to duplicate exactly using film, but you can still get the flavor of it with crisp edged pieces.

Naturally, start with airplane parts that have been covered already in your base color; the example I'm using here is a Ki61 in overall natural aluminum (Ultracote 'Silver'). For the olive color camouflage, I like to start by establishing three or four basic 'squiggle types', then cutting several pieces of each to get going with the job. In the example shown, I've decided on straight squigs, 'L' shaped squigs, 'V' shaped squigs, and short, shallow crescent squigs. I've also thrown in some elongated 'spot' squigs to fill in little gaps. Take a piece of the olive covering material about 6 inches square, and start cutting the squiggles... Keep the scissors gyrating wildly, so as to get very random edges, and work quickly! The quicker you cook along, the more consistently you'll make the shapes required, and the more homogenous they'll seem; you'll sort of get in the 'groove'. Photos 1 through 3 show me cutting an 'L' squig. Notice I save time by using the prior squig's cut line to form one side of the next squig; this reduces your insanity-borne squig cutting by 50%! Also notice my growing collection of squigs in the photos.. I was able to cut all the squigs for an approximately 1/18 scale plane in about an hour. Got plenty of squigs? Good! On to the fun part: sticking 'em on!



Photos 1 thru 3 - Cutting squiggles for New Guinea camouflage on a 30 inch span Ki61 Hien foamie. Work with small pieces of Ultracote at a time, as they're easier to handle and allow you to swing the piece in the scissors to get the wavy edges.

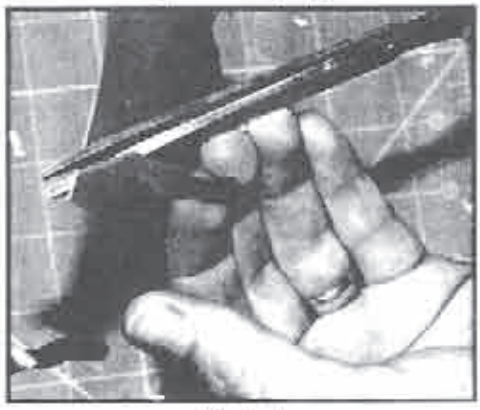


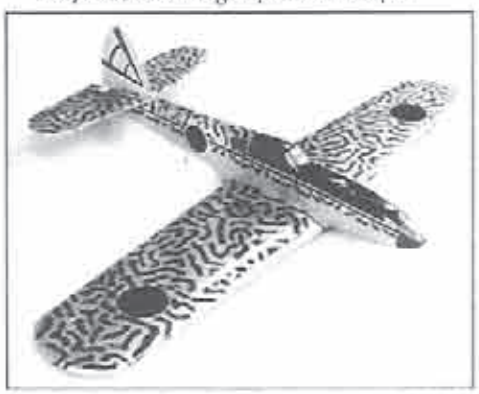
Photo 2

Photo 3

For sticking squigs, I like to run my iron a little cooler than I use for normal covering

Applying squigs to the wing with medium iron heat. Notice outline of 'meatball' on wing; no camouflage is necessary under the insignias, so save yourself the work!

Apply squigs across hinge lines. In this case, I've already hinged the aileron using covering film. If you prefer tape or conventional hinges, tape the control surfaces in place while applying the camouflage, then cut away after completing the job. Iron firmly in place, then hinge up with the tape.



The finished product! Looks pretty nice, eh? The camouflage work itself took about three hours, with another couple of hours spent applying insignias, stripes and canopy trim. The plane is a real eye catcher and well worth the extra effort!

so as to prevent altering my already tuned parts. You want enough heat to set the adhesive well, but not do much shrinking. Start applying squigs toward the middle of the area you're going to camouflage and work toward the edges (except fuselages, which we'll discuss in a minute). Also, you can whisk the iron over the surface of the part, and enough heat will be left to hold several squigs lightly in place. You can then adjust their positions as required before passing the iron over to set them permanently; a technique that will speed you up a lot. Only stick squigs where necessary. I like to mark the position of insignias, etc., on the airframe prior to applying the camouflage; then I don't have to waste any time applying squigs where they'll be covered by a big red circle or something.

So what happens when you get to the edges? Easy on the wings and tailplanes; just let the squigs run past the edges, then trim flush after ironing down. Fuselages, however, require a little more strategy. Here, you want to delineate the bottom edge of the camouflage treatment on the fuselage sides. Depending on the region, nation or even the unit C.O.'s personal whim, these varied from full-sided to partial treatments; where the camouflage extended from the top surface of the fuselage to about one half or two-thirds of the way down the sides of the fuselage. Either way, I like to mark this line with a strip of masking tape, then begin applying squiggles from this demarcation line up both the fuselage sides, paying attention to blend them well on the top surface of the fuselage. Often, you only need to take real care on the rear turtle deck areas, as there was frequently a black anti-glare panel applied to the cowling ahead of the windscreen.

After you've applied all the squigs, go ahead and place your national insignias, stripes, unit markings, etc., right over the camouflage. After you're finished, go over the whole plane with the iron at shrinking temperature and get everything tight and smooth. Do final assembly, tuning check and then admire your slick new toy! The result of my work is the plane in photo 6. CAUTION... The Japanese camouflage patterns work VERY well, so I often like to use the early era insignias that have the red 'meatball' on a rectangular white background, which give you some bright visual landmarks to keep your eyes on, as well as reducing the required area of camouflage to apply. In the example shown here, I used the later yellow-outlined roundels, so created a slight bit more work for myself and my eyes... That's okay, it was worth it.

READER'S RIDE...

This month's Reader's Ride model is Erik Hansen's dynamite little slope jet. Erik lives near my place, so he dropped by the shop one day and grabbed a set of EPP handlaunch wings and a slab of EPP foam and said, "Wait'll you see what I do with these!" A few weeks later, he came by the shop with the plane you see here, the venerable BD-5 at about 1/6 scale. At 60 inches span, and with the fat fuselage, it's a pretty hefty little critter. She flies on 432 square inches of area with a SD7037 airfoil and tips the scale at about 38 ounces; so while not a floater, it's still capable of flying in fairly light lift if you keep your speed up and don't do dumb stuff. The plane really comes into its own in big air and can be heavily ballasted to achieve prototypical speeds... Well, okay... Maybe not prototypical, but pretty darn fast... And very aerobatic!

One interesting feature of Erik's model is its full-flying stabilizer. This was achieved by creating a plywood plate for each side of the fuselage with a pivot tube mounted through holes in the plates. The plates provide a large surface area attachment point for the pivot tube, and spreads the point loads induced by the tube ends across a wide horizontal area (the fuselage side surfaces). An alignment pin is used to keep the stabilators in synch; like the flying stab on a TD ship. A horn is mounted on the left stabilator's bottom surface over the pivot tube's location, and a conventional pushrod actuates the surface in the normal manner; no complex linkages buried in the foam... Very smart.

The canopy is removable, providing access to the elevator servo, receiver and battery. The wings have torque rod linkages with a single servo in the center of the wing which can also be reached through the cockpit opening. Erik has also created a clear canopy complete with pilot figure which gives the plane a great deal more realism in flight. Covering is Goldberg Ultracote over carefully placed 3M Super Strength Strapping tape. Nice work, Erik!

Erik has considered offering a kit of this model, but hasn't promised. If you'd like to rattle his cage about it, go ahead and contact him at (949) 376-4888.

Signing Off for Now...

That's all for this month's edition. Next time, we'll take a look at applying lettering using Ultracote... If you don't have a Stika machine. (More insanity). 'Til then, thanks for dropping in! ■

Erik Hansen with his scratch built, EPP BD-5 slope jet at Los Banos, C.A. Photo by his lovely wife Nikki.

Erik's BD-5. Tail feathers are 3/16 balsa, all other parts EPP / Ultracote. Note pivot tube fashioned from scrap pushrod housing. This shot shows the Ultracote covered canopy.

BD-5's clear canopy. A little further work was done later to achieve better fit. Looks very realistic in flight with helmeted driver wearing his O2 mask!

TECH TOPICS

Dave Register
Bartlesville, Oklahoma
RegDave@aol.com

Schuemann Ellipse Planform

Last month we discussed design considerations for an optimized wing based on the Schuemann-Ellipse (SE) planform. To be specific, this means a geometry in which the trailing edge of the wing has no taper (and is orthogonal to the fuselage), while the leading edge describes the outline of an ellipse.

This would be fine except that the effect of Reynolds number is to decrease the efficiency of the airfoil at the wingtip (smaller chord). Another issue is that the elliptical distribution can be optimized for a single angle of attack whereas a real sailplane operates over a fairly wide range of incidence angles and airspeeds.

To address the latter question, we'll set our design target somewhere near the maximum lift coefficient of the selected airfoil. At this point, the induced drag is greatest, so getting the best efficiency from the wing is particularly critical here. This is also very important for controlling stall effects. If the lift distribution is deficient at the wingtips, tip stall is likely to be a problem. At lower angles of attack, this approach will err on the side of excess tip stability but the induced drag penalty is low at lower angles of attack; so this looks like a 'safe' trade-off (Correction - last month, I inadvertently noted that the planform efficiency factor, 'e', should be >1. As defined in the induced drag equation, that should be e<1. The rest of the discussion is OK with that correction).

A final caveat. It is recognized that a full 3 D vortex model is the right way to do this problem. However, that approach is not readily available to most modelers. If we can get 90% of the way by a simpler method, that may be a help to a bunch more folks.

Reynolds Number Correction

We can conveniently represent the S-E geometry by the equations shown in Figure 1. (Proof is left as an exercise for the student - didn't you just HATE that in school!) Based on those formulae, once you've chosen your span and aspect ratio, the rest of the planform is uniquely defined. If no other effects come into play, our wing layout is done and we could turn our attention to the multi-taper fit side of the problem. However, as noted, this underestimates the lift distribution near the wing tip due to the Reynolds number response.

Now, our design objective is to create an elliptical lift distribution near the maximum lift coefficient of the airfoil. So if the lift coefficient decreases near the tip, then we need to increase the local chord by the same amount as the loss in C_l at that local chord.

Referring to Figure 2, one finds that the lift coefficient of a of turbulent flow airfoil such as the SA7035 decreases as the Re decreases. Our area of particular interest is the range from 20,000 to about 100,000. In this region, especially at the lower end, the data is a bit sparse so we'll have to make an educated guess.

Figure 1

Define Span and Aspect Ratio

Then:

$$\text{Root Chord} = 4 \cdot \text{Span} / (\pi \cdot \text{Aspect Ratio})$$

$$\text{Area} = \text{Span} \cdot \text{Root Chord} \cdot \pi / 4$$

$$\text{Chord} = \text{Root Chord} \cdot \sqrt{\left(1 - 4 \cdot (X/\text{Span})^2\right)}$$

Referring to Figure 3, we see that down to about a Re of 80,000, the maximum lift coefficient from the UIUC data (SA7035 and NACA0009 in these examples), decreases somewhat linearly. However, from the old NACA, we find that the data begins to fall off more rapidly below 80,000. Finally, from some work done in the little tunnel down in our basement (data courtesy of Mike Register), we find that the trend seen in the NACA data is reasonably well duplicated down to Re – 20,000, even with a turbulator to improve boundary layer attachment in this range.

In this figure, the slope of the lift coefficient

Figure 2

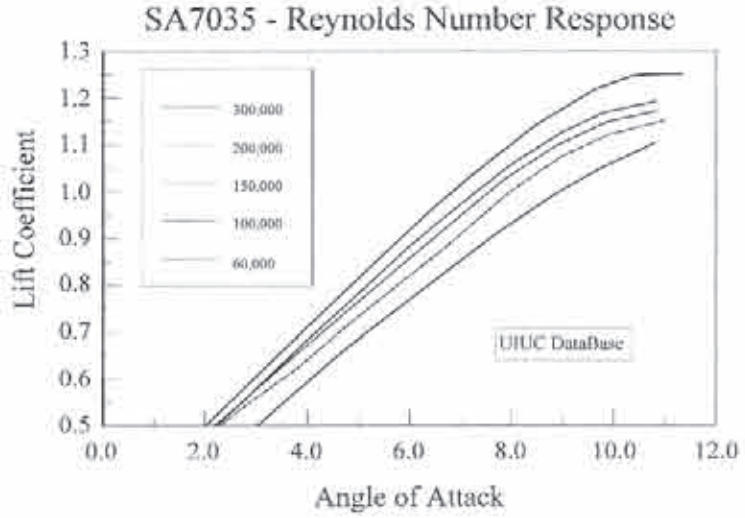
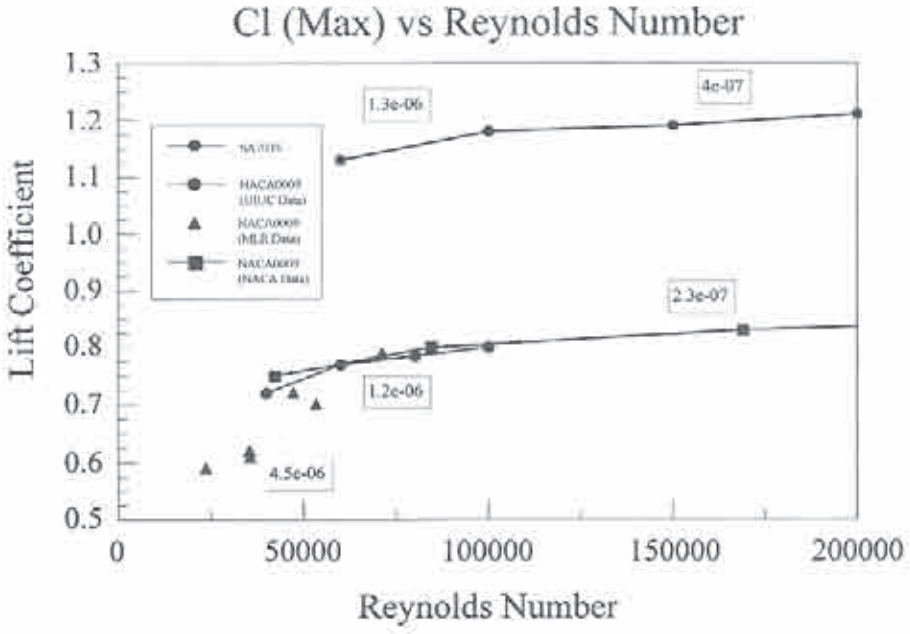


Figure 3



vs Re is given for different parts of the curve for each data set. It appears that this slope is ~ 2e-07 for Re >100,000, but increases as the Re decreases. Both the old NACA data and the UIUC data for the NACA0009 exhibit a slope ~ 2e-06 down to an Re ~ 60,000. The data from Mike Register's work indicates a somewhat higher slope on the order of 5e-06 in the range of 70,000 - 20,000. Since there is scatter in all these data sets, down at the low Re ranges, these slopes are my best guess from an interpolation of the data through the data points near stall for all of these data sets. You might come up with a slightly different number based on how you interpolate the data. However, it seems clear that the slope of the Re response near max C_l in a region of interest to us is in the 2e-06 to 5e-06 range. So for this analysis, I'm going to use a conservative value of ~ 4e-06. This might overcorrect the tips slightly, but that's the more conservative way to go anyway.

