R/C Soaring DIGEST

Vol. 6 No. 11 November, 1989

The Computer Age & R/C Soaring

Computer Aided Sailplane Design

Airfoil Basics, Books, Reviews & More

About the Cover... page 1

Special Features:
- **Historical Basis for the "One - Design" Concept**
- **The MENKE Aluminum Spoiler**

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High Start

I hope you've noticed the improved quality of *RCSD* during the past few months: better photo reproduction, improved layout and graphics, better printing, etc. These have not been accidental!

Judy Slates, through her expertise with the computer, has lifted *RCSD* out of the "dark ages" and into the 21st Century, and is totally responsible for our improved image. As you have probably deduced, *RCSD* is now a desktop publication and has joined the many other publications using this form of production. Also, we have a new printer, effective with the last issue, and I think you'll see the gains that can be made by modern printing technology. For the first time, all of the many segments of publication have integrated which means a better digest for our readers.

The next step will be to modernize the mailing procedures and bring those under the same corporate "roof" as the rest of the publishing and printing functions...for YOUR benefit.

While kudos are being awarded, I'd like to mention that *RCSD* is one of the few — if not the only — reader-written publication in existence. A great big THANKS is due for Your articles, photos, letters, ideas and suggestions which have been contributed graciously, promptly and freely — an astonishing thing in today's society. Your efforts have reinforced our original premise: the widest possible dissemination of information vital to R/C soaring; and I think it's time for me to again pass along my appreciation to YOU, our readers, for making it possible. I wish I could share with you all the letters of praise and appreciation we get from readers around the world. We are now 1200 subscribers in 16 countries, and the "passalong" is probably at least 2:1 which means that for every subscriber another two or more individuals see *RCSD*...and we're still growing!

By removing the publishing load from my shoulders, Judy and Jerry Slates have given me that extra bit of time to do a better job of planning, letter- answering, and guiding *RCSD* into the 1990's. More improvements are coming, so "stay tuned!"

Happy Soaring,
Jim Gray

About the Cover...

My Newly Completed GRUNAU BABY II ...by Stanley B. Koch 180 Carnavon Pky. Nashville, Tenn. Although a relatively difficult kit to build, it turned out reasonably well. It's 1/4 scale with a span of 11'2", and weighs in at 10 1/2 lbs. which includes 2 1/4 lbs. of ballast in the nose (to balance). The controls include rudder, elevator, ailerons and spoilers. I am using the new Vision radio and, man, this is the only way to fly! What a piece of equipment!

My wife, Doris, is having trouble holding 'Baby' up.

How to Build an Aluminum Spoiler from...

Jer's Workbench

Harry Menke of Santa Rosa, California has come up with an aluminum spoiler. It is clean, easy to make, inexpensive and reusable.

This month I'd like to share some thoughts with you about that rack of aluminum stock that you have probably seen in the back of your favorite hardware store. Over the years I have looked at that same stack, myself, and knew that it was good for something, but wasn't quite sure what that something was...

The MENKE SPOILER

Harry Menke of Santa Rosa, California has come up with an aluminum spoiler. It is clean, easy to make, inexpensive and reusable. It addition to all this, it won't warp, crack or bend when painted or covered with my favorite heat-shrink material.

Construction

I followed Harry's instructions on building the spoiler:

Step 1: Select 1" aluminum angle stock.

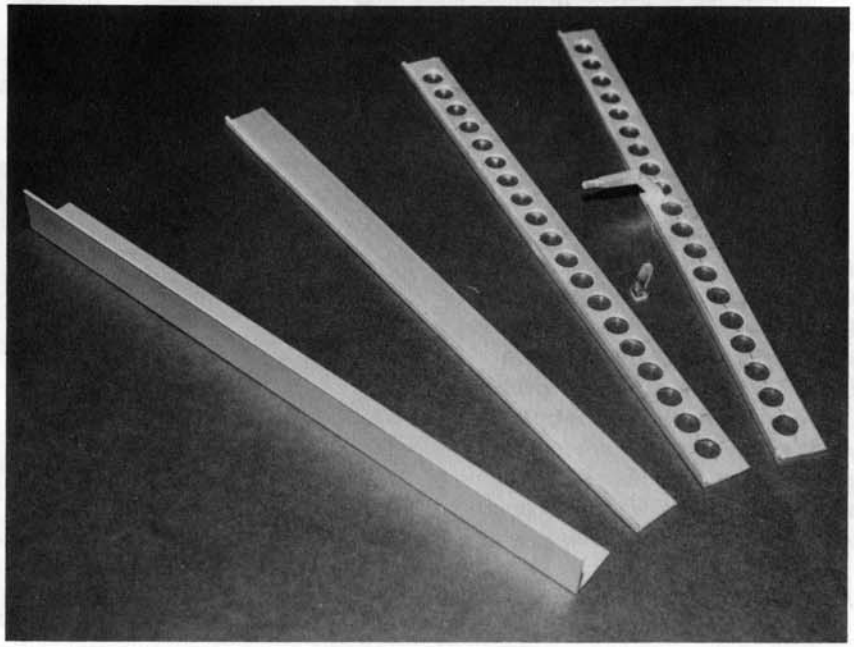
Step 2: Cut to the desired length. Cut off one side of the angle stock. (Note: aluminum cuts very easily.)

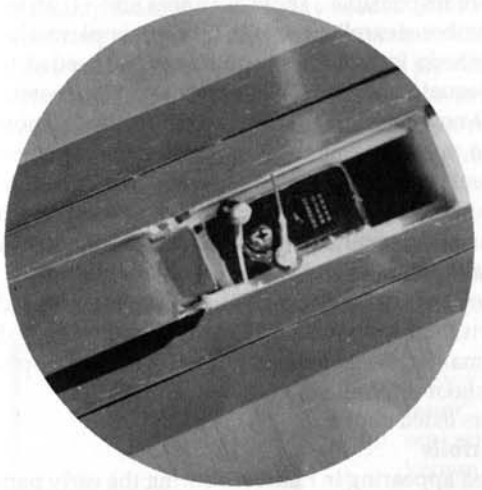
Step 3: Drill 3/8" lightening holes. (This is not required, but it looks neat!)

Step 4: Deburr each hole by running a counter-sink into each hole on both sides. File the ends.

Step 5: Fashion your control horns (make 2) from printed circuit board. Cut to fit your wing.

Step 6: Install the control horn using Hot-Stuff and baking soda.



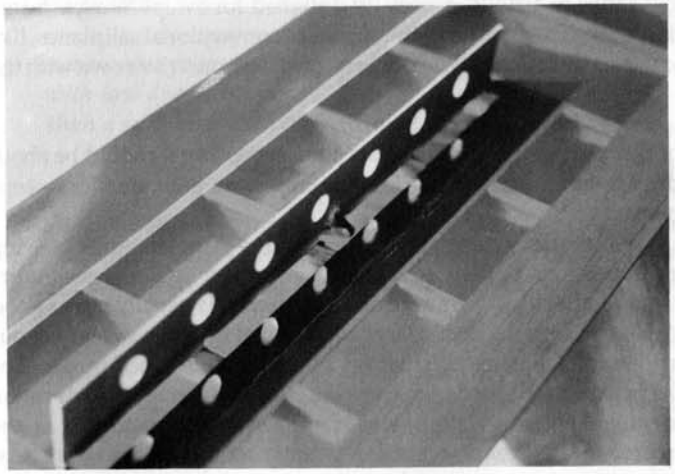


The Resulting Strength

I did a bit of testing to see what it would take to break the control horn off the aluminum. Using a pair of vice-grips, I bent the spoiler before it parted from the control horn.

Installation

At Harry's workshop the MENKE SPOILER was installed into the wing using a tape hinge. According to Harry, the thing that makes the spoiler work really smooth is the use of cable for a push-pull action (no pull string). See photo at left.



