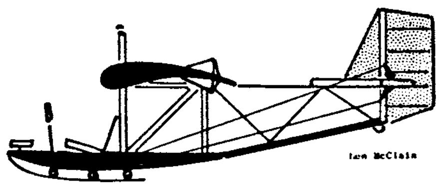

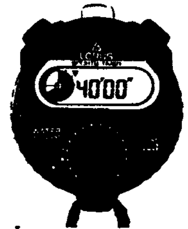

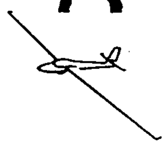

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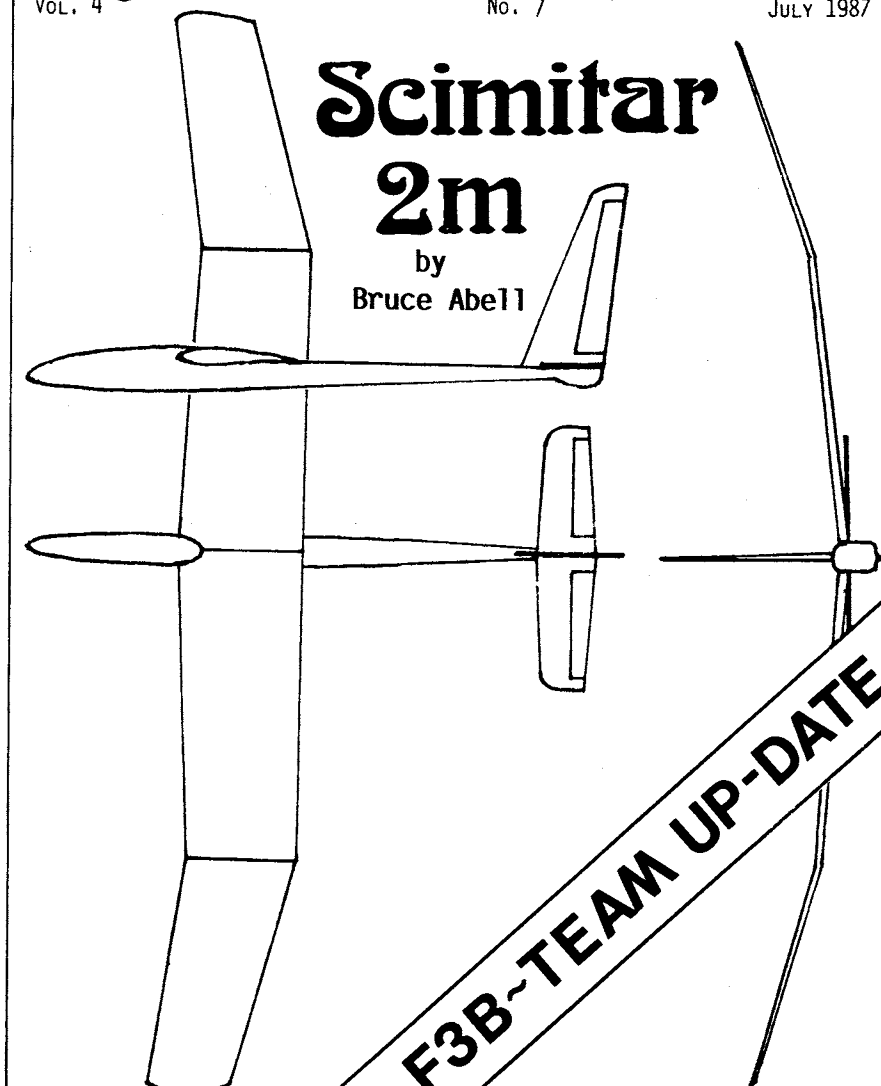
VOL. 4 No. 7 JULY 1987

Scimitar 2m

by Bruce Abell



F3B-TEAM UP-DATE

SCIMITAR - 2 METER Bruce Abell

This bird uses the BA-25 airfoil designed by Bruce, and here's what he has to say about the sailplane and the airfoil.

"The airfoil combined with the scimitar shape is really exciting. I've been flying it on the slope lately and find that it will stay airborne in lift from a 3 - 4 knot breeze (barely noticeable on your face) yet still handle and penetrate into a 15-knot wind...all without adding ballast! It will even handle the stronger breeze on the same trim settings, but a few clicks of "down" help it penetrate. Here are some of the features of the total package, in case you may be interested:

1. BA-25 airfoil: thickness/chord ratio - 14% at root, 10% at poly break; 8% at the tip. Peak of curve at top surface: 27% of chord at root, 30% at poly break, and 33% at tip. The section progresses from normal undercamber at the poly break to flat-bottom at the tip.

2. Scimitar planform

3. Sheeted wing undersurface with turbulator spars at the top

4. Wing undersurface covered with tissue, and top surface covered with chiffon Polyester material. Finish is dope and paint trim.

FUTURE PLANNED DEVELOPMENT

"THE NEXT STEP WILL BE TO SHEET THE TOP SURFACE OF THE WING BACK TO THE MAIN SPAR AND THEN ADD TURBULATOR STRIPS. I plan to do this to one wing only, an leave the other wing as before to find out what effect (if any) they produce. I'll know by watching the differential lift/turning of the odd wing. The next project top go on the building board is a 120" span, 15:1 aspect ratio, Scimitar wing...and will build a plain, polyhedral version before I go 'whole hog' with an aileron and flap version."

This month is as good a time as any to talk about recent developments in our plans to move to Arizona. We have a buyer for our home here in Peterborough, and the closing is scheduled for August 21st. We plan to start West on or about August 24th and take a week to make the trip...stopping along the way for visiting friends and sightseeing. We ought to be in residence on September 1st.

As you might imagine, I've been thinking about how to do a mailing of the August issue and preparation of the September issue while all of this activity and change is going on. By now, you've probably concluded, as I have, that there just <u>isn't any way</u> that this can be done satisfactorily.

Therefore, I plan to make the August and September issues into <u>one double-size issue</u> and call it the August-September issue. Yes, I know I promised you twelve issues a year, and - so far - I've been able to keep my promise. This time, however, it looks like I have to make an exception, and I ask you to go along with it if you can. If not, then I'll gladly refund the unexpired portion of your subscription. It's as simple as that; just let me know in advance so that I can get your check in the mail early. Frankly, I don't anticipate many refunds...but I want to give YOU the choice.

Peggy and I are really looking forward to the move -- or at least the arrival and setting up of housekeeping in Payson. It is a small town, much like Peterborough; about 4,000 or so residents. Payson is located about 90 miles northeast of Phoenix in the high plateau region where the air is clean and the elevation averages 5,000 feet. Piñon and Ponderosa pines grow in abundance, and other trees and shrubs like cottonwood and manazanita are plentiful. There's not much grass, but most of the flowers that one finds in the East grow well there. Our street address will be 210 East Chateau Circle, but I plan to have a post office b ox number (as yet unassigned) for <u>RCSD</u> mail. We don't have a telephone number yet, but will have one about the time we get there, and I'll let you know what it is in the October issue which should be out approximately on time.

I plan to set up my amateur radio station as soon as I can after arrival, and will be QRV on most of the ham bands in the HF spectrum, and on 2 meters as well. The ZIA network connects two-meter stations in the Southwest from Texas to California.

The Mogollon Rim averages about 7,000 feet elevation and is more than 100 miles long, facing southwest, and over 2,000 feet above the "valley". Think of the slope possibilities! See you there?

Happy soaring, JIM

SLOPE SCENE

PRACTICAL VACUUM FORMING FOR THE HOME SHOP MODEL MAKER

(Part Two of Five Parts)

This is a continuation of the series of articles which began with the May issue of RCSD.