We now have some handy rules for correcting our SE planform for Re effects. Let's review how we'd do that. Remember that we're trying to generate an elliptical lift distribution. The product of the lift coefficient and the local chord determines the local lifting force. (Actually, we should use the local area, but if we use a constant span increment then this is OK.) Thus, if the lift coefficient decreases as a function of span location, we simply have to increase the chord at that location by the amount of that decrease.

If we were doing this in a spreadsheet we would first use the equations in Figure 1 to determine the root chord and other parameters for the planform. With these data in hand, we would then create a column of spanwise positions (X). The chord for a SE planform at each of those positions would be placed in the next column. Now determine your minimum speed for the airfoil and wing loading of your design (typically between 15 and 20 ft/sec - use Chuck Anderson's code or other similar polar software to figure this out). Then create a third column for Reynolds number using the equation:

Re ~ 525 • Velocity (ft/sec) • Chord (inches)

Now assuming you know the max lift coefficient for your airfoil at the root chord, you can calculate the lift coefficient as a function of Re at each spanwise location using the slope derived from the data we've cited. So create another column of C_l as a function of spanwise position. Create another column adjacent to that which will be the ratio of $C_{l(max)}$ at the root chord of the wing to $C_{l(max)}$ at each of the spanwise positions. As the final step, create a final column which is the product of the lift coefficient ratio and the original SE chord (the 2nd column in our spreadsheet). This last column is the Re corrected SE planform.

Multi-Taper Fit

Now that we've got a reasonably good estimate for a Re corrected SE planform, how do we go about estimating a multi-taper fit to this layout? Best way I know is a least squares fit to the selected number of taper breaks using the Solver macro in an Excel spreadsheet.

Although that sounds like a lot of techno-babble, it really works quite nicely. To make this easy and accessible to anyone who wants such a spreadsheet, I've parked it out on our TulSoar website for down-loading. Go to the TulSoar website (http://www.mccserv.com/tulsoar/) and click on the download page and follow the instructions. Alternatively, drop me an e-mail and I'll attach a copy and send it back to you.

This is an Excel 95 workbook which contains a sheet of instructions, worksheets for double, triple and quad taper planforms, and a worksheet of macros to seed the solution and run it for you. This file has been virus checked carefully but, as with any downloaded software, you should run Norton AntiVirus or McAfee to be sure it's OK for your system.

I've cheated a little bit in the spreadsheet analysis by adding a tip taper on the final outboard section of the wing. This is to more easily match the large elliptical curvature very near the wing tip. For the tip core, the root and tip chords are given for cutting the core. Also listed is a span position at which a tapered cut should be made from the LE at this position to the TE at the full span position. This triangular taper is typically in the last inch or so of the span and should be rounded before bagging. Or glue on a balsa block and round the tip that way. In effect, the double (or higher) taper planform is actually a triple (or higher) taper, but only two cores need be produced.

That wraps up our discussion of planform design for now. Please drop an e-note if you have any questions regarding the spreadsheet. I don't know how to convert it to Lotus or Quattro Pro so you're on your own there. But if you load it into those programs, the instructions should give you a pretty good idea how to get things going. ■

ZIKA

"SHORT CUTS"

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

U-2 Building Project, Part 5

Well, here we are again. First of all, thanks go to David Garwood for providing us with the history of the Lockheed U-2 Spyplane last month. The U-2 is obviously quite unique and Dave's excellent, in-depth research on the aircraft's mission, technology, and innovative design clearly provides insight as to why we chose to construct a model of this plane.

When we left off last, the fuse was about ready for the final primer. Three cans of sandable primer later, and a lot of spot putty, and we were ready to proceed. The last coat of primer was wet sanded with 600 grit and washed quite smooth. I was going to use it as is since it did have a good surface finish, but a quick telephone call to Jerry Slates convinced me otherwise. (Jerry was laying up glass work before most of us were flying.) Jerry highly recommended that I paint the fuse with epoxy paint, because the exotherm (heat) of the mold lay up would cause most paint systems to fail. So, off I went to the hardware store to pick up some black epoxy, appliance spray paint. The paint went on smoothly and wet sanded with 600 grit rather nicely; it was a great prelude to what the final fuse would look like.

With the fuse ready for molding, it was time to build the parting tray. Jerry wrote a series of article for *RCSD* which extensively detailed fuselage mold building; it's a great reference. The parting tray was made with a removable and reversible top tray section, which was supported by foam blocks over a bottom plate. I was going to use melamine shelf stock, but it was difficult to find in the required length. Luckily, a thin carbon fiber skinned panel was available (scrap from work) in a 1/2" thickness. It was cut to length and the side profile of the fuse was traced onto 2" wide masking tape placed on the panel. I used a right angle tracing guide to lay out the cut line. The outline was cut using a router with a spiral cut rotary carbide bit.

The upper panel was supported by 6" blocks of 2" blue foam, double face taped to the bottom panel. Since Jerry's previous article emphasized the need to support the plug relative to the tray, this was done with blue foam blocks taped to the bottom panel. The fuse was now ready to mold. I used 9 coats of butcher's wax to ensure the plug would release from the mold. The plug was positioned in the tray and the gap between the two was filled with modeling clay using a plastic putty knife. The parting tray was given a few more coats of wax and everything was ready for laying up the mold.

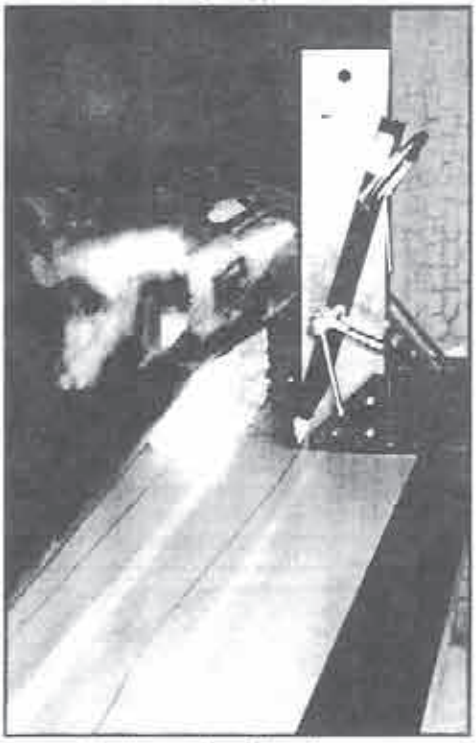
The next obstacle to overcome was to find a nice warm area and a flat table to place the tray and plug assembly. Well, the workshop was out of the question, so I removed the top off the dining room table and flipped it over to reveal a flat smooth working area. (Oh yes - the wife was at work all day and, of course, all would be done before her return... Right Murphy?) To begin the process of laying up the mold, I cut 6 oz. plain weave glass into 4" diagonal strips; then, placed the weave at 45° to the fuselage and improved the drape of the cloth. Additional strips of cloth were cut normal to the weave to build up the flanges of the mold - with all the glass cut to build up 4 plies on the fuse and 6 plies over the flange area. The last thing to be done before mixing the epoxy was to place index buttons (plastic peel and stick coaster buttons) on the parting tray flange. These would be used to register the mold flanges against each other.

The next step was to mix up the surface coat. Surface coat is an extremely viscous pigmented epoxy that has an extremely hard surface finish. I did not have the time to purchase surface coat and, besides that, I felt is wasn't needed since we were not building a commercial mold. I called Jerry, again, and decided to use West Epoxy, slow set, mixed with powdered graphite and Cabosil. The mixture was thickened to the consistency of molasses, though mixing this brew did entrain a lot of air, which would prove to be difficult to remove.

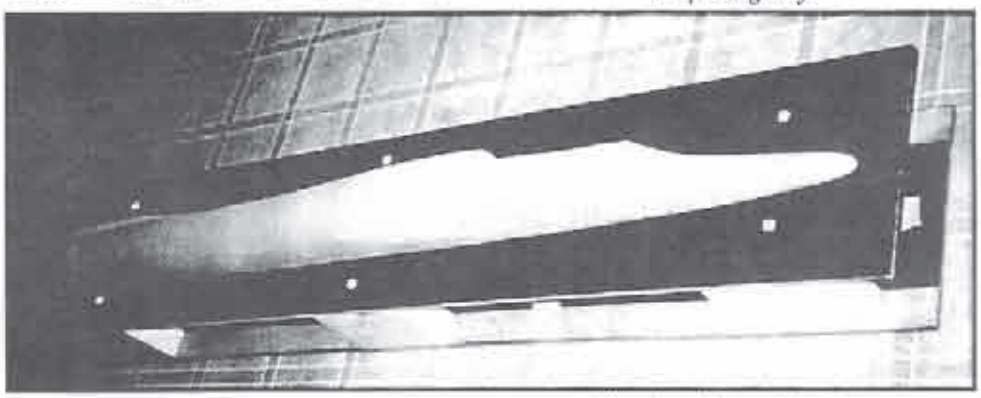
The surface coat was mixed and applied to the mold surface of the plug, and parting tray surfaces, to a thickness of about 1/16" per Jerry's recommendation. This was then allowed to tack up and a second coat applied. The first ply of glass was laid up directly over the second surface coat and then thoroughly wet out with regular West Epoxy that was pigmented black with the ground graphite. This was followed by 3 more plies over the fuse area and 6 over the flange area. Jerry recommended at least 8 plies over the fuse and I agreed with him, except that I wanted the mold to be flexible to remove the plug due to the negative draft over the engine intakes. The plan would be to lay the additional plies of glass over the backside of the mold once the plug was removed.

The last plies of glass had tacked up long after the wife came home and saw her dismembered dining room table, but that's another story. The entire assembly was allowed to cure overnight in the old electric blanket to post cure the mold and make it ready to lay up the other side. I believe the

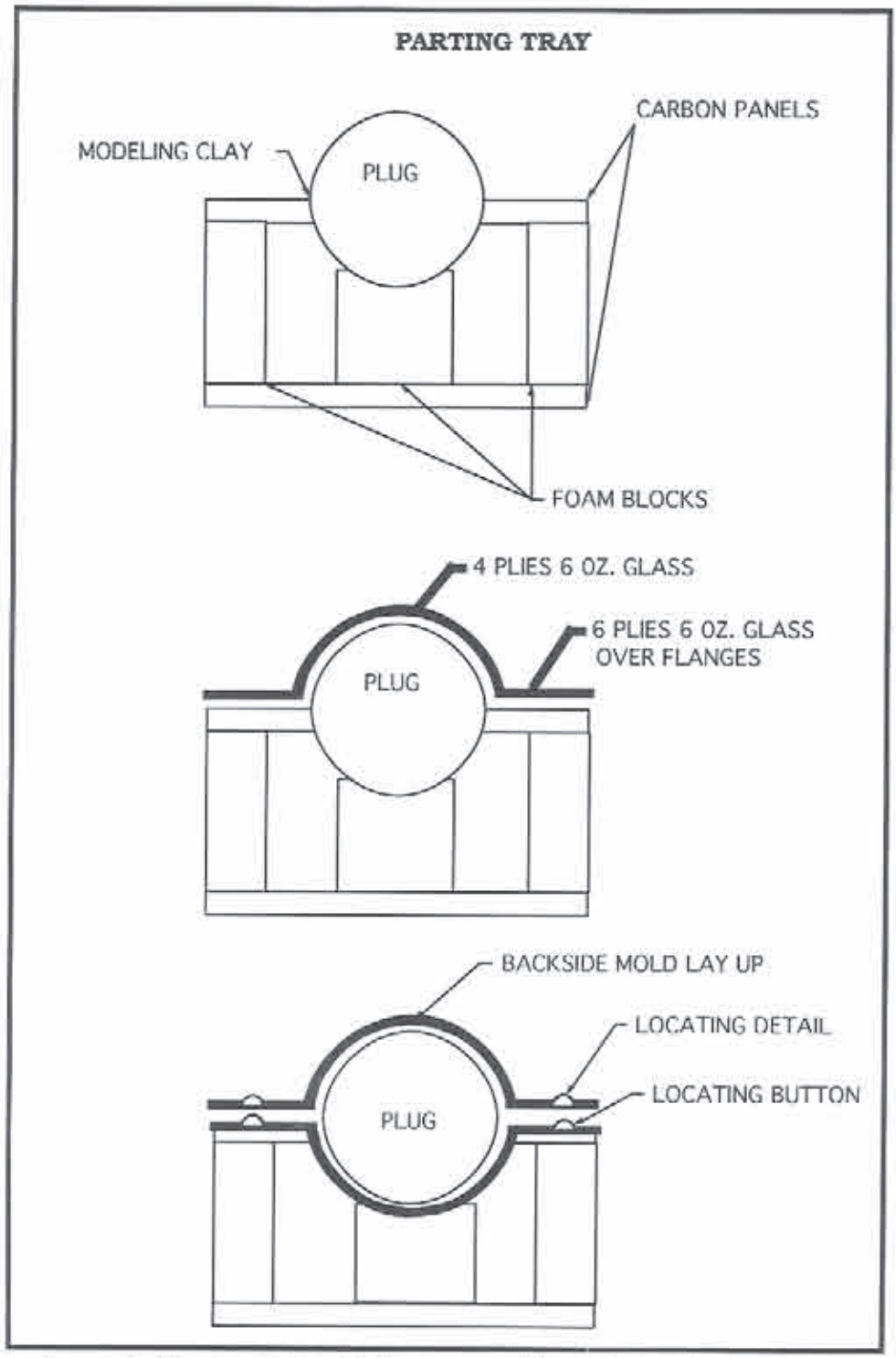
Finished plug after painting. (Angel approves...)



Tracing outline of the plug onto the parting tray.



Plug fitted into parting tray.



exotherm probably got up to about 130°, which really caused the mold to cure up, fast. The next morning, the mold half with plug intact was removed from the parting tray. The excess modeling clay was cleaned up from the parting line area and the plug and flange areas of the mold were waxed up. The lay up was repeated and the entire assembly was then allowed to cure in the electric blanket, again. The next step was most uncertain and a bit disappointing.