Harry constructed this spoiler, moving it back about 70% from the leading edge, so that the glider won't pitch over into a nose-down attitude. In this position, the spoiler becomes an air-brake. It works very well with full control.

A Closing Note

The MENKE SPOILER has been around for a long time. Since the next few months will be dedicated to special tips and how to's...if you have something in your workshop that you would like to share with the readers of *RCSD*, drop me a line or give me a call. I'm also available for questions, suggestions and for providing directions on getting to the local club soaring sites (But, I don't like doing windows...I'd rather be soaring!).

Jerry Slates
2026 Spring Lake Drive
Martinez, California
94553
(415) 689-0766

On The Wing

...by B^2

Swept 'wings now offer the strength to survive and take advantage of full power winch launches. They are stable, maneuverable, and capable of high speed.

Swept 'wings have gained in popularity over the last few years, and it is our opinion that several technological advances are responsible. These advances are: (1) an increasing number of excellent airfoils, (2) very simple mathematical methods for computing the washout needed to provide adequate stability, (3) better construction materials, and (4) new and better construction methods, most notably the vacuum bag technique. Because of these improvements the performance of swept 'wings has increased dramatically. Swept 'wings now offer the strength to survive and take advantage of full power winch launches. They are stable, maneuverable, and capable of high speed. In short, they are now very nearly the equal of their tailed counterparts, and it may not be long before they exceed that performance. When the latter does occur their popularity will shoot up even more!

Let's take a look at each of the four factors listed above...

Airfoils

Radio controlled swept 'wings first started appearing in numbers during the early part of this decade. Airfoils used included the then new Eppler 174-186 series. More popular now is the Eppler 222-230 series of airfoils, especially designed for swept 'wings. Some flying wing enthusiasts have taken to modifying the airfoils of conventional sailplanes, like the Quabeck sections, for use on their wings, while others have designed their own with the computer assistance.

Wing Twist & Stability

It seems to be a rule of thumb that the quarter chord line sweep angle should be about 20°. Larger sweeps produce large amounts of detrimental cross span flow, smaller sweeps require more twist or reflexed sections.

In an effort to obtain stability, many designers have included large amounts of wing twist, along with reflexed tip sections, in their designs. While providing the large amount of stability the designer intended, the performance of these aircraft is usually not as good as anticipated. Heavily reflexed sections create large amounts of drag (as we saw in our discussion on planks), and excessive wing twist works against a wide speed range. The individual looking for the performance needed to compete effectively in thermal duration contests and F3B tasks will likely use airfoils which are nearly symmetrical, as the combining of undercambered and reflexed sections inherently requires more twist. Maneuverability and maximum speed range come through measured decreases in stability, not increases.

Construction Materials

Swept wings can make good use of new construction technologies. Two compatible goals are now being achieved with the use of composite technology — reduced weight and increased strength. The use of foam core wings is but a first step when constructing a swept 'wing. Diagonally oriented fiberglass skins, obechi veneers, Kevlar for high stress areas, and carbon fiber spar systems can all provide strength far in excess of conventional balsa and spruce construction. Well designed composite structures using these materials weigh substantially less than their wooden counterparts, while providing great increases in structural strength.

(Installing arrow shaft hinges can provide another quantum leap in both appearance and performance.)

Construction Methods

Using a vacuum bag system saves even more weight by reducing the amount of epoxy needed, it also integrates the structure and nearly eliminates paint and other weighty finishes. Additionally, vacuum bagging provides the builder with a straight, true, and accurately constructed aircraft. Vacuum bagging a composite aircraft can result in an incredibly strong flying machine with astounding performance.

♣ ♣ ♣

Readers interested in airfoil coordinates and/or computer programs to assist in swept wing design can obtain these by sending their request and a SASE to us.

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

Flys Faster

...by Michael Selig

Ever wonder why a sailplane with low drag "flys faster" than a sailplane with high drag?

Ever wonder why a sailplane with low drag "flys faster" than a sailplane with high drag? Probably not, since it makes perfect sense. From the well known equation for the lift:

$$L = \frac{1}{2}\rho V^2 S C_L \qquad (1)$$

we can write:

$$V = \sqrt{\frac{2\,W/S}{\rho\, C_L}}. \qquad (2)$$

This equation shows that the speed depends on the wing loading W/S, the density ρ, and the lift coefficient C_L. The speed does not depend on the drag — a result that does not seem to make the perfect sense we expected. The equation is correct, but the approach is incorrect.

The flaw is related to what is meant by "flys faster". When we directly compare two sailplanes in flight side-by-side, we fly them at approximately the same glide slope (or L/D). In other words, we do not match the lift coefficient C_L, but rather the L/D which equals the ratio C_L/C_D. For the two aircraft, this requirement gives:

$$C_{L1} / C_{D1} = C_{L2} / C_{D2} \qquad (3)$$

where the subscript (1) refers to the sailplane with the lower drag and (2) the one with the higher drag. (Except for this difference in drag, the sailplanes are identical.) Equation (3) gives:

$$C_{L1} = C_{L2}\,(C_{D1} / C_{D2}) \qquad (4)$$

Since $C_{D1} / C_{D2} < 1$, we get $C_{L1} < C_{L2}$. Thus, through equation (1) for the speed V, we find that the speed of the aircraft with the lower drag (flying at C_{L1}) is higher than the aircraft with the higher drag (flying at C_{L2}) — a result which agrees with the right answer.

Michael Selig
233 Hammond Bldg.
University Park, PA 16802

The Historical Basis for... The One Design Concept

...by Jim Gray

It began in the late 1930's when a competition for the design of a new sailplane to be chosen for a new category of Olympic competition — soaring — was held in Europe....

In the late 1930's a competition for the design of a new sailplane to be chosen for a new category of Olympic competition — soaring — was held in Europe. The winner was Hans Jacobs 'Meise, later called the OLYMPIA. There were three or four entries by different manufacturers, including the Polish Orlik, but the superb handling characteristics, decent performance, and overall construction advantages won the day for Germany. The OLYMPIA (Meise) was put into production and would have been THE sailplane for the 1940 Olympics to be held in Finland. However, WWII came along and put a stop to Olympic games for the duration.

Nevertheless, the one-design concept did not die. Instead, after WWII, Schweizer Aircraft Corporation of Elmira, New York, the only sailplane manufacturer in the United States, and the Soaring Society of America proposed that the one-design concept be resurrected in America. At the time, many war surplus sailplanes were available for the pilots to fly — at extremely low prices for a surplus machine. The TG-4A (Laister-Kaufman LK-10A) and the Schweizer TG-2 and TG-3 models were some of those available. However, none of the war-weary types was really suitable. Spare parts were becoming scarce, and their ability to be dismantled and re-assembled was not all it should be, as ground handling was a chore. Further, they were not really suited for a pilot of every country to fly, as they existed only in the United States — hence were unsuitable for one-design. Not only that, not enough of them were available in quantity by this time to even consider proposing their use. For all the above reasons, these WWII surplus machines were not even in the running for a one-design sailplane.

After the war, it took about five years or so for the soaring movement to really get going again, and by that time Schweizer had introduced their new 1-23, but had not given up on the one-design idea. The Schweizer 1-23 series, though very good, did not lend itself to one-design because of its complicated all-metal construction and consequent cost that required extensive factory tools and jigs to build. What was needed was a simpler, less expensive sailplane that even a homebuilder might assemble from factory-supplied parts.