In this article we will deal with the "frame" which supports the plastic during heating and forming, and the "buck base" which is the changeable tooling plate used for the forming of various parts.

Lets take an overview of frame and buck design: The general sequence of determining the size of the frame and buck base are first to design the forming tool or mold itself; then, the buck base must be made so that it is at least one inch larger than the buck in all directions.

It is important to consider that deeply-formed parts cause a lot of stretching of the plastic which results in thinning of the finished part. On deep-drawn parts, you can decrease thinning by increasing the amount of flat area around the forming. Certain areas of the part can be reduced or increased in thickness by the way you place the form on the buck base. Sometimes you just have to give it your best shot and experiment until you get the results you want, then mount it permanently.

The size of the frame is directly related to the size of the buck base; that is, the inside dimensions of the frame are 1/8" larger than the outside dimensions of the buck base, allowing the frame to fit around the buck base. I generally use 1" x 2" lumber to make the frame.

The frame can be made in any of several ways which will make easy the mounting and holding of the plastic sheet during the heating and forming operations. The frame must firmly clamp the plastic around the perimeter so that when the forming takes place, the plastic is forced to stretch rather than drawing the surrounding plastic in, which would cause wrinkling.

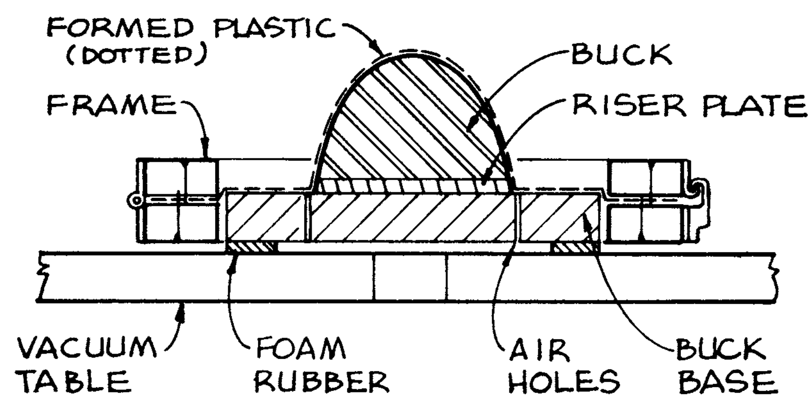
A simple frame construction is shown as an example. It is hinged at one side and latched at the other side with a simple window latch which will exert clamping pressure at the latch side. On larger frames, use two or more latches. Nails are driven through the frame so that their points protrude about 1/16" from the opposite side. When the plastic is heated, the nails

will "bite" into the softened plastic, holding it firmly

The buck base is generally a flat plate onto which the form tooling is permanently mounted. Refer to the drawing which shows how the buck and buck base relate to each other.

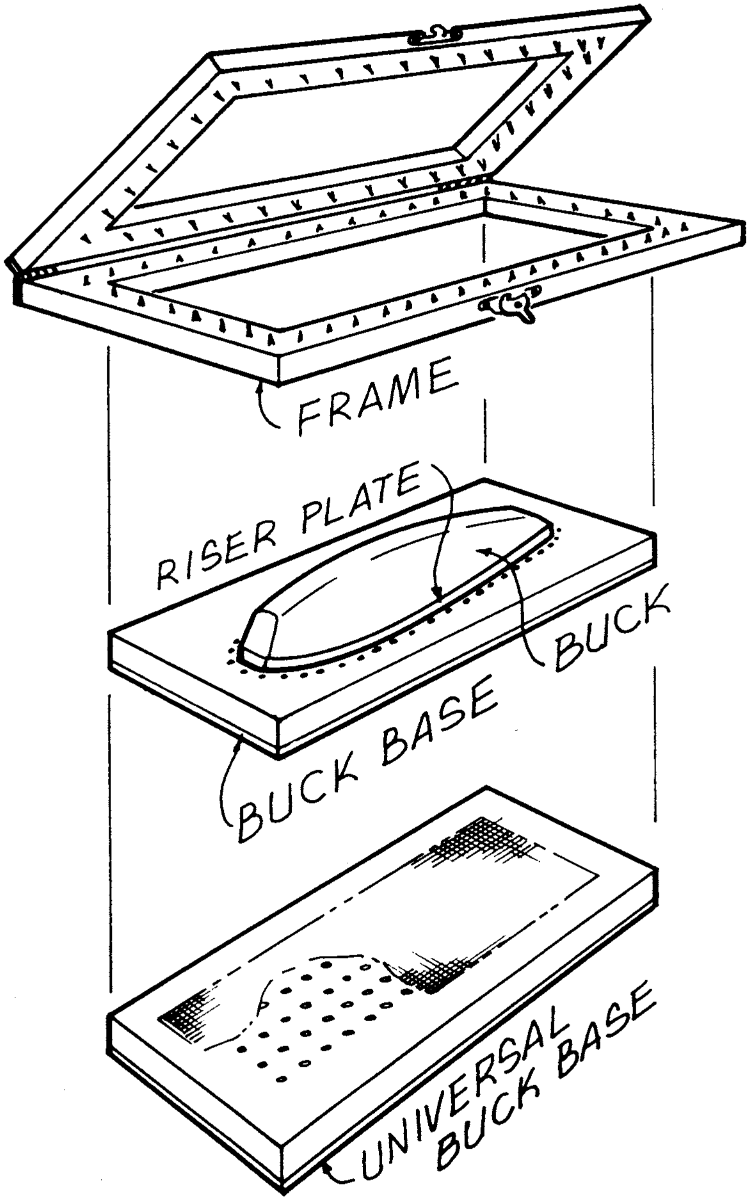
The lower half of the frame and the buck base should be the same thickness, which actually measures about 3/4" in thickness. The buck base receives a perimeter strip of firm foam rubber (weather seal strip) of about 1/4" or 3/8" thickness, providing a seal between the table surface and the buck base, and allowing the vacuum pressure to cover the entire surface of the underside of the buck base.

The plastic is heated in your oven and then the frame is pushed down over the buck and held firmly in place until the vacuum pressure grabs it and magically sucks it tightly around the buck. The plastic itself must form the vacuum-tight seal, right at the perimeter of the buck. The drawing shows this clearly.



It is very practical to consider making a couple universal buck bases. We can make one or two sizes of buck bases and frames for general interchangeable use. Maybe one about 6" x 12" which can be used for most small parts such as canopies, cowlings, wheel pants, etc; and a somewhat larger one, perhaps about 10" x 16", for the somewhat larger parts you will want to form.

The universal bases should be drilled with vent holes of 1/8" in diameter and spaced apart on a 1" x 1" grid pattern. Find some hardware cloth with about a 1/8" x 1/8" mesh size. Place this on top of the buck base and it will allow the vacuum to circulate all around under the various pieces of tooling. Be sure you keep the vent holes and hardware cloth back at least one inch (1") from the perimeter.



Every piece of form tooling must be placed on top of a riser plate. The riser plate must be at least 1/4" thick, and provides the required "overdraft". The line between the part forming tool and the riser should be made sufficiently distinct so that it shows up on the inside of the finished part, providing a distinct line you can trim the part to.

On fuselages or other symmetrical halved parts, I ALWAYS FORM BOTH HALVES ON THE SAME BUCK BASE AT THE SAME TIME. You will probably want to mount your larger forms on their own individual buck bases. After experimenting with location, position the buck and secure it to the base with flathead screws (up from the bottom). Then, drill small holes of about 1/16" diameter spaced on 1/4" centers all the way around the perimeter of the buck, making sure that the holes go all the way through the buck base. These holes allow the vacuum to draw all of the air out from under the plastic to form the part. As you work with the tooling and experiment with your own setup, you may find it necessary to drill more holes through the buck and the base to evacuate air from a troublesome area.

