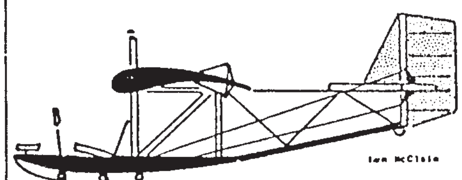

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R/C Soaring Digest

Vol. 7 No. 1 January, 1990

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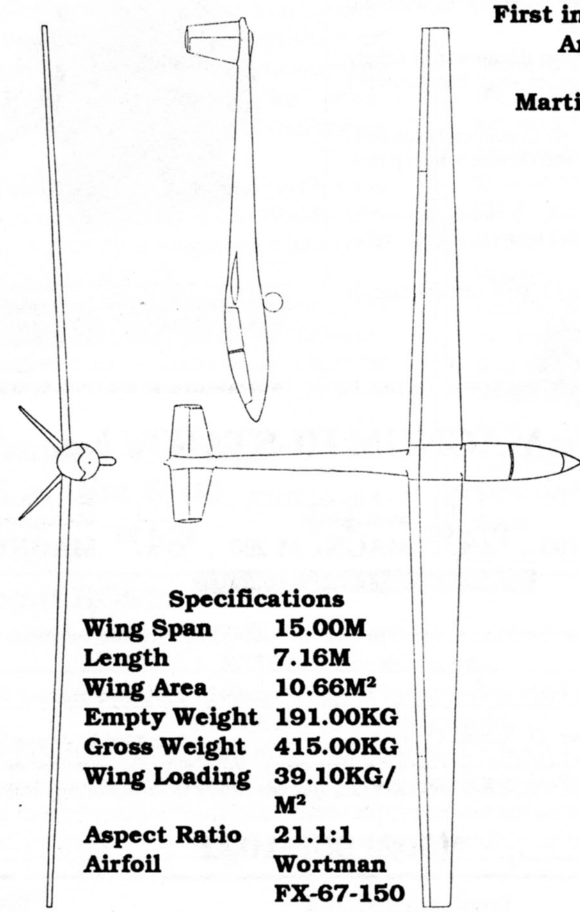
"Special Edition" Issue

Featuring the First in a series of Articles by Martin Simons



Specifications

Wing Span	15.00M
Length	7.16M
Wing Area	10.66M²
Empty Weight	191.00KG
Gross Weight	415.00KG
Wing Loading	39.10KG/M²
Aspect Ratio	21.1:1
Airfoil	Wortman FX-67-150

High Start

We are proud to announce that world-famous author, pilot and educator, Martin Simons will begin a regular column each month in *RCSD* and titled: UNDERSTANDING THERMAL SOARING SAILPLANES. The material, half of which has already been received, is expected to take up at least a full year's-worth of issues!

Martin Simons is fundamentally a TEACHER and is lecturer at the University of Adelaide (Australia). He has authored the book *Model Aircraft Aerodynamics*, now in its second and updated printing, and is columnist for the Australian model publication *AIRBORNE*. Additionally, Martin has been a full-scale glider pilot for years, having begun in England some years ago, and has been President of the Gliding Federation of Australia as well as being editor of *Australian Gliding* — their national soaring publication. Besides all these accomplishments, Martin Simons has designed out and flown many original R/C sailplanes, including his current MARTINI, as well as scale models of well known gliders.

Perhaps Martin's "magnum opus" in the view of most soaring enthusiasts is *The World's Vintage Sailplanes 1908-45*, a magnificent and comprehensive reference work.

RCSD wishes to welcome Martin Simons to its pages with gratitude and appreciation for his excellent — and original — material, seen here for the first time.

Happy Soaring,
Jim Gray

Important Notice to Subscribers

The bulk mailing process has changed with the mailing of this issue. Your subscription, effective with the January issue, is being mailed from California. Please carefully check your mailing information on the label and, if you find that any of the information is incorrect, please contact:

Judy Slates
P.O. Box 6680
Concord, CA 94524
(415) 689-0766

Because of this change, we realize that one of you may not get your issue. So, we would appreciate it if you would ask at least one other subscriber, "Did you get your January issue of *RCSD*?"

Please remember that, if your mailing is done via bulk mail or surface mail, the subscription arrives approximately 2-3 weeks after the airmail & 1st class.

Additional information will be forthcoming in the February issue.

About RCSD...

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

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

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

How to Avoid Hanger Rash from...

Jer's Workbench

I have found an easy way to avoid most injuries caused to my fuselages...

Have you ever sat down at your work bench to install the radio, servos and other miscellaneous equipment into the brand new fuselage (the one that you just painted two days ago), and discovered scuff marks or hanger rash because of those little things that hide on or about your work bench? I have found an easy way to avoid most injuries caused to my fuselages by putting them into a form of cradle that is used to hold the fuselage in an upright position.

Construction

The cradle is constructed out of a 1" X 6" X 72" piece of clear pine. Using a hobby jig saw, I cut out the parts, as shown in the diagram, and then I drilled and screwed them together. For an extra touch, after adding a coat of paint, I added some carpet for the fuselage to rest on. Then, I added a set of rubber bumpers so that the cradle wouldn't mar any delicate surfaces. Although the photo shows that a lid can be added, it is not required. I find that the addition, however, transforms the cradle into a "tool box" that can hold miscellaneous parts belonging to the glider.

