RC SOARING DIGEST
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CONCORD, CA 94524

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FORWARDING POSTAGE GUARANTEED

R/C Soaring DIGEST

Vol. 7 No. 3 March, 1990

The PHOEBUS

Schedule of Coming Events

Date	Event	Location	Contact
March 11	Thermal Soaring Unlimited	Carson, CA	I. Aker (213) 604-0253 (SULA)
March 17-18	Masters of Soaring Tournament	Chatsworth, CA	Myles Moran (818) 882-4687
March 18	Thermal Soaring 2 Meter & Unlimited	San Diego, CA	J. Menard (619) 475-0958 (Torrey Pines Gulls)
March 18	Thermal Soaring Unlimited	Morgan Hill, CA	T. Simoni (408) 733-7701 (SBSS)
April 1	Slope Race - Open	Davenport, CA	G. Page (415) 352-7543 (SBSS)
April 22	Thermal Soaring 2 Meter & Unlimited	San Diego, CA	J. Menard (619) 475-0958 (Torrey Pines Gulls)
April 22	Slope 2 Meter	Colorado Springs, CO	B. Welsh (719) 495-3572
May 5-6	Cross Country	Snow Camp, NC	D. Barry (919) 229-5234 (BARKS)
May 6	Thermal Soaring Unlimited	Modesto, CA	R. Lenci (209) 838-5869 (Modesto RC)
May 19-20	Cross Country	California Valley, CA	R. Mullen (805) 736-5777 (Santa Maria)
May 20	Thermal Soaring 2 Meter & Unlimited	San Diego, CA	J. Menard (619) 475-0958 (Torrey Pines Gulls)
May 25-27	International Scale Soaring Fun Fly	Richland, WA	Wil Byers (509) 627-5224 (Tri-City Soarers)
June 2-3	Cross Country Sugarloaf Classic	Dickerson, MD	G. Dickes (301) 484-2627 (Capital Area)
June 3	Thermal Soaring 2 Meter & Unlimited	Abingdon, IL	N. Garrett (309) 343-0181 (Western Illinois)
June 9-10	Thermal Soaring 2 Meter & Unlimited	Prescott, WA	H. Michaelis (509) 529-2562 (Walla Walla)
June 9-10	Western U.S. R/C Soaring Championships Unlimited	Modesto, CA	R. Lenci (209) 838-3869 (Modesto RC)
June 24	Thermal Soaring 2 Meter & Unlimited	Novato, CA	M. Clancy (415) 897-2917 (North Bay)

The Soaring Site

Some of you have called to ask if articles must be submitted on computer disks. The answer is, "No! Of course, not. Not all of us have computers or access to computers, and it is your article content that really counts." For those of you that have computers and are able to provide disks, they are most appreciated, as they save a great deal of time that can be used to concentrate on the layout and design. Because of the disks and the typewritten material (that could be scanned), I was surprised to discover that the text for this issue of *RCSD* was almost entirely computer generated. Thanks!

On another subject, we have been working hard to make the transition of the publishing and production responsibilities as smooth as possible. Please note that, if you are writing to Jim, you should use his street address which is shown on this page. The P.O. Box in Arizona forwards everything to the new P.O. Box in California.

Are you wondering what Jim is up to? Well, without the rigid schedules for *RCSD*, he and Peggy are working on all kinds of projects they've wanted to do for a long time. And, when he wants to send in High Start? Why, he takes his Tandy with him...

Read & Enjoy,
Judy

About the Cover... The PHOEBUS

The cover photo was taken in January at the Pasadena Show. Offered by American Sailplane Designs, the PHOEBUS comes with an epoxy glass fuselage and foam cores. (You sheet with 1/32" balsa.) This sailplane has a wing span of 48" and is ready to fly at 10 oz. The cost is $89.95 plus S&H and tax. See the ad for American Sailplane Designs towards the end of this issue.

About RCSD...

RCSD is a reader written-publication. The articles & letters are freely contributed to *RCSD* in order to provide:

"The widest possible dissemination of information vital to R/C soaring to enthusiasts all over the world."

It is the policy of *RCSD* to provide accurate information, but if we print a factual error, we want to make it right. Please let us know of any error in *RCSD* that significantly affects the meaning of a story. The opinions expressed are not necessarily those of *RCSD*. Please see the back cover for subscription costs and additional information.

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High Start

...by Jim Gray

Several times during the past year or so I have mentioned the German publication FMT - Flug und Modell Technik*...the magazine for modelers, especially model builders. In my opinion this is the premier modelling publication in the world — except for* RCSD *of course!*

FMT is definitely sailplane/soaring oriented, and each issue features at least one R/C sailplane...many of them being SCALE designs...and a cover photo in full color directed to that feature.

The articles are thorough, giving a materials list, several photographs of the completed model, a reduced-size plan, full building description, and test-flying comments. The plan that accompanies the article is usually half-size or 2/3-size, depending on the size of the model...and it is an exact duplicate of the full-size plan, so you can see what you will be getting when you order the full-size plan should you decide to build the model.

Now, *FMT* has produced a plans catalog that includes a complete list of plans for R/C models, free-flight models, electric-powered models (all aircraft), plus plans for automobiles and ships as well as some unusual plans such as steam-engine plans, dirigibles, parachutes and ducted fans. Each listing contains a photograph of the model, a complete descriptive paragraph, the name of the designer, the wingspan, and the price of the plan. When you get the plan, you will find a glossary of terms German-English and a metric-English conversion for dimensions.

Sailplanes are well represented in the plans catalog with eighteen pages of sailplane models listed, which include 20 flying wing types and 70 SCALE types! A few of the new PSSS (Power Scale Slope Soaring) types are also featured.

The cost of the plans vary, depending on size, from about $10 to $25 each. The catalog costs 9.8 DM, or about $5 U.S. You can order the plans, the magazine *FMT*, or the plans catalog directly from the publisher. Access, VISA, MasterCard and and EuroCard are accepted.

You will find that the contact persons speak English and can correspond in English. When you write or call, please mention *RCSD*, as we exchange our publications.

Write or call: Verlag fuer Technik und Handwerk GmbH, Postfach 1128, D-7570 Baden-Baden, West Germany. If you call, use the telephone numbers 07221/2107-11 for Fraulein Werner, 2107-12 for Fraulein Mettman, and 2107-81 for Herr Heinze. They will be pleased to hear from you. The catalog is called Modell Bauplaene 1990/91 (Model Building Plans Handbook 1990/91).

Happy Soaring,
Jim Gray

Special Announcement

Soaring With Intent of Finding Thermals (S.W.I.F.T.)

In Nebraska

S.W.I.F.T., AMA chartered club #2749, has been recently formed to provide a focal point for those interested in gliding and glider activities such as Soar-Ins and League of Silent Flight/F3B competition. Also, the club will be responsible for overseeing the operation of the newly acquired Chalco Hills area flying site. For more information, contact Ron Ponec, P.O. Box 174, Elkhorn, NE 68022.

News Release

Scale Model Research

...from Bob Banka

100 Sailplane Foto-Paaks
21 Powered Sailplane Foto-Paaks
(Most 3-Views Available!)

Scale Model Research, the world's largest collection of full-color aircraft documentation Foto-Paaks and Koku-Fan 3-views, expands inventory again with over 400 new additions. They now have over 2700 different Foto-Paaks with more than 70,000 photos in inventory. These photo studies cover Antiques, Golden Age, Military, Civilian, Helicopters, Aerobatic, Experimental, Sailplanes, Racing Models and also Aircraft Engines. All are full-color 3 1/2" X 5" photos, taken with the modeler in mind, to show details like landing gear, instruments, hinges, flaps, paint schemes and markings. The pictures are sold on a satisfaction guaranteed basis and, because of the large inventory, orders are normally mailed within 24 hours.

Most Foto-Paaks have 3-views available that enable the modeler to have complete documentation for their project. The 3-views are either Koku-Fan drawings, or photo copies of drawings gleaned from modeling and/or full size aircraft magazines and other sources. Scale Model Research is the world's exclusive dealer for Koku-Fan 3-views with over 900 subjects and more than 5,000 drawings in stock. The Koku-Fan drawings are considered by many modelers to be the world's standard in accuracy and detail.

Modelers can get the NEW Scale Model Research catalog listing all Foto-Paaks and 3-views by sending $3.00 (foreign add $2.50 for A/O postage).

Editors & Columnists:

If you are in need of documentation for your next Scale Kit Product Review or Plan Presentation, I will gladly provide the photos and 3-views FREE! (I would, of course, appreciate acknowledgement.) Please contact me stating when and where the article is expected to run and which documentation you want. If you need extra catalogs, just send me a Long Self-Addressed, Stamped Envelope, and it will be in the mail the next day. Bob

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Aviation and Computer Enthusiasts A.C.E.