The next day, I trimmed up the perimeter of the flange line so that I had two defined surfaces to separate. I used a plastic putty knife to separate the mold halves all around the perimeter. The next step was to use 1/32 ply wedges (Thanks, Jerry.) to help pry the molds apart; they were then doubled up and the mold separated a little. The next step was to use 3/8" wedges to pop the mold halves. The mold popped open and the plug remained wedged in one mold half. Unfortunately, the high curing temperature induced by the electric blanket (Jerry usually let's his mold sit at least a week to fully cure.) caused the bond between the primer and the epoxy paint to fail, leaving an ugly tool and a mold surface scared with paint, spot putty and primer.

A frantic call to Jerry helped me to realize that all was not lost, just hidden under the mess. I proceeded to remove the heavy build up with acetone and dope thinner. This left a fairly smooth surface, which was then wet sanded with 400 and 600 grit. The final step was to apply rubbing compound, using a dremel buffing wheel, to obtain a nice molding surface. The next step was to bond a plywood flange to the backside of the mold in order to stiffen up the flange. Trying to manage the material and conserve epoxy, I decided to use the Bondo, which did not work out well on the plug; so I just laid it in between the wood and the flange backside.

Well, that's about it for the mold. After I clean up the other side, I'll begin vacuum bagging each fuse half into the mold. As for the tail surfaces, Dave is making those and plans to share a few paragraphs on that subject, in an upcoming issue. Dave's cores were cut a few weeks ago out of pink foam using SD6060 with a few degrees of washout at the tips. He plans to skin them with 1/64" ply and use 1/4" or 3/16" root and sub-roots in the cores. My wings are being skinned with .030" poplar veneer utilizing 3 airfoil combinations.

We plan to provide additional information dealing with the fuse construction, internal supports and molding techniques. Until then, we'll take a lot of pictures and keep you up to date.

■

HAVE SAILPLANE WILL TRAVEL!

by Tom Nagel
904 Neil Ave.
Columbus, OH 43215
tomnagel@iwaynet.net

Travel Gear for
The Wandering Sailplane Pilot

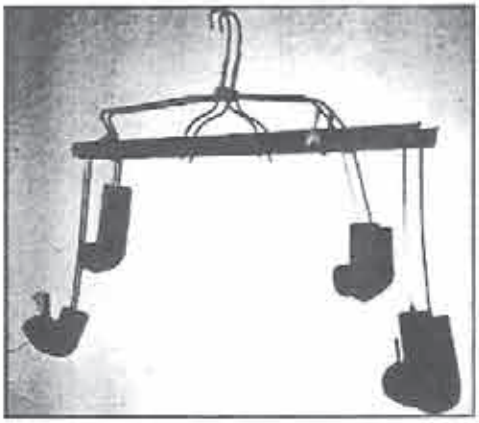
We all have our standard collection of gear which we schlep out to the field or slope each time we go flying. When you are vacationing with sailplanes, or exploring new soaring sites, you need to slim down your kit to the essentials, and there are a few additional items you might consider taking along:

- Rand McNally Road Atlas. You ought to have one of these in the car anyway.
- DeLorme Mapping Company "Back Road" map books. These show all of the county and township roads, down to the level of goat paths, and although topo lines are not included, wooded areas are delineated with remarkable accuracy; often, this is enough to spot slopes. Scale 1:150,000 or about 1 inch to 4 km. DeLorme, P.O. Box 298, Freeport, Maine 04032. 1-800-227-1656 ext 5900. (For computer, laptop versions, check out <www.delorme.com>.)
- Binoculars. To locate slopes or locate downed planes.
- Pruning shears. Help you penetrate the briar patches, or in case you really need some prunes.
- Light nylon cord. 100 feet or so, for plane retrieval, in the event Gordy is not with you.
- Compass. Not only to help you find your way, but also to let you check and make note of wind and slope directions, for further trips.
- Pen and pad, or your flight log. To takes notes on wind directions, conditions and facts for your HSWT article.
- Backpack or shoulder bag. I have a book bag that some relative got for renewing their subscription to *Time* magazine. I added a stick to stiffen the spine a little, and it works fine to carry my TX, gear and water bottle on hikes out to distant slopes.
- Stock permission slips. I keep a few under the car seat, with the maps, and use them on both flying and hunting trips when I have land owner permission and I am not one of the "regulars."

Of course, you will need a separate little travel kit with repair materials, voltmeter and portable battery charging equipment. A charge that works off your car's cigarette lighter is probably the best bet.

Then there is the question of actually traveling with often-fragile sailplanes in the luggage.

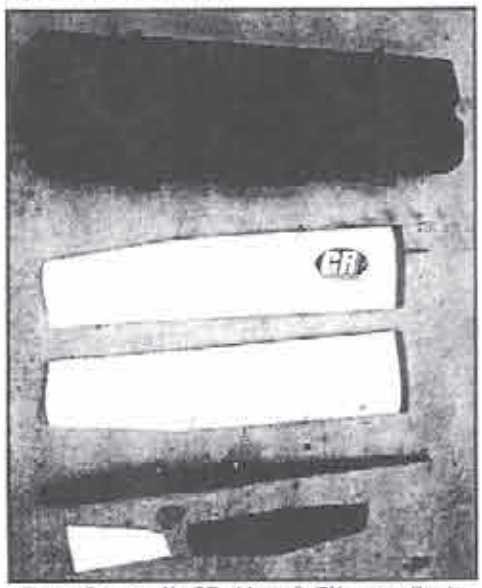
For his vacation travels, Dave Garwood has a DAW 1-26 that breaks down and fits in an arrow case, and a Birdworks ZIPPER that fits in a rifle case for transport.



Tom Nagel's double Zagi rack, made from a scrap of wood, coat hangers, and some pieces of foam pipe insulation.

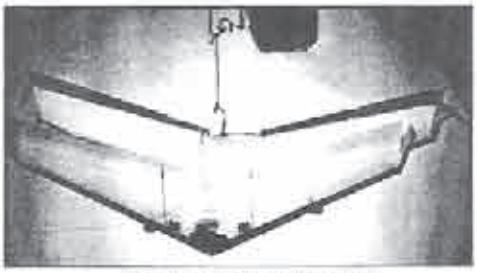
I usually travel with two Zagis hanging in a rack from a coat hook in the back of the mini-van. The rack is a simple device made out of old coat hanger wire and a 1"x 1" stick. The wire hooks are padded with foam pipe insulation. The Zagis stay out of harm's way in their rack, and do not interfere with vision out the back of the van.

A few years ago I bought a used flying wing from Ken Bates at the Toledo show. He built this HLG sized plane with a 3-piece take-down wing. I can pack the whole plane, a transmitter, a charger, a small highstart and lunch in the cardboard box that a case of motor oil comes in. Whatever approach you take, protect the plane from "trunk rash" and keep in mind your need to carry the plane out to distant points, to do repairs, and to keep your equipment charged.



Dave Garwood's CR Aircraft Climmax fits in an arrow case for easy transport. The key is two-piece wing, bolt-on stab, standard removable rudder.

(Right) Traveling Climmax assembled.



"Under the Double Zagi"
Tom Nagel uses a home made rack to carry 2 Zagis from the luggage hook in the back of his mini-van. (The floppy fins are the result of an experiment with ruddered winglets, not combat damage.)

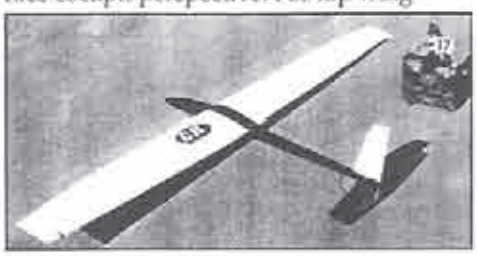
One final consideration for itinerant sailplaners is the desire to document the event. Bill Mulder wrote an earlier article for this column, and I have asked him to describe how he put a camera on board his 60" sloper, an AGR Python.

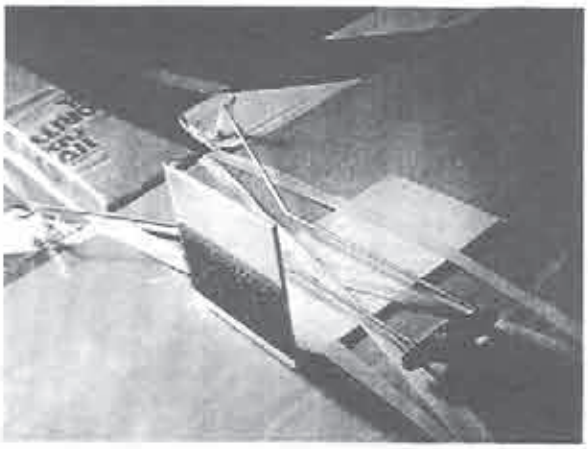
Cam Setup
by Bill Mulder

"My personal enjoyment in flying R/C sailplanes is hiking to remote back country slopes, and hucking my plane. To remember these spectacular spots, I have added an onboard digital camera to my flite pack. Aerial perspectives of topographic terrain makes for a nice "angle" on soaring escapades. An onboard camera is like being in the cockpit of your R/C glider. In my case, it's about being out there — in the landscape, and mentally, on the wing. With pictures in hand, it's proof that I flew there!

How it Works

"The electronic controller plugs into the Rx on one end and the digital camera at the other. The throttle stick is used to "click" the pictures. I fly an AGR Python slope foamy for aerial photo reconnaissance missions. Though, this season I'll be using the AGR 60" Whiplash flying wing for its packability and durability. The digital camera, battery and electronics, weighs in at 5.2 ounces. I can get up to eight shots per session, and average about half of these as good. Since I'm not looking through the viewfinder, I must anticipate the "shutter" and rely on my wits for good aim. The Kodak DC20 camera is fairly compact and slim. It can be mounted on a small 60" slope model like the Python using strips of adhesive-backed Velcro, near the CG point of the plane. It can mount under the wing looking off to the side or straight down. Side view perspective includes part of the wing in the picture. This gives the viewer a nice cockpit perspective. For top wing





mounting, I use a balsa L-bracket with Velcro on one side. The other end slides under the wing rubber band and mounts near CG. After my aerial outings, I find myself racing home to download the pictures onto my computer. It's a great way to enjoy two hobbies at the same time and share them with others.

"If you wish to see my onboard shots on the world wide web and other aerial links, go to www.compcurr.com/~bmulder/BayGliders/BayGliders.html click on "aerial" and behold."

Where to Get it

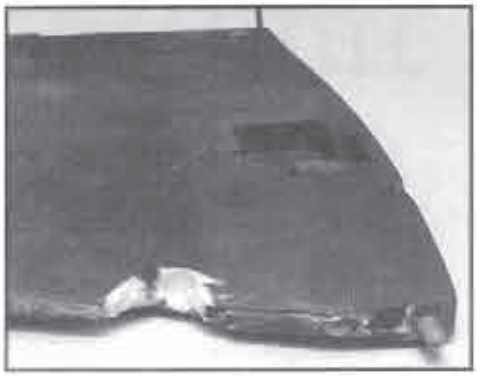
AGR Python or Whiplash - AGR Models
www.onevisalia.com/agr

Remote camera activator - www.wco.com/~dgreno

■

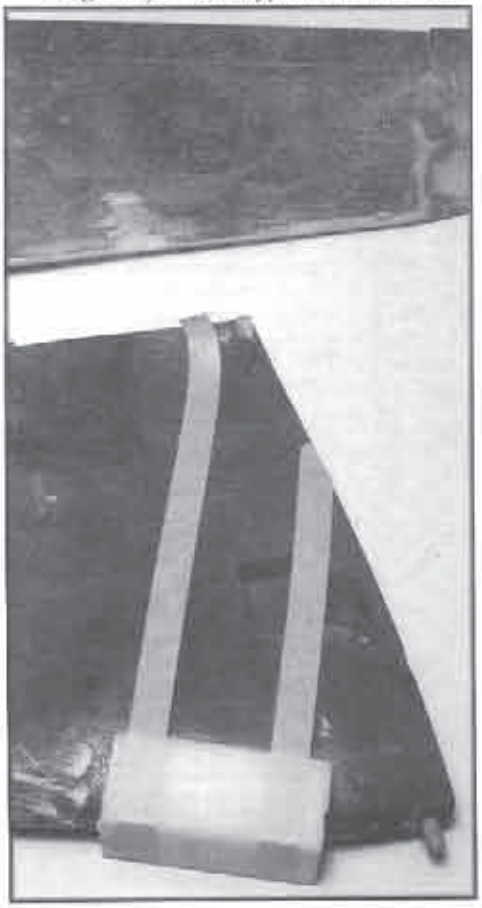
FOAM WING REPAIR HOW-TO

by Dave Garwood
Scotia, New York



BAe Hawk wing showing Point of the Mountain "ironweed" damage and general wear.

First step is to cut out the damaged part (foreground) back to undamaged area of the wing, and fit a block of foam to the cut-out.



"You hurt only the ones you love," goes an old saying with plenty of truth in it. In sailplanes it seems like the planes you like the most get beaten and battered more than lesser loves. Likely this is because they get flown more, and taken to unfamiliar hills and exposed to less familiar dangers.

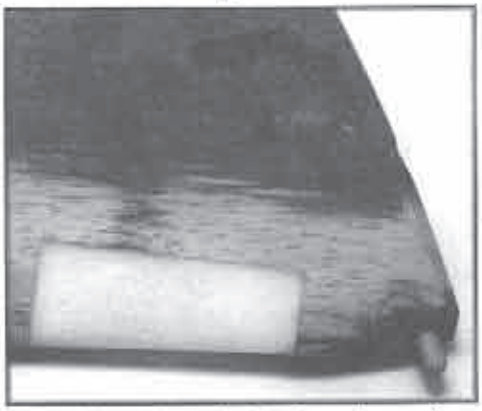
My Doug Buchanan BAe Hawk made two trips to Salt Lake City and accumulated new types of damage both times. At Soar Utah 95 the wing sheeting cracked in the sun from heating expansion of the foam underneath. At Soar Utah 98 a landing approach through "ironweeds" ripped the leading edge in two places.

I love this plane, so time for a rebuild and refinishing job to keep it flying. Here's how to repair gnarley damage to a foam wing leading edge.

1. First, cut out the damaged section with a razor saw. Cut back to undamaged wing. If you make the cut-out rectangular, it'll be easier to fit the repair material.
2. Cut a foam block to fit the wing cut-out. Final shaping and sizing is easily done with sanding blocks.
3. Glue the repair block in the cut-out and let it dry or cure overnight.
4. Shape the repair block with sanding blocks. Long sanding blocks make it easy to match the airfoil shape.
5. Sand the repair foam to a recess slightly below the wing sheeting, ideally to the thickness of the sheeting material. Fit new sheeting made from either the original sheeting material or fiberglass cloth and epoxy.
6. When cured, final sand and paint or apply heat shrink covering.