The final length of most of the cradles I have built is approximately 18" long and, generally speaking, one size "fits all".

Jerry Slates
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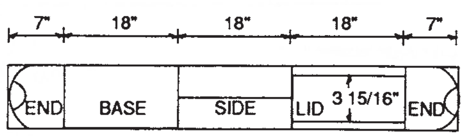
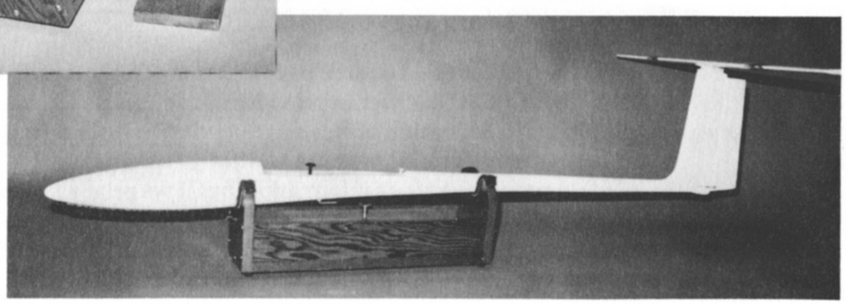


Pattern



Electric Currents

...by Felix Vivas

I've been very pleasantly surprised by the amount of mail I've received about electric flight with a good portion of the inquiries relating to: "How do I get started in competition?"

In the August issue, I alluded to Harbor Soaring Society's upcoming second bi-annual F3E FAI Seven Cell Contest, which I organized. It had cash prizes totalling $2000.00 ($1000.00 for first place down to $150.OO for fourth place), and only for beginners/novices. No F3E FAI team members or candidates attempting to make the team or the first and second place winners of our first contest were allowed to enter.

We had a good turn out of 14 contestants (our first contest had 18 contestants and I had hoped maybe we would get 20 plus contestants for our second), but some of the contestants failed to appear contest day because of crashed airplanes in last minute testing/ practice and a couple of people were still building.

One interesting result is that the winners who received the $1000.00 first prize in both contests were slope flyers, Jerry Bridgeman and Jason Perrin, and the winning aircraft were modified slope gliders (Snipes built and kitted by Jerry Bridgeman). Hence, a fair conclusion would be that with a good, fast kit slope glider, with a fuselage large enough to hold an Astro FAI 05 Cobalt motor, seven 900 MA batteries, an on and off switch or speed controller, and a couple of servos, you have an FAI F3E 7-cell competitor. Mark Allen's Flite-Lite makes some very good slope glider kits which should be looked at. The budding adventurous electric competitor/builder might think of building his own fuselage to mate to one of Mark Allen's wings or scratch build your own.

This coming February 17, 1990, Harbor Soaring Society is holding a seven-cell and unlimited F3E contest in Costa Mesa, California, open to anyone for trophies as a warm-up to the AMA F3E team selections at a not yet selected site sometime in July 1990. For those interested in knowing the rules, write the competition secretary at AMA Headquarters in Reston, Virginia, for the 1990 FAI rule book. Or, send me a SASE and I can mail you a course diagram and the main rules. Also, feel free to call me for information or help.

It's interesting to note that in the past years in Europe, at National and International F3E contests, it's common to have 40 to 50 plus unlimited contestants participate. In their ten-cell class they usually have 50 plus participants. In comparison, at our last two AMA F3E team selection competition, we got 9 participants and, at the second one, 7 participants.

F3E electric competition is the most dramatic, exhilarating, high adrenaline, rewarding type of competition flying around. One round encompasses pylon type flying, a high speed dive bomb run, thermalling for five minutes and a precision landing. Common phrases heard from beginners to F3E flying are: "This is really neat" or, "I'm glad I finally tried it!" So what are you waiting for? A thousand dollars could be yours in 1990.

Questions? Call or Write:
Felix Vivas
1800 16th Street H-310
Newport Beach, CA 92663
(714) 645-3263

On The Wing

...by B²

We've received several letters, and even a few 'phone calls, from RCSD readers who are designing, building, and flying their own swept 'wings. A common area of interest is "winglets", and so that is this month's topic.

Nearly all modern swept wing tailless soarers have fin area at the end of each wing. These winglets usually incorporate some sweep in their form and are mounted vertically, with their trailing edge meeting that of the wing itself.

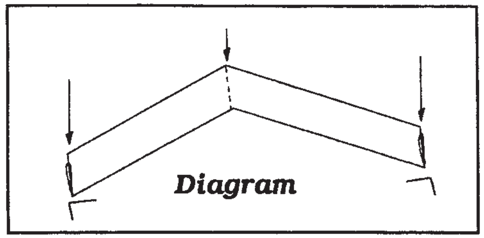
Swept wings have some inherent directional stability. This is because as the wing yaws the span of the forward wing is effectively increased, creating more drag, while the drag of the receding wing decreases. The devilish problem that arises is that of yaw-roll coupling. This occurs because the forward wing creates more lift, as well as more drag, while the receding wing produces less lift. Yaw-roll coupling is not inherently bad, but it is something that needs to be kept under control.