2009 Camelot Drive
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A.C.E. is the official publication of Aviation and Computer Enthusiasts, a non-profit organization with the purpose of education and sharing knowledge of the use of computers in any aviation field.

President: Carl H. Bogardus (also Commodore librarian)
Vice President: David Selwyn (also Apple, Mac, and MS-Dos librarian)
Model Editor: Glenn Whitener

On The Wing

...by B²

While it may be possible to construct a swept 'wing without incorporating any twist at all, most of us would like to have a degree or two of washout to assure us that any tip stalling problems will be minor. Most of us have cranked in the twist as we cut our cores by simply placing the root and tip templates at an angle to each other. This method spreads the twist evenly across the semi-span of the wing.

Featured this month is a jig for cutting foam core wings. Of interest to tailless fans is the jig's ability to automatically cut the desired washout.

When we consider that the wing tips are taking the place of the tail assembly, it seems immediately obvious that we should concentrate the twist at the end of the wing. Placing the twist at the end of the wing will inhibit tip stalling and will also be a small step toward increased efficiency, as none of the lifting center portion of the 'wing will be twisted to a lower angle of attack.

Featured this month is a jig for cutting foam core wings. Of interest to tailless fans is the jig's ability to automatically cut the desired washout into the 'wing. Specifically, this jig is set up to begin the twist at the one half semi-span point; the root end wing half has no twist at all. The entire set up is adjustable to construction parameters.

Our jig was started with a base of flooring plywood. With a thickness of well over an inch, this three foot by eight foot base is heavy, but it is also very resistant to both bending and warping. All of the wooden strips are of 3/4 inch pine and are nailed in position.

We utilize aluminum roof flashing for template material, making a female template for the wing's lower surface and a male template for the upper. The templates are mounted one at a time between two pieces of pine stock fixed an appropriate distance apart. You will no doubt want some sort of locking mechanism to hold the templates in place in order to get consistent alignment. As these templates absorb heat from the cutting wire, be sure to mount the templates at least an inch away from the ends of the foam.

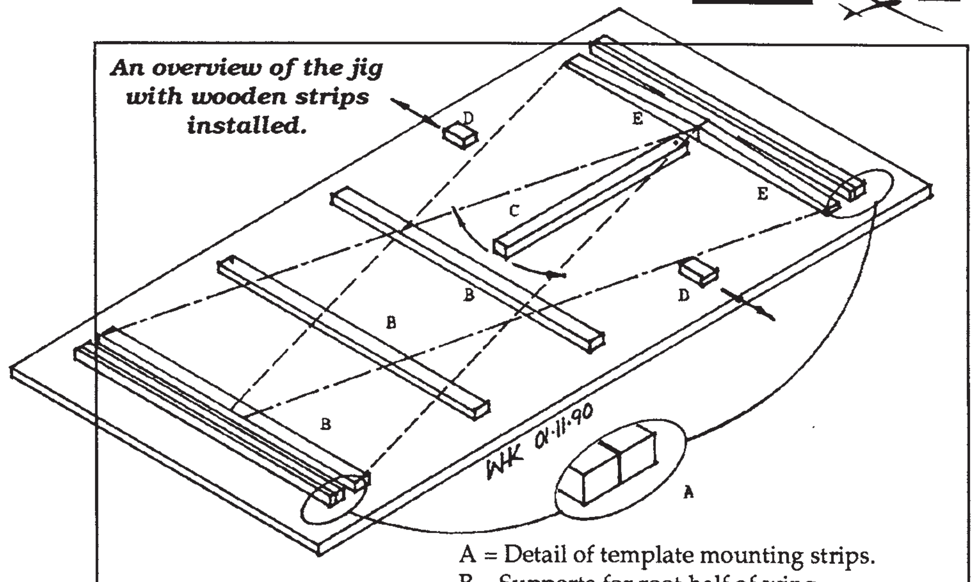
The root of the wing is always positioned at the left end of the jig, as shown in the drawing; the tip will always be at the right end, resting on the bevelled support strip. The bevel is set to the washout desired at the wing tip, but in the reversed direction. Note that after weighting down the foam block that the leading edge is straight, while the trailing edge is lower at the tips. After cutting, when you place the foam beds on a flat surface, the correct amount of washout (trailing edge up) will be automatically built in, along with the distribution of the twist across that part of the span.

The drawing shows the moveable leading edge brace (the swinging piece) and positionable trailing edge blocks. By varying their thickness and position, these TE blocks can control the rate of twist across this half of the semi-span. The left wing is outlined by the "dashed" line, the right by the "dash-dot-dash" line.

Our jig is easily adjusted. We just pull a few nails and tack the wooden strips in their new position(s). As we said before, the jig is heavy and is not easily moved. For this reason, some of you might want to try a good hollow core door as the base and use 3M "77" spray to "tack" the strips in position. An alternative that is a bit more sturdy would be to epoxy together a sandwich of two pieces of 1/4 inch plywood with one inch foam between, using a giant vacuum bag.

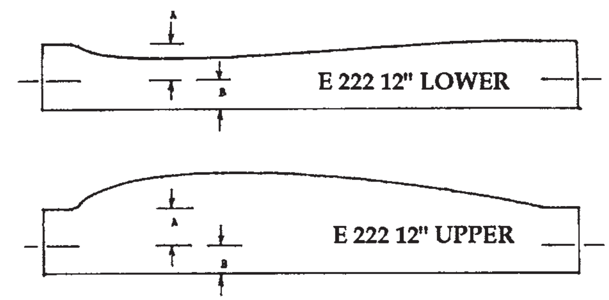
♣ ♣ ♣

Like most of our projects, we cannot claim credit for much of this. First, the concept of twisting the foam before cutting, and "shelling" it while on a flat surface, is a simplified version of a process for creating elliptical wings of foam for use ...continued on page 12

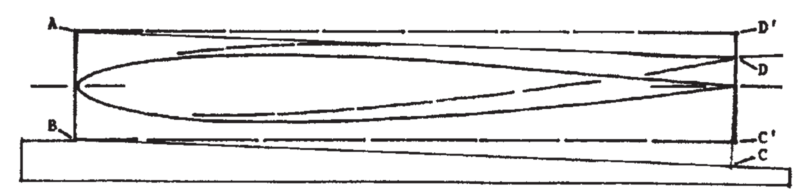


An overview of the jig with wooden strips installed.

A = Detail of template mounting strips.
B = Supports for root half of wing.
C = Movable leading edge support.
D = Trailing edge blocks.
E = Wing tip support. Note direction of slope!



These two diagrams show the female lower and male upper templates.
A = A distance usually equivalent to one half the foam's thickness.
B = The thickness of the supporting strips.



This diagram shows the foam block's orientation in the jig, at a two degree angle, and the airfoil's eventual washout when the foam is placed on a flat surface after cutting. ABCD is the block as set-up in the jig. Note that the airfoil is horizontal against the angled foam. ABC'D' outlines the foam block as placed on a flat surface. Note here that the airfoil is now oriented at the planned two degree negative angle.

How To Install Push-Rods from...

Jer's Workbench Part I

I have received several calls and letters asking me how I install push-rods into a long, thin fiberglass fuselage. I have found two methods that work well when I can't use my fingers to install them. The second method will be the subject for next month.

Installation Materials

Obtain cable/sheath type push-rods, thread (black is my preference) and 3/16" X 3/8" balsa stock.

Before cutting, be sure to take some time to study the fuselage and ask yourself, "Where will the elevator and rudder push-rods need to be positioned?"

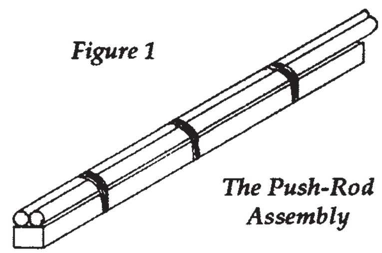
Starting with the tail section (as with most gliders), the rudder push-rod should be a few inches longer than the elevator push-rod, because it will have to come past the elevator horn. At the servo end, the push-rods must be long enough so that they can be fitted to the servos when the servos are installed, later.

Installation Set-Up

Figure 1

Start by using the black thread to wrap the push-rods and the balsa together. Wrap the thread every 3 or 4 inches. The number of wraps will depend upon the length of the fuselage. Glue the wrap with Hot Stuff or whatever you normally use or have handy around your workshop. Now, slide the push-rod assembly into the fuselage and check to see how well it fits. Unfortunately, this type of push-rod assembly will probably want to roll over onto its side.