With care, this type of repair can be invisible.

■



Finished repair, sanded flush to wing surface with long sanding blocks. It's now ready for sheeting with your choice of skinning material.

(Left) Glue the foam block in place and let it set up overnight. Damage to second wing in background was not as serious, and was repaired with epoxy mixed with microballons and poured into a form made from vinyl tape.

DAW MINI FO

Flight Report

by Dave Garwood
Scotia, New York

"Yee-Haaa," cried Wayne Rigby as he released the DAW mini foamie warbird on bungee launch for the fifth time today. "You gotta start the article with Yee-Haaa, Dave, that says it all about this plane," Wayne exhorted.

This is a flight report on the Dave's Aircraft Works (DAW) Kawasaki Ki-61 "Hien," representing a new class of sailplane called "mini-foamie." While it is suitable for slope soaring on small hills in good lift, it makes a major contribution to soaring by re-defining low-cost bungee-launched gliders.

The 30-inch span plane is constructed of strapping tape and EPP-foam: the bounceable, crushable, miracle material that revolutionized the design of durable slope planes starting in 1996 and gave us the sport of foamie slope combat. The kit builds in about 12 hours, is covered in Goldberg Ultracote and can be finished to look as plain or fancy as you like. No need to detail the construction steps here, they are explained thoroughly in the excellent instruction manual that comes with the kit.

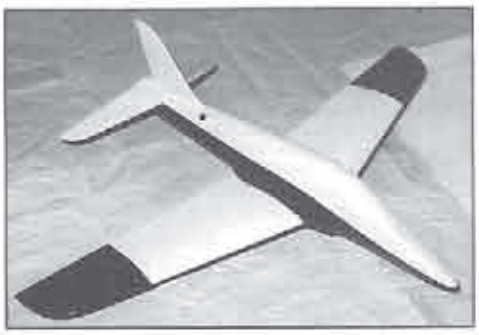
Building a light airframe is important for small planes and mine makes good use of modern miniaturization in radio gear by mounting a Hitec 555 micro receiver, a pair of Hitec HS-81 micro servos, and a 270 mAh battery pack, finally tipping the scales at 9.2 ounces, a little lighter than the 9.5 to 10.5 ounces specified in the kit instructions. The Hitec radio gear in this plane and four previous sailplanes has proven 100% reliable.

Today, we got a break in the ice age weather we've had in New York this past winter and Three Amigos took the opportunity to try out the new Hien, flying in the athletic field of a local high school. The plane felt good in trim tosses,

Ph to

Specificatio:
Span:
Length:
Wing Area:
RTF Weight:
Airfoil:
Control functions:
Price:

Other types va
- North Amer
- Messerschm
- Macchi C-20
- Lavachki LA-3



Fresh from the spray paint booth, it's tough to see repairs to damage in both wings of Dave's BAe HAWK.

showing snappy controls and a surprisingly flat glide in ground effect.

The launch gear was the red rubber tubing from a small Northeast Sailplane Products Pinnacle Up-Start with welded rings from the hardware store on each end. We stretched the rubber back 30 paces for this day's testing.

The Hien *rockets* from the launcher's hand, spending about 1.3 seconds on tow and zooming upward to an easy 300 feet altitude or more. Launching makes a *thrumming* sound that has to be heard to be believed. To me it's one of the coolest sounds in silent flight, right up there with the whistling of a F3B plane on a speed run or a long-wing scale plane hurtling by on the slope. Note that the flight path on launch tow is essentially *level*. The plane climbs on its own when it comes off tow. Do not touch the controls until the plane is off the line.

You never tire of this sound and it signals the onset of an adrenaline dump into your bloodstream that is not seen in everyday flatland flying. You may do rolls on the way up, maybe pull a 150-foot loop before leveling out, or just maximize your launch height and search for lift. Yes, search for lift. Our expectations for this small plane did not include signaling lift, but it does.

Now the plane is 500 feet away from you, and a military camo scheme can trick your eyes as to the attitude of the plane, so concentration is in order. First you discover that *this baby is sensitive!* The tiniest control movement produces radical changes to the flight path. I've flown some planes that require only 1/8 inch stick movements, but this one requires only 1/16 inch movements with the trusty thumb. This translates into extreme maneuverability.

The plane tracks rock-steady through loops. Rolls are blindingly fast and a little barelly, maybe aileron differential would get them closer to axial. Inverted flight is terrific, requiring only slight forward stick pressure to hold. The plane is much happier when you remember to keep the speed up, but stalls are shallow and uneventful. Intentional stalls showed a warning mush and no tendency to fall off to one side. We even *tried* tip-stalling the plane and had a tough time doing it, and the plane recovered quickly. I wonder how the designer gets this small plane to fly so well.

With a little stick time pumping up our confidence, we tried outside loops. Smooth, man, very smooth, and all the more impressive that we're flying them in a school yard. The mini-foamie does Cuban-Eights and Split-Ss as easily as it flies straight and level.

While not rated for full-contact combat, this plane is tough. With the EPP-foam and filament tape, combined with low weight and small size, it shrugs off crash damage that would put you back at the repair bench with a plane of any other construction method. I did have one occasion to test the plane's ruggedness. I was working on a low inverted pass for the camera, drifting the Hien into position for the photographer. I intended to make a slight altitude adjustment, to bring it down from 15 feet to five feet, when BLAMO! A one-point landing right on the nose. We glued one elevator half back onto the link stick and re-launched.

I've flown some fast slope planes, some fairly sophisticated thermal planes, I have bungee launched 48-inch foamies, and I've seen radical bungee launching of carbon fiber Renegades with giant "garden hose" tubing. All were cool. But flying a plane *designed* for bungee launch, and a bounceable plane at that, re-defines the sport. In addition to the adrenaline rush and reaction-time tune-up that bungee launch flying provides, the mini foamie gives us an alternative to hand launch gliders when waiting on the hill for wind and on flatland flying days when you're up for some radical action.

Rich Loud summed up the day's experiences by saying, "Just when you think you're set for the season with one plane in each category, somebody invents a new category."

Salute! to Steve Patton for inventing the mini-warbird category and to Dave Sanders for making the Hien kit available at the righteous price of $44.95 (plus $4.00 shipping). And thanks to flying buddies Rich Loud and Wayne Rigby for flying for the camera and sharing their flying impressions. I think they'd do it again if I asked.

■

by Richard Loud.

30 inches
20.25 inches
180 square inches
9.5 to 10.5 ounces
NACA 2412
Aileron and elevator
$44.95 + $4.00 S&H

ilable include:
A-36 Apache
e-109E

(L) Dave Garwood prepares to launch the Hien with Wayne Rigby on the sticks. Photo by Richard Loud.

DAW Hien mini foamie on bungee launch. Wayne Rigby of Clifton Park, New York flying in local school yard over "almost gone" snow.

Author Dave Garwood holds a new type of sailplane: 30-inch span mini foamie designed specifically for bungee launch. Photo by Richard Loud.

DAW Hien mini foamie equipped with Hitec 555 micro receiver and a pair of HS-85 mini tough-guy servos. Span, 30-inches, weight 9.2 ounces, finished in Goldberg Ultracote.

Suppliers Mentioned

Ki-61 Hien, A-36 Apache, and Me-109E mini foamie kits are available from:

Dave's Aircraft Works
34455 Camino El Molino
Capistrano Beach, CA 92624
(949) 248-2773
e-mail: daw1@access1.net
web site: www.davesaircraftworks.com

The radio set used is available from:

Hitec RCD
10729 Wheatlands Ave. #C
Santee, CA 92071-2883
(619) 258-6940
web site: www.hitecrcd.com

The launch rubber was borrowed from a small high start available from:

Northeast Sailplane Products
16 Kirby Lane
Williston, VT 05495
(802) 658-9482
web site: www.nesail.com

KIT REVIEW

Multiplex Twin Star

by William G. Swingle II
Pleasanton, California
bill_swingle@electro-test.com

Temptation can be a powerful thing. Until recently, I wasn't interested in electric powered airplanes. The extra gear they required and the associated costs made them easy for me to resist and I didn't pay them much attention. Then, many of my fellow glider guiders began talking about a new twin engined SP400 model from Multiplex called the Twin Star.

There were several flying about at the Visalia Fall Fest even at night via Night Ops. My disinterest continued but the seeds had been sown. Soon there after the discussions on the internet began touting the model and I began to weaken. Then I made the mistake of asking a friend, who happened to have one, for his impressions. Specifically, I asked my friend John, a man who could sell ice cubes to Eskimos. He spoke quite highly of the Twin Star. He is also the one who got me started on EPP foamies. He'd not led me wrong before... I could resist no longer and bought one.

The Twin Star is not a builder's kit. It's an assembler's kit and very simple to construct. Everything needed is provided: hinges, clevises, wire harness, pushrods; the only things needed are servo extensions and glue. Even the Z-bends are already installed on the pushrods!

The fuselage is nearly complete out of the box. The only assembly needed is the tail group and the attachment points for the wing bolts. **One cautionary note:** The foam is not too heat tolerant. The Twin Star uses a foam that appears similar to white foam albeit with some gray coloring. Except for that, unlike the typical foamie, the Twin Star's foam pieces have been molded. This makes them lighter than would be expected with a somewhat hardened surface. If you apply heat to the foam, the smooth finished surface dimples as the individual beads revert to their original round shape. Light sanding does restore a smooth surface.

The wing construction is similarly straightforward. The wing halves are first glued together with a simple butt joint. Then the servos are installed. The manual describes a method of wrapping the servos in a removable liner and then gluing them in place. I felt this was too complex. I simply shimmed the holes with scrap foam for a nice, snug fit and slipped in the servos. I then secured them with a single layer of clear packing tape. They're tight, secure and easily removable. The motor wires and servo leads are laid in the grooves provided at the bottom of the spar slots. The spars are then glued into place over them. It's very tidy looking, but this is a one shot deal; so be sure the wiring is correct before gluing the spars. Radio installation into the fuselage is the last step in the construction. The elevator and rudder servos are installed into the designated location. Wood is provided in the kit to allow for

Bill Swingle and completed Multiplex Twin Star. (Right) Major pieces right out of box. The tail surfaces have already been attached.

either standard or micro sized servos. I chose micro's and went with HS-80's. Unfortunately, I only had three and had to skip rudder function. When I free up another servo I'll slip it in and the rudder will be up and running. Be careful with the set screws for the clevis attachments. They are quite tiny and easy to lose.

Once the plane was constructed, I applied the supplied decals. I often look down my nose at applying stickers but the ones supplied are sharp and yield a good looking model with little fuss. The final weight with a 7 cell 1.4mAh pack came out to 43 ounces. That's about 8 ounces less than the published weight. I always like it when that happens!

With the plane completed, I checked the CG and control throws. The CG came out right on the spot specified in the plans with no additional weight needed. The control throws recommended in the manual seemed quite tame. I set the surfaces to just about double the recommended values and headed to the local field. It was time for the maiden flight.

At the field I checked the control surface directions (I've never made that mistake!), applied full throttle, and threw the plane. It flew straight out of my hand and began to climb. A few clicks of trim later and it was flying hands off. It's smooth, stable and will do basic aerobatics. It does adverse yaw quite a bit and, as the manual recommends, the Twin Star likes aileron differential. My friend John suggests mixing some rudder with the ailerons. Hopefully, I'll be trying that soon.

My initial flight was on a 7 cell pack. I then tried a low cost 6 cell pack. I was pleased to find there was not too much difference. I'd say both are quite viable choices.

I've now been flying it for several days and have made no changes or alterations. I have noticed the bottom of the fuselage is prone to damage from small rocks or other debris. I applied a layer of bi-directional fiber tape to the bottom of the fuse for added protection. On smooth grassy surfaces, I'm doing touch and go's! It's difficult because if the plane touches down completely friction will over come the thrust of the motors and is a great challenge. I'm now looking for more odd or unusual flight profiles! ■

Specifications

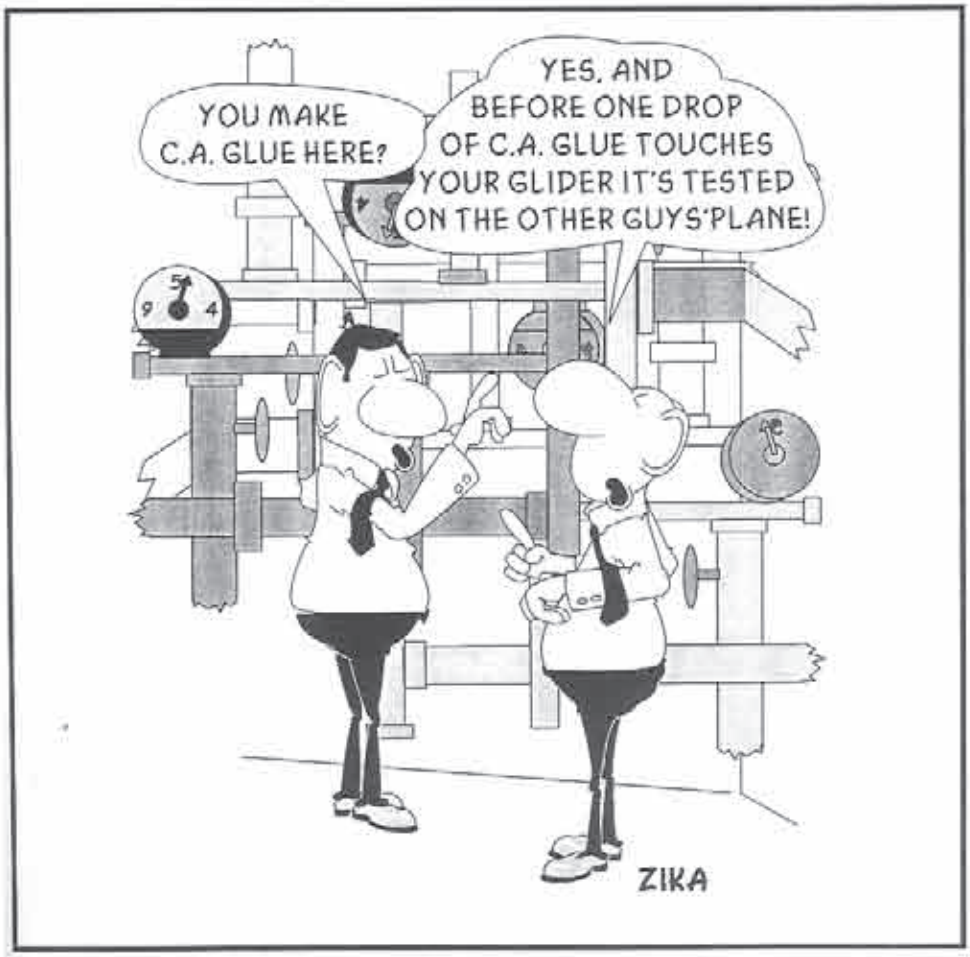
Span:	56"
Length:	39"
Area:	620 sq. in.
Weight:	51 oz.
Wing Loading:	13.5 oz/sq. ft.
Airfoil:	mod. Clark-Y, thickened
Controls:	Elevator, Rudder, Aileron, Throttle