The 1-26 was the answer. A simple, easy-to-fly sailplane of modest performance and low price, the 1-26 was born on the drafting board of Ernie Schweizer (President and Chief Engineer of the company) in 1952. The first flight of the prototype 1-26 took place in January 1953. With a weight of only 350 pounds and small dimensions (40-foot span) plus an L/D of about 23 or 24:1 and a minimum sink rate of between 2 1/2 - 3 feet per second, the 1-26 seemed to meet all the requirements...except that it was a U.S. design, and the Europeans had already begun their post-war gliding and soaring. English, French and German factories had begun cranking out different varieties of wooden sailplanes...one of which interestingly enough was the OLYMPIA-Meise, redesigned to British standards and produced by Elliotts of Newbury. It was called the OLYMPIA IIB or EON OLYMPIA and still possessed the wonderful handling and performance of the original, but it was even easier to tow, land, and especially handle on the ground because it had a wheel.

Meanwhile, the U.S. soaring movement, typified and dominated by Schweizer sailplanes, had switched to all-metal designs.

"One-design" was DEAD, because nobody strictly maintained the concept as originally proposed. They all built "rule beaters" — something that has often happened in sailing where one-design began...

The "one-design" concept was very much alive in Europe, and a fifteen-meter class of sailplane was once again proposed by the soaring sub-committee of the FAI, with OSTIV chosen to evaluate the designs put forward by various countries to meet the new criteria. Once again, the idea was low cost, reasonable performance, volume production, and ready availability with good handling and safety into the bargain. These were to be called the "standard class" and the Schleicher Ka-6 was an early example of the concept reaching its fruition in an all-wood machine. Later, the Polish Foka, and numerous others were designed to the same criteria and concept...but the Ka-6 was the first post-war winner on the one-design class. Unfortunately, the Olympic Committee did not see fit to re-propose soaring as an Olympic game, but the idea of a one-design machine still existed.

Along with the SSA's desire to get soaring going again in the U.S., and the fact that Schweizer developed the 1-26 as a one-design class, brisk sales for this sailplane began quickly, and the first 1-26 one-design "regatta" was held in 1956 with 20 entries. The 1-26 and the idea of a one-design class existed simultaneously and by original intent, and not because "people already had the 1-26", as some sources have suggested. Indeed, people DID buy them specifically to compete in the class they were designed for! At that time, there were few sailplanes available to the American sailplane pilot, but even if there had been more, the 1-26 had the advantages of decent performance, safety, and rugged all-metal construction, besides the fact that it was available and met the criteria for "one-design". Later, when pilots did have a choice among European designs in the standard class, things got way out of hand, and — because the one-design concept was not strictly maintained — the standard class split into the fifteen meter class and the fifteen-meter racing class...something that got so far away from the one-design concept that pilots could no longer compete with each other on an equal basis, even though they could enter contests with many different machines all having a fifteen-meter span. "One-design" was DEAD, because nobody strictly maintained the concept as originally proposed. They all built "rule beaters" — something that has often happened in sailing where one-design began — and cost became prohibitive for most potential contestants.

Fiberglass Sailplanes

It was later that the Germans began their construction of fiberglass sailplanes. Incidentally, that was an American idea I proposed back in 1956 in an article in *Soaring* magazine, but it took a few years for the idea to catch on even in Europe, where they were far ahead of the U.S. in the use of that relatively new material.

R/C Soaring

If the 1-26 concept were to be applied to R/C soaring, Gentle Ladies (sic) would NOT dominate the class, as at least one

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A limited number of back issues of *RCSD* are available. They can be obtained, while they last, by writing to *RCSD*, P.O. Box 1079, Payson, AZ 85547.

Year	Month(s)	Price/Issue
1985 1986	Nov & Dec Jan Apr - Aug	$1.50 3rd Class or $1.75 1st Class
1988 1989	Aug Feb - May July - Oct	$2.00 1st Class

The One Design Concept

...continued

This would seem to indicate that it's not what you fly, but how you fly it.

critic has publicly suggested, because when I proposed the idea initially last fall in *RCSD*, there were much more exotic machines available. Might I point out, however, that there is absolutely nothing wrong with having a one-design class based on the Gentle Lady!

Pilots, not sailplanes, win contests...and when you try to fly a Gentle Lady against a Falcon 880, there is no contest. BUT, if you were to put all pilots into, say, a Falcon or a Pulsar or a Camano, then PILOT skill would establish the outcome...and that gets us right back to the correctness of the one-design concept: absolute fairness in the choice of weapons for the duel. The reason that most sailplane pilots DON'T WANT one-design is that they are constantly seeking something "better" in the nature of a machine that they can use to beat whatever competition happens along. Fairness or fair play has NOTHING to do with it, as has been made amply clear by the lack of interest in one-design competition.

The 1-26...a most pleasant machine to fly.

Today there are nearly 1,000 of them in existence, including the original few that came off the Schweizer production line. Consider, then, that this successful design has now been in existence for 35 years and is still going strong! It is one of the safest sailplanes ever built, and dozens of complete diamond badges have been won in the 1-26. Of course, in the light of what has transpired in the past 35 years, in terms of materials and airfoil design, it is easy to say that 1-26 performance is "highly limited", but it almost ideally met the criteria for one-design at the time of its conception...and still does!

A Background in Soaring

My background in full-size soaring long preceded my background in R/C soaring, and goes back to the early 1950's. I have over 1,000 glider flights in various sailplanes and have a Gold Badge with a single diamond...earned in a sailplane of "highly limited" performance which I flew for 200 miles over the mountains to the Atlantic coast of New Jersey. Although the flight was in the 1-23D model Schweizer, a predecessor to the 1-26, many 1-26's have flown the same route to earn their goal diamonds for their pilots. This would seem to indicate that it's not what you fly, but how you fly it—emphasizing the pilot rather than the sailplane...the intent of a one-design class.

Pilot Error

October Issue — Address Correction

The product review of PC-SOAR, done by Doug Klassen, shows an incorrect address. The correct address for Doug is:

4038 South Lebanon
Tempe, AZ 85282

Our apologies to Doug and anyone trying to reach him.

WORLD F3B CHAMPIONSHIPS
*** PARIS, FRANCE**

TOP TEAMS	TOP INDIVIDUALS
1. Austria	1. Nic Wright
2. Netherlands	2. Peter Hoffman
3. West Germany	3. Joris Ten Holt
4. Great Britain	4. Karl Wasner, Jr.
5. United States	5. Reinhard Liese
	7. Seth Dawson
Via the SBSS *Silent Flyer*	10. Larry Jolly
	31. Rick Spicer

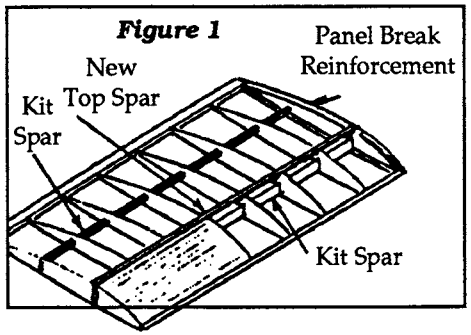
Gentle Ladies

...by Bill Miller

via Capital Area Soaring Association Newsletter (CASA)

The Gentle Lady is a popular first sailplane for many good reasons. The kits are readily available at reasonable prices, they go together well, and they are quite docile in the air. If you build the airplane exactly per the plans, it will work well. Nevertheless, there are things you can do with the basic kit to improve the airplane.

Since you are reading this article, it is safe to assume that you have at least an acquaintance with CASA. This means that you have met some people who know what they are doing with RC sailplanes. Take advantage of their help. Everybody was a beginner at some time, and we all remember what it was like at first.