Figure 1

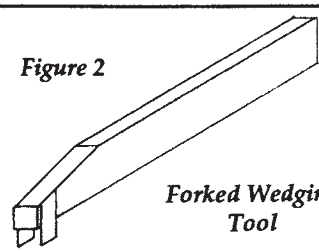


The Push-Rod Assembly

Figure 2

In order to stop this from happening, I have constructed a special tool that I call a "Forked Wedging Tool". This tool allows me to reach into the tail and grab the end of the push-rod assembly and turn it to an upright position. (The tool is constructed from 1/16" plywood and 3/16" balsa.)

Figure 2



Forked Wedging Tool

Figure 3

While the tool is in place holding the end of the push-rod assembly, the servo end can be easily checked to determine proper fit.

Figure 3

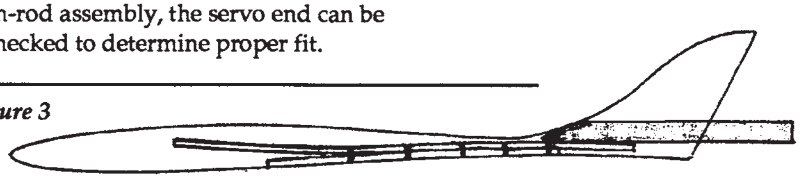
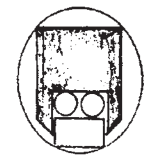


Figure 4



Blocking Tool

Installation Set-Up

Figure 4

Prepare a "blocking tool" from scrap balsa to insert over the push-rod assembly at the servo end. The balsa will hold the assembly in place so that later, when epoxy has been applied, you won't have to hold the push-rod assembly while waiting for the epoxy to cure.

Installation

- Remove the push-rod assembly from the fuselage. Mix up a batch of SLOW cure epoxy (30 or 60 minute type). I add flocked cotton fiber (P/N 01-14800), which I obtain from Aircraft Spruce and Specialty Company, to thicken the epoxy. When the epoxy is thick, it won't drip on the floor, and I have found it easier to handle when spreading it on something that is approximately 3 feet in length.
- Epoxy the entire length of the balsa on the push-rod assembly and fit it back into the fuselage.
- Re-position the "forked wedging tool" and install the "blocking tool".

  Use care not to epoxy the "tools" in place as you will want to remove them later. You're right! This is not as easy as it looks.
- Set the fuselage aside for an hour or so while the epoxy cures.
- Remove the tools. The push-rod assembly should be installed as shown in figure 5.

Figure 5

The Finished Installation

RCSD Database

The Reference and Sources Appleworks databases are available 24 hours a day on the Bears Cave BBS (414) 727-1605 (from the main menu). First, go to the (F)ile section and view the directories by requesting (F) Directory List. The files are then listed for downloading. These are text files which can be used as input for a number of database programs. These databases are also available on floppy disc for $5.00. Updates are available for a minimal charge. Database TEXT files on disc for IBM compatible computers is available for $7.00. Listings sorted by key words is available for $5.00. (Lee Murray, LJM Associates, 1300 Bay Ridge Road, Appleton,, WI 54915)

♣ ♣ ♣

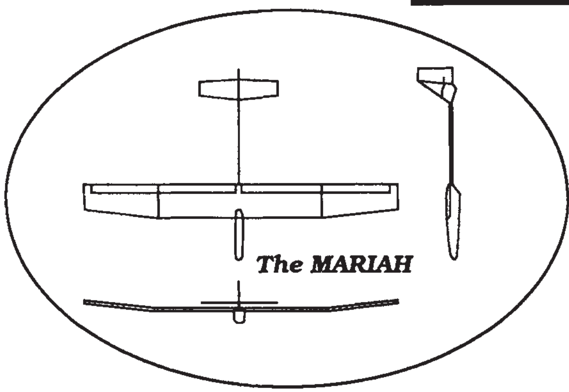
The reference listing was used several times in the month of February to answer reader questions. This sophisticated cross-referencing of information can help to research a project or find a particular subject. *RCSD* thought it would be an appropriate time to revisit the database for those of you who are unfamiliar with it's workings. Thanks, Lee. JAS

The MARIAH Modified

...by Don Anthony

Specifications

• Span:	78.5"
• Length:	45.6"
• Weight:	34-37 Oz.
• Area:	590 Sq. Inches
• Airfoil:	S4061
• Wing Loading:	8.75 Oz./Sq.Ft.



I hope this information will prove helpful to you. The Mariah was a bit difficult to build compared to other kits I have built. It is not even an intermediate builders plane. But, if you think your way along, you can put this thing together and have everything work right the first time.

I made numerous changes during the building of the Mariah. After reading the building instructions and studying the plans, I thought that a concealed flap activation system was possible, and it was. However, here is what I had to do:

1) Change the wing mounting system and move the wing forward about 1/4 inch.

2) Use a micro servo such as a Futaba S33 or equivalent.

3) Offset the aileron servo sufficient to allow for the flap linkage.

4) Cut a small slot in the top of the fuselage, under the wing, to allow space for the flap horn to operate.

5) In my Mariah, I used push cables instead of the push-pull rudder system. (i.e., I used the same system that is used for the elevator for the rudder.) I was thus able to route the control cable to the side, so that there was no interference with the flap control horn.

Just a side note, I also cut the rudder area by about 30%. In an aileron ship, the same rudder area and travel that one would use for a polyhedral ship is simply not required. If I had to do it again, I might cut the rudder by 50%.

I also assembled the wing using Epoxy and carbon fiber reinforcements. In front of, between and behind the wing mounted servos are tows of carbon fiber. They are probably not necessary unless you have a heavy foot on the winch. If I had to do it again, I might not build the wing with epoxy. Instead I would use spray glue or double stick tape. The Mariah is NOT an F3b ship and although my ship weighs in at 39 ounces and flys superbly, I can not help but wonder how it would fly 6 ounces lighter and go easier on the winch.

Anyhow, Here is what I did:

1) Fuselage former F1 is installed as per plan. The additional 1/4 plywood called for to be glued onto F1 for wing mounting is not used. Instead, the wing is mounted directly to F1, which allows the wing to move forward 1/4 inch. I used a single point wing mount

instead of the two tube affair. See Fig #1.

I have a rather easy way to do this with the Mariah. If the wing is not sheeted and only the bottom front plywood brace is installed between the center section ribs, mount the wing on the fuselage. Place a 3/16 brass tube on the plywood brace and use it to mark F1. Then drill a 3/16 hole in F1. Epoxy a dowel in the brass tube and adjust the 3/16 hole for a slip fit with the brass tube. Align the wing on the fuse, put the brass tube in the mounting hole and epoxy the tube to the plywood plate in the wing center section. Remove the wing. Put the top plywood brace in place and fill the space between the braces with microbloons and epoxy. Your front mount is finished.

If the wing is more complete, the job is more difficult. In this case drill a 3/16 hole in F1 approximately at the center of leading edge. Then mount the wing on the fuse and mark the leading edge through the hole just drilled in F1. Drill an oversize (1/4") hole in the leading edge. Partially fill the 1/4 hole with epoxy. Wrap the leading edge of the wing with plastic wrap. Make a small "X" cut in the plastic wrap to allow the brass tube to slid into the epoxy filled hole.. Put the brass tube assemble into the ...continued on page 10