Available from:

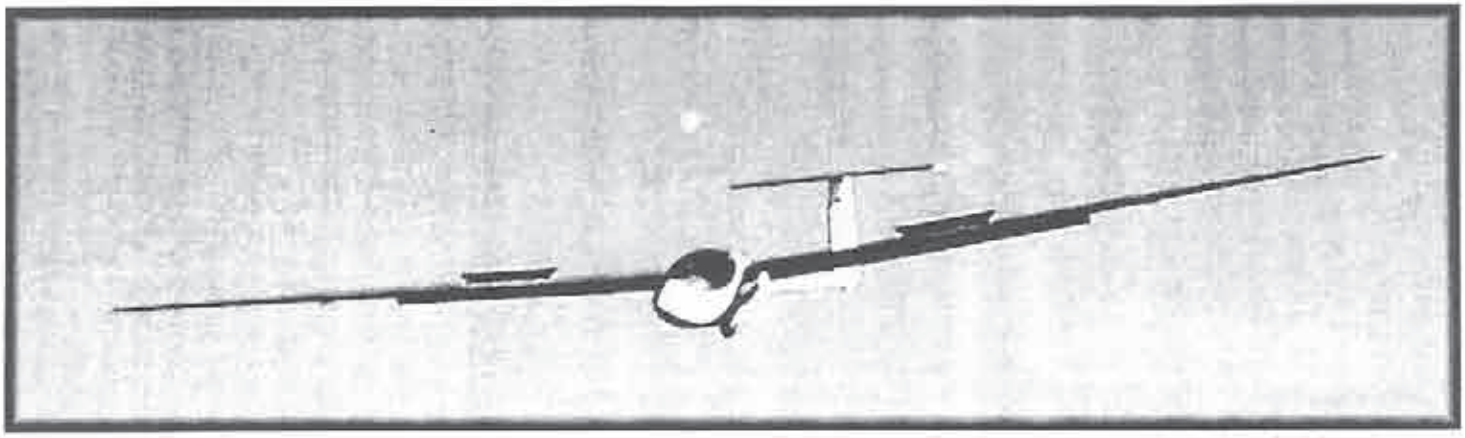
Multiplex USA
14751 Calvert Street
Van Nuys, CA
(818) 785-2401

Aerofoam
1913 E. El Parque
Tempe, AZ 85282
(602) 968-6007

Northeast Sailplane Products
16 Kirby Lane
Williston, VT 05495
(802) 658-9482



("Here I am.")



Dave Miller's 1/4 scale ASW 27. Photography by D.O. Darnell.

Spring is Here!

"Hot Air"

Robin Lehman
63 East 82nd St.
NYC, NY 10028
(212) 879-1634

It's now our prime time for flying. Enjoy it everyone!

It's not too cold up north and not too hot down south. The weather's just right! The juices are beginning to flow again. The birds and the bees are flying and the grass and the trees are greening. Very soon all of us will be out there enjoying some great flying. Los Banos, Fayetteville, Elmira and lots of great new local fly-ins are just around the corner. Those of you with computers might want to check out the sailplanes.com calendar of coming events at <http://www.sailplanes.com/events.shtml>. No doubt we're going to see lots of interesting first flights going up! Good luck you guys and may all your landings have that velvet touch!

The Aerobatic Bug Bit Bad!

I hear through the grapevine that there's a stirring of interest in scale aerobatics out west. The bug infected at least one pilot! I should warn you that this bug is extremely infectious and is quite incurable once caught. You can get it by watching just a few seconds of video. Beware of John Derstine's new Elmira tape! You might get aerobaticitis too. This guy got bit after watching the aerobatic sequences from the 1998 Akro-Cup. John shows us two complete flights from the German scale sailplane aerobatic contest, one by an almost half-sized Fox and the other from a 1/2.2 Swift. This section of the video gives you some idea of what a good aerobatic sailplane is capable of when flown by an excellent pilot (who has practiced, practiced, PRACTICED!).

There will be a few Foxes flying in the east as well. Look to see a large one performing some of the 1999-2000 Akro-Cup stunt routine (http://www.sailplanes.com/akrobatics.htmat) at Fayetteville. For those of you not on the web, you can also find this stunt routine in the last issue of *RCSD*.

Torrey is Not Immune

A word of warning: you might well start to see a few Foxes tearing up the skys in Southern California. As these pilots become more and more familiar with their aerobatic birds, they will fly more and more spectacular stunt routines at eye level. Soon many excellent pilots will begin to fully appreciate the real potential of a good slope with a stiff breeze.

In a couple of years, slope aerobatics will come into its own. The slope will be recognized as an ideal place to enjoy the beauty and excitement of aerobatics up close and personal. Little by little, others will join the fun with aerobatic "ballets" of their own. Soon many pilots will be out there to entertain us with their antics!

New Pilots

Aerobatics will also begin to attract some thrill-seekers new to scale sailplanes. Some will come from the thermal duration crowd while others will have hereto fore flown only powered aircraft. I say "only" flown motor planes, but the truth is, some of these pilots will have flown Extras, Sukhois or Pitts types and these guys will transition to the aerobatic sailplanes in but a couple of flights. Some of these folks will likely become the best aerobatic pilots in the USA. Look to see one of these guys at Fayetteville.

Los Banos is going to be The Very Best Ever

Los Banos promises to be the best scale slope event yet. Best of all, if the wind doesn't cooperate, it won't make any difference because airtowing will be the method of launch. Look to see many new and very powerful tugs. These will be some of the very best towplanes in the country. Those of you with airtow releases in your sailplanes will no doubt be rewarded with some great tows. From what I hear, you will also be treated to some of the largest scale sailplanes in the USA! You will also see to a towplane-sailplane team tearing up the sky with a Bruckmann 1/3 Fox. Los Banos '99 is going to be a great event. Those interested in scale sailplanes will be able to see all types and sizes.

Bigger and Better

To the delight of those folks with the largest gliders, the towplanes seem to be getting bigger and more powerful. Look to see the most powerful 1/4 scale Wilga ever at Los Banos; a 1/3 monster Wilga and perhaps a very large Piper Pawnee Airtowing in Elmira this year, and many others all over the USA.

Elmira 99 will be even BIGGER this year

I hear that the Germans will be coming to Elmira with some new and as always, some very interesting big scale sailplanes. If the weather is better than last year (and it could hardly be worse), look to see well over a hundred sailplanes with at least five or six towplanes on duty. Thursday and Friday should prove to be excellent days for those of you who can get there and want to fly a lot. On Saturday and Sunday you should be able to see just about every imaginable sailplane from 4 to over seven meters span. Because there will be so many sailplanes in attendance, you will probably have a bit of a wait to be towed on the weekend. Be nice to the towpilots, who will be squinting into the wild blue yonder for long periods of time! They will be trying to get you up, up and away as best and as fast as possible. Please be advised that they can only do so much; figure on a maximum of around twenty gliders to be airtowed per hour. That estimate doesn't take into account probable additional delays due to air traffic, refueling, battery checking and aborted tows and line breaks, to mention a few. So if you're planning to fly over the weekend, please be patient because it'll take time to get everyone launched. If you attend the weekend's festive activities, bring along as many sailplanes as you want, but don't forget an added dose of patience and courtesy. With this in mind, you will surely have a wonderful time!

Miracles!

For the first time, airtowing is planned to be the available at the Nationals in Muncie, Indiana. Sailplanes up to 25 lb. will be allowed to compete, and for the first time they will be able to get excellent high launches. Airtowing will quickly become the launch method of choice, especially for those competitors with larger sailplanes. Pete George is planning to be there with his 3.2 Brison-Powered 1/3 Spacewalker. He might well bring another, larger and unique scale tug, a Dornier 28, which will be seen for the first time in the USA. Pete might be joined by one or two other excellent towpilots, which should make for a most interesting event. Look to see the largest scale sailplane Nationals ever! To the delight of those who wish to participate, at long last this scale competition will begin to grow. For those of you who have never airtowed, there will be at least 2 excellent pilots to tow you aloft. Those of you who have never seen towplanes in action will have ample opportunity to see what it's like, and why we enjoy it so much. Beware! You might get bitten by the bug!

As of this writing, John Derstine tells me that he's planning to attend. Not only will he be helping out, but will provide a demonstration with his extremely aerobatic and agile 1/3 Fox. Likely most of you have seen a house fly, and even a horse fly, but if you ain't never seen a Fox fly, this is your chance!

Airtowing is Growing in Popularity all Over the USA

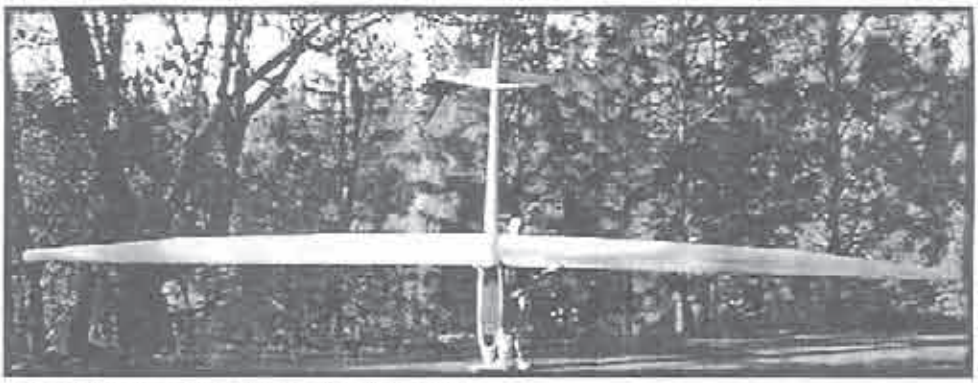
You will have noticed by now that many more airtow get-togethers are planned this year (visit the sailplanes.com calendar to find nearest event). Airtowing has taken hold all over the country and by the end of the summer, many folks will have seen it for the first time. I've heard of many new groups of two, three or more pilots planning to get together on a regular basis over the summer. These folks will surely introduce the wonderful world of large scale sailplanes to others. Soon we will have caught up with the Germans and airtowing will be as common as winching. Along with slope soaring, airtowing may soon be the preferred (and safest) method of launching large scale sailplanes (4 meter and up).

This Will be the Best Scale Sailplane Year Ever!

If only some of these predictions come true, this will be the best year ever for scale sailplanes. More and more folks are now becoming familiar with the wonderful world and magic of scale flight.

Whether aerobatics or thermals make your blood flow faster, there's a gorgeous and wonderful scale flying machine out there to tickle your fancy. You're bound to see something just right for you!

And now to change the subject a little, here are a couple of hints you might find helpful.



Tony Elliott's 1:2.75 scratch built, 10.54 meter span SB-10. Weighs in at 65 lb., and will have an AMA permit to fly. Tony plans to have it finished by the time you read this. Photo courtesy of Tony Elliott.

A Helpful Hint for Towees

Some guys never listen! You know who they are! There's one (or more) in your club. Here's a helpful hint for you glider pilots, which might get you consistently good, high tows, every time.

When you're the glider pilot you're responsible for 50 percent of the tow team. You bear some responsibility for helping your tow pilot to get you (effortlessly) to height.

How often have you seen two guys with exactly the same gliders? One always gets near perfect tows while the other is forever having premature releases and chastising the poor towpilot? What do you think might be going on here?

This first came up when I towed a 1/3 Duo Discus at Elmira a couple of years ago. Every single time I towed this glider was a real drag in more ways than one! It got so I just dreaded having the Duo hook up. I was convinced that the 3.2 powered Spacewalker wasn't up to the task and the glider pilot certainly made me look and feel like a twit. It wasn't a heck of a lot of fun hearing, "Tow faster! Climb! Dive! Don't stall! Higher! Keep the line tight! Turn! Don't turn!" And then, "Oh shit!" And yet another lousy tow with a premature release. Yuck! It was worse than, "Tora! Tora! Tora!"

Well, a year later we had the first flight of the very same Duo Discus down in Pensacola and guess what? The tow was a piece of cake. Why? We had enough UP TRIM on the sailplane to keep the glider climbing while on tow.

It might seem obvious that you'll want to go up if you're being airtowed, but it's amazing just how many experienced glider pilots don't seem to understand this. Sometimes a little (or lot, if needed) of up elevator trim on the sailplane makes all the difference in the world. You can almost never fly the sailplane in too high a tow position. A high tow position won't bother a towplane much (with the attach point somewhere just behind the trailing edge of the tug's wing). On the other hand, if the glider is flying just a bit low, it makes it very difficult for the towplane to climb. Worst still, if the towline begins to pull down on the elevator, the nose of the towplane will come up, making the glider go further and further below and soon both towplane and the glider will stall and we'll have yet another premature release (with at least an uncomplimentary thought directed to the poor towpilot). WRONG! In this case, it's the glider pilot who made the mistake of not adding enough up trim! Anybody out there reading this?

Mr. Tireless Towplane, Landon Grindstaff, with unique invention, the Phoenix. Twin-boomed wonder is powered by Zenoah G-62, and will haul just about anything off the ground. One of the best tow pilots around, Landon plans on attending the Fayetteville event this month.

Obviously, this doesn't mean to say that the towpilot always makes perfect tows. Just bear in mind that if you're having a hard time getting towed, sometimes adding a bit of up trim solves the problem. If full up trim isn't enough, then fix the problem by adding additional elevator movement from the servo or from the radio. The more marginal the power of the towplane, the more important it is to fly the sailplane as well as possible.

You'd be amazed how puny a tug can pull up very large sailplanes!

The trick is to fly both aircraft the best they can be flown. Once you become accustomed to how your glider acts on tow, you will know what to do. Some gliders require no up trim, but most are happier with a little up elevator on tow.

One of the reasons we've gone to monster power in our towplanes is that, with brute force, it doesn't matter all that much if the glider gets a bit out of position. However, if your towplane is somewhat less than a brute, don't forget to add a bit of up trim. You'll very probably get a better launch

and it'll make your towpilot look much better. So do yourself a favor and make your towpilot feel good! That's why he's towing you in the first place. He wants to give you perfect tows every time!

Do get some great tows in this year!