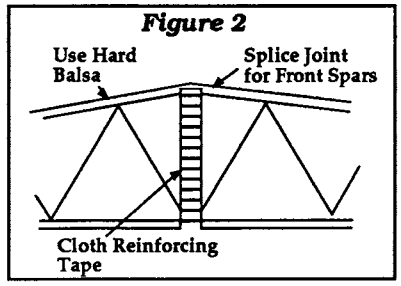
Assuming you have just gotten your Gentle Lady kit, also get two 48" long pieces of 3/16 by 3/32 spruce. If 3/16 by 3/32 is not available, go a bit larger rather than smaller. When the time comes to build the wings, install them as top spars. Figure 1 shows the installation. The top spar stiffens and strengthens the wing, thus making launches a little less frightening. It also eliminates the "starved horse" look the covering would otherwise take on the wing.

If you are going to use removable wing tips, add a 1/4" wide reinforcement around the edges of each rib at the panel breaks. Figure 1 shows this. Make the reinforcement out of scraps from the kit. This reinforcement will prevent the panel break ribs from distorting when the covering is put on the plane.

I have found from experience that in bad landings, the most vulnerable part of a Gentle Lady is the horizontal stabilizer. The kit instructions say to use the hardest pieces of wood on the leading edge of the stabilizer, and they mean it. I have gone two better. Figure 2 shows a splice joint to use where the leading edge spars join. In addition to using the splice joint, I put a layer of reinforcing tape over the stabilizer center platform; this keeps the platform from splitting during a bad landing.

So far, we have discussed things to do during construction. What if your Gentle Lady is already built? There are still a few things worth doing.

First, The as-designed pushrods tend to buckle when the plane is flying at speed. For normal Gentle Ladies, this means that right turns and up elevator will both be sluggish when flying fast. If the servo can travel to the full right rudder or up elevator position while the associated control surfaces are held in position, then the pushrods are buckling. Replace the 1/4 by 1/4 pushrods with 3/8 by 3/8 by 1/16 hollow pushrods, or make the existing pushrods 5/16 by 5/16 by gluing strips of 1/16 balsa to two adjacent sides of the existing pushrod.



You may find (as I did) that your Gentle Lady requires a considerable amount of up elevator trim to fly level. If so, you might consider raising the

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Airfoils for the R/C Sailplane

...by Randy Reynolds

via
The Spoiler
(Journal of the
Pikes Peak Soaring Society)

"The point we have been trying to make is that a reproducible airfoil with moderate performance characteristics is going to be superior to the latest exotic section with wild undercamber and a thin trailing edge that has been poorly made. If you accept that point of view, then let's look at some recommended airfoils for various situations.."

The time has come for you to select an airfoil. Ten years ago this was no problem. Just use the templates from your old world beater or "french curve" one from scratch. What the heck, they all had a flat bottom and looked about the same, didn't they? But these days, half of the .... sessions you get into seem to revolve around the relative merits of exotic computer aided design programs as used by mysterious fellows with Northern European surnames. What to do?

Lets try and simplify things a bit and screen out some factors that might make research and selection efforts a moot point. First, if you are going to use an open bay structure, it is probable that you needn't worry about the finer points of selection characteristics since this construction method is not precise enough to produce any but the most gross of predicted performance. Second, if you prefer lightly loaded ships with very moderate range requirements or if you fly from very confined flying sites, then your needs probably won't require a sophisticated airfoil. Finally, recognize that a commitment must be made to precision craftsmanship in order to realize the benefits of computer designed airfoils. One of my flying buddies maintains that there will be as much difference between "identical" wings with the same airfoil fashioned by two different builders as there are between various airfoil designs! I realize this might take some of the romance out of armchair designing, but there are still some theorizing left for us "gas baggers". Take heart, and read on.

Now on the other hand, if you like to fly aggressively, have the need to cover a lot of territory and are willing to develop accurate building techniques, then you can justify spending those long winter evenings educating yourself in the esoterics of airfoil dynamics. Wind tunnel data is suggesting that predicted performance differences between airfoils begins to be reliable around the Reynolds Number 200,000. With the chord lengths we use, that would mean the higher flying speeds normally associated with aggressively flown L/D/ ships. This article will not attempt to venture to the brink of technical aerodynamics as those inclined that way will find superior resources already published in *Model Aerodynamics* by Martin Simons, *Soartech* publications by Herk Stokely and numerous *Model Builder* columns by Bill Forrey. Rather, we will spend our time on the practical realities of airfoils relating to AMA thermal soaring.

Sheeted Built-Up Techniques

The nature of this technique relies on a flat pinnable work surface and, therefore, the physical nature of the section should co-operate with these limitations. Flat bottom airfoils such as the Eppler 205 or the Selig 3021 are proven performance winners and can be reproduced accurately with conventional hobby techniques. Both of these airfoils are highly recommended.

Composite Techniques

Composite techniques, otherwise known as "foam wings", will handle undercamber easily and probably more accurately, given equal craftsmanship, than built-up techniques. There are still considerations of trailing edge reproduction and, if you are using balsa sheeting, you should avoid the thin, curved variants. Try the Quabeck 2.0/9 or 2.0/10, Eppler 374 or Selig 4233. If your technique allows accurate, straight trailing edges, then the Quabecks with higher camber, such as the Q2.5/9 or the Selig 4061, are good ones.

High Lift, Moderate Range Airfoils

For the pilot who prefers or requires the ship best suited to searching closer in and features maximum still air times, then the following airfoils seem to have proven their worth: Selig 4061, Eppler 214 and Selig 2091. All feature difficult trailing edges and pronounced undercamber. The Selig 3021 is close to these airfoils for maximum still air times, but is easier to duplicate.

Moderate Lift, Low Drag (L/D) Airfoils

Thanks to F3B, we have more confidence in airfoil selection for this category. Again, the Quabeck sections can be recommended: Q2.0/9 & 10 and the proven Q2.5/9. The Eppler 374 and Selig 3021 would be excellent choices, also. By the way, the use of camber changing seems to have lost favor in thermal mode due to efficiency losses. Most F3B pilots are using it primarily during launching and landings, although some will set up a configuration for distance flying. Therefore, the need to select an airfoil designed for camber changing for AMA thermal flying would seem inappropriate. The use of flaps with elevator compensation is extremely useful for our AMA ships for all of the same reasons F3B people use them, but I don't believe that a special airfoil is required.

Thick Airfoils

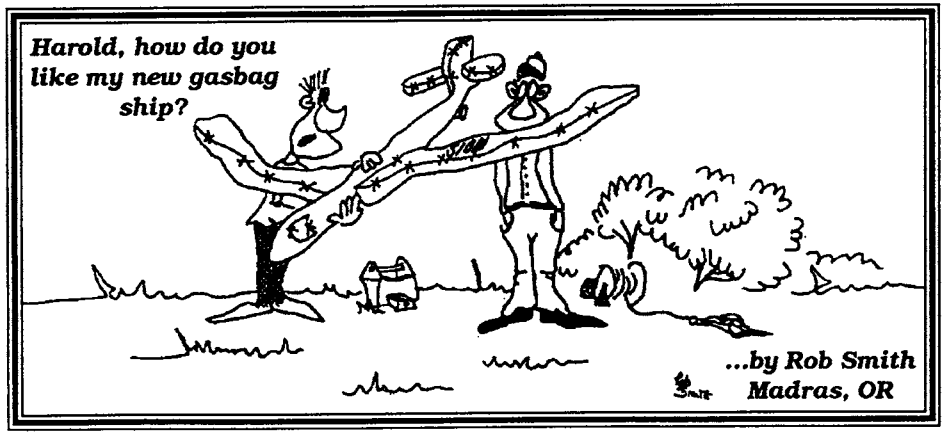
Why thick airfoils? Some of us believe they launch better, have better stall characteristics and feature great strength without the need for exotic construction techniques. Finally, they contain lots of room for internal servos, ballast tubes, hinge mechanisms, etc. The justification for their use would seem to be for working small, patchy lift or for confined flying sites where a lightly loaded thick wing could maneuver without danger of stalling out at high angles of attack. If your club has hot winches or you just plain like to do zoom launches, then the extra margin of safety offered by the thick airfoil might be for you. Good performers here would be the Selig 4233 (13.6%), the Quabeck *...continued on page 12*

Gentle Ladies

...continued

leading edge of the wing about 1/8 of an inch. Try this as a temporary modification at first, and if you like it, make the modification permanent.