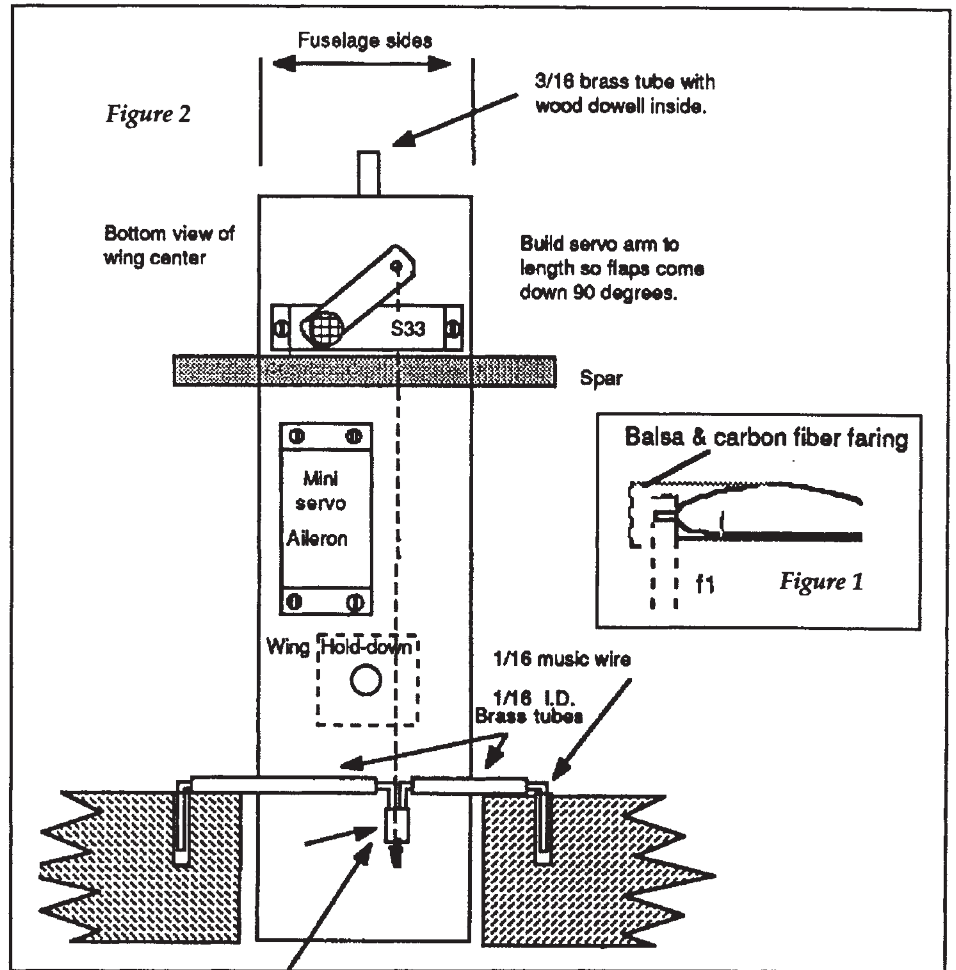


Figure 2

MARIAH ...continued

hole in F1. Mount the wing on the fuse making sure the brass tube slides into the epoxy filled hole. Double check the wing alignment to the fuse: Square and at right angles. When the epoxy sets, if you were careful with the plastic wrap and the epoxy didn't bleed through, you should be able to easily separate the wing from the fuse with the brass tube epoxied into the wing in perfect alignment.

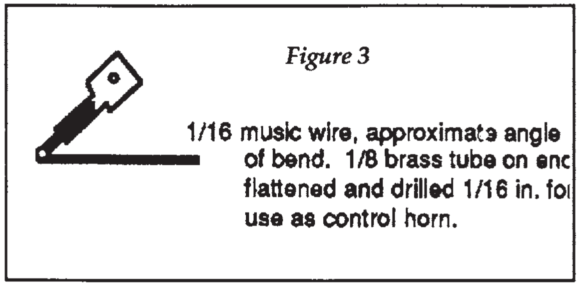


Figure 3

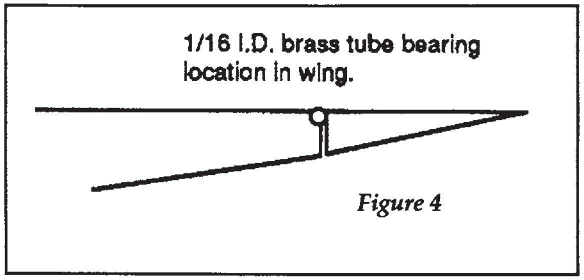


Figure 4

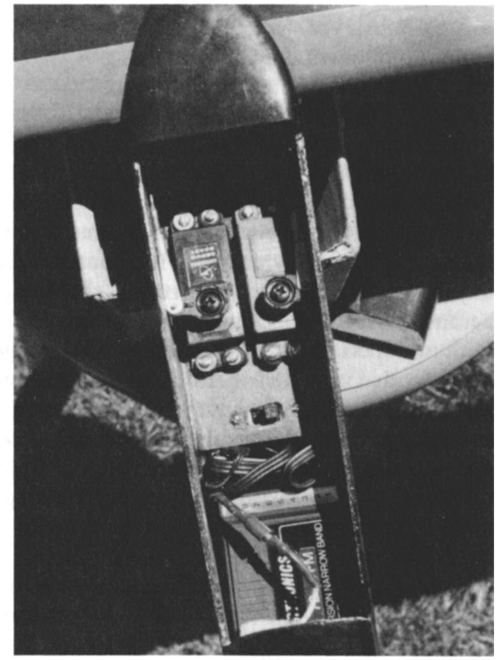
For whatever it's worth, after the wing is finished (covered and everything), I rewrap the wing with fresh plastic and grease the brass tube. Using some glass cloth and carbon fiber I pre-cut for a wing faring. Then, using 24-hour epoxy, and a little extra batch with micro bloons, I fill the front area with the epoxy and bloons, mount the wing and built the fairing right on the mounted wing using the glass cloth, epoxy and microbloons. This makes a form fitting, very strong and light assembly. When hard, the microbloons make an easily sandable mass that can be shaped as you wish into a fairing that not only looks good, but is very structural as well. Needless to say, I finish my fuse work last.

2) See Fig #2. This drawing and the photographs are fairly self explanatory. I used 1/16 plywood to build small mounting pads for the servos. Bending the 1/16 music wire for the control horns is a little difficult, but with some heavy long nose pliers it goes O.K. (Fig #3 shows the approximate angle need to give 90 degree flap movement.) Note that the wire horns are built and mounted offset to clear the aileron servo. I actually made a mock-up out of scrap balsa to make sure it would work before cutting into the wing. I also made a 3-piece wing and reworked the control horns to exit the top side of the wing. I sheeted the bottom of the wing first, thus I was able to work on the aileron control linkages from the top.

3) When the center section of the wing was sheeted and sanded, I taped the flaps in place and cut in the flap horns. These are mounted so that the brass bearing tubes are flush with the bottom and edge of the wing. (See fig #4.) I reinforced these areas with small strips of Kevlar set with thick, slo-cure Jet, using a quick curing spray and wax paper to establish the surface. (Spray it with quick set and hold wax paper on it with your fingers to force everything together.)

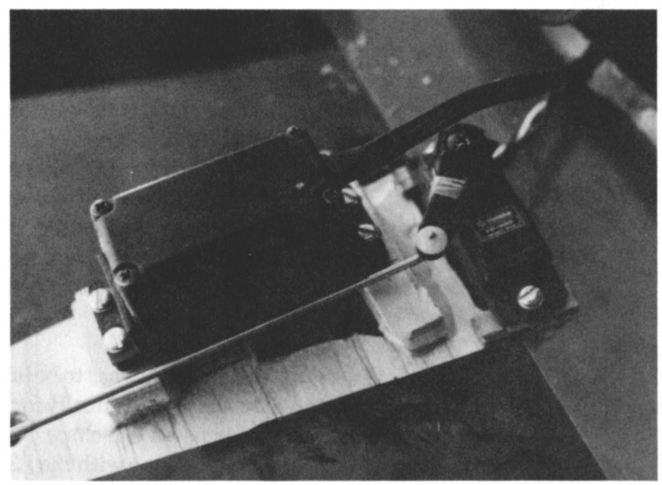
4) Make sure the edges of the music wire horns that go into the brass slide tubes in the flaps are sanded smooth. Epoxy/hotstuff the slider tubes in place. Reinforce with a fiberglass, Kevlar or carbon fiber patch. Run a piece of tape across the hinge line for a temporary hinge and check out the action. Correct as necessary.

5) Clamp the flaps in place and mount the flap control horn tube and solder in place. This locks the flap alignment, so be sure it is right. Also, you should have tested this with a simple mock-up to make sure the horn length and throws are right to allow 90 degrees of travel. I actually try for about 95-100 degrees of travel to allow for flex under air pressure. Be careful not to get the servo horn so long that it strikes the side of the fuselage.



6) Make a cardboard template up to use in cutting the slot in the fuselage top to provide operating clearance for the flap horn. The slot I cut was about 1/4 inch wide and 5/8 inch long. I have to put the wing on with the flaps at 90 degrees. This is no big deal, because I almost never take the wing off. I found that I can load the Mariah with the center section in place into my Honda Accord. No sweat.

7) The last thing I do is to wrap the wing in plastic wrap taking care to pull out all of the wrinkles. Then I either use silicon rubber or epoxy and microbloons on the wing saddle area of the fuselage. Bed the wing and lightly tighten it down. Wipe off the squeezed out surplus and walk away. Next day pull apart and find a custom fit, almost air tight wing saddle. My Mariah makes NO SOUND at fifty feet overhead during a high speed pass. (No cracks to whistle.)