We could go on and on about tooling, but I have presented only the basics, so I would recommend that you pick up a book or two on the subject at your local library. You'll find that many have been written on the subject of sheet plastic forming processes.

Next month, in our last and final part of the series, we will discuss materials selection and the actual forming sequence.

POWER SLOPE SCALE-JET:

Our publisher, Jim Gray, sent the following suggestion for a series of articles;

Harry;

Here's an idea I've been kicking around lately, and want someone to develop.

Power slope scale - Jet:

Use one of the Kyoshom electric car motors (15,000-20,000RPM) with a Midwest or similar ducted fan assembly; i.e., RK-20 or similar.

Add Futaba micro airborne flightpack

Use the smallest suitable battery for the Kyosho motor (the battery that comes with the car ubit would be okay).

Now you have a ducted fan (jet scale) slope soarer and power craft, capable of flying at speed, or slowing to soar on slope lift only. Mock combat & slope aerobatics excellent capability.

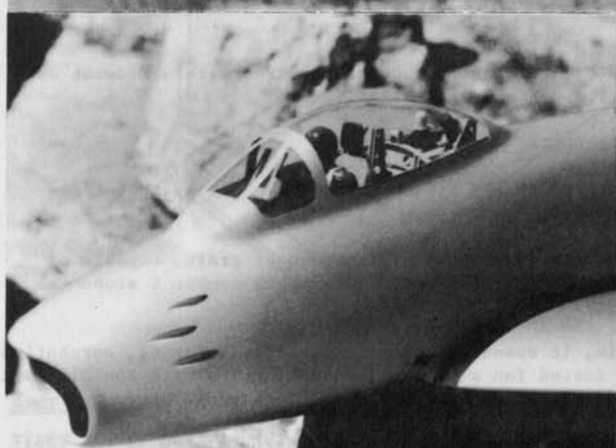
Further, if no slope available, it opens the door to flat-field flying, aerobatics, etc, due to the launching by ducted fan alone, or in combination with the hi start or winch to give added initial thrust and reduce take-off time/distance.

This is an idea waiting to be done...and I think your gang out there is the ideal one to try it. If it goes well, I'd ask for first opportunity to offer article series in RCSD/MAN.

Jim Gray

This sounds great! I have personally built several scale jets for the slope and all is well as long as the lift is strong. Even a brief lull in wind velocity will put you on the ground, usually in the middle of a rock garden. Most power scale jets depend entirely on slope lift and will not thermal. Turn on the fan to get out of trouble, do aerobatics, wonderful.

Just to get things started, I have some photos of one of my favorite air planes, the F86.



I purchased the basic parts (glass fuse, wing cores, and canopy) from Larry Wolf at jet Hanger Hobies. This is a large scale model measuring 50" span and 50" length.

My completed model is flown with two channel control, ailerons and elevator. It is stable, and easy to control, does aerobatics well. I suggest you set it up on a transmitter with dual rates. Use low rates for launching and high speed runs and switch to high rates for aerobatics.

The real draw back to this and similar models is its dependance on strong lift. The hill which I fly most of the time, has let me down now and then. Adding an electric ducted fan will take the constant fear out of flying this model.

Please send me your ideas on this and any other subject which relates to slope soaring, I need help.

Harry Finch 1150 N. Armando St. Anaheim, CA 92806

US F3B Soaring Team Up-Date 1st Practice March 21 & 22, San Jose, California

By Jerry Slates

US F3B Soaring Team: Standing L-R: Steve Lewis and Rich Spicer, Front row: Rich Tiltman, Phil Renaud,(team Mngr.); Steve Work, Seth Dawson,(assn. mngr): Lynn King, Tom Thompson, standing next to me,also taking pictures, Don Edburg back-up team member. Jerry Slates Photo

The first week-end of spring held the get together of the "U.S. F3B Soaring Team" in San Jose, California, in their first practice as a team.

The practice included setting-up the winch in the required time, being ready to fly and to fly in the allotted working time. Then, per the pilot's discussion, they determined if the air was good and if the task should be completed or go for a relaunch. Typically, these are the last-minute discuss--ion by the pilot, team mngr. and the co-pilot. This takes a lot of team work. They work as a team-not as an individual. I believe this has to be done and as usual was done very well.

Quiet Men at Work: Flagman at sighting device, Field judge calling off the working time, pilot and co-pilot calling the turns. Very intense time.

Jerry Slates Photo

Workers required in F3B - Flagmen at near & Far Turn. Slates photo

Steve Lewis: Last-minute check before practice flight is just like the real thing in July. Slates Photo

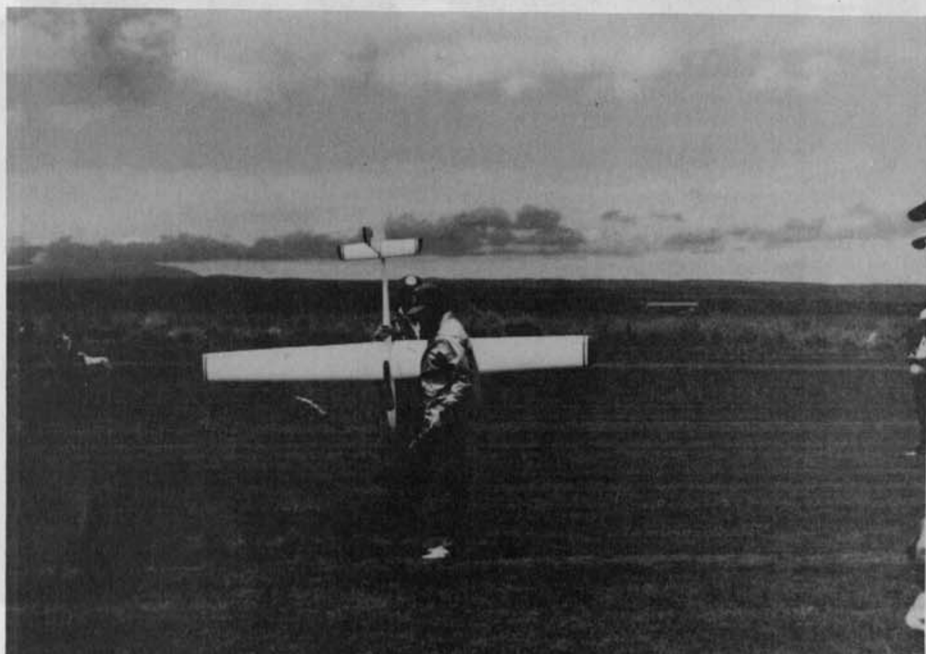
There was a complete rhythm within the team. As a spectator, standing behind the line, I saw no arm waving and heard no raised voice's. I couldn't fly. I couldn't go on the field to help as this was a team practice. What I did do was enjoy seeing a very well managed/org nized "U.S. F3b Soaring Team".

FAI - F3B TEAM PRACTICE, ALBUQUERQUE NEW MEXICO...............DAVE WILLIAMS

The United States R/C Soaring Team held its second practice session as a team in Albuquerque, New Mexico with the following results: (May 23 - 25, 1987)

" This last weekend the second team practice was held here in Albuquerque. The weather was not as good as we would have liked, but it did provide good practice in situations that could well be encountered in Germany. Some minor trim changes were required by the SYNERGY aircraft because of the altitude. The sod farm on which we fly is about 6400 feet but that presented no major difficulties. Rich Spicer and Steve Lewis have done a beautiful job on the new SYNERGY. It is about a pound lighter and still just as strong as before. It is a beautiful airplane to look at, but the engineering is equally impressive. During the speed runs Rich turned the fastest time of just over 18 seconds. This was in a wind that was gusting to 20 mph and with thunderheads popping up all over the place.