A Helpful Hint for Towpilots

We had some very interesting towing in Pensacola this year. The tireless Landon Grindstaff was at it again, towing everything in sight with his unique twin-boomed tug. Appropriately named the Phoenix (from the Flight of the Phoenix), this towplane is Landon's own design. It's really most excellent in many ways (and Landon has become one of the very best towpilots around). Watching him tow, what struck me in particular was that I could always see the Phoenix much better than any of the much larger sailplanes it was towing. Some of the sailplanes had red and one had dark blue under the wings, but the Phoenix was always easier to see no matter what the sky conditions. Landon put black under his wings for the best possible visibility. Taking a feather out of his cap, if you want to see your bird at height, then black under the wings is the way to go!

Last, but not least, let's all have the very best year ever! Go on out there and catch some thermals, do some stunts and may all your landings be perfect! Above all, don't forget to enjoy yourself! Have a ball whenever you go flying!

■

How to Install Aileron Torque Rods

by Dave Garwood
Scotia, New York

Many models, including small sailplanes, operate their ailerons from a single servo mounted in the center of the wing. Pushrods connect the servo arms to a pair of torque rods which link to the ailerons. Ingenious in their simplicity, traps and pitfalls to getting them correctly fitted await the sloppy builder.

Installing control surface actuating mechanisms so they operate smoothly brings great joy. Poorly installed aileron or elevator control mechanisms can plague you throughout the life of the model. Formerly ham-fisted when installing aileron torque rods, late in life I've gotten smoother. Here's how:

1. Assemble the torque rod mechanism for each side. This may involve inserting a wire through a brass, aluminum or plastic tube, and bending the wire at each end. Commonly, a threaded end connects to the servo link and a plain end to the aileron. The outboard ends may be glued into the aileron or may fit into a tube in the aileron, according to your preference. You might make the assembly from raw parts, they may come pre-bent in the kit, or they can be purchased as accessories.
2. Lay out the torque rod parts to get the correct length of the trailing edge piece, and to locate the notches that will allow the fore-and-aft rocking of the torque rod.

   I like the inboard ends of the torque rod to be about an inch apart. Allow for final sanding of

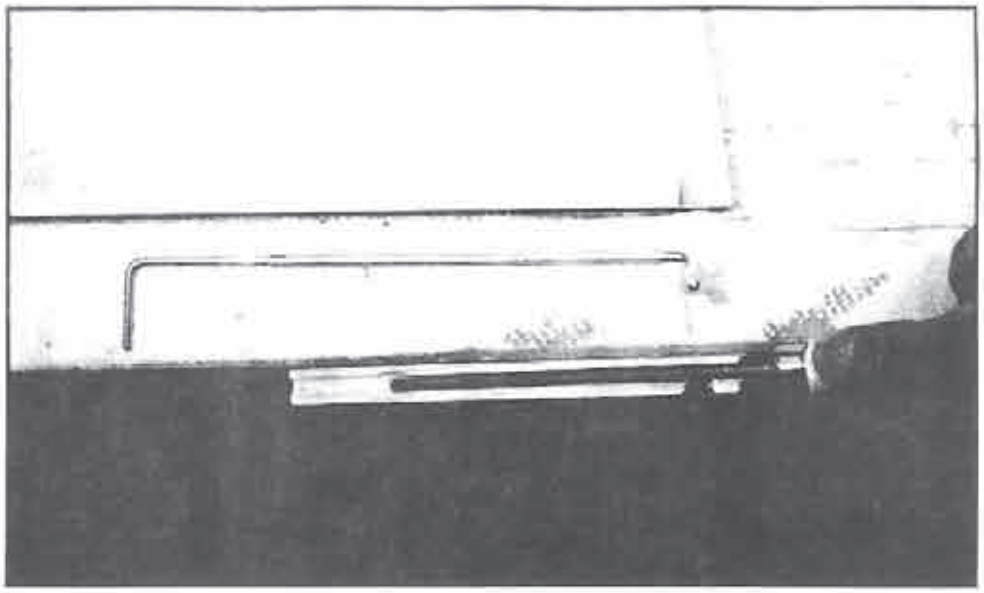
the wing roots if the wing halves are not yet joined. Cut the TE parts to length, and cut the notches in the TE and sub-TE in front and behind the inboard end of the torque rod. Use a motor tool or the round file for the notches.

3. Now comes the tricky part, cutting the slot or groove that holds the tube around the torque rod. It's easy to goof this up because the tolerances are close. Too tight or too shallow and the TE fits poorly, too big or crooked and the assembly is mis-aligned. The solution is to use a small round file for shaping and sizing the groove. Hardware stores don't tend to stock round files small enough for our use; you'll have to get one from the hobby shop or a small-tools supplier.
4. Rough cut the groove in one or both the TE and sub-TE with a hobby knife or motor tool, but do the final cutting and shaping by hand with the small round file.

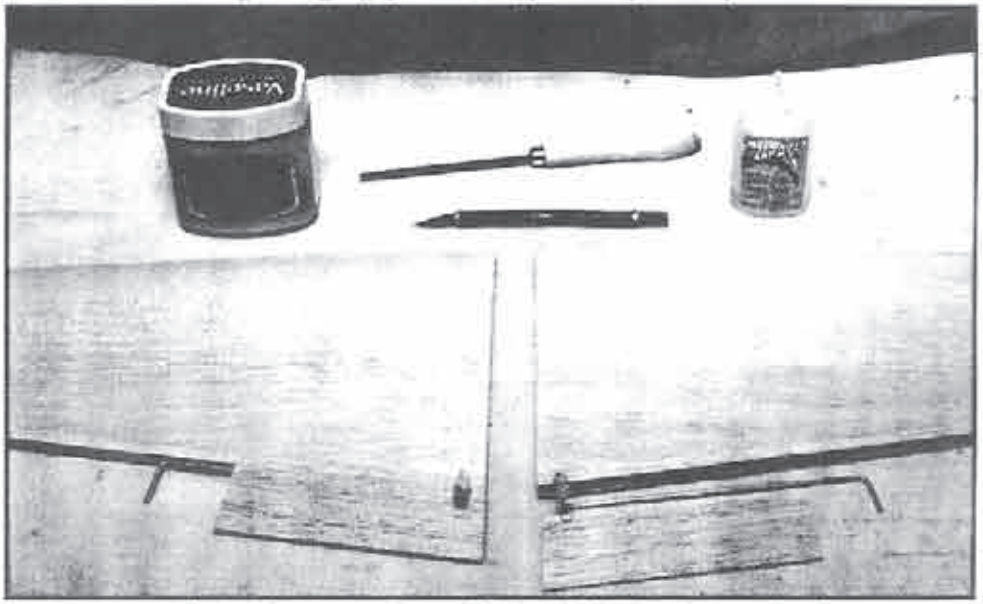
   Cutting the groove in only the TE is easier, because it's easier to manipulate the smaller part, but it results in the torque rod being off center of the hinge movement, and receiving tubes should be installed in the ailerons to allow the outer torque rod end to slip inside the tubes in the ailerons. Cutting the groove half from the TE and half from the sub-TE centers the torque rod and the ends can then be glued into the aileron parts.
5. Work slowly and carefully, trial-fitting often until you're happy with the fit of the parts. Make sure the mechanism operation is "correct and free," remembering the left and right parts are not interchangeable. Take note of the manufacturer's or designer's instructions on alignment of the TE pieces. Sometimes they're glued up with the parts flat on the bench, sometimes with the wing in the fuselage wing saddle.
6. In preparation for gluing, swab the torque rod carrier tube ends with Vaseline (TM) or similar material to keep glue out of this tube. Apply adhesive and position the parts together. Medium CA or five minute epoxy are commonly used for this; as the adhesive cures, gently test the movement of the assembly to make double sure glue is not binding the torque rod.
7. Let the installation fully cure to gain maximum strength, then sand where necessary and proceed to finish the wings.

Care taken with torque rod installation pays off with smooth-working, evenly-balanced aileron movement. Control linkage binding can drain the receiver battery, and errors in linkage geometry can give you headaches during final setup and in-flight trimming.

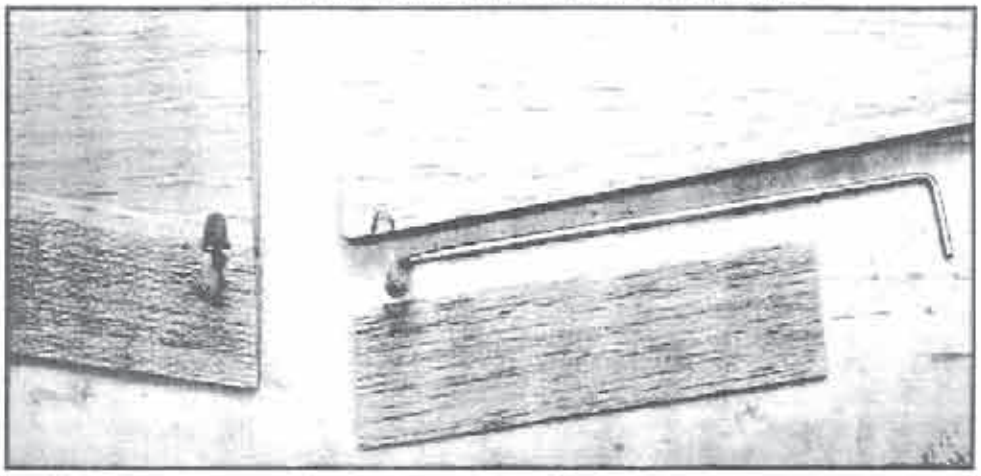
■



Top view of the wing, the torque rod assembly, and front view of the wing trailing edge piece under application of a round file.



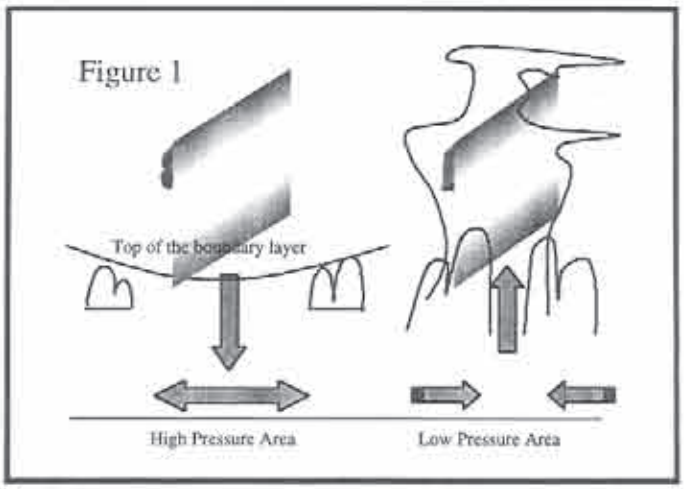
Left wing has torque rod assembly installed, right wing next. Vaseline (TM) petroleum jelly is used to keep adhesive out of the tube and off the rod. Medium CA was the adhesive used on this installation.



Close up of torque rod assembly, wing and TE piece marked for cut out to allow torque rod fore-and-aft movement.

THE NATURAL SIDE OF THERMAL SOARING

By Lee Murray
1300 Bay Ridge Rd.
Appleton, WI 54915
(920) 731-4848 (after 5:30 p.m.)
lmurray@athenet.net
http://www.athenet.net/~atkron95/pcsoar.htm



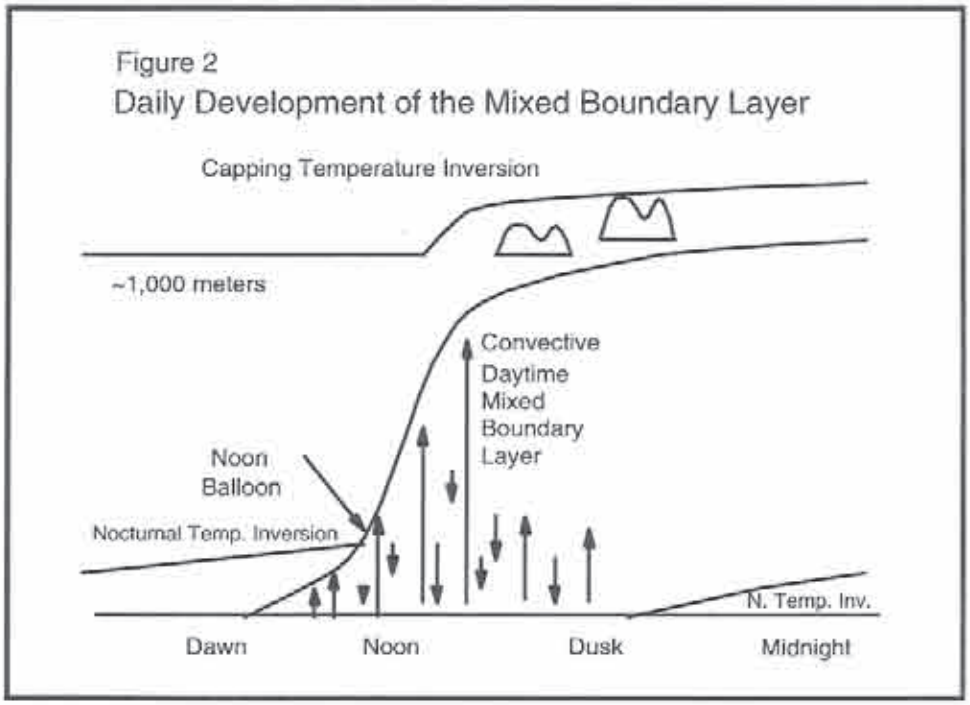
High & Low Pressure Areas, Mixed Boundary Layer, Nocturnal Inversions, Noon Balloons, and Plumes (Part 3)

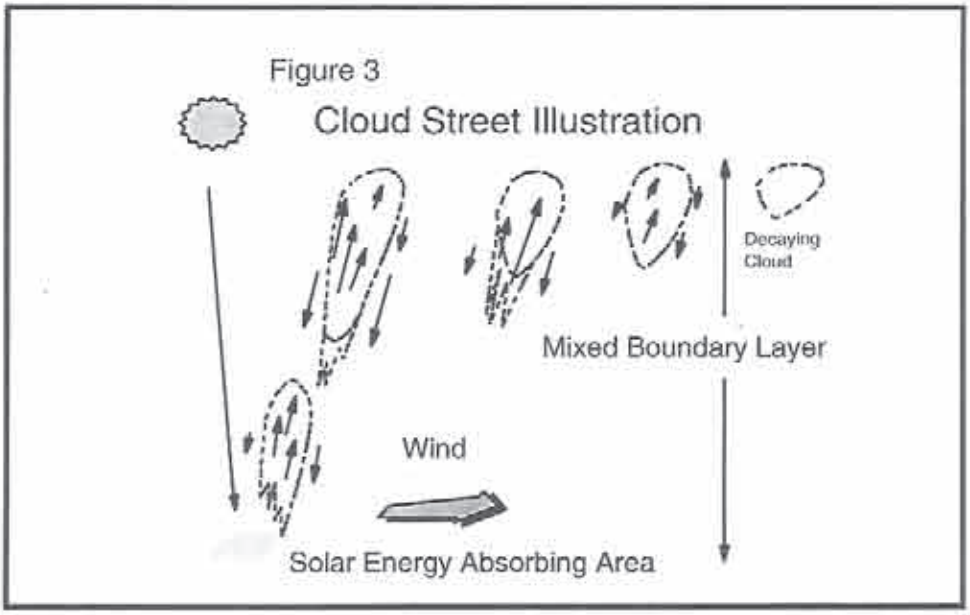
Our last column described how solar heating created convective air movement including thermals. Moisture evaporation, wind and light reflection from light colored or smooth surfaces reduce the amount of warm air convection. The topics for Part 3 listed above deal with some sources for variability we can expect in the mixed boundary layer where we fly and the nature and shape of the low-level lift we use.