Keep the center of gravity of the plane at the forward edge of the range given to the Gentle Lady plans. Mark this range on your plane, and check the c.g. location after doing any work on the plane. Don't be afraid to add lead in the nose; this isn't a Free Flight plane.



Airfoils for the R/C Sailplane ...continued

2.5/12 or the MB253515. The Selig 2027, which is a refinement of the Bame MB253515, is a good choice, also. The Eppler 374, at almost 11%, is close enough to "thick" to be considered here, as well.

Special Situations

• **High Aspect Ratio** — Performance gains utilizing high aspect ratio are well known. The thick airfoils would be a natural for this application. The writer has always wanted to try a 20:1 wing with a Selig 4233. This would still yield a wing with enough strength to launch well and should be a good performer.

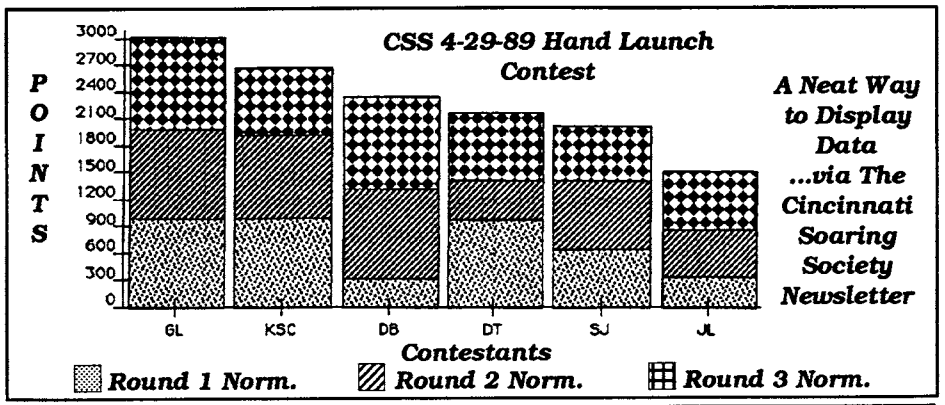
• **Low Aspect Ratio** — My experience with low aspect ratio wings indicates that they like to be flown fast and that a development need is to refine the tip airfoil/tip shape combination to improve efficiency losses due to vortice flow. How about a thin 8% airfoil? The Quabeck 1.5/8 would promote the faster flying speeds and, of course, since the airfoil is large in size, it would still retain plenty of strength.

• **Low Reynolds Number Chords** — Typically, we associate hand launched gliders with low Reynolds Numbers. For these ships, the Selig 4061 seems to be gaining favor, although the Selig 3010 and 3021 should work beautifully, also. Of course, the tip of a standard wing often features the same low Reynolds Number condition as a HLG, and perhaps some experimentation with foam wings could develop an airfoil "Streak" whereby the smaller tip could transition to one of the proven low Reynolds Number airfoils. Just the ticket for experimenters!

Conclusion

There is a lot of romance about airfoils...and there are a lot of airfoils! But, the practical reality is that there are probably not significant realizable gains between most airfoils within the families described above. There are recognizable differences between the families, however. It is worthwhile to learn about the published theoretical data regarding airfoils for R/C soaring since it is becoming apparent that predicted performance can be attained in real life. As we learn to replicate these sections accurately, our sport/art will find new levels of performance.

Personally, I hope we never find the best airfoils, the best tip shapes or the ultimate planforms since this would remove much of the mystery that seems to drive the creative juices of so many of us. Also, there is nothing like an unresolvable argument over these topics to add zeal to what we do. Just remember, This ain't rocket science, it's just a video game in real time. Good Lift!



Book Review

The Compleat Airfoiler

...by Jim Gray

Yes, they are in German text, but the data itself is in the universal language of mathematics and computers.

I just received from Germany four soft-cover volumes of airfoil information: "HQ Profiles for Thermal, Slope, Electric and Giant Sailplanes"; "NACA Profiles"; "Eppler Profiles"; and "Profile Collection for Model Aircraft". Each soft-cover book in an 8-1/4" x 11-3/4" format is jam-packed with the kind of things you can really use. For example, the Profile Collection for Model Aircraft contains 208 pages of airfoil data. There are twelve full-size plots from 4-3/4" to 10-1/4" of each airfoil covering Wortmann, Benedek, Isaacson, NACA, and many others — PLUS the X-Y plot data for computing and printing your own versions.

The NACA Profile book in the same format contains 55 pages with all of the popular sections including the symmetrical ones. A complete section at the beginning covers information about the NACA designations, how they were derived, and what they mean...as well as how to change them to suit your needs.

The HQ (Helmut Quabeck) Profiles contains 71 pages of information about the famous and much-used Quabeck series of airfoil sections. Once again, you get the computer data as well as the full-size plots plus explanations of airfoil characteristics for the various groups - with and without flaps.

The Eppler profile data is perhaps the most comprehensive of the books and contains 176 pages. You get most of the well-known Eppler 'foils, the computer data, the full-size plots, and lift-drag curves. Besides all that, a rather complete exposition of how these sections are derived and how they are used...along with practical examples. A table is included that suggests which airfoil to use for your intended purpose.

I did not receive a price sheet for each book, but would suggest that you contact the publisher as follows: Fachbuchservice, Verlag fuer Technik und Handwerk GmbH, Postfach 1128, 7570 Baden Baden, West Germany. You can correspond with Frank Shwartz in English. My guess is that each book will sell for about $10-$15 U.S. currency, by airmail. Yes, they are in German text, but the data itself is in the universal language of mathematics and computers. If you don't want to bother with reading or translating the information, then you can just draw around the curves and cut out the ribs or make the foam cutting templates for the airfoil of your choice. I've been asked by many people where this information is available, and now you have it.

New Generation Airfoil

via The Silent Flyer (South Bay Soaring Society) Newsletter

The Selig-Donovan wind tunnel testing has produced some new, better airfoils, which have not yet been published. The SD-7032 is one of them. This airfoil has been created specifically for the Reynolds Numbers that RC sailplanes typically fly at — less than 100,000. It is said that the 7032 has a 20% better L/D than the Eppler 214 (the airfoil used by the Windsong). If this is true, it represents a significant advance in airfoil design!

Ace RC is reported to be kitting a new design by Harley Michaelis, of Walla Walla, using this airfoil. It is a 2-Meter with construction much like the Gentle Lady, which incorporates optional flaps for better launches and landing control. Harley claims that it is the fastest climbing airplane he has ever seen! It will be exciting to see the full published results of the Selig-Donovan tests when they come out in *Soar Tech*, possibly this next Fall.

Software Review

SAILPLANE DESIGN 3.0

...by Doug Klassen

Features of Sailplane Design 3.0

- L/D and Sink Speed graphs
- Complete printouts of sailplane performance
- Comes with over 100 airfoils including all the Princeton Data
- Input new airfoil data anytime
- Change sailplane configuration at will (weight, area, span, etc.)
- Easy to use — 49 page user's manual
- "Bullet proof." Make a misteak? No problem — press <Esc> and keep on going.

David Fraser has recently released a new version of his program for estimating the performance of sailplane designs. The program is written for the IBM PC, PS/2, and compatibles. It is available on both 5 1/4 and 3 1/2 inch diskettes.

The manual is complete and to the point. It takes you, step by step, through an explanation of the program's general operation and how to produce a graph...the fruit of your labors.