"That afternoon during distance practice one round of 24 laps was recorded by Rich, and both Steve Work and Steve Lewis recorded over 21 laps. There was some additional excitement as we watched a tornado form and touch down about 15 miles away. Frank Green, one of our local members, was v ideo taping the speed runs and got about 3 minutes of the tornado...and would have gotten more...but Phil Renaud wouldn't stop practice long enough for him to get any more footage!



Rich Spicer - Pilot; Seth Dawson, and plane
Albuquerque, NM , May 21, 1987. Photo by Erin Williams

Photo by Erin Williams.

Team practice: (From left) Seth Dawson, Steve Work, Phil Renaud (Team mgr.) Dave Williams, Lynn King, Nancy Lowe, Rich Spicer, TU crew at A-G Sod Farm

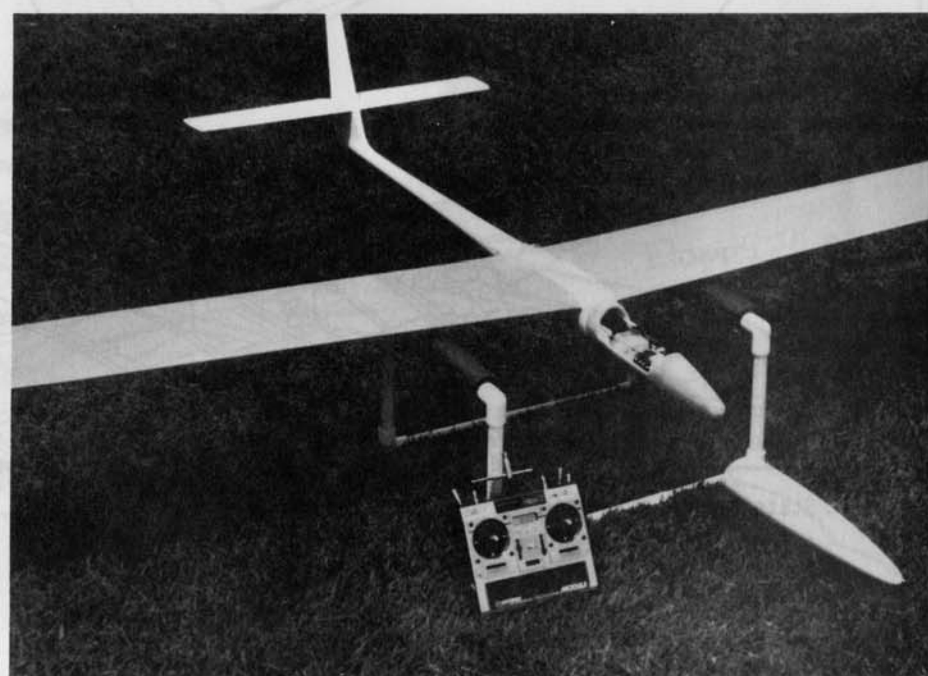
"The second day of practice was a little better. The speed runs were done in less wind, but it was about a 90-degree crosswind, so the times were slower. Everyone came away feeling that things were improving, and there was a very apparent comning together of the individuals into a functioning unit.

"TV station KOAT-TV from Albuquerque was at the first day of practice and did a v ery nice 2-minute spot on the 10 o'clock news-cast. ESPN and CNN have broadcast short segments nationally from the material sent to them by KOAT-TV. One was five or ten minutes long and the other about three minutes in length."

Thanks, Dave for the news. I'd like to remind readers that the team funds are slowly catching up to what is needed to send our guys to Germany. Pleas make any further contributions you can to the US R/C Soaring Team.*

Third and final team practice will take place in Sunnyvale, CA on 27, 28 June.

* Dave Williams, P.O. Box 9328, Albuquerque, NM 87119 USA.



COMET at Albuquerque during Second Practice Session   Photo by Erin Williams.

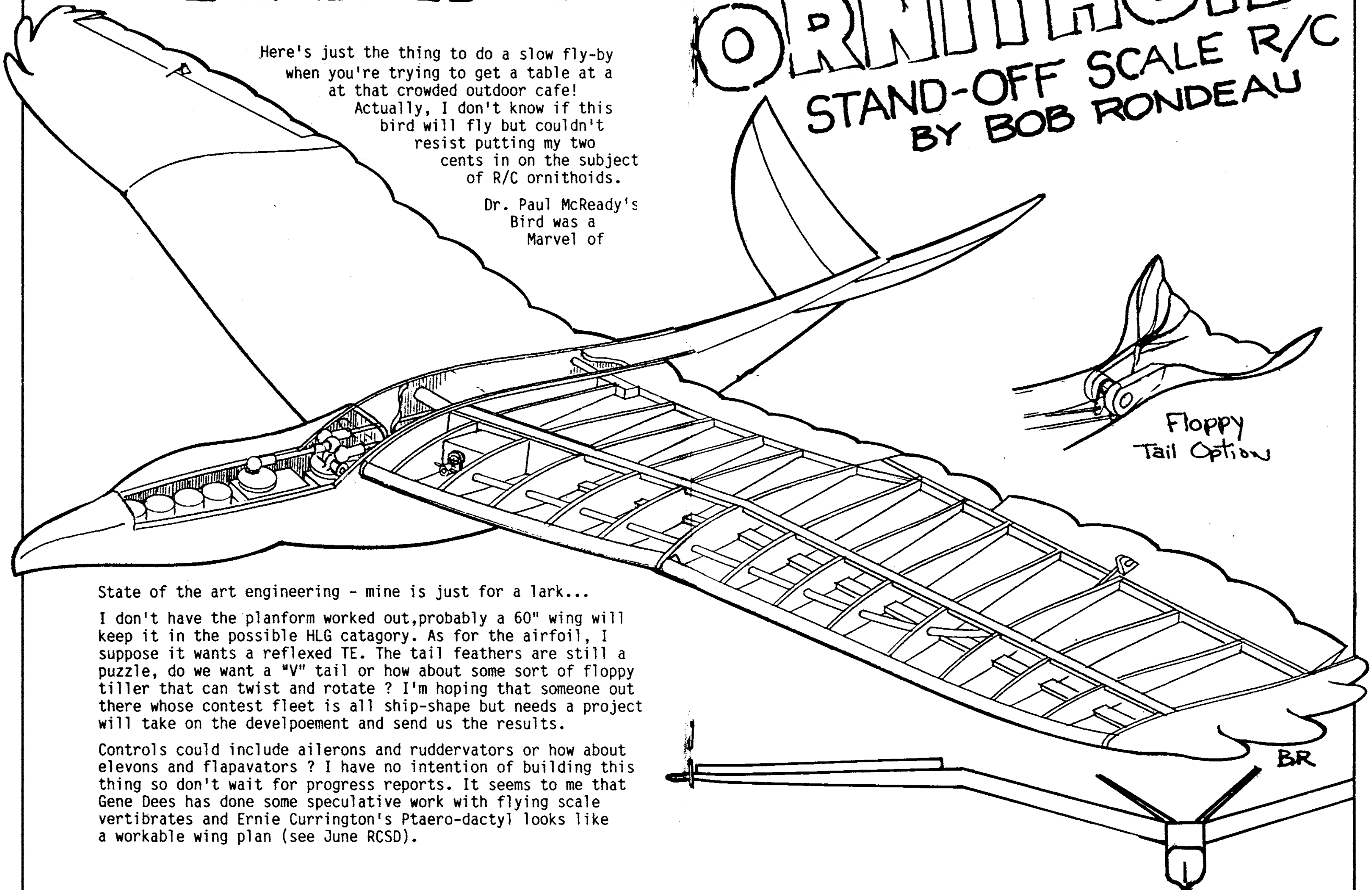
GULL-WINGED ORNITHOID

STAND-OFF SCALE R/C

BY BOB RONDEAU

Here's just the thing to do a slow fly-by when you're trying to get a table at a at that crowded outdoor cafe! Actually, I don't know if this bird will fly but couldn't resist putting my two cents in on the subject of R/C ornithoids.