The first purpose of fin area, then, is to provide additional directional stability, hence reducing yaw and the associated roll. The second purpose is to prevent a steeply banked 'wing from sliding span-wise toward the ground.

If these were the only reasons for fin area, we'd be likely to see only a single fin mounted on the centerline of the wing, perhaps on the end of a small boom if the sweep angle is large enough.

But by splitting the fin area in two, and placing each of the resulting smaller fins at the ends of the wings we are able to effectively inhibit the vortex usually formed there. This increases efficiency. Some designers have taken this a step further and extended the elevons all the way to the winglets, allowing the winglets to seal the outboard tips of the elevons, thus increasing their effectiveness.

Most of the winglets that we've seen extend only upward from the wing, apparently because the smaller downward projecting portion of a true Whitcomb winglet would be easily broken off during landing. These winglets are commonly made of sheet balsa, with the leading edges rounded and the trailing edges sharpened. These "flat plate" winglets are prone to stalling, and are therefore mounted parallel to the direction of flight and aircraft centerline.



Admittedly, the flat plates seem to work well and are easily constructed, but the relationship of tip fin airfoil and toe-in is certainly a topic worthy of investigation.

The diagram shows a positively swept wing yawed slightly to the left. Notice that if the tip fins are toed in just a couple degrees then the right fin tends to correct the yaw. The left fin would similarly correct a yaw to the right. No drag penalty would be incurred at low yaw angles (compared with a flat plate mounted at O degrees) if the symmetrical airfoils used were chosen carefully. Anyone interested in obtaining coordinates and plots of several appropriate tip fin sections for such an investigation need only send a request to us along with the usual SASE; a legal size envelope is best. The plots will be 7 inch chord, the average for 'wings of about 2.4 meter span.

In an attempt to smooth the lift distribution at the end of the wing, a few designers have tipped the winglets outwards at a 5 to 10 degree angle from the vertical. The effectiveness of this technique is probably variable.

One final note: The term "winglet" does not properly describe the tip mounted fins we've talked about here. Neither does the term "tip plate". Personally, we're rather fond of the descriptive term used by Dr. Martin Lichte in his book *Nurflugelmodelle* - "Ohren" or "ears".

Bill & Bunny Kuhlman
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Olalla, WA
98359-0975

B² Streamlines

The address for the plans service is different than the address for " On The Wing"!
In prior issues, the zip code was incorrect. Please correct the address for B² Streamlines if you are writing regarding the plan service.
B² Streamlines
P.O. Box 976
Olalla, WA 98359-0976

Coming Event

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Chatsworth, CA 91311	Ridgway, PA 15853

All-grass field, shade, parking, bar-b-que, 10 miles from Pasadena, Saturday nite banquet, prizes & awards. Limit of 60 contestants (5 or 6 per frequency); Flights: 3-minute Precision Duration, landing on a 25-foot grid, scoring as a % of flight points; 22-minute "add-'em-up" max per flight 7 minutes, total four flights, landing grid with landing points (instead of percentage); 3-5-7 minute duration with landing points.

Bumblebee

Bob Fronius says, "My son, Floyd has a Bumblebee, but no engine!"

Understanding Thermal Soaring Sailplanes

...by Martin Simons

(This is the first in a series of articles by Martin Simons. Reproduction of this material requires the permission of R/C Soaring Digest & Martin Simons.)

PART 1

Introduction

An international competition class, F3J, for model thermal soaring sailplanes is now recognized. The provisional rules are those of the long-established and popular Open Class championships run by the British Association of Radio Control Soarers (BARCS). There will be no speed or distance tasks. The emphasis is on duration.

Summarizing the rules, only hand towline launching is permitted, with 150 metre lines. The contest site must be as flat as possible. The pilots aim to achieve the maximum possible flight time within a ten minute period or 'slot'. Models are launched immediately at the start of the 'slot' and aim to touch down just before the end of the ten minutes. One point is scored for each second of flight after release from tow up to the end of slot time.

A penalty of 30 points applies for overflying the slot and the score is zero if the overflight is more than 60 seconds. A bonus of 50 points is earned for landing within a 12.5 metre radius circle, 25 points if the model comes to rest only partly within the circle. To score landing points the model must be at rest before the end of the slot. The small bonus for landing within the 12.5 metre radius circle, although not negligible, reduces the likelihood of a contest being decided by landing points alone. Landings more than 75 m from the centre of the target reduce the flight score to zero.

The models are limited in size and weight by the general CIAM rules: total surface area not more than 150 square decimetres, mass not more than 5 kg, area loading between 12 and 75 grammes per sq dm. (1.2 to 7.5 kg/sq m, or 4 to 24.5 oz/sq ft.).

A five minute preparation time is allowed before the start of each 10 minute slot. The usual normalization of scores to 1000 championship points for the winner of each heat applies.

Full details of the rules should be available from the National Soaring Society and the AMA.

A ten minute maximum is unattainable because the models are not launched until the start of the slot time. A potential point is lost for each unnecessary second on tow. Launching is hard and fast. After release, to achieve something over a nine minute flight requires soaring.

The aerodynamic design of the sailplane is only one of the important factors to be considered. Success depends greatly on the pilot's skill and experience, finding and using thermals efficiently, and getting the glider down in the target circle within the stipulated time. The structure of the model is also vital. The models are not launched gently and may have to descend fast.