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Dublin, Ca. 94568

Eppler 221
A Low Drag Section
...by Wil Byers

A couple of years ago, I decided to build a model which would utilize a fuselage I had laying around (just pulled out of the mold). The fuselage was actually intended for a thermal model which was designed around F3B guidelines and, therefore, was also not at all out of place on a slope glider. The intent of my creation was to come up with a design which could fly in relatively light air...8 to 10 mph and, yet, still penetrate on those days when the wind is blowing 40 mph, which the wind does quite regularly here in the spring time. So, as with any design one creates, I entered into that hunt for the ideal airfoil. In the past I have used a number of sections for one reason or another. However, for this model I wanted a section with an especially low drag bucket. This would mean that my model could really cruise when loaded up with a material having a density of 11.34 grams per cubic centimeter. But then, I also wanted it to have a low sink rate so that I could enjoy climbing out in thermals as they drifted by the slope on calmer days. Well, after pawing through a number of my airfoil books, which is just about as fun as flying, my choice was the Eppler 221.

Why the Eppler 221?

Well, if one looks at the polar for the 221 you will see it has a very low drag bucket! I realize that some of you will want to point out that this specification is for a Reynolds number of 500,000. You're right, but note that when the section is flying at 60 mph, with an approximate MAC (mean aerodynamic chord) of 6 inches, and in air that yields a kinematic viscosity of nearly .0001576, it has a Reynolds number of about 270K. So, I try and cruise near 100mph most of the time!!! Ha! Anyway the point is, the section won't always be suffering when cruising around in slope lift. Another feature of the 221 that attracted me was its CMO. The section has a very low coefficient of moment at zero lift (CMO) of -.0012; which is to say, it is pretty darn stable. This factor may have helped my design because I am running only 1 degree of positive incidence in my stab with good handling and stable results. And, in terms of thickness, it is 9.3%, which may not be thin by some standards, but it will carry a load nicely and doesn't kill the design in terms of profile drag. Nor does it puke away its energy in high G turns, but rather it hussles right through them and comes out saying, "Where's Daryl!"

The Acid Test

The acid test for any airfoil though has to be how well it performs on a model and, specifically for us slopers, how well it performs on the slope. All I have to go by is my own experience with the E221 when applied on my model. On that model, the E-RACER, it performs very, very nicely. Now, I know that many of you will say, "Well, he is proud of his model and what would one expect." Yep! You are right...I am. But, all that aside, the section performed very nicely. It penetrates with the best of them and I have, no bull, flown the model in winds which were at least blowing 40 mph. This is to say, I not only hovered in the wind, but was able to easily penetrate up wind and perform aerobatics without constantly being blown downwind. In terms of aerobatics, it performs well. Maybe not like a symmetrical section, but it allows for inverted flight, inside and outside maneuvers, and it carries the speed well even without ballasting up. When I have ballasted, the performance is no less than fantastic. In the past, I've loaded her right up to the FAI limit of 24 oz./sq.ft., which includes the elevator area in the calculation, and carved some pretty nice hunks out of the sky with absolutely outstanding L/D.

Light Air Performance

What I found the most enjoyable about the airfoil was its light air performance, which lets me take the model to the slope on the lightest of days and have some fun pretending it is blowing hard. The E-RACER has a span of 98 inches and a aspect ratio of 16.6 with a wing loading of 14 oz./sq. dry. However, it will climb nicely, even in light thermals, letting the model climb to sufficient altitude so that the altitude can be converted to velocity for some fun.

OK! OK! Take it easy! It really wasn't climbing out on my hot air. But, I want to emphasize it is just a nice flying airfoil section which some of you may want to use on your designs.

In Summary

If you are looking for an airfoil to stick on that racer for the 1991 Mid-Columbia Slope Races to win some big money, maybe you ought to take a look at the Eppler 221 and see how it might fit on your world beater. I think you will be pleasantly surprised by the performance the airfoil can offer you in terms of penetration, speed, and maximum C_L. At any rate have fun designing and building!

Wil Byers
632 Meadows E.
Richland, WA 99352

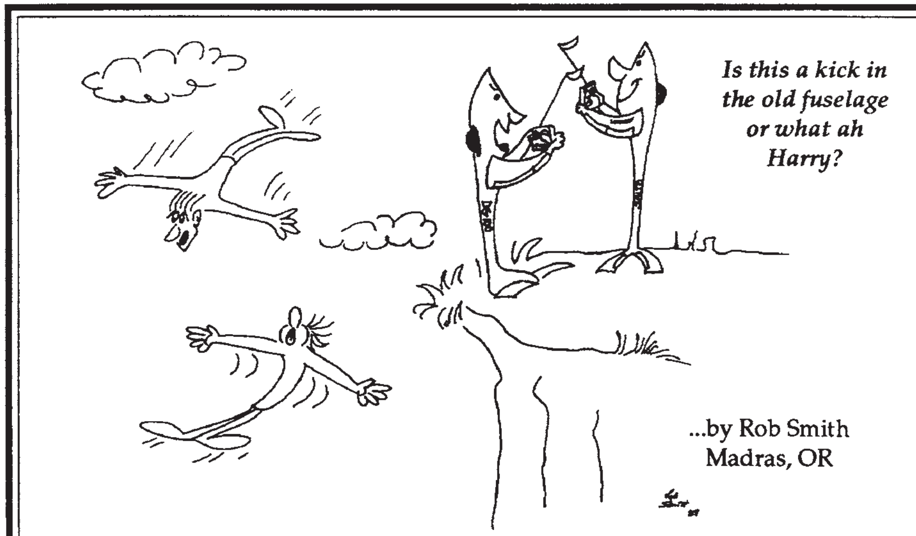
On The Wing ...continued

with F3D pylon racers. This was described in an *RC Modeler* article by Jaromir Bily.

Second, the use of female and male templates is the recommendation of Bob Bayard of the South Bay Soaring Society (*Silent Flyer* newsletter). Third, placing the twist near the tips, rather than across the entire span, came from the Hortens.

Please drop us a line with any questions, comments, or improvements you might have.

Bill & Bunny Kuhlman
P.O. Box 975
Olalla, WA
98359-0975



...by Rob Smith
Madras, OR

Understanding Thermal Soaring Sailplanes

Part 2 Section 1

on

Weight & Ballast

...by Martin Simons

(This is the third in a series of articles by Martin Simons. The material in this section may refer to information & drawings in part 1. Reproduction of this material requires the permission Martin Simons.)

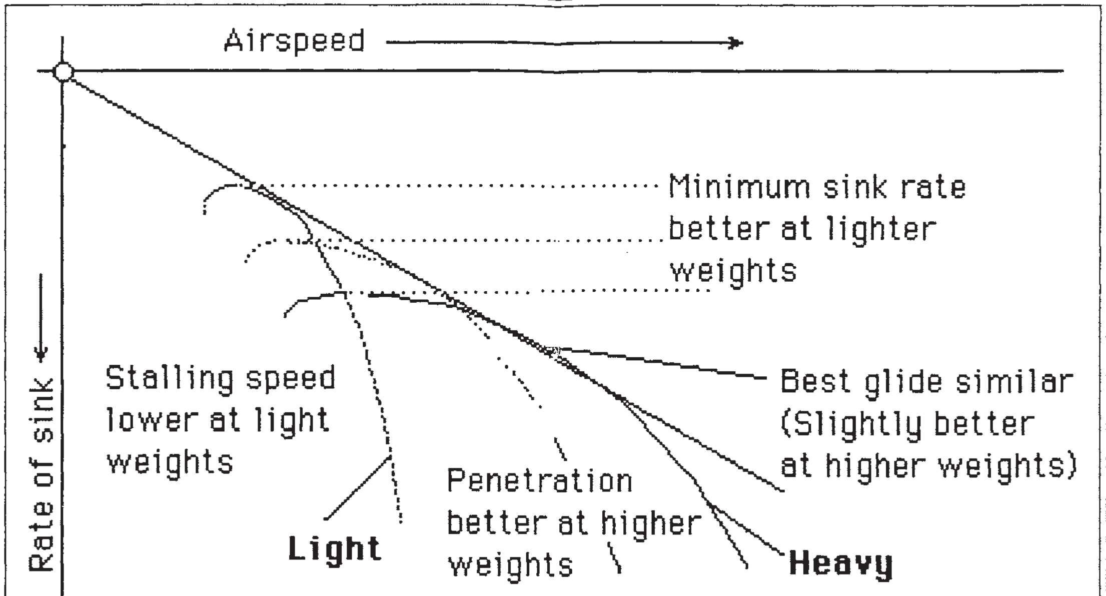


Figure 7 The Effects of adding and removing ballast

In the previous article the importance of penetration combined with the ability to circle with low sinking speed in thermals was emphasized. These requirements are to some extent in conflict.

Weight and ballast

If the weight of the sailplane is reduced, the model will fly more slowly for any given elevator trim position, and its minimum rate of sink will be reduced. The polar curve will take on the appearance shown in Figure 7 on the left. If there are no thermals, or if the only thermals available are extremely feeble and narrow, a very light glider with its low minimum rate of sink and small turning radius may achieve a good duration.

There are few occasions when such a lightweight will actually prove superior in the rough and tumble of contest flying, to somewhat heavier and more robust models. It is certainly not wise to build a sailplane so lightly that it becomes flimsy, especially since the launch must be fast to avoid wasting 'slot' time. Apart from this, there are other disadvantages.

With a very light model the polar curve becomes more 'peaky'. That is, the trim for minimum sink comes closer to the stall, the best L/D speed is closer to that for minimum sink, sometimes so close that the three are almost indistinguishable in practice. More importantly, the right-hand side of the polar curve falls away steeply. Penetration suffers. Taking weight reduction too far can produce a sailplane which will fly efficiently at only one trim: a fraction too slow and it will stall, a little too fast and it dives steeply; aptly termed a 'one speed' sailplane. Trimming a very light sailplane is therefore difficult. (Free flight contest sailplanes are in this situation.) Quite a small error or a disturbance in flight brings the model off its peak and in turbulent air such a model hardly ever does fly at its best rate of sink.

As will be explained later, there are bad 'scale effects' for the very light model, especially if the wing chord (the distance across the wing from leading edge to trailing edge) is small. A narrow-chord wing flying slowly does badly.

The polar can be made less critical if mass is added, which increases the total weight to be supported by each square metre of wing area, raising the **wing loading.** The additional weight may be used to produce a more practical model, extra material being introduced to strengthen the structure. Alternatively, or as well, penetration can be improved by adding ballast. This option is always open if provision for housing the ballast is made when the model is being built, or by retrospective modifications. On a day with little wind and no thermals, or very feeble ones, the glider may be flown at its minimum weight, that is, at a low wing loading. If the wind strengthens and/or better thermals develop, ballast may be added. The effect on performance is illustrated by the right hand curve in Figure 7. The entire curve with the higher wing loading tends to be flatter. Trimming is therefore less critical, since a small error will move the model only slightly off the highest part of the curve. Still more ballast flattens the curve further.

Adding or removing the ballast ought not to cause changes of trim, so the ballast should be placed as close as possible to the un-ballasted centre of gravity. The structural problems associated with fitting a model to carry ballast will not be discussed, except to say that there are important advantages if the extra mass is carried in the wings as a load distributed spanwise, rather than in boxes in the fuselage or as concentrated lumps of lead in the wing. It is also preferable for ballast to add strength. One convenient and well-proved method is to use very long wing joiner rods of steel which, when in place, form an reinforcement to the main wing spar for a considerable distance inside. Tubes to house the ballast are built into the wing spar itself adding their own strength to it. Different lengths of the joiner/ballast rod allow adjustment of the total weight.

A ballasted model is less easily upset in flight by rough air since the model's greater mass and flight speed will give it more resistance to disturbances. Control response will be changed. The average speed of airflow over the control surfaces will be greater, improving their effectiveness slightly although the additional mass will increase the model's inertial reactions, so response to controls may be slowed. This is particularly noticeable in rolling and turning models with the spanwise distribution of the load, mentioned above, but this effect is usually tolerable. Unfortunately, the heavy model also lands at a greater speed because the stalling speed is higher and, because of the greater momentum on touchdown, there is more risk of damage in a bad landing.

...continued on page 16

Understanding Thermal Soaring Sailplanes ...continued

The minimum rate of sink for the glider with high wing loading is worse, as shown by the flatter top of the polar curve, so the ballasted model will always be less successful in weak lift or in dead calm. In addition the whole polar shifts to the right on the chart, indicating faster airspeeds at each elevator position or trim. Slightly more skill is required from the pilot to manage a faster model.

The best L/D ratio in straight flight remains almost exactly the same, ballasted and un-ballasted, although it occurs at a greater airspeed with the higher weight.[1] Increasing the wing loading raises the whole of the right hand, high speed part of the polar. The heavy model at high flight speeds has a lower sinking speed and so loses less height, than the light model at the same airspeed. That is, penetration is improved.

Turning

At any given angle of bank the radius of the turn, ballasted, will be larger than for the lightly loaded model. Putting this the other way round, to circle tightly and efficiently with a high wing loading requires a steep angle of bank.

A model will fly straight unless there is some lateral force acting to turn it to one side or the other. To compel the wing to provide this lateral turning force it is necessary to bank. If there is no bank, there will be no turn, or at best a very sluggish, inefficient, skidding turn. Trying to turn flat forces the fuselage to yaw, to provide a lateral force which it is not designed to do. Not only is the lateral force small, producing a very slow response, but the fuselage, in a yawed attitude, acts as an airbrake and brings the model down rapidly.

In a turn, the wing must still maintain the upward support which keeps the model in flight, while also providing the additional force which turns the model. This additional lift can be obtained by increasing the wing angle of attack, normally by trimming in some up-elevator. The stalling behavior of the wing becomes especially important because of this. To avoid stalling in a steep turn it is necessary to accept some increase of airspeed. All this increases the rate of sink in turns, the effect being greater as the turn becomes tighter.

Since there is this inevitable loss as the bank angle increases, the rate of sink of the heavy model in a steep turn is considerably worse than the minimum sink rate shown by the straight flight polar. A model with light wing loading can turn on the same radius with less bank, so its rate of sink suffers less in proportion.

The pilot of a thermal soaring, heavily ballasted, model has to choose between a large radius of turn with small bank and only a small deterioration in sinking speed, or a steeper bank, with smaller radius of turn, but with a noticeably worse sinking speed. If the thermals are narrow but have strong centres, the heavy model can still use them by finding the cores and turning in them steeply. If thermals are wide and diffuse but fairly strong, a gentle bank will be sufficient. But a weak thermal which is also narrow presents the heavy model with an impossible task. Circling tightly in the core increases the rate of sink so the model loses height. Turning gently with low rate of sink, finds the model flying round outside the thermal altogether.

Thus, increasing wing loading improves penetration and increases the chances of getting through bad air and finding a thermal, but it reduces the ability to gain height after the thermal is found. Reducing weight to help climbing in the thermal, reduces the chances of reaching a thermal to climb in. This is the fundamental problem facing the model glider flier and, on any particular occasion with a particular model, only experience and judgment can provide a solution as to whether to add ballast or not. The upper limit of 5 kg on mass becomes relevant when ballast is to be carried.

♣ ♣ ♣

[1] There is a slight improvement of best glide ratio at the higher loadings because of the scale effect, already mentioned and discussed in more detail below. In practice this is hardly noticeable unless the difference in weight and flying speed are very large.

Martin Simons
13 Loch Street
Stepney
South Australia 5069

CASIO DIGITAL BAROMETER WATCH Model #510

...by Jim Gray

Here's just what we've all been waiting for: An Altitude Reporting Watch!

Bill Kournakakis, Medicine Hat, Alberta phoned me the other night to tell me about the watch he just bought in Florida called a CASIO DIGITAL BAROMETER WATCH Model #510.

Features

Altitude recording to 13,120 feet.

Accurate to +/-.15% (Fifteen hundredths of one per cent).

Reads in 20 foot increments.

Three Alarms

Countdown Timer

Stop Watch

Depth Meter for Divers

Water Resistant to 100 Meters Depth

Calibration set to altitude or zero depending on whether you wish to read absolute altitude above sea level, or altitude above your location.

This watch is very light and probably weighs about the same as a servo. You could put it in your plane (if you don't need it for timing) and get an altitude readout.

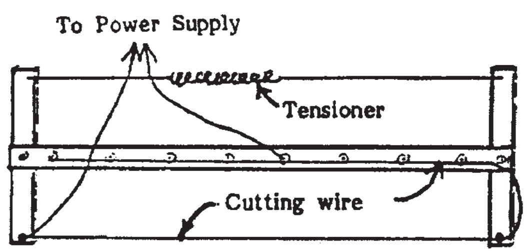
The price is $99.95. Another model, with slightly fewer features, is available for $79.95. See your Casio dealer

Foam Wing Tools #1

...by Bob Bayard
from
The Silent Flyer
Newsletter
of the
South Bay
Soaring Society

Recently I decided I wanted to learn to make foam wings for a hand-launched glider, including using the vacuum bagging technique. I was surprised at how little I could find in the way of "how to" literature, so I did some brain bleeding on some club members, notably Oscar Rico, John Dvorak, and Karl Paulson. I've developed fairly satisfactory and quite simple arrangements for cutting the foam and for bagging the vacuum. In this part I'll describe the foam cutter and in another segment, in a later newsletter, I'll describe the vacuum system.

There are basically four aspects of foam cutting, namely, power supply, cutter, wire pulling arrangement, and profile guides. For each I'll describe the one I use as well ar same other possibilities I've heard or read about.

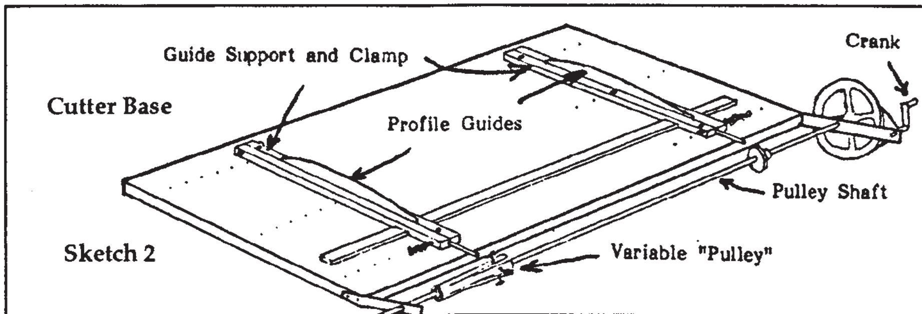


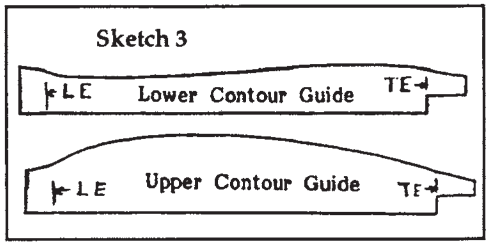
SKETCH 1

The power supply has to provide somewhere in the range of 20-50 watts at low voltage and it should have some arrangement to adjust the power. Some of the professionals use a big variable transformer. Another arrangement I've heard of is an ordinary transformer and a light dimmer switch to vary the power. The secondary winding voltage you would need would depend on the resistance of the cutter wire which in turn depends on the wire material and diameter. A 3 amp filament transformer (6.3 v) should work with the .022" music wire cutter that I use.

The power supply I have used has been my automobile battery charger, a 3 amp model with choice of 6 or 12 volts. I use the 6 volt option on my .022" music wire cutter. I have also used a .015" wire on the 12 volt option but this wire is probably too small, as it can"t be tensioned really well without breaking. To get the power adjustment that is needed to make the wire temperature right, the length, and therefore the resistance, of the cutter wire is varied. The longer the wire the more the resistance and therefore the less the power. I don't actually vary the wire length. I just make the electrical connection at different places along the length. (See the cutter description, below).

Most of the professional core cutters use a cutter bow made from a piece of 3/4" conduit, with ends bent to a bow shape, and a means for tightening the cutter wire. My bow is a simple affair made from a few pieces of scrap wood, as shown in Sketch 1. Tension of the wire should be at least 20 lbs. In my cutter this is provided by a strong spring stretched across the top, using a piece of heavy cord to tension it. The wire is about twice ar long as the tensioned portion and the extra length is stretched along and bolted to the center wood piece with several small bolts. These hold-down bolts then act as electrical contact points to connect the power supply leads to. The wire temperature can then be varied by





connecting to different hold-down bolts. Some builders use Nichrome wire rather than steel. The main advantage I see with Nichrome is the ability to use higher voltage lower current power supplies, since Nichrome has high resistance. However I don"t know of a convenient and inexpensive supply of Nichrome wires of various sizes. By contrast, music wire of a wide range of diameters is readily available. Orchard Supply Hardware has spools of many gages of wire, from much smaller than we need to much larger, all very reasonably priced.

The really professional foam cutters often have a table just for making cores. Many have a weighted tray hinged to the fronts of the front table legs in such a way that pull-strings connected to the cutting wire pass over a guide bar and down to hooks in the weighted tray. The weight pulls the cutting wire through the foam, and tapered cores can be cut by hooking the pull-string to the weighted tray at different distances from the hinge line.

My shop can't afford a space just for cutting cores so I wanted an easily stored and easily set up apparatus. I settled on the arrangement shown in Sketch 2. The base board is 1" particle board and it has a wood stop to keep the foam block from moving as the cutting wire is being pulled through it. The stop also acts as the locator for the aluminum profile guides, described later. The base also has metal straps screwed to the ends, projecting forward, which carry a 1/2" steel shaft. The pull-strings lead from the cutting wire to pulleys on the shaft. Rotating the shaft then pulls the cutting wire through the foam block.

The profile guides are held in a vertical position on top of the cutter base board by being pinched between a couple of pieces of wood, one of which is screwed to the top of the cutter base board. The base board has sets of screw holes pre-drilled so these pieces of wood can be unscrewed and moved right or left on the base board to allow for various lengths of foam blocks to be cut. The other piece of wood is held against the screwed down piece by a pair of loosely fitting machine screws. The rear ends are adjusted to hold the profile guide firm while the front ends are held together with a strong coil spring over the machine screw. The front ends can then be pried apart (I use a short piece of dowel as a sort of"screw driver".) and the profile guide slipped between the boards. See Sketch 2. To cut a core, the pulleys are adjusted to move the cutting wire so that it starts out aligned up at the leading edge position and finishes at the trailing edge line. Then a foam *...Continued on page 20*

Foam Wing Tools ...continued

block of the proper planform is placed on the cutting board, against the wood stop, and it is weighted down with a board and a couple of bricks. With the lower profile guides in place, the first cut is made. I cut rather slowly, taking about two minutes to cut through a seven inch wide block. Without touching the foam block, the profile guides are changed and the second cut is made. Foam cores cut with the setup described here are quite uniform and have good surfaces. Blue and white foam cuts equally well. My particular apparatus will cut cores to 30" long. I'm told that one is not a true professional until he has mastered cutting really long cores. I'll buy that, and will keep my amateur status for the time being.

I've used two ways to rotate the shaft. One is to attach a weight to a string on another pulley. The other is to turn the shaft by hand. I don't like the weight system because the motion is erratic due to the friction between the cutting wire and the profile guide being sensitive to the pressure between them. Therefore, I have settled on the hand-feed system.

When making a cut the shaft turns very slowly (about one RPM). To make it turn smoothly, I use an auxiliary crank shaft mounted on the right hand shaft-supporting strap and "geared down" about 10 to 1 with a belt drive arrangement (the "belt" is a few rubber bands). The arrangement is shown is Sketch 2. An even better system, I believe, would be an electrical drive system in which the speed could be adjusted. I haven't found anything that's cheap enough to suit me and also I'm reluctant to give up the utter simplicity of my hand driven system, so I continue to hand crank.

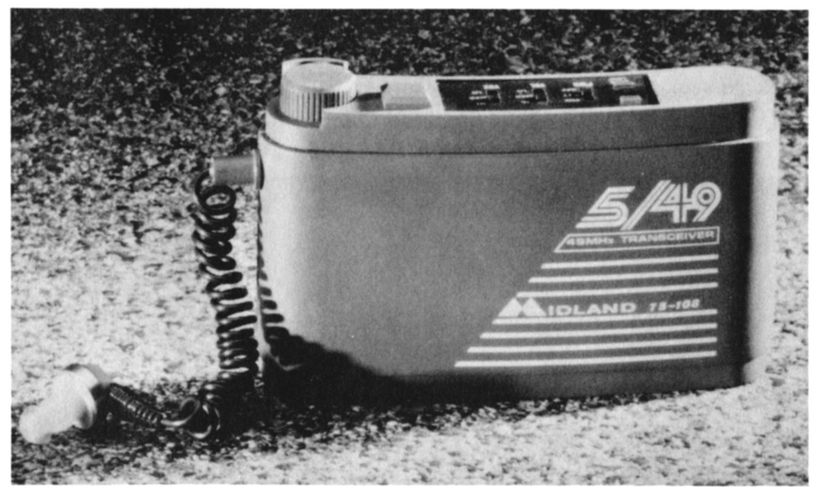
Straight wing sections can be cut using a pair of identical pulleys to pull the pull-strings. Tapered wing sections need one pulley with a variable diameter because the cutter wire needs to move different distances at the two ends of the foam block. To accomplish this I'm using a "pulley" suggested by my wife, Jean, which is a piece of heavy plastic pipe split most of its length with two perpendicular cuts and fitted on the unsplit end with a bushing that fits the 1/2" shaft. The resulting four leaves have screws tapped into them which bear against the shaft. Turning these four adjusting screws varies the effective diameter of the "pulley".

For the profile guide some builders use a piece of 1/8" plywood cut to the profile shape and glued or pinned to the end of the foam block. This system has a number of problems. For one, any profile guide, even a wood one, sucks heat from the cutting wire. As a result, the cut near the guide is not quite right. It is better, I believe, to have the profile guide at least a half inch away from the foam block. Another problem is that of finding a logical place to lead in the cutting wire at the beginning of the cut. It is hard to get the cut started smoothly. Still another problem is that the two guides have to be properly located with respect to each other so that there is no unplanned wing twist, etc. Also, if the guide is glued on, it"s messy, and if it's pinned on it will shift around.

A much better system, used by most experts I've talked with and which I also use, is one in which the bottom surface of the core is cut first with a female guide form mounted to the table and the top surface is then cut with another guide, also mounted to the table, which is the male of the top profile. In principle, the foam block drops down after the bottom cut is made so that no allowance need be made for the cut thickness in making the top and bottom profile guides. This isn't quite true, I've found. Any cut creates a sort of tangle of "threads" of melted Styrofoam that the cutting wire seems to lay down behind it. Thus this mat of "threads" keeps the two cut surfaces slightly apart. I have found that in order to make the finished core be the desired thickness it is necessary to make the top surface a bit

higher than where it should be theoretically. I believe that this is because the mat of polystyrene "threads" keeps the bottom side cut from closing completely after the wire passes through. The mat thickness is related to the cutting wire diameter-cuts with a .015" diameter wire look much cleaner than those cut with the .022" wire because the melted material is less and the "threads" are smaller. For the .022" wire, allowing about 8 or 10 mils seems to be about right. That's pretty small and it might be tempting to say "forget it". That is probably OK, too. There may well be worse things than that that are being missed.

The profile guides are made from aluminum flashing material. A paper copy of the profile is stuck to the aluminum using double sided tape and it is cut with a good pair of tin snips. It is truly amazing how accurately the guide can be cut this way. A good way to make the paper profile would be to draw a base line on a copy of your profile and get two copies made of that. I use a baseline that is 3/4" below and parallel to the chord line. Stick each copy to a piece of aluminum and cut one of them to the bottom contour line and the other to the top, making smooth transitions beyond the leading and trailing edge positions. Then cut to the baselines, allowing for the difference in height of the two contours mentioned in the previous paragraph. The bottom guide should be narrower than the top by about the thickness of a pen line, so cut it so the base line barely disappears on the bottom form but not the top. On my forms, I notch the guides right at the trailing edge so they fit against the wood stop on the cutter base that locates the foam block. See Sketch 3.



Midland Consumer Products has introduced a 5-channel, "hands-free" 49 MHz radio with earphone/earbone microphone. They consider the 75-109 to be ideal for outdoor enthusiasts and work related applications. Should you have an interest, the address for Midland is 1690 North Topping, Kansas City, MO 64120.

Dear Readers,

We received a letter from Ed Elsner in Pennsylvania. He asked the following questions:

" I would like to take this opportunity to inquire about the enclosed photo of a sailplane I saw in the July, 1989 issue of *Model Builder*. **(Not included, here. It is on the bottom of page 13 in *Model Builder*.)** The model that caught my eye is in the upper center of the picture (D-1097), and I believe it is the Glasflugel Libelle, a sailplane I've always admired because of its beautiful lines. I would appreciate any information on the aircraft from you or your readers...or, an address I could write to for it. I am not familiar with the Krause Company."

"If you know of any slope soaring spots on the east coast, I sure would like to hear about them."

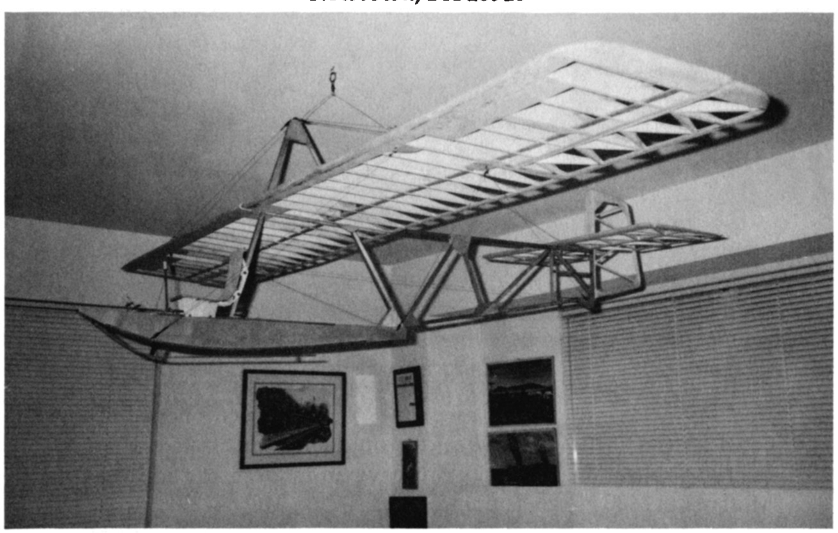
Sincerely, (signed) Ed Elsner, 30 Crestland Terrace, Doylestown, PA 18901

<u>Response</u>: **In studying the photo, I don't think that it is a Libelle. I would suggest that either Gary Gray or J. Walter might be able to direct you. They can be reached at Aeromax Scale Documentation, Vorm Niederend 5, D6108 Weiterstadt, West Germany. Should anyone have a different contact, please let Ed know.**

For slope flying, Bill Carlton of Stroudsburg, Pennsylvania may be able to direct you and can be reached at (717) 421-7858. JGS

My SG-38 PRIMIER

Photo by Raymond L. Cindric
44 Stockton Court
Newtown, PA 18940



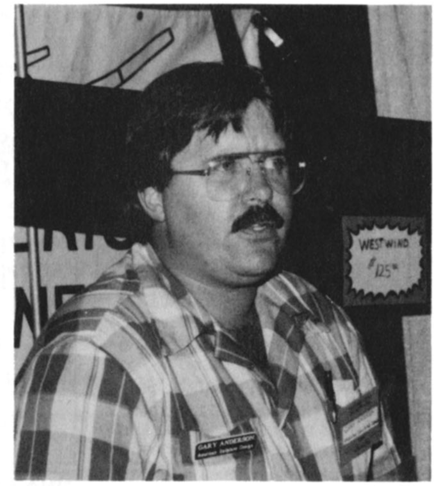
Behind the Scenes with Gary Anderson

...by Jerry Slates

American Sailplane Designs of San Diego, California is a small mail order supply house operated by a gentleman named Gary Anderson.

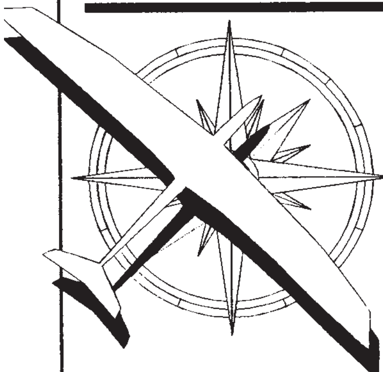
Gary specializes in glider kits and supplies for the enthusiastic glider guider. On his shelves, you will find many of the more popular kits and many kits that you might not be familiar with. These are the low production kits from cottage industries. They range from the Sportsman F3B type to the 4 meter Salto, ASW-17, LS-3 and the 5 meter ASW-20, just to mention a few. Gary carries supplies such as stop watches, wing bags, winches, and too many more to list.

Gary is not only a businessman who knows what he sells, he is a builder and a flier, himself, and he will tell you the honest truth about every kit in his stock. He can be found anywhere, from the slopes of Richland, Washington to the flatlands of Visalia, California. So, if you see a Dodge van full of gliders and a big man at the wheel, check out your local flying field, because Gary Anderson may be, too.



Above: Gary Anderson at Pasadena.
Below: Gary's at Richland.

NorthEast Sailplane Products



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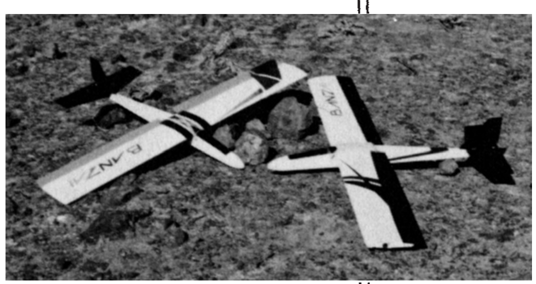

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