Dr. Paul McReady's Bird was a Marvel of State of the art engineering - mine is just for a lark...



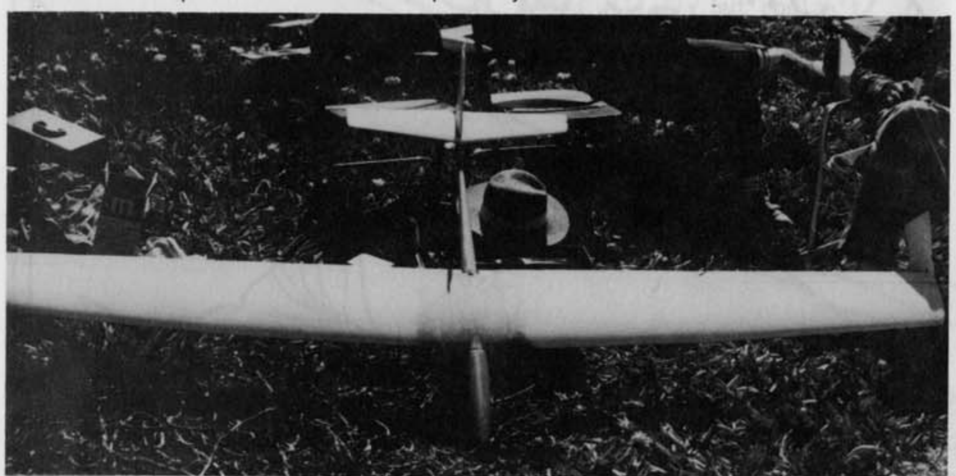
I don't have the planform worked out,probably a 60" wing will keep it in the possible HLG catagory. As for the airfoil, I suppose it wants a reflexed TE. The tail feathers are still a puzzle, do we want a "V" tail or how about some sort of floppy tiller that can twist and rotate ? I'm hoping that someone out there whose contest fleet is all ship-shape but needs a project will take on the develpoement and send us the results.

Controls could include ailerons and ruddervators or how about elevons and flapavators ? I have no intention of building this thing so don't wait for progress reports. It seems to me that Gene Dees has done some speculative work with flying scale vertibrates and Ernie Currington's Ptaero-dactyl looks like a workable wing plan (see June RCSD).

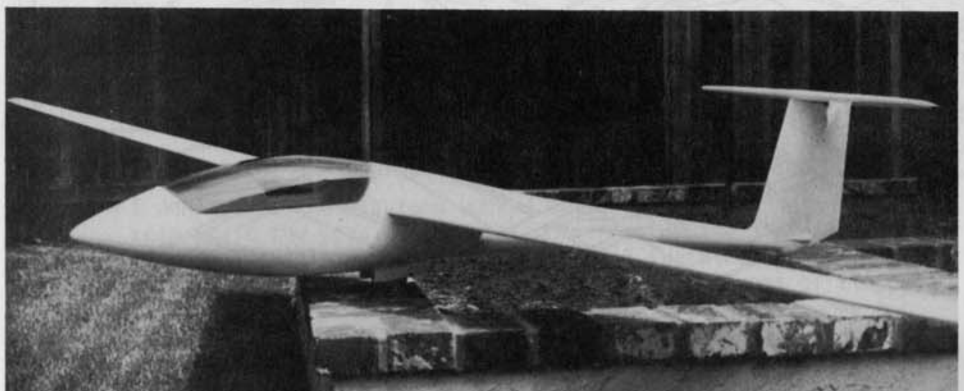
LETTERS

Steve Chan wrote about the Santa Cruz slope race, and mentioned some of the "goodies" that he saw there, Here's Steve:

"...Probably the most innovative plane there was Joe Wurtz's. Specs are Span 98", Eppler 374, Root chord 10½", mid-span chord 9½", tip chord 7½". Weight unloaded about 6 pounds. What makes it unique is that, other than a 30" and 18" ballast tube, there is NO WING SPAR! Joe uses pre-impregnated fiberglass stringers about 1.5mm wide and 3/16" deep - full span. There are eight on the top and eight on the bottom. The core is blue foam, glassed by the vacuum-bag method. Bill Forrey described it in his March 1987 Model Builder column (one of the best around...JHG). The wing is extremely strong, and Joe's sailplane was the fastest plane by far at the race.



JOE WURTZ'S SCRATCH-BUILT SLOPE RACER.



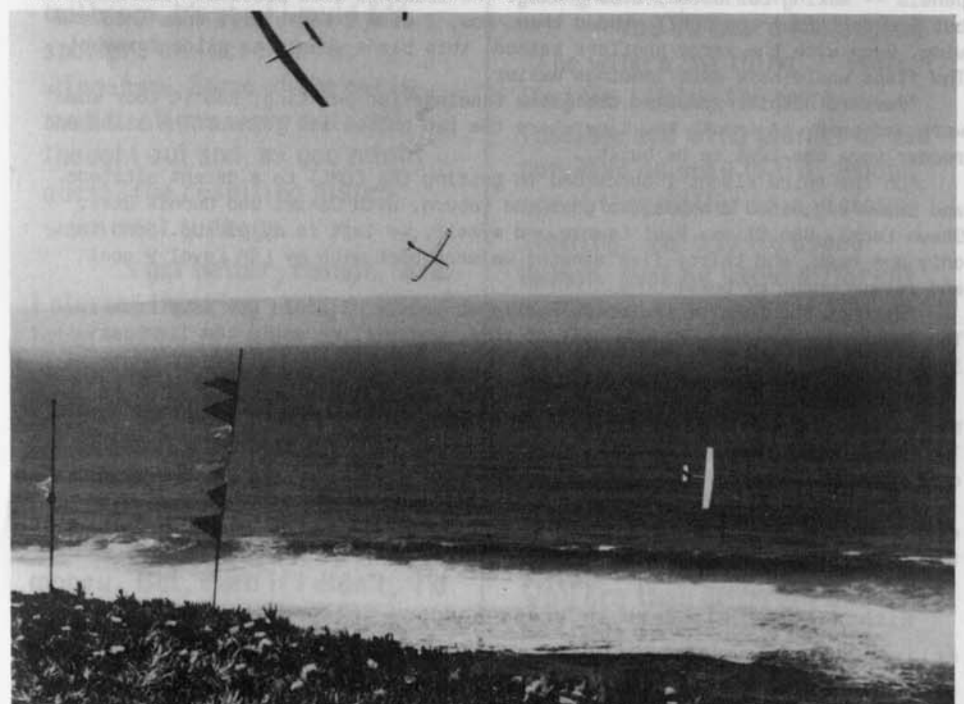
FIBER GLAS FLUGEL ASW-20L. NEED MORE BE SAID?

"I've enclosed a photo of my ASW-20L made in Germany by Fiber Glas Flügel. Its span is 4.5 meters and the quality is outstanding. I've talked with the owner of Fiber Glas Flügel-Andreas von Schoenebek-about importing his planes. He says he can ship (via air freight) three planes in one box for about the same price as one plane (about $110 to the West Coast)..so split three ways by potential buyers the cost isn't so bad.