Even so, attention to the fundamental points of sailplane performance will help to direct sailplane development and piloting strategies along the lines required by this type of contest. These are familiar already to many but it is necessary that they should be well understood, because almost everything else follows from them.

The sailplane polar

Figure 1 shows the appearance of a typical sailplane performance or polar curve. The curve is a plot of flight speed against rate of descent through the air. The scale along the top shows the airspeed of the glider; the scale down the side gives the rate of sink. Whatever system of units is preferred it is best on such a chart to keep both airspeed and sink rate in the same units, such as metres per second. It is not very satisfactory to use, say, kilometres per hour for airspeeds and metres per second for sink, or nautical miles per hour (knots) for airspeeds and feet per second for sink rates. The reason will become plain when the glide ratio is considered.

Suppose the model is flying straight in calm air with no up or downcurrents. To dive, the elevator is deflected down. The glider will accelerate but after a little time, if the controls are held in one position and if the model is stable, it will settle down to a constant, fast, flight speed. Because it is diving it will lose height rapidly. The elevator position as held by the pilot or fixed by the trimmer, determines the airspeed and also the rate of descent. This gives a single point to be plotted down near the right hand, lower part of the chart, or even off the chart altogether if the dive is steep. An airspeed of so many metres per second results in a sink rate of so many m/s. The ratio of airspeed to sink gives the glide ratio; 12 m/s airspeed with 1 m/s sink gives a glide ratio of 12:1. for example. (This is why it is wise to keep the units the same on both scales. If the airspeed is recorded as 43.2 km/h and the sink as 1 m/s some arithmetic is required to work out that the glide ratio is 12: 1.)

If the elevator position is altered so that the model dives less steeply, the airspeed reduces. Any control movement usually causes some oscillations but these are damped as much as possible by the pilot, aided by the inherent stability of the model. The glider soon settles to a new trim at steady, slower airspeed. The rate of sink is also less because the dive is less steep, so another point can be plotted higher on the chart towards the slower end of the airspeed scale. Within the normal flight capabilities of the glider, for each elevator position decided by the pilot there is one steady airspeed and a corresponding steady rate of sink through the air, so for every possible stable flight trim there is a single point to be plotted on the chart. This can be repeated many times. Plotting the points and linking them up allows the construction of the whole polar performance curve.

One end of the curve is at the stall. Normal flight is not possible at slower speeds. The other end of the curve is the vertical dive but the speeds and rates of descent in this trim are too high to be included on charts of reasonable size and are not of much interest in practice. (In a truly vertical dive, airspeed and rate of descent are the same thing. It would be possible also to construct another curve representing the inverted performance of the glider, but this does not normally interest the thermal soaring pilot.)

The general character of the polar curve is roughly similar for all sailplanes, but individual sailplane polars will occupy different places on the chart. The entire curve as a whole may be towards the high speed side of the airspeed scale, or towards the low speed end. Some curves may be high, indicating very low rates of sink, others may be lower down the chart. Some curves are somewhat flatter than others indicating a wide range of airspeeds with relatively small changes of sink rates. Some polars have sharp peaks, indicating rather critical dependence of the rate of sink on trim. The differences in straight flight performance of various designs can be represented by constructing polars and comparing them. Any change of the characteristics of a sailplane is usually reflected in a corresponding alteration of the polar curve. For example, decreasing the total weight tends to shift the curve as a whole leftwards to the lower speed side but also makes it come to a sharper peak, spoiling the high speed portions of the curve. ...continued on page 8

Understanding Thermal Soaring Sailplanes ...continued

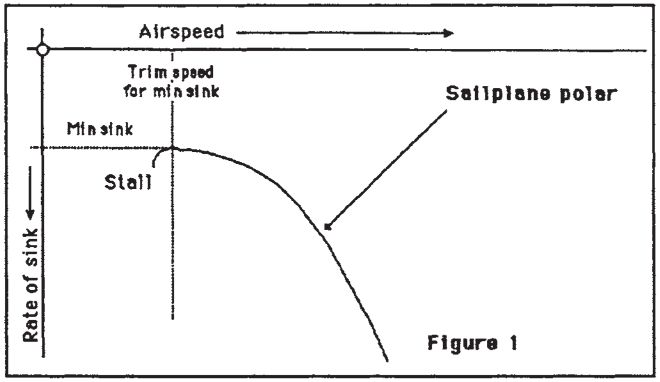

Figure 1

Increasing the weight shifts the curve to the right, flattens the peak and raises the faster side of the curve but increases the stalling speed and the minimum rate of sink.

The polar for a particular aircraft, at a particular weight, may be constructed either from measurements in flight or by calculation. Measurements in flight are extremely difficult to do accurately with models and have rarely been attempted. We normally have to rely on calculation and computer programs are now available for this. The general principles are all that need concern us at present.

It is easy to do worse in flight than the polar suggests. If the model is allowed to skid or slip sideways the fuselage and wing will meet the air at a lateral angle instead of being aligned correctly with the flow. A great deal of extra drag will result. The glider will sink faster than the polar indicates.