Much of my information on this topic comes from talks given by Professors Roland Stull and Ed Eloranta, Senior Scientist, recognized authorities in the mixed boundary layer micrometeorology[1]. At the time, both were teaching at the U. of Wisconsin - Madison. Roland is now at the U. of Vancouver, British Columbia. He spoke at the '84, '87 and '92 MARCS National Sailplane Symposium in Madison, Wisconsin[2]. Ed Eloranta, a pioneer in the development of Lidar (a laser Doppler radar) gave a talk at the MARCS[3] National Sailplane Symposium in '89.

Figure 1 contrasts low and high-pressure areas. The low-pressure area is where the air is generally rising. Cloud cover is common. The humidity trapped in this rising air becomes saturated as the temperature falls with increasing altitude. Clouds develop and precipitation can occur. High-pressure areas are where clear air is descending (subsiding if you are a meteorologist) from higher up in the troposphere. The air here is relatively free of ground level pollutants and particles from natural sources. High-pressure areas produce fair weather (clear skies) in the morning and, depending upon the humidity, clear to partly cloudy skies mid-day.

You might think that the low-pressure areas would be the best place to soar





because the air is generally rising, although slowly. The problem is that with the cloudy sky associated with low-pressure areas, the ground does not heat as well and convection is not as useful for soaring (less common and/or not as strong). The better choice is to fly in the high-pressure area where there is less cloud cover and more effective solar heating. In this situation we can soar between the ground and the top of the boundary layer which varies greatly by time of day, season and location. Meteorologist Frank Gouveia summarized data on this subject from Holtzworth[4] by saying, "The mean afternoon mixing depth for several cities east of the Mississippi (New York, Pittsburgh, Nashville, Dayton) varies from about 700 meters in the winter to 1700 meters in the summer. The mean morning mixing depth for the same cities was between 300 and 800 meters." The top of the boundary layer can vary greatly. In Figure 1 you will see the illustration of the fair weather clouds common in these situations.

Figure 2 shows the daily development of the convective, or mixed, boundary layer. Across the bottom (x-axis) is the time of day. There is a daily nocturnal temperature inversion that begins its development at dusk and continues until near midday the following day in the absence of strong winds. This is called the **nocturnal inversion**. Within this nocturnal inversion there isn't much vertical movement of air. Sometime after the sun comes up, convection heat transfer from the warmed surface causes mixing within the nocturnal inversion cap. Rising air (called plumes in this case) can be used by R/C sailplaners. Based on the descriptions I have read and my personal experience, the strong trailing or downwind side of a plume will lift your circling sailplane more than the more diffuse and less distinct up-wind edge. As a result, you don't find a place to circle near the ground where you can smoothly circle. In calm or nearly calm air, the plumes may be uniform. Much of the time the plume will become weaker or will stop rising before you hoped it would. Plumes usually dissipate before they get a few hundred feet above the ground.

As the sun rises and the ground heats up, the nocturnal inversion is modified, becomes convective and reachable altitudes will increase. Sometime late in the morning, the surface heated air gets warm enough to rise through the nocturnal temperature inversion. The first folklore I ever heard on this subject was from more experienced R/C sailplaners who talked about the **"Noon Balloon"**. I didn't understand it at the time but I knew that something usually happened about 11 am to noon when almost anyone who could get in the air could "sky out". In my experience, the noon balloon lasts about 15 minutes if you got into it before the thermals disconnected from the ground. They are best called bubbles after the connection to the ground has been broken. That rising air cycle is followed by a down air cycle while the ground level air gets heated again after being replaced with colder air, at least some of which is subsiding air. For several hours the up-down cycle will continue. There will be longer periods of neutral or slightly down air but periods of rising air happening with some regularity unless interrupted by clouds.

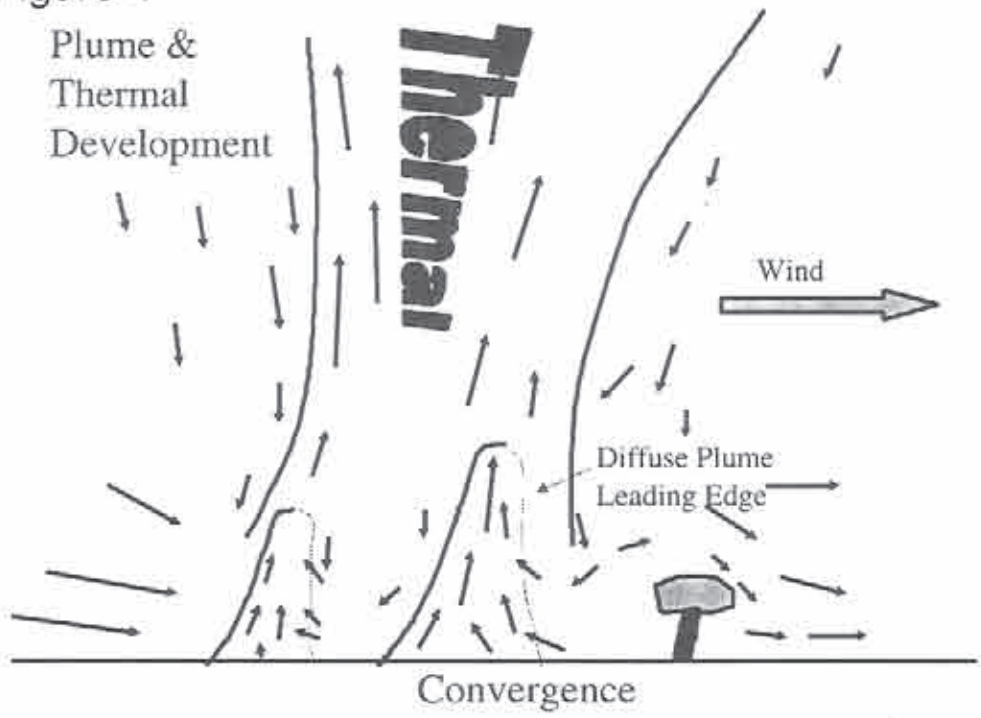
An unusually strong thermal producer such as a quarry or a hill[5] may cause a string of puffy clouds called a cloud street in light winds. The periodic thermals rising off a warm surface may become visible when the moisture level reaches saturation. There are other causes of cloud streets as well, which I won't discuss at this time. What makes this kind of cloud streets distinct is the lack of an equally spaced pattern of other cloud streets. Cloud streets are great for full size sailplaners who can extend their cross-country range by going quickly from one cloud to another. The older thermals become less useful as the vertical air movement ends. Figure 3 is patterned from an illustration in Helmut Reichman's well-known book Cross Country Soaring published in 1978[6].

Full size and R/C soaring pilot Joe EnHuei[7] has indicated that when flying R/C sailplanes, one may never find the source of heat that triggers repeating thermals or a ground level feature that might cause them to leave the ground, especially if there is significant wind. On the other hand, I've seen more experienced R/C pilots fly way off the flying field to find lift over a building or area where they suspected lift might be found. When flying full size in calm or low wind conditions, it is much easier to find and use cloud streets to extend flight time. When the humidity is low, you may not see the tops of the "blue" thermals because moisture saturation is never reached. You will hear from Joe later in this series with his perspective on using clouds for RC Soaring.

There are levels of organization of warm air convection as described by Stull[8]. You might think of plumes as miniature thermals, but they won't rise as high unless they combine with other plumes to form a thermal. One of the ways in which these groups of plumes might organize to become a thermal is if there is some feature on the surface that slows the wind down causing convergence. Features such as a tree line, a hill, a building, or the edge of a wooded area can create this situation. The Figure 4 illustrates such a situation with plumes, wind direction, and wind vectors noted for clarity.

Figure 4

Plume & Thermal Development



There is more to be learned about this organization and the shape of thermal clouds, but I'll leave that for another article in the series.

[1] Personal Communications with Frank Gouveia, meteorologist at Lawrence Livermore National

[2] The proceedings that are still available can be obtained from Al Scidmore, 5013 Dorsett Drive, Madison, WI 53711.

[3] Madison Area Radio Control Society

[4] Holtzworth "Estimates of mean maximum mixing depths in the contiguous U.S." in Monthly Weather Review, Volume 92, 1964

[5] Pagen, Dennis, Understanding the Sky, Pg 223

[6] Helmut Reichman's book Cross Country Soaring is available in the Internet from Amazon.com

[7] EnHuei, Joe, Article submitted for publication in *RCSD*, May 7, 1996

[8] Stull, Roland, ibid

■

NEW PRODUCTS

The information in this column has been derived from manufacturers press releases or other material submitted by a manufacturer about their product. The appearance of any product in this column does not constitute an endorsement of the product by the R/C Soaring Digest.

1/3 Wilga
...from Sailplanes Unlimited, Ltd.

Span: 148 inches
Weight: ~36 lb.
Motor: 120 cc and up

These unique tail draggers are the most popular European towplanes of all. Wherever gliders are being towed you're sure to find a Wilga hard at work! The fuselage and cowl are epoxy glass. Wings, flaps, ailerons, rudder and elevator are obechi-covered styrofoam. The wings have aileron and flap cut outs for servos.

These newly-designed kits come with built-in tubes in the wings, which fit the main wing joiner tube. This new wing joiner system makes it much easier to build and align the wings to the fuselage and to get the wings on and off. Towplane come with a functioning scale shock-absorbing landing gear, tail wheel assembly, windows and decals.

By the time you read this, there will probably be some 1/3 Wilgas in stock. Contact Sailplanes Unlimited, Ltd., 63 East 82nd St., NYC, NY 10028; 212-879-1634, fax 212-535-5295, e-mail <sailplanes@worldnet.att.net>. ■

Hobby Shops that Carry RCSD

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

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

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

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

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

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

King R/C
Five Forks Village
King, NC 27021

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

Closet Scale Stuff
At Sailplanes Unlimited. Ltd.

1/3 Pribek ASW 27 - 5 meter span (196"), wing profile HQ 2.5/12, ca. 20 lbs.

1/4.2 FiberClassics Nimbus 4 - 6.28 meter span (246"), wing profile E 68-66, ca. 18 lbs.

1/3.6 Roedelmodell DG 800 - 4.15 meter span (163"), wing profile E 207, ca. 11 lbs.

1/3.75 Roedelmodell Fox MDM-1 - 3.8 meter span (149"), wing profile RG 12, ca. 15 lbs.

1/2.77 PriBek ASW 19 - 5.4 meter span (212"), wing profile Ritz 3 mod., ca. 20 lbs.

Please call for additional info: (212) 879-1634.

SCHEDULE OF SPECIAL EVENTS

June 5-6
LOFT Weekend (2M, Unl, RES), OVSS#2 Ft. Wayne, IN
Bob Steele, lsfpres@aol.com, (219) 485-1145
Mike Remus, (219) 485-6453

June 5-6
CASA-2M (Thompson Field) Warrenton, VA
Rodney Armistead, roda@msn.com

June 10-13
Elmira Aerotow '99 Elmira, NY
John Derstine, johnders@postoffice.ptd.net
(717) 596-2392

June 10-13
Montague Cross Country Challenge Montague, CA
DG Airparts, Inc., dgair@cdsnet.net
(541) 899-8215

June 12-13
Land of Lincoln Electric Fly Springfield, IL
Tim McDonough, tim@mcdonough.net

June 19-20
LISF Open Long Island, NY
John Hauff, tankman58@aol.com
(718) 767-1369

June 24-27
MSSC '99 (Incl. XC) Huntsville, AL
Ron Swinehart, (256) 722-4311 (days)
(256) 883-7831 (eve), on.swinehart@lmco.com

June 26
LOFT Electric Contest Ft. Wayne, IN
Class A - LMR,& Battery Allotment, Class B - LMR, & Battery Allotment
Pat Mattes, Pat-Ingrid-Mattes@juno.com
(219) 478-7302

June 26-27
ESL-F3J Long Island, NY
Tom Kiesling, kiesling@ctc.com
(814) 255-7418

June 27
LOFT HL Contest (Open, JR/SR Comb.) Ft. Wayne, IN
Jerry Shape, (937) 843-5085

July 3-4
ESL/LISF Hosted USA F3J Long Island, NY
Team Selection Competition
Fritz Bien, fritz@spectral.com

July 17-18
TMSS Open Richmond, VA
Josh Glaab, (757) 850-3971
ljglaab@pinn.net

July 17-18
CRRC RES Contest Sudbury, MA
Dick Williamson (Sat.), williamson@ll.mit.edu
(781) 981-7857
Les Gerhardt (Sun.), lesgerhardt@aics.net
(978) 263-3246

July 10-11
LASS Open Lancaster, PA
John Murr, jmurr@redrose.net
(717) 285-7025

July 10-11
Nats Warm Up - LASS, OVSS#3 Louisville, KY
Ed Wilson, ewilson1@bellsouth.net
(502) 239-3150

July 10
CAF's 2M & Unlimited Tullahoma, TN
Herb Rindfleisch, herb@cafes.net
(931) 455-1836

July 24-31
AMA NATS Muncie, IN
24th: Sport Scale Sailplane, F3B, XC
25th: F3J
26th: HL
27th-28th: 2M
29th-30th: Unlimited
31st: NOS & RES

August 7-8
MVSF Princeton, NJ
Bill Miller, jerseybill@worldnet.att.net
609-585-6779

August 13-15
GNATS Aerotow '99 Ontario, Canada
Phil Landray, (905) 468-3923, linden@niagara.com
Gerry Knight, (905) 934-7451
Lou Kleiman, (905) 688-4092, mistral@niagara.com

August 14-15
CRRC Open Boston, MA
Fritz Bien, fritz@spectral.com
(508) 369-1720

August 14-15
DARTS Man-on-Man Challenge, OVSS#5 Yellow Springs, OH
Bob Massmann, rmassmann@in-touch.net
(937) 382-4612

August 21-22
Blanco II, The Pilgrimage Cape Blanco, OR
Mike Shaw, (541) 269-2423
grizzy2@gte.net

August 21-22
BASS Open Frederick, MD
Jack Cash, jcashjr@cyberun.net
(301) 898-3297

August 21-22
Mid-American Championships Lexington, KY
Bluegrass Soaring Society, OVSS#6
Buzz Bruszewski, 76722.3421@compuserve.com
(606) 382-4612

August 28-29
SKSS Open Newark, DE
John Kirchstein, kirchste@voicenet.com
(302) 731-2831

September 4-5
LOFT/OVSS Fall Round Up (2M, Unl, RES) Muncie, IN
Marc Gellart, isoar2@wcoil.com
(419) 229-3384

September 11-12
CASA Open D.C.
Steve Lorentz, lorentz@fred.net

September 18-19
LISF-2M Long Island, NY
Gordon Stratton, (718) 847-8299

September 25-26
ESL End of Season Reading, PA
T. Kiesling/J. Glaab, kiesling@ctc.com
(814) 255-7418

September 18-19
CAF's 2M & Unlimited Tullahoma, TN
Herb Rindfleisch (Sat.), herb@cafes.net
(931) 455-1836
Chuck Anderson (Sun.), canders@edge.net
(931) 455-1836

October 1-3
Great Midwest Oc-TOW-berfest St. Louis, MO
Scale Aerotow
Pete George, (314) 664-6613
twometer@worldnet.att.net

October 9
NASF Unlimited Huntsville, AL
Lars Ericsson, lars_ericsson@atk.com
((256) 859-0255

4TH ANNUAL

G.N.A.T.S. AEROTOW '99

"Come fly with us in Canada's beautiful Niagara Wine Country!"