"If anyone is interested, they should get a couple of other people together and call Andreas for details. As you can see from his price list, his planes aren't cheap, but for the quality, I think they represent an excellent value.

"If anyone would like to 'phone or write to me about Fiber Glas Flügel, I'd be more than happy to help them as much as I can. Thanks for putting out a great little newsletter. I get more useful information from RC Soaring Digest than from any other magazine or newsletter. Keep up the good work."(signed) Steve Chan

BRIAN SCHWARTZ WITH HIS SCRATCH-BUILT SLOPE RACER



PYLON TURNS OVER THE PACIFIC NEAR SANTA CRUZ

Awww...shucks, Steve. Those kind words are going to my head, and my soaring hat won't fit any more...but thanks anyway! If any of you would like to write or call Steve, his address is: 11160 Warner Avenue, Suite 205, Fountain Valley, CA 92708. His telephone number is: (714) 968-2451. For the strong-hearted, the ASW20L runs around 1,000+ Deutsch Marks...a lot of sauerkraut in any language!

LJMP "COMET" KIT REVIEW..................................ARLIE STONER

This review comes to us through the courtesy of THERMAL TOPICS, newsletter of the Modesto (California) R/C Club. It covers Larry Jolly's Model Products Comet sailplane.

"After watching Larry Jolly fly his COMET at our first ceoss-country contest, I was quite impressed with the speed and penetration of this large ship. I have flown a SAGITTA XC for two years, but it had two drawbacks: 1. The wing loading was too low for good speed, and 2. Penetration was poor in any wind above 5 miles per hour. The COMET excels in both departments.

"I received my COMET kit from Larry personally...the fuselage is so large that it is separate from the box the rest of the kit came in! After getting it home, I spread it out in my shop...boy, is this a Big Bird! Let me say that it is NOT a plane for the Novice Builder. There were no instructions with the kit, as Larry had not finished them at the time I got the kit, but no experienced builder should have trouble with building it. I asked Larry for some building tips, and he suggested that I build the stab and rudder as light as possible, and use just enough paint on the rear of the fuselage to cover it.

"With this in mind, I built up a set of stabs following the GEMINI construction mehtod. They turned out to be very light, yet strong. I started construction of the wings, and they go together quite easy -- but with no details on wing rods, some care and planning must be taken to get the rods and tubes at the right angle.

"The wing has two sets of spars, and they are completely sheeted on the center panels -- making for a very strong wing. The drawings show provision for flaps but I didn't feel the COMET needed them. Now, I wish I had b uilt them into the wing. Even with the large spoilers raised, this plane weants to glide forever! The flaps would have made landings easier.

"Bernard Simpier prepared the glass fuselage for painting, and it took some work and putty to smooth the line where the two halves are joined. The stabs and rudder were the last to be built.

"On the third flight I succeeded in getting the COMET to a decent altitude, and Shawn suggested I attempt a goal and return. With Daniel and Dennis Dias, Shawn Lenci, Ben Cliex, Paul Lowrie and myself, we left in my pickup...and in only one hour and thirty-five minutes we were back with my LSF Level V goal and return under my belt!

"Without the help of the above-mentioned people, I would not have made it. The COMET will cruise with the best of them, and will go up in the lightest lift.

"Two weeks later, with the sensor hooked up, I almost went out of sight, and had to keep Bernard Simpier close to me to help spot the COMET from time to time. Two hours and forty-two minutes later, I landed with the thermal duration requirement of Level V done; also, a new club record!

"In closing, I have to say that this sailplane is one of the finest I have ever owned. If you like a big and graceful plane with no end to its performance, thisis the plane for you.

*****

(With all the interest in cross-country these days, I'm sure that Arlie's COMET Comments will be read with enthusiasm, and it wouldn't surprise me if Larry Jolly received some orders for his COMET. Good luck in trying to get one, as Larry is <u>extremely</u> busy...JHG)

SQUIGGLY LINES

From the S3 Newsletter
John Puppo Author

How many of you have read an article praising some airfoil and wondered what those funny little graphs were trying to tell you?

Several years ago I suddenly realized that, for about a year, I'd been modifying every kit plane I had bought. I would fiddle with the tail of change the length of the tailboom. Maybe I would add spoilers or increase the wingspan. Some of the early modifications were not well thought out and, as you might guess, the resulting planes were real turkeys.

I got better, though. And I started thinking why spend a lot of money for a kit when I'll end up modifying the whole thing anyway? Why not try designing my own planes? I've always liked designing and building things anyway.

Maybe I'd save a little money. But, even if I didn't, I'd have the satisfaction of flying something I had designed and built myself. And who know, maybe I'd luck out and build a real winner.

Since then, with much scratching of head and chewing of pencils, I have endeavored to learn the art of good sailplane designing. During the struggle, I stumbled on an important fact. Choosing an airfoil is probably the hardest part of designing model planes.

Once you've decided on the airfoil, planform and size of the plane you want, its fairly easy to Fig. out the moment arms, shear stresses, and bending moments. You just take the measurements, plug them into the appropriate formula and voila, you have your answer.

But the choice of an airfoil is a bear-- there are so many to choose from.

You've heard the saying "The wing's the thing"? Well, its true. Using the same fuselage and wing planform you can have an easy to fly, sedate sport thermaller or a vicious stalling, hard to fly speed demon just by using different airfoils.

Enter the airfoil polar curves. A cursory look at airfoil texts reveals a bewildering variety of shaped and positions of these curves. What makes them all so different? More importantly, why are they different and what do those differences mean?

Fear not, this won't turn into a heavy treatise on aerodynamics. In fact, there aren't even any formulas in it. I'm going to make a valiant attempt at taking some of the mystery out of polar curves by describing what all those squiggly lines mean and how they relate to airfoil performance.

Polars are the key to intelligent airfoil selection.

Before I get to the explanations, though, we should review a few and facts to make sure we're all on the same wavelength.

LIFT AND SPEED

You should know that the lift co-efficient (Cl) rises steadily with increasing angle of attack. Speed is also dependent on the attack angle (among other things). As the angle increase, the speed decreases.

In general terms, the higher the Cl, the slower you can fly without stalling-- up to a point. Put another way, high Cl indicates slow speed, low Cl means high speed.

AIRFOILS

Airfoils are simply thickness forms wrapped around a camber line. The camber line is the line from leading edge to trailing edge that is equidistant from both upper and lower surfaces -- NOT to be confused with the chord line which is a straight line between the leading edge and trailing edge.

On a "symmetrical" airfoil, the camber line and the chord line coincide. They'll look like one straight line between the leading edge and trailing edge. Such an airfoil is

said to have zero camber. The airfoil is symmetrical because the thickness form above the camber/chord line is a mirror image of the thickness form below the camber/chord line.

The camber of an airfoil is the greatest distance between the chord line and the camber line. It's most commonly expressed in percent of chord. Note also that this "greatest distance between" occurs at some one point along the chord.

You might see this distance mentioned in some texts. You could read that some airfoil has a 2 percent camber at 45 percent of chord. On a 10" chord, such a statement means that the greatest distance between the chord line and the camber line is 0.2" and that the "greatest distance between" occurs 4.5" aft of the leading edge. It does not mean that there are two or three other cambers lurking around at different points along the chord.

If an airfoil designer wanted to raise the Cl potential of an airfoil, he would increase the camber--say from 2 to 3 percent. Increasing the camber of any airfoil will raise the maximum Cl that could be reached by that airfoil.

There are two ways to develop airfoils, of families of airfoils. One way is to place different thickness forms on one camber line. The other way is to use different camber lines for one thickness form.

AIRFOILS VS AIRPLANES

One last point before we get down to the nitty gritty. This is important.