Also, if the model is unstable it will not hold any steady glide for long. Every movement of the controls causes a slight increase of drag and loss of performance, so an unstable glider, tending to veer off line and requiring constant corrective action by the pilot, is not likely to achieve its potential. Stability, as most experienced pilots know, is determined chiefly by the position of the centre of gravity. A c.g. well forward makes for a stable aircraft and as the balance point is moved aft, the stability margin decreases.

If the air is turbulent the pilot has to apply numerous corrections and this, too, spoils the glide. Nonetheless, other things being more or less equal, the sailplane with the best polar curve will perform best in practice.

The minimum sinking speed

The highest point on the polar curve represents a trim which will give the model its absolute minimum rate of sink. There is no way, for a particular glider, at a particular weight, that the minimum sinking speed relative to the air can be reduced. The sailplane with a low rate of sink on the polar will, in general, be capable of soaring in weak lift, but there are important reservations to be made here.

A glider which has a good basic polar for straight flight, will also perform well in turns. When circling in a thermal for instance, the polar curve, airspeed against rate of sink, is similar in general shape but the drag is higher and the stalling speed rises. The entire polar moves down and to the right on the chart by an amount depending chiefly on the angle of bank. The stalling speed and drag are both increased and the rate of sink increases. This cannot be avoided and the steeper the angle of bank the worse it gets. However, the losses certainly cannot be reduced by 'turning flat' without bank, as some pilots seem to believe. If the bank angle is either too flat or too steep for the rate of turn required, the glider will skid or slip and come down faster. A stable glider, trimmed for turning flight, is best left to settle down in its natural steady turn at a constant angle of bank. Too many adjustments by the pilot tend only to increase the drag and increase the rate of sink in the turn. Such frequent changes also make the circles, as flown, irregular. It becomes impossible, from the ground, to judge whether the sailplane is in the best part of the thermal or not, if it is constantly varying its attitude.

The rate of turn (that is, the number of complete circles made in a given time) is decided almost entirely by the angle of bank so, for a given model, at a given flying weight and airspeed, time taken to complete a circle is constant so long as the angle of bank is constant. However, the radius of turn at a given angle of bank depends on the flight speed, wing area, total mass, and stalling characteristics. Thus a heavily loaded jet fighter aircraft flying fast, at a bank angle of 60 degrees, might require the airspace over half a county to complete a circle, whereas a light aeroplane at the same 60 degree angle of bank can circle with a radius of only a few score metres. A model sailplane at 60 degrees bank may complete a circle in much smaller space again. The radius of turn thus depends on the bank, the weight, and the airspeed.

If a thermal is very narrow, a light, slow sailplane which can circle tightly with correct bank at a slow airspeed without stalling, may outclimb a model which has an apparently better straight flight polar, but which flies faster and cannot circle tightly without having to bank excessively. It is often found that even when a thermal is wide, there are narrow 'cores' within it so a sailplane which can find these and circle tightly within them, has an advantage. If thermals are very strong, this difference will hardly appear but with weak and diffuse thermals, it can be very important.

One of the things to be discovered therefore, is how to make a model glider with the least possible rate of sink. But we also like to have a low stalling speed, allowing a small turning radius with gentle bank angles. These requirements are to some extent incompatible with other desirable qualities

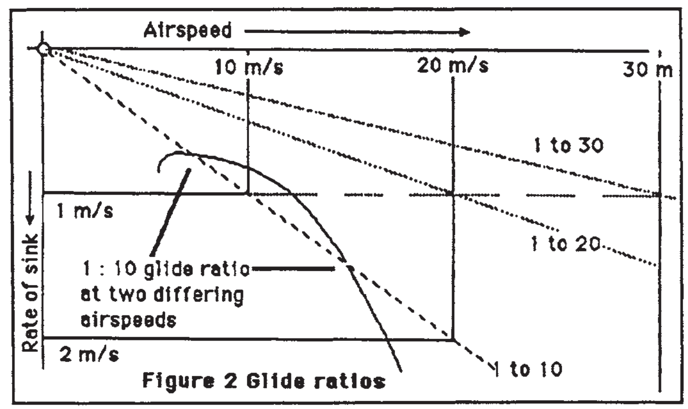

Figure 2 Glide ratios

The best glide ratio

Unless the sailplane happens to be launched straight into a thermal, which does happen sometimes but cannot be relied on, after coming off tow it will be necessary to explore the air for some distance to try to find lift. During this search the sailplane will be descending so the distance it can glide in relation to its rate of losing height becomes very important.

If a glider is flying at 10 metres per second horizontally, and descending at 1 metre per second, it is gliding ten units along for one down, a glide ratio of 10 to 1 (Figure 2).