August 13 - 15, 1999

To be held near Winger, Ontario, Canada
(Approx. 30 Miles West of Buffalo/Ft. Erie)

Co-sponsor: Canadian Model Aerotow Society

Emphasis will be on fun and aerotowing. Tow planes and experienced pilots will be available to tow you to altitude. Bring your 3 meter (118") or larger sailplanes, fitted w/ ailerons and tow release, and join the fast growing aerotow movement. Scale Motorgliders will be welcome at this event as will non-scale large sailplanes fitted with tow releases.

Pilots' choice awards include Vintage & Modern sailplanes, and tugs. Proof of 1999 MAAC or AMA membership is required, along with gold sticker radios. Meals and accommodation are available nearby in Dunnville. Registration fee: $12 ($10 US).

For information package & map contact:

Phil Landray, (905) 468-3923
Linden@niagara.com
Gerry Knight, (905) 934-7451
Lou Kleiman, (905) 688-4092
Mistral@niagara.com

Classified Advertising Policy

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

For Sale - Business

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

PRECISION AMAP WING CUTTER, replacement parts, and service. AMAP Model Products, 2943 Broadway, Oakland, CA 94611. Butch Hollidge, (510) 451-6129, or fax (510) 834-0349.

A.M.P. Aerial Model Products, sport, slope, race prototypes - all airfoils. 60" Del Valle Snake, 94" H&K Cobra, AMAP Flair, Kevin Cutler's full house Davenport Monitor. All race tested. Butch Hollidge, (510) 680-0589, eve, California.

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

Custom Cut FOAM WING CORES. White, pink, blue, and Spyder foam available, most airfoils available. Send copy of drawing for quote. Viking Models, U.S.A., 2 Broadmoor Way, Wylie, TX 75098; (972) 442-3910, fax (972) 442-5258.

For Sale - Personal

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

Synergy 91 w/servos in wings... $420.00; Oden 135" span, battery & all servos, test flown only, red/white/blue, RTF... $650.00; Glasflugel Mosquito 1/4 scale, scratch built w/all servos (8) & battery, set up for aerotowing, wonderful flyer... $950.00; Giant Stinger tow plane, 2 piece wing extended to 96", 3W60 eng, excellent for towing w/all servos, ready to go... $1200.00. Add shipping to all the above. Dale King, (972) 475-8093, Texas.

Please send in your scheduled events as they become available!

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

R/C Soaring Resources

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

Contacts & Soaring Groups - U.S.A.

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

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

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

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

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

Arizona - Southern Arizona Glider Enthusiasts, Bill Melcher (contact), 14260 N. Silwind Way, Tucson, AZ 85737; (520) 825-2729. SAGE welcomes all level of flyers!

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

California - DUST, Buzz Waltz, 68-320 Concepcion, Cathedral City, CA 92234, (760) 327-1775.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Indiana - League Of Flight by Thermal (LOFT), Ft. Wayne, IN based soaring club, LOFT supports RC soaring activities for pilots in northeast Indiana and northwest Ohio; Marc Gellart, (419) 229-3384, <isoar2@wcoil.com>, <www.rc-aero.com/LOFT>.

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

Iowa - Eastern Iowa Soaring Society (Iowa, Illinois, Wisconsin, Minnesota), Ed Harris (Editor), 2000 NW 84th Ave., Ankeny, IA 50021; (515) 965-5942, <harris.edwin@mcleodusa.net>.

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

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

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

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

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

Maine - DownEast Soaring Club (New England area), <Jim.Armstrong@juno.com>.

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

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

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

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

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

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

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

Missouri - Mississippi Valley Soaring Assoc. (St. Louis area), Peter George, 2127 Arsenal St., St. Louis, MO 63118; (314) 664-6613.

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

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

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

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

Nevada - Las Vegas Soaring Club, Jim Allen (Pres), 7117 Caprock Cir., Las Vegas, NV 89129; ph (702) 658-2363.

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

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

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

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

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

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

New York - (Buffalo/Niagara Falls area) - Clarence Sailplane Society, Lyn Perry (President), (716) 655-0775; e-mail perryl@sstaff.sunyerie.edu; Jim Roller (Competition Coordinator), (716) 937-6427.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Tennessee - Tullahoma (Southern Middle Area), Coffee Airfoilers, Herb Rindfleisch, 106 Inglewood Circle, Tullahoma, TN 37388, (931) 455-1836, <herb@cates.net>.

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

Texas - aerotowing, Dallas area, Andrew Jamieson, 9426 Hillview, Dallas, TX 75231, (214) 349-9346, e-mail ajsleep@aol.com. Larry Sengbush, (972) 291-4840.

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

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

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

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

Virginia - Appalachian Soaring Association, Virginia's Southwest (Bristol area), Greg Finney, 106 Oakcrest Circle #5, Bristol, VA 24201, (540) 645-5772, e-mail <gfinney@naxs.com>.

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

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

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

Outside U.S.A.

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

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

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

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

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

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

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

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

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

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

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

RCSD Index/Database

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

Reference Material

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

"Aerotow '97" Elmira!" video taken at the Annual Northeast Aerotowing Fly-in, New York. 56 minutes of great flying, interviews, pristine scale models, demos, full-scale as well as models, and rare vintage film from Harris Hill in the 1930's. Check or money order, $24.95 plus $3.00 S&H (U.S.), payable to John Derstine, RD 3# Box 336, Gillett, PA 16925; (717) 596-2392, <johnders@postoffice.ptd.net>.
S&H foreign: $6 Canada/Mexico, $7 Europe, $8 Asia/Africa, $8.50 Pacific Rim. VHS format, NTSC standard. PAL format $40 + applicable shipping.

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

Seminars & Workshops

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

BBS/Internet

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

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

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

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.

The Vintage Sailplane Association

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

Vintage Sailplane Association
13312 Scotsmore Way
Herndon, VA 22071 USA

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

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

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

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

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

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

Advertiser Index

Please be sure to tell our advertisers you found them through *RCSD*!

Subscription Costs
USA: $30 First Class
(Texas res., please add $1.52 tax.)
Canada & Mexico: $30 Air
Europe/U.K.: $45 Air
Asia/Pacific/Middle East: $52 Air

Back Issue Cost
Back issues are available for the current year. All are mailed via first class or airmail.
U.S.A., Canada, Mexico: $2.50 Per Issue + Tax (Texas Only: 7.25%)
United Kingdom/Europe: $3.75 Per Issue
Asia/Africa/Middle East: $4.35 Per Issue

❑ Please renew my current subscription.
❑ Please enter my new subscription to *RCSD*.
❑ Please send the back issues I have selected.

(Check or Money Order, only, please. U.S. funds.)

Name_____
Address_____

Please return to R/C Soaring Digest,
P.O. Box 2108, Wylie, TX 75098-2108

THE CONDOR

SPECS:	
WING SPAN	112.5"
WING AREA	918 SQ. IN.
AIRFOIL	SD7035
WEIGHT	62-66 OZ.
WING LOADING	9.7 - 10.3 OZ./SQ. FT.

CONDOR

Tomorrow's Sailplane, Technology Today

The Condor is designed by Mark Allen, who is considered one of the best model sailplane designers in the United States, if not the world. Mark has taken all of his previous experience in competition thermal duration flying, plus all the knowledge he has gained from his earlier contest and sport designs, to design the Condor. Mark Allen's previous planes, to name only a few, are: Falcon 880 and 800, Falcon 600, Swift, Thermal Eagle, Vulcan, Night Hawk, Sky Hawk, Electric Hawk, Falcon 550E, Rocket, Pocket Rocket and, of course, the molded, world championship F3B Eagle. By taking the best of these designs and the new construction techniques available today, Mark has come up with, what we feel, is the absolute best open-class sailplane available.

The wings are made in America by Ron Vann, owner of Spectrum Enterprises. Ron is also an avid competition flier, and is considered to be one of the best wing manufacturers in the industry. Taking his years of experience in manufacturing wings, Ron has produced wings and stabs for the Condor that we feel are world class. Starting with the spar that Mark Allen designed, Ron uses only the best and most accurately cut foam cores available. He then uses hand-picked obechi from Kennedy Composites, which is applied with West Systems epoxy. This is after he has first reinforced the wing with carbon fiber and fiberglass. The servo wells are routed out, as are the flaps and ailerons. What this means for the sailplane enthusiast is a minimum amount of work before getting the sailplane into the air. The wing is light but strong enough to take "pedal to the metal" launches. Also available as an option is Ron's unique internal capped hingeline. This means even less work for the modeler.

The fuselage is made by Steve Hug, owner of the Fuse Works. Steve is another master at what he does. Fuse Works makes what we consider to be the best fuselage in the business. Steve uses only the best fiberglass and Kevlar™ available. All fuselages are manufactured using the West Systems epoxy. Steve's fuselages have the least amount of pinholes, if any, that we have seen. In fact, the fuselage is so pretty that many people do not paint it. The fuselage is extremely light, and yet strong enough for very aggressive flying and landing. For those with very little building time, and those who don't like to paint, there is an optional pre-painted, in the mold, fuselage which includes a unique carbon fiber canopy.

All kitting is done at Slegers International's new and larger manufacturing facilities. We have spared no time or expense with supplying the modeler with the best materials available. The kit contains pre-sheeted wings and stabs by Ron Vann, fiberglass and Kevlar™ reinforced fuselage by Steve Hug, 3/8" diameter titanium wing rod from Kennedy Composites, optional 3/8" diameter steel wing rod by Squires Model Products, control horns and tow hook by Ziegelmeyer Enterprises, pushrods by Sullivan, or optional one piece steel rods. All wood is custom cut. Specially cut basswood of 60" is supplied to eliminate splices in leading edge, flaps and aileron capping. All balsa is hand picked, light to medium, to ensure light weight wing tips, stab tips, and rudder. Aircraft ply is used for the pre-fit servo tray and towhook block. A comprehensive instruction manual is included.

The Condor, designed by Mark Allen, wings by Ron Vann, fuselage by Steve Hug, and kitted by Slegers International, we feel, is the best open-class, thermal duration sailplane available, at an affordable price of $395.00 plus S&H.

★ VISA ★ MASTERCARD ★ DISCOVER ★

SLEGERS INTERNATIONAL

P.O. Box 364, Long Valley, NJ 07853
Shipping: 35 Hacklebarney Rd., Long Valley, NJ 07853

(908) 879-9964 - FAX (908) 879-8177
http://www.slegers.com

SAILPLANES UNLIMITED, LTD.

IN STOCK

Krause

1/3.75	Discus	HO2.5/12	158" (4m)
1/3	Salto	HO3/14	179" (4.53m)

Roedelmodell

1/4.5	ASK 21	E393	165" (4.2m)
1/3.6	Ka6E	E392	165" (4.2m)
1/3.75	Fox	RG12	149" (3.77m)

PriBeck

1/3	ASW27	HO2.5/12	196" (5m)
1/2.7	ASK18	E203-201-193	209" (5.53m)
1/3	Ka6E	E207-205-205	196" (5m)
1/2.7	ASW19	Ritz3 mod.	212" (5.4m)

Schueler & Fleckstein

1/3 all glass	ASW24	E203	196" (5m)

Bruckmann

1/3	Salto	Ritz 2	176-203" (4.5-5.2m)
1/3.8	ASK 18	E 203	165" (4.2m)
1/3	Fox	E 374 SD 6060-6062	183" (4.66m)

Czech these out!

All completely finished with retracts installed:

1/3 all glass Ventus 2C	HO 3/15, 13, 12, 10, 8	237" (6m)
1/3.75 all glass ASW 27	HO 3/12	158" (4m)

And more

TOWPLANES in stock

Frisch: 1/4 Wilga 109" (2,78m)
Bruckmann: 1/4 Piper Pawnee
Roedelmodell: 1/4 Jodel Robin 86" (2.18m)

SPECIAL ORDER

PriBek

1/3	ASW24	E203-201-193	196" (5m)
1/2	ASW27	HO2.5/15	294" (7.5m)
1/3	Fox	E374	183" (4.66m)

Bruckmann

1/2.5	Fox	222" (5.65m)

Frisch

1/3	Wilga	147" (3.73m)

Schueler & Fleckstein

1/3 all glass	Fox	RG12	183" (4.66m)
1/3 all glass	ASH 26	HO3/14-10	235" (6m)
1/2.8 all glass	ASW15B	HO3/14	235" (6m)

very realistic **PILOTS** from 1/4 to 1/2.5

For Price Information, Scale flying news, Message board, Classified and much more...Visit our website @ http://www.sailplanes.com

Sailplanes Unlimited, Ltd. 63 East 82nd Street, NYC, NY 10028 Phone: (212) 879-1634 Fax: (212) 535-5295