Airfoil polar curves -- "polars" in common parlance -- address the characteristics of the AIRFOIL SECTION ONLY.

Whole-plane considerations, such as induced and parasitic drag, degrade the performance suggested by the airfoil section polars. But you have to start someplace. Airfoil polars first. Whole-plane calculations some other time.

That brings up another point. Throughout the rest of the article I'll constantly be mentioning aero-dynamics angle fo attack, angle of attack, to attack angle. These terms are interchangeable--as are the terms zero lift angle and aerodynamic zero. They all relate to the airfoil section only.

Only of I specifically use the term "incidence angle" will I be talking about the whole wing's angle of attack.

FROM SQUIGGLY LINES TO POLARS

The term, "polars", encompasses a wide range of graphs of airfoil characteristics. We won't talk about all of them. However, the most common ones are velocity distributions, profile drag, lift curves. pitching moment curves, and boundary layer conditions. Fig. #1, below, illustrates these most common

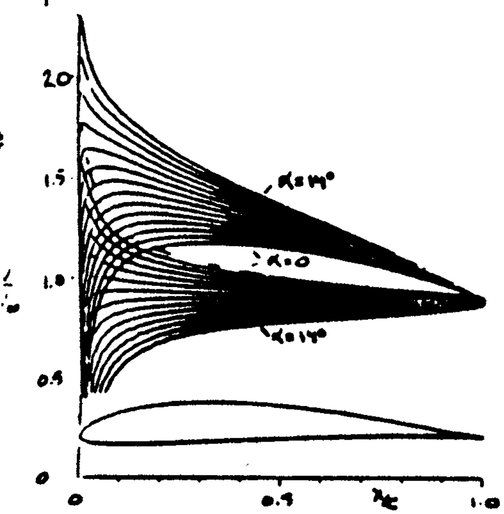
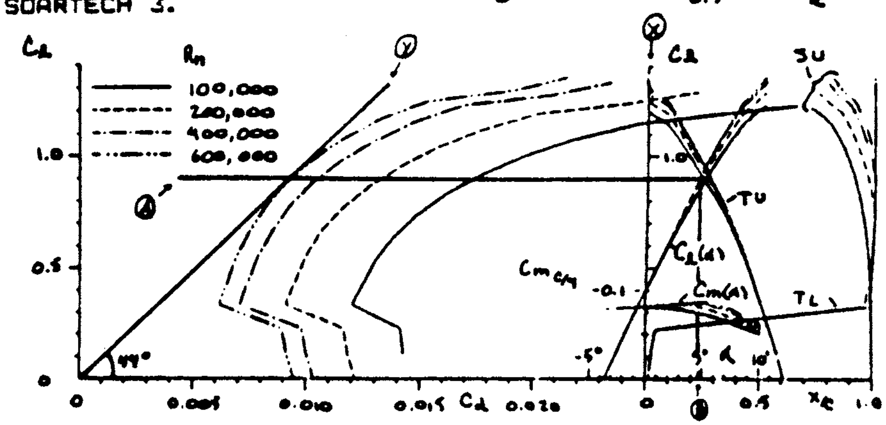


FIGURE 1.

Velocity distributions, airfoil profile, and theoretical section characteristics for the Selig 2091-101-83. From SOARTECH 3.



same info can be obtained with a lot less hassle from the other sections of the graph.

THE NITTY GRITTY

Now for the important stuff. The center and right sections of Fig#1.

THE DRAG POLARS

The center section, the drag polars, shows the change in profile drag (Cd) as the lift coefficient is increased or decreased.

It is common practice to show the coefficient of lift (Cl) on the vertical axis and the Cd on the horizontal acis. Once in a while you might run across a book or article showing them the other way around but this will be rare--unless you make a habit of reading aeronautical engineering texts.

As I said, the Cl goes up and down the vertical axis, shown on the left. It can extend as far as needed in both positive and negative directions and is usually divided into increments of 0.1.

The Cd, on the horizontal acis usually ranges from 0 to 0.025 although it too can be extrapolated farther out if needed. It is usually divided into increments of 0.001.

Profile drag is a term used to combine two sub-species of drag. Form, or pressure, drag and viscous drag--skin friction. Pressure drag is the total of all the pressure variations over a body as the

air flows around it. Viscous drag is caused by the contact of the air with the body's surface.

The two forms of drag are sometimes split for purposes of details analysis but the relationship between form drag and skin drag is very close--the two affect each other.

For example, skin friction is very much governed by the speed of the airflow, and the speed of the airflow next to the skin is mainly determined by the shape of the body as a whole. For this reason, particularly where wings are concerned, skin drag and form drag are commonly lumped together as profile drag.

The three Fig.s below show three different profile drag curves. Even though they have decidedly different shaped, there are characteristics common to all three of them and, not surprisingly, common to almost all airfoil drag curves.

Look at the bottom of the drag curves first. As the Cl rises, there is a slow decrease in profile drag. At some point, determined by the shape of the airfoil, a further small increase in Cl produces a rapid decrease in profile drag. This rapid decrease ends at the airfoil's minimum drag point--commonly called the knee of the curve.

From that point upward, the drag slowly increases with rising Cl. Further increases in

graphs.

There are three sections to Fig.#1-- three separate graphs. On the left are the velocity distributions and the airfoil profile. In the middle, are the profile drag curves. Finally, on the right, is a section containing the lift curve, pitching moment curve and boundary layer conditions.

VELOCITY DISTRIBUTIONS

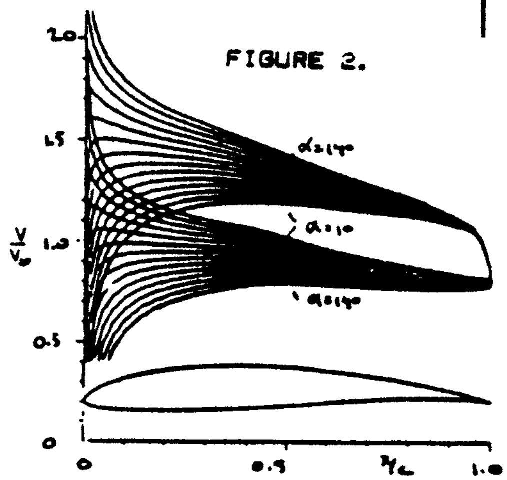
We're going to quickly gloss over the velocity distributions for reasons I'll give you in a minute.

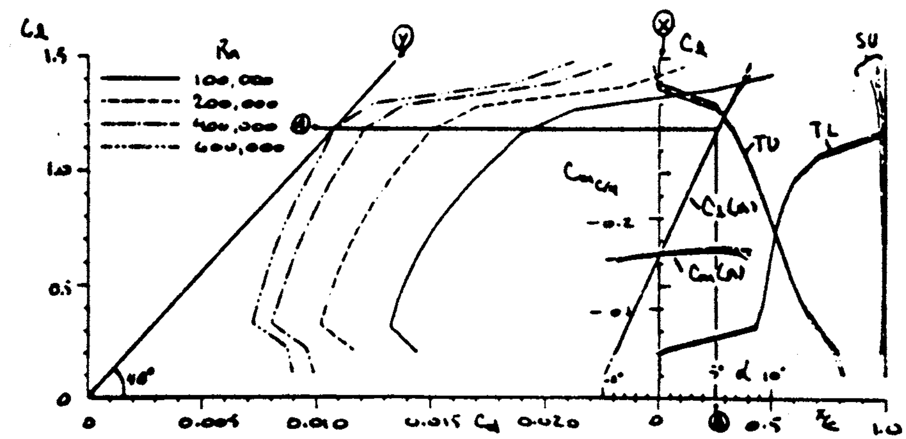
Velocity distributions should have a smooth look. The lines should flow smoothly--without bumps, dips or quick little wiggles. As soon as you've confirmed that the lines flow smoothly, you can go to other things.