Such a glide ratio would also be achieved by gliding at 20 m/s horizontally and descending at 2 m/s, a ratio of 20 to 2 which cancels down as 10 to 1, and so on, 30 m/s speed with 3 m/s sink is the same 10 to 1 ratio. A straight line can be drawn on the chart to show all combinations of speed and sink rate which will give a glide of 10:1. On the chart the 20:1 glide ratio line is higher than 1:10, the 30:1 glide ratio line higher ...continued on page 10

Understanding Thermal Soaring Sailplanes ...continued

still, and so on. All these L/D lines radiate from the zero-zero or origin point on the chart. The glide ratio is often expressed as the ratio of total lift to total drag or L/D, because when the drag force on the glider is one tenth of the lift force, i.e, L/D = 10/1, the glide will be 10 along for 1 down. Since the lift is for practical purposes equal to the weight, the L/D or glide ratio may also be thought of as the ratio of weight to drag.[1]

A particular glider may never reach high glide ratios With the example of Figure 2, the polar curve does not reach the 20:1 glide line anywhere. However, the polar cuts the 10:1 glide ratio line twice, at low speed, near the stall, and again at a higher speed. The glider can achieve a 10:1 glide ratio by flying at two different airspeeds, slow and fast. It will achieve a flatter glide if it is flown at any trim between these points. The best glide ratio of this model is thus somewhere between 10:1 and 20:1. A straight line drawn from the origin, to touch the polar curve tangentially, indicates both the best possible glide ratio and the speed at which it should be trimmed to achieve it (Figure 3). It is, in this case, roughly, 11 m/s speed to 0.8 m/s sink, a ratio of 11:0.8 or 13.75:1. As the diagram shows, the best glide ratio is not found at the same trim as the minimum sink rate. Minimum sink is found where the polar curve is highest on the chart. The best glide is found where the tangent from the origin touches the curve. These two distinct points require different elevator positions. This is often misunderstood.

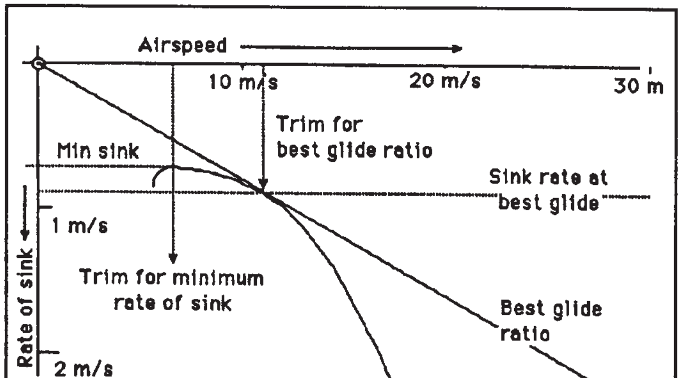

Figure 3 Trim and performance

Martin Simons
13 Loch Street
Stepney
South Australia 5069

The trim for the best gliding angle is hardly ever used in practice. The only time when it might be needed is when the air is perfectly calm with no wind and no up or downcurrents. This is a very rare situation. On almost all other occasions the required trim will be either faster, or slower, than that for the best L/D. (Slower when soaring, faster when searching for lift.)

♣ ♣ ♣

[1] Strictly, the lift is equal to the weight multiplied by the cosine of the angle of glide. At glide ratios better than 5 : 1 the lift is always more than 98% of the weight.

Press Release

NorthEast Sailplane Products

...by the NSP Gang

As any devout RC sailplane enthusiast knows, finding information on RC sailplane kits and related products can be a frustrating experience. This is especially true of the higher performance ships in the market since they are manufactured mostly by small and widely diversified cottage industries which make great kits, but have difficulty making them well known. Further, aerodynamic design technologies are advancing at such a rapid pace that it is nearly impossible for RC soaring pilots to be aware of the newer kits which exploit these technologies. Indeed, some of the more popular kits currently being flown are relatively outdated from a design perspective simply because information on the newer, more advanced kits is not readily available.

Difficulties such as these are what led to the creation of NorthEast Sailplane Products, or NSP. NSP was founded by Sal Defrancesco, a Marketing Expert, and Jay Kempf, an Engineer, and made its debut at the 1989 WRAM show. This turned out to be a tremendous success, and feedback obtained from RC Sailplane Pilots confirmed the need for NSP services. This year, Stan Eames, a Computer Systems Expert, joined Sal and Jay to create a three man partnership we feel has a special synergy of skills. All three members of the NSP team are fanatical Builder/Pilots of soaring ships and represent a combined experience of over 35 years in RC soaring.

NSP is a mail-order business intended to cater to the RC soaring enthusiast (we don't do power, the airfoil is the airplane). In creating NSP, we set the following goals for ourselves:

- To be a focal point for the latest information on RC Soaring Technologies.
- To provide the largest selection of RC Soaring kits and accessories available in the industry.
- To only sell high quality kits, and to aid designers and manufacturers in improving quality through providing customer feedback.
- To help the hobby of RC Soaring grow by making useful information available to hobbyists.
- To have our catalog be not just a catalog but a key reference on kit specifications that will be a "must have" for any RC Soaring Pilot or Builder.

We're excited about providing our services to the soaring community, and looking forward to making our NSP catalog available soon. The catalog will feature over 70 kits and accessories, full kit descriptions, technical specifications, and valuable reference information for comparing kit specs. Also, we'll include plenty of building and flying tips. Enclosed you will find an excerpt from the catalog. **(Not included in *RCSD*. Please see ordering information below.)** As you can see, our product descriptions go beyond simply copying what is on the kit cover. We review the kits, talk to people who have flown them, and build and fly many ourselves. We want people to be happy with the kits that they buy from us, so we provide the information necessary for a person to make an informed purchase.

People desiring a catalog may call us at 802-658-9482. Also, feel free to call to chat as we love to get information and are always willing to share it.