"I'm not sure that this short review does Dave's program justice. I think that it is fantastic!"

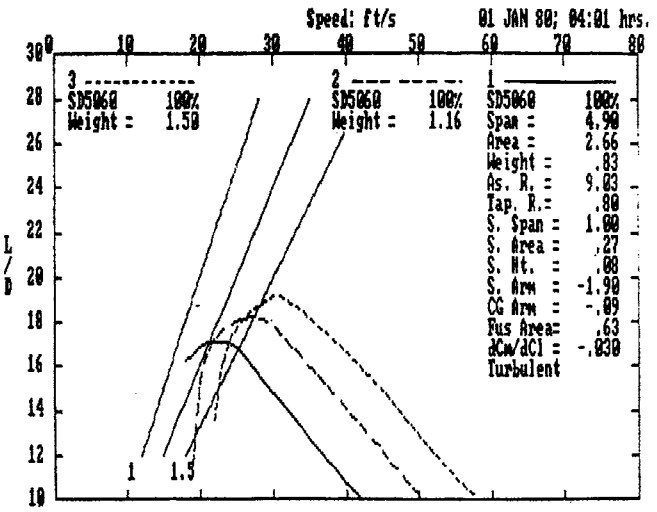
Basic operation of the program involves selecting one of eight commands, from one of five menus on the bottom of the screen, with the function keys. When a function key is pressed, the program asks the necessary information for the selected command, the results appear on the screen, and the computer waits for the next command. Text or graphic data is left on each of their corresponding screens until you request that the screen be cleared or you select another function. You may plot up to three variations of your glider on a single performance graph.

Now, what is so special about this program? Besides being very useful in computing performance and stability, and being very easy to use, it comes with Mike Selig and John Donovan's wind tunnel data INCLUDED! This is the largest, and I feel the most accurate, set of data ever compiled on modern, and a few not so modern, low speed airfoils. No performance estimate is any better than its database, and this program has the database needed. The program also has features for digitizing or typing data for additional airfoils, but these features probably won't get much use.

I entered the data for a hand launch design I've been dreaming about for a while, and I found I had used the wrong airfoil and made the stab too large. By reducing the stab size and moving the CG forward to achieve the same stability, the glider would perform better. Calculating relative performance is what this program is for. Absolute sink rates and glide ratios may be off by a percentage, but it should do an excellent job of computing which configuration or variation will perform better.

Also available from Dave is a disk containing performance, and coordinate data of the airfoils in his program. This disk can be read by most any word processor and is available for the Macintosh computers as well as the IBM. This data may be needed to plot your ribs or templates after you finish designing your new bird to take on the world champions.

Graph Example: Final Design at 5, 7, and 9 oz. per sq. ft.



Doug Klassen
4038 South Lebanon
Tempe, AZ
85282

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Electronically SPEAKING

...by Doug Klassen

The Computer Age is here!

When I bought my home computer I, for no particular reason, bought a modem to go with it. If you don't know what a modem is, it's simply an electronic device that allows one computer to talk to another over the telephone lines. This may not seem too exciting until you discover electronic bulletin boards (bulletin board systems or "BBS").

The BBS

A BBS is simply an electronic version of the old community bulletin board that you might find at a laundromat, corner grocery or employee lunch room. If you've got something to sell or say to the world in general, you post it on the bulletin board and, while the old Maytag is doing its thing, the patrons of the World O'Wash browse the notices, read what's there and, perhaps, leave a message of their own.

A BBS works exactly the same way, but the physical board doesn't exist beyond the confines of the "host" computer. Dial up a BBS (done right from your keyboard) and, after "logging on" (typing in your name, city, etc.), you can browse the message area and even more. The beauty of the bulletin board system is that it isn't limited to just the local folks. If you've got a computer, a modem, and a telephone, you can call bulletin boards all over the world...and people do! It doesn't even take a fancy computer. A friend of mine recently bought a used IBM compatible system with a printer for $300. With the addition of a modem at $50 to $150, he's in business.

You may wonder how many electronic bulletin boards there are.

How many people would dedicate the use of their computer to being a public message and discussion area? In Arizona alone, we have approximately 175 BBS's active 24 hours per day, seven days a week! I recently obtained a national BBS phone number list that was nearly thirty-five pages long! There's a bunch out there, friends!

What does this mean to model airplane people?

...continued on page 16

Electronically Speaking ...continued

Electronic BBS's are often times oriented towards special interest groups. That is, the general topic of discussion is directed towards a given area of interest. A board might be dedicated to discussions of outdoor sports and recreation, computer technical problems...or, R/C sailplanes. On most BBS's there are a number of message areas called "forums" or "conferences" with each conference dedicated to a particular special topic of discussion. Perhaps the best known BBS is Compuserve, a commercial system that contains over 500 different conference areas. Among model airplane people, the best known conference on Compuserve is called "ModelNet". Within ModelNet you will find conferences on R/C power planes, sailplanes, boats and rockets. Compuserve is a commercial venture, and there is a variety of fees involved in using the system. Their basic "on-line" charge is $12.50 per hour. About 95% of all privately run BBS's are...free. Yep, free. Just somebody's hobby, one person's window to the world. Call up, leave your name and number, and you're welcome to join the discussion. If you find a favorite BBS and want to donate a couple of bucks to help the system operator (SysOp) keep it going, I believe money is cheerfully accepted.

Dieter Eberbach & His Large Red Monster

7.30 meters, tricky to fly & heavy for FAI Cross Country

Dieter writes, "There has been a great boom in the R/C gliding field with large numbers of new and old pilots flying, again. In our national mag. this last issue, I saw more gliding news than power which is a record in more than 12 years. Great stuff! The flying has been so-so in South Africa, but we are going into the good season. I have had bad luck on our field and smashed my K6e due to radio interference by a ham radio operator in our area, but we caught him. It seems I have damaged about $5,000.00 worth of planes, some of which are now "throw away". We all thought I had problems with batteries. Now we know. The K6e has been rebuilt, but it no longer is scale, as it now has a taper cut back on the wings."

Public Domain & Shareware

Beyond the message areas there are, among other things, file areas. In BBS-land a file is a computer program that is available for you to take...again, free of charge. Programs available run the entire spectrum from word processing to desktop publishing to computer aided design to games. A file or program can be either "public domain" or "shareware". A public domain program is one that is absolutely free to own and use. Shareware programs are programs that can be copied, looked at, used for a period of time and then, if you like it and continue to use it, you register it with its author. The fee is usually very nominal...in the area of $10 to $40. Compared to commercial programs like Lotus 123™ or Wordperfect™, that cost hundreds of dollars, shareware is a terrific bargain.

Model Airplane BBS's

Sorry, there's not thousands out there, but I have found three besides Compuserve. Three doesn't sound like much after all this build-up, but it's better than zero! And think of it...three places you can access from the comfort of your home and carry on discussions with modelers from all over the U.S. and even the world. You can't go to contests all over the U.S. and, even if you did, how many people could you really talk to? You could write a letter to *RCSD* or one of the lesser magazines, but what's the chance of it getting published let alone generating lots of answers and discussions that get back to you? Just about zip. With a BBS, your message is public. It's there for the whole world to see and comment back to you on. Like to discuss F3B or AMA policies? Post a message on the BBS. In no time at all you'll know whether your ideas and opinions are shared, interesting, controversial or just dumb. Here's the numbers for the BBS's besides Compuserve. (You can get their number at your local computer store along with a membership kit for about $26.00.):

Sam's Place, Gilbert, Arizona (602) 926-9276
The Hanger, So. California area (714) 740-0551
Int'l Miniature Aircraft Association BBS (201) 852-2584

Sam's Place is a general interest BBS run by Jim Schuring, an avid power plane modeler. He added the model airplane conference about two weeks ago, and about half the messages posted have to do with gliders. If he got enough input from sailplane people, we could probably persuade him to have a special conference just for soaring topics. Sam's is also my "home board" (the one that I call most frequently). If you would like to contact me and tell me how much you love my articles, you can leave the message at Sam's.