We won't, right now--but you can later.

Essentially, the velocity distributions show where along the airfoil's chord, and by how much, the air flowing over and under the airfoil speeds up in response to the particular shape of the airfoil.

All of the aerodynamic characteristics of an airfoil can be found in or calculated from these velocity distributions.





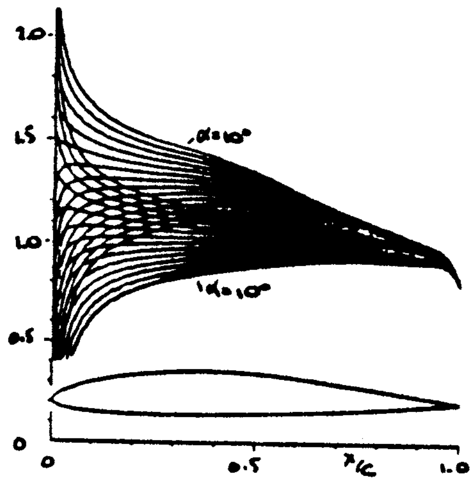
Velocity distributions, airfoil profile, and theoretical section characteristics for the Eppler 214. From SOARTECH 3.

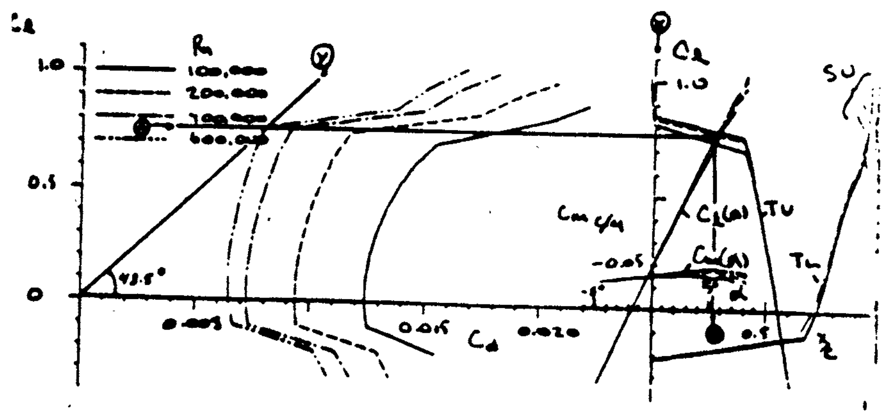
The bad news is that the information is wrapped up in some very heavy fluid dynamics.

The good news is that the angle of attack produces stronger pressure variations across the wing and the profile drag starts increasing rapidly with small increases of Cl. On the graph, this is where the upper portion of the polar line is turning toward the horizontal. In flight, the airfoil is getting close to a stall. This middle portion of the curve--from the point where the drag starts decreasing rapidly to where it starts increasing rapidly--is usually called the low-drag range of an airfoil. Sometimes it's called the drag bucket.

The shape of the airfoil determines how radical the transition from slowly increasing drag to rapidly increasing drag will be. One of the primary factors seems to be how far back from the leading edge the airfoil's point of maximum thickness is. Another factor is the amount of camber and how far back from the leading edge it occurs.

FIGURE 3.





Velocity distributions, airfoil profile, and theoretical section characteristics for the Eppler 374. From SOARTECH 3.

Usually curves for several Reynolds numbers are shown. The Reynolds number is a non dimensional number. Just a number; no inches, pounds or feet per second. It's derived from a combination of velocity, chord length and the properties of air, such as density.

RC sailplanes operate in a range of Reynolds numbers between 60,000 and 600,000. The lower portion of this range-60,000 to 100,000--is a very troublesome and little understood region of flight characteristics. I won't get into the reasons why here--just take my word for it.

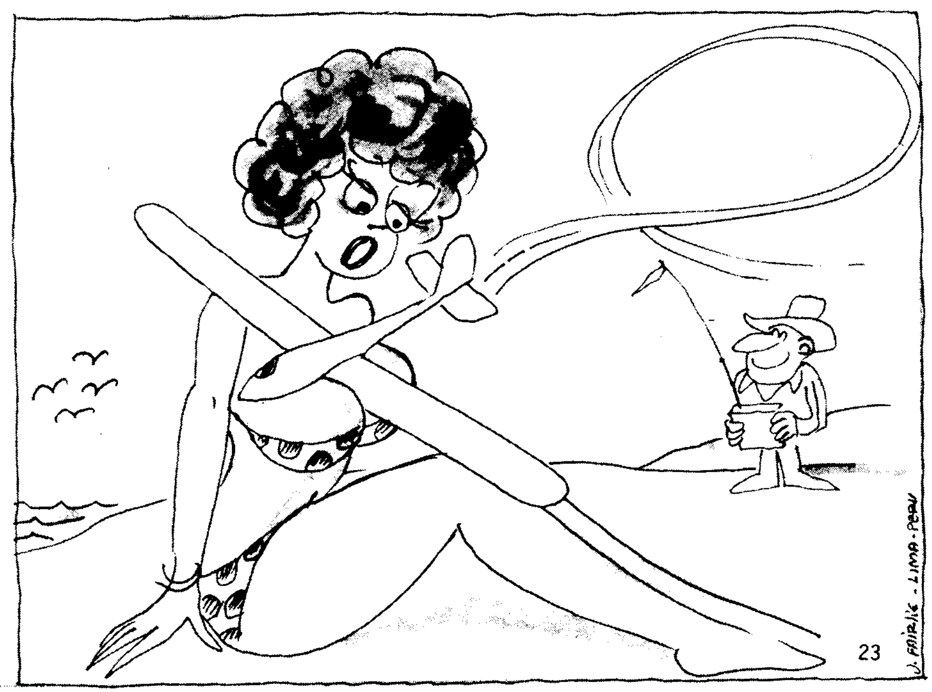
Basically, increasing the speed or the chord length or both will increase the Reynolds number. In all cases the bigger the Reynolds number the better.

Re-printed from the S3 newsletter by way of the TOSS newsletter.

SOURCES

For anyone who is interested in **AERO TOWING**, and supplies for same, (including an excellent video tape), contact J. Lee Smith, 15 Ravenhill Road, Winnipeg, Manitoba, Canada R2K 3K4.

WINCHES are always a popular subject, and a new supplier has just announced availability of a 12-volt winch using late model GM starters. Write to FLIGHT LINE SYSTEMS, P.O. BOX 1502, Lewiston, Maine 04240.



Comet Spec. Sheet Flown By Steve Work at The FIA-F3B World Champs

see photo page 11

C O M E T

TOTAL WING AREA:	6,467.16 cm^2 (1,002.41 in^2)
TOTAL SPAN:	2,854 meters (112.36 in)
TOTAL WEIGHT (DRY):	82 oz. (2,330 grams)
WING LOADING (DRY):	11.8 oz/ft^2
LENGTH:	138.75 cm (54.625 in)
STAB AREA:	568.8 cm^2 (88.16 in^2)
AIRFOIL (WING)	HQ 2-9

CONTROLS: AILERON, FLAPS ELEVATOR, RUDDER
AILERON/RUDDER MIX
FLAPS/AILERON MIX
FLAPS/ELEVATOR MIX
FULL SPAN FLAPS FOR LANDING

CONSTRUCTION

FUSELAGE: KEVLAR

WING: FOAM CORE
CARBON FIBER SPAR
CARBON FIBER JOINER (5/8 DIA ROD)
GERMAN PINE SHEETING 1 MM THICK

STABS KEVLAR HOLLOW CORE