NorthEast Sailplane Products
16 Kirby Lane
Williston, Vermont 05495

Square-Cube Law & Scaling for RC Sailplanes

...by Michael Selig

So that you will not be easily deceived by what you see, it is worth going over why large aircraft appear to fly slower than small aircraft.

This past summer I, unfortunately, found myself at the controls of someone else's large Sagitta XC after having been calibrated for years to fly my 2M Prodigy. The sailplane was high and downwind when I pushed the nose over to penetrate upwind. I had just reached what seemed to be a moderate and safe speed when suddenly the wings folded and the glider tumbled to the ground in pieces — a fuselage and two wings. The problem was that I attempted to fly the large XC at speeds that appeared to be on the order of my small 2M. On another occasion, a friend on mine scaled a 2M Prodigy up to XC size. His initial reaction to the first few flights was that the 2M flew better — it "seemed" to fly faster than the XC. As further examples, a scale model sailplane looks faster than the full scale, a sparrow looks faster than a crow, and a Learjet looks faster than a DC-10.

So that you will not be easily deceived by what you see, it is worth going over why large aircraft appear to fly slower than small aircraft.

If we consider a class of aircraft of similar geometry and construction (for example, balsa and monokote or fiberglass and foam), the weight will scale as the cube of a characteristic length. This follows generally from mass being equal to density times volume. Taking the wing span as the characteristic length, we can therefore write

$$W \propto b^3 \quad (1)$$

Likewise for the wing area we have

$$S \propto b^2 \quad (2)$$

These relations form what is often called the square-cube law from which a wealth of useful information may be derived. For instance, these equations can be combined to give

$$W/S \propto b \quad (3)$$

Thus if a model is scaled up to twice its size, the wing loading will double if the construction materials are similar. This relationship can be used to estimate the weight of new designs based on old ones. It is only necessary to determine the proportionality constant. Also, since $L = 1/2\, \rho V^2 S C_l$ and $L = W$, we have

$$V \propto \sqrt{\frac{W}{S}} \propto \sqrt{b} \quad (4)$$

This shows that if we increase the span and keep geometrically similar models with the same type of construction, then the speed at a given lift coefficient will increase with wing loading. It does not yet show why large aircraft look slower than small aircraft.

When an aircraft is flying, the only relative measure of length or size is the aircraft itself. Therefore, we can only base the speed on how long it takes the aircraft to cover some distance relative to its size. We can write that the time it takes for the aircraft to travel the length of one wing span b is

$$t = b/V \quad (5)$$

From (4) we can then write

$$t = \sqrt{b} \quad (6)$$

Immediately we see that as the span increases so too does the time it takes to travel a

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Book Review

Soartech 8

...by Jim Gray

It's out, and well worth the wait...

I just received my copy of Soartech 8, published by Herk Stokely and based on the Selig - Donovan - Fraser airfoil tests in the Princeton (University) wind tunnel. To say that this is a magnificent publication would be an understatement; it's the definitive work that we've all been waiting for!

The book is divided into two major sections, consisting of chapters 1 through 4, including the introduction, and chapters 5 through 14 covering the test results, tabular data, polars and lift plots, and comments on each airfoil or group of airfoils tested.

Although one does not normally review books by the pound or by their size, it is worth mentioning that this 8 1/2" X 11" X 1" soft-cover, bound volume weighs two and a half pounds and contains 398 pages covering 164 tests and 2 years of work in the tunnel and one year of work in preparation.

Credit is given by name to all builders and suppliers of the test sections used in the tunnel. If you participated in the research, your name is prominently recognized at the very beginning of the book under "Forward and Acknowledgements".

Whereas the data is all-important, I found chapter 5 — "Comments on Airfoils" the most interesting to the casual reader. It covers airfoil discussions, stall behavior, trips and surface roughness, trailing edge thickness, and surface waviness and contour accuracy. By reading this chapter alone, you can get an idea of what airfoil to use for a given purpose, and why. You can discover why the world-famous Clark Y is still a good airfoil, and why the AQUILA flies so well...and how each can be improved upon. You will find data on the "new" airfoils by Selig, Donovan and Fraser, developed from the data recovered from tests of their "earlier" airfoils. You get accurate line drawings of each 'foil so that you can see just how their shapes differ. An interesting section (7.1) shows nominal airfoil coordinates, and (7.2) shows actual airfoil coordinates.

Another interesting feature is a discussion of how differences in building techniques will change the test results of a given airfoil.

All-in-all, the data accumulated here will be used for years to come, and — most importantly — contains lessons for those who wish to design new airfoils. If you are curious about a term called "Bubble Ramp", what it means and how it affects airfoil performance, you'd better get this book!

The price of this indispensable book follows:
U.S. / Canada: $15 (book rate)
Elsewhere: $20 (surface mail)
Foreign Airmail: $27 England & Europe; $32 Australia & Asia

Order your book from Herk Stokely: via H.A. Stokely, Publisher, 1504 North Horseshoe Circle, Virginia Beach, Virginia 23451 USA.

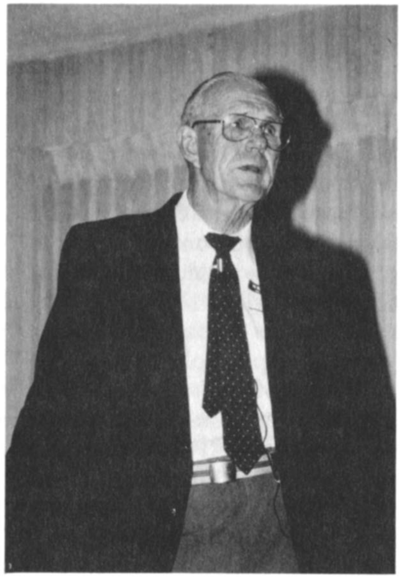
You will also be interested to know that David Fraser's "Sailplane Design 3.0" is a computer program for sailplane performance evaluation and is available from David B. Fraser, 1335 Slayton Drive, Maple Glen, PA 19002 USA. The program comes with 100 airfoils, including ALL THE PRINCETON DATA, and costs $35 in USA/Canada and $37 elsewhere. It is available on 3 1/2" or 5 1/4" floppy diskettes for IBM PC or PC clones, only. This program makes a very desirable adjunct to the book, and for serious designers and builders will be considered a "must".

MARCS National Soaring Symposium '89

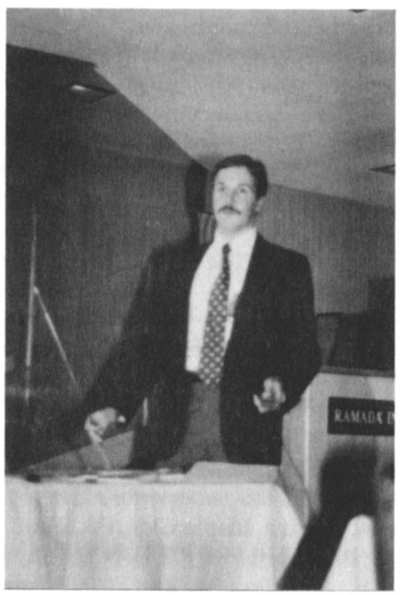
...by Lee Murray & John Palfery

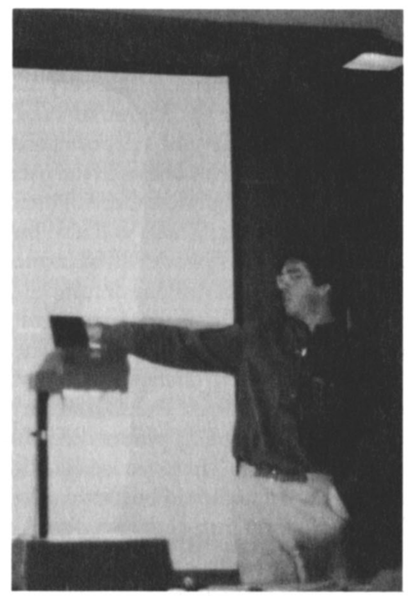
The '89 National Soaring Symposium in Madison, WI was an excellent place to be if you are into high performance RC soaring as were the 102 people attending from places as far away as Oregon, California, New Jersey, & Florida. As in years past the agenda started with Walt Good the father of R/C modeling who took us on a trip to Europe to discover where electric flying combines with soaring at the Militky Cup electric event. This Swiss electric model competition encompassed a wide range of models ranging from small pylon racers with 30 cells to a scale B-36 with six motors. The most popular electric soaring event, The Swiss Cup, uses 6 cell models, a 40 second engine run and a 5 minute max.

Walter Panknin followed with an excellent talk about his developments in flying wings. Walter dispels the myths about flying wings being unstable or difficult to fly. Walter predicts that flying wings will be used in speed and distance events in the future because of the inherent advantage in speed and L/D for flying wings as compared to models of the same size with tails. The most successful designs should have an aspect ratio of about 10 have only moderate taper in the wings and have winglets to improve the visibility of the model. Equations appropriate to flying wing design were presented.



Left: Bob Champine giving his banquet presentation on his many experiences as a NASA test pilot. Right: David Fraser discusses the engineering features of the Princeton test equipment which he provided.





Left: John Donovan discussing the wind tunnel experiments. Right: Michael Selig reviews the scope of the Princeton Wind Tunnel tests.

Larry Jolly gave a talk about competition flying and the evolution in RC Sailplane design. The heritage of the Sagitta model was traced from the west coast model "Shaker" and the Eppler 205 airfoil. The E205 airfoil remains very popular because it gives good results and can be built with ordinary tools by the average modeler. Improvements on the E205 were first the S3021 and, as a result of recent Princeton tests, the SD7032.

The attributes of competition models for the various classes or RC sailplanes were described in quantitative and meaningful ways. His principal advice on competition flying was to match the glider design to the competition task. Aileron airplanes are recommended only for higher wing loadings on models. At low speeds ailerons do not work well. The Cheeta is a good first aileron ship. E374 is a good airfoil for XC ships because it is not pitch sensitive. Sheldon's has perhaps the best supply of LJMP models.

Michael Selig, John Donovan, & David Fraser described the wind tunnel tests they conducted at Princeton Univ. A total of 54 airfoils were tested (38 old, 19 new) using computerized equipment provided by David Fraser and 1200 hours of wind tunnel experiments. The work resulted in 130 polars (descriptions of airfoil performance) with