The IMAA BBS is for giant scale modelers (power, primarily), but with a bit of coaxing, they might find a spot for soaring people. You east coast guys might want to give them a call.

Out in California "The Hanger" is the only BBS I know of completely dedicated to R/C airplanes, and the primary emphasis of the board is soaring. You west coast guys should give them a call. You east coast folks can call too, and find out what is the latest hot topic in California.

Do you know of other BBB's or programs?

If you know of any other bulletin boards that feature a model airplane conference (soaring or power), drop a note to *RCSD* or leave me a message at Sam's Place. And finally, if you know of or have written a model airplane oriented program, let me know about it. I'd like to compile a good list of such programs.

In Summary

I've really just touched the high spots regarding electronic bulletin boards. It's a vast and fascinating subject that literally circles the globe. The potential for communication among modelers is enormous. Programs, ideas, even drawings can be shared and disbursed internationally in just a matter of minutes. The computer age is here. Join the fun.

High Tech Modeling

...by Lindsay Blair

Finished all your winter building? Looking for an excuse to put off winter building? Well, as it turns out, if you are so inclined, there are numerous projects that can be computerized. The only unfortunate thing is you've got to do it yourself. Modeling is not a high volume market, but programing can be both fun and relaxing.

You have been flying your latest and greatest for some time now but would like to know if some weight can be saved...

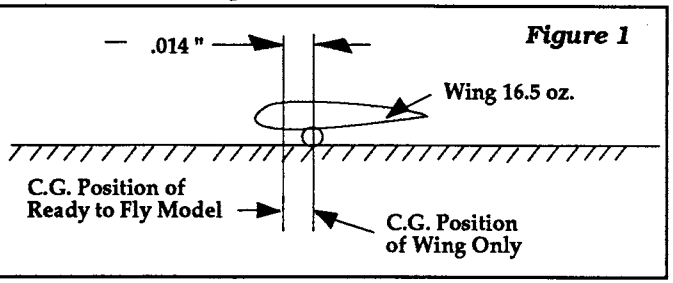


Figure 1

Figure 2

Item	Inches from CG	Weight (oz.)	Moment
Fuse	-5.43	7.75	-42.08
Wing	-0.14	16.50	-2.31
Stab	-23.88	1.70	-40.60
Engine	0.00	0.00	0.00
Nose Wt.	10.80	3.00	32.40
Rx	6.20	2.10	13.02
Bat	9.10	3.80	34.58
Servo 1	4.01	0.60	2.41
Servo 2	2.10	1.30	2.73
Servo 3	-0.25	0.60	-0.15
Servo 4	0.00	0.00	0.00
	Total	37.35	.00

Set-up

Since it is not so easy to arrive at 'dimension from C.G.' (e.g., fuse, wing), then adjust these dimensions until total moment is zero.

Principle of Use

To reduce nose weight:

a. Lighten stab.

b. Adjust nose weight until moment is zero.

This same technique can be used for a lighter or heavier engine, different placement of equipment, etc.

This time we will start with a small program. The first thing, as in all projects, is to have a clear idea in your mind what you want to solve. Only then can the problem of how to do it be explored. Next is what do you have, or what facts are known. Lastly, what facts do I want to know. This can take two forms:

(1) It's something I know, but want to change

(2) Something I do not know.

The Analysis Machine (A Simple Beam Balance)

The Problem: You have been flying your latest and greatest for some time now but would like to know if some weight can be saved by moving or rebuilding part or all of the components (e.g., build a lighter stab), and save some nose weight (or use a lighter engine).

The Facts: Since the model is finished and flying, note the center of gravity (C.G.) position of the finished model. Tabulate weights and C.G. of individual components. In the case of a pattern model with a fixed fin and stab, just measure it as a whole. It is, of course, far easier to measure the parts before the radio, etc. are installed. (Do it with every model as it is being built.) The easiest way to find the C.G. of a wing or fuse, etc., is to use a piece of dowel as shown in figure 1.

What this boils down to is that you require: the weight of the wing (16.5 oz.), and the distance from the C.G. of the ready to fly model to the C.G. of just the wing itself (-0.14 in.). This is required for all parts: engine, servos, wheels, wing, etc. The more parts you can subdivide into, the greater the flexibility of changes. The end result of this exercise is shown in figure 2, and produces a 0 (zero) total of moments (i.e., balanced).

The Program: Any spreadsheet piece of software can be used including the Public Domain (free) versions. The following list of coding is for LOTUS™ as used on an MS-DOS machine. The only difference between this and any other coding might be in the way formulas are specified (C5*C10 instead of @SUM(C5*C10)). **(Please contact Lindsay for coding.)**

The Results: Now that the spreadsheet is written (you did save it I hope) and you have a series of numbers entered, look at the bottom line. If the result is not 0, then some of the dimensions or weights are wrong. Usually, just a fraction of an inch can make a difference. Check the entries. Fudge whatever until the result is 0. Now you can print the results to keep as a reference or store in your computer.

What If: What if I had a lighter stab? Move Receiver battery? Heavier servo?

a) Enter new servo weight.

b) Observe that result is no longer 0.

c) Change position of new servos until result is again 0, or

d) Change anything...weight or position until result is 0.

Lindsay Blair
64 Starwood Drvie
Nepean
Ontario, Canada
K2G1Z3

Selig, Donovan, Fraser Airfoil Book

via Portland Area Sailplane Society (PASS) Newsletter

The following information is from USENET, a computer network of UNIX operating systems used in the scientific / engineering / academia world. Those of you with access (Intel, OSU, Sequent, Reed College, Tektronix, etc.) can follow the discussions in the "rec.models.rc" newsgroup:

Question

"Can anyone recommend a good book about airfoils? What I am looking for is something showing shape and performance graphs. I'd like to do some scratch building of slope soarers, so anything in that realm would be of interest. Thanks, -lex"

Response

"Lex, I was recently (past 2.5 years) involved in an experimental program at Princeton University. We tested more than 60 airfoils for RC sailplanes, but the data will be useful to anyone who flys model aircraft. Most of the airfoils are in the 10% thick range with 2% camber for soaring."

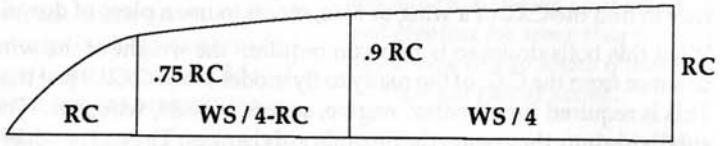
"The results will be published in a book form available from Herk Stokely (who by the way is editor of Soaring in FM) 1504 Horseshoe Circle, Virginia Beach, VA 23451."

"Ask for Soar Tech VIII by Selig, Donovan, and Fraser. The cost will be on the order of $20 (non-profit). For this you will get 300-400 pages of text, plots, airfoil coordinates, tabulated and polar data. — Michael Selig"

CAD Corner

Via Sierra Silent Soarers Newsletter

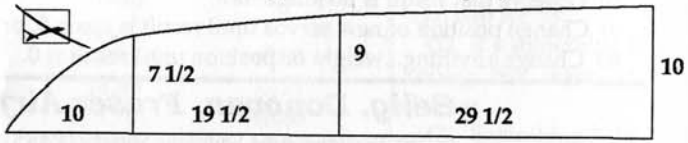
While I was designing a Schuemann wing planform for a 3 meter ship, I ended up with a mathematical relationship (formula) which gives me the root chord when I know the span and the wing area. The wing is shaped as shown:



The formula is: .468RC^2 - .888*RC*WS + WA + 0 where WS = span, WA = area and RC = root chord. This is a quadratic equation which has the basic form of Ax^2 + Bx + C = 0. For our example A = .468, B = -.888*WS and C = WA. You can calculate the root chord using your calculator or use the following BASIC program in your computer:

```
1000 PRINT "Solve quadratic equations"
1010 INPUT "Enter A" ; A
1020 IF A = 0 GOTO 9999
1030 INPUT "Enter B" ; B
1040 INPUT "Enter C" ; C
1050 D = SQR((B^2)-(4*A*C))
1060 P = ( (-1*B) + D )/(2*A)
1070 M = ( (-1*B) - D)/(2*A)
1080 PRINT "P =" ; P ; ", M =" ; M
1090 GOTO 1010
9999 END
```

Let's finish the design which was a 118" span 1000 sq." Schuemann wing. A = .468, B = -.888*WS = -.888*118 = -104.8 and C = WA = 1000. Running the program and inputting this data results in the program printing "P = 213.944, M = 9.98742". Using the most reasonable answer, the root chord = M = 9.98 inches. Rounding the root chord off to 10 inches gives the following layout:



The wing tip is elliptical and next time I'll show you a program to calculate its coordinates.

Sal Iasilli of E. Norwich, N.Y. and his ASW-24

Sal says, " It is from a Robbe kit which has a 3.5 meter wing span and approximate weight of 7 pounds. The airfoil is a modified HQ. It was featured in the July issue of *Model Airplane News* in which I did a "Field & Bench" review of the kit."

Airfoil Primer

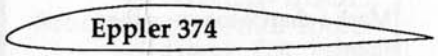
...by Pat Chewning

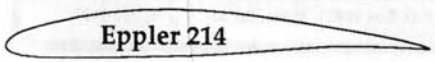
Via Portland Area Soaring Society (PASS) Newsletter

The following airfoil information was written by Pat Chewning and reformatted in tabular form for the readers of *RCSD*. Pat says, "For a more complete listing of airfoil performance data, order the *Soar Tech VIII* book."

Airfoils

	Flat-Bottom	Phillips-Entry	Under-cambered	Semi-Symmetrical
Shape	Flat bottom Convex top	Flat bottom, except front is curved upwards from about the spar to the leading edge. Convex top	Concave bottom Convex top	Convex bottom Convex top
Examples	Clark-Y	Eppler 205 Selig 3021	Eppler 214 Selig 4061 Eppler 387	Eppler 374
Aircraft	Gentle Lady	Gnome, Sagitta, Olympic, ODR-1	Windsong, Orbiter, Sunrise, Ultima	Rotor, Ridge Rat, generic slope soaring
Performance Characteristics	Narrow speed range (slow), easy to build, low lift/drag performance, gentle stall, best for light wing loadings.	Wide speed range, relatively easy to build, higher lift/drag performance at higher speeds, can handle heavier wing loadings, very versatile.	The undercamber provides the highest lift for minimal sink rate thermalling, with a speed penalty. With the addition of variable camber control (flap/aileron reflexing), the speed range can be improved.Usually the most difficult to build.	High-speed maneuverable airfoil capable of inverted flight and aerobatics. More difficult to build than flat-bottom. Handles highest wing loading well. Does not fly so well at slow speeds.



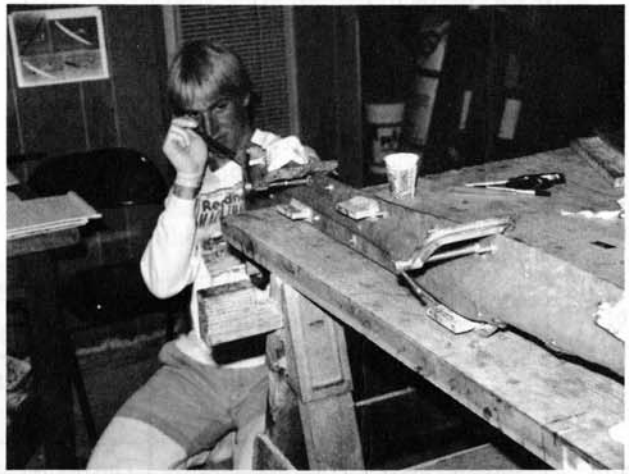


Behind the Scenes at **Flite Lite Composites**

...by Jerry Slates

Mark Allen of Flite Lite Composites, a new company, has come up with one of the best competition gliders to hit the the market in some time...the FALCON 880. Two years in the making, and a great deal of time and research, have been devoted to making the FALCON emerge from a dream to a reality. Today, the FALCON 880 has proven that reality by demonstrating its special abilities at competitive and contest winning events.

Mark is producing a complete kit with an epoxy glass fuselage reinforced with Kevlar, wing cores cut from 1.5 lb. density foam, along with all the wood and hardware required to complete the FALCON.



The production staff, Steve Hug & Tom Roberts (not available at photography time), take pride in the work that they do. As modelers themselves, they like to open a kit and find all the necessary wood and hardware. Concentration, a good eye & a steady hand are required to do a wet seam inside the FALCON 880 mold and Steve has obviously mastered the techniques

Visitors are always welcome at Flite Lite Composites. So, if you are ever in Windsor, California, give Mark a call (707-838-3390) and ask for directions. You won't find the shop without them...and this will give Mark a chance to sweep the floor!

T.W.I.T.T. (The Wing Is The Thing)

T.W.I.T.T. is an organization of engineers, scientists, pilots, sailplane enthusiasts, model builders and many other persons having an interest in flying wing/tailless aircraft technology. Write to T.W.I.T.T., P.O. Box 20430, El Cajon, CA 92021 to find out how you can participate.

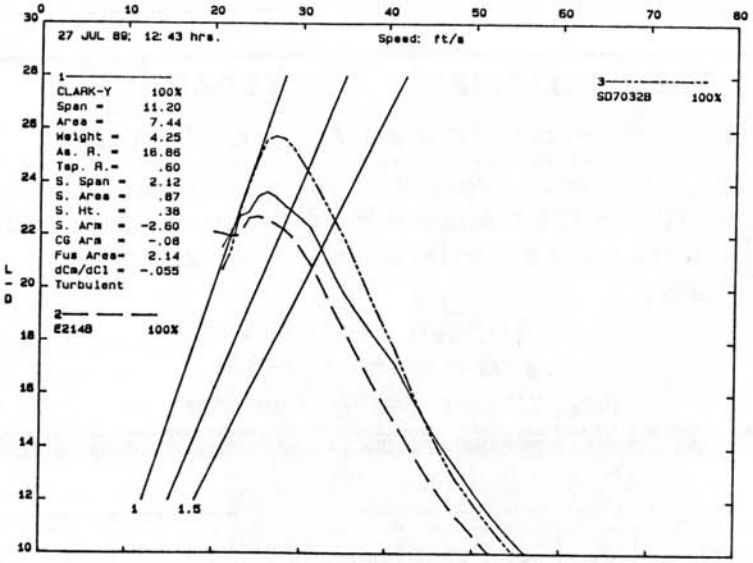
Send SASE for membership application and flyer: "What is T.W.I.T.T." or, send $2.00 for full information package including one back issue of our newsletter, postpaid. Full membership is $15.00 per year and includes twelve issues of the newsletter. Back issues of newsletter are $.75 each, postpaid.

SAILPLANE DESIGN 3.0

A COMPUTER PROGRAM FOR PERFORMANCE EVALUATION

***** NOW WITH ALL THE PRINCETON DATA *****

Want to know why your bird does what it does? Want to design a better one? SAILPLANE DESIGN shows you exactly how well your sailplane performs and what you can do to improve it. With SAILPLANE DESIGN you can plot the performance of any configuration you can dream up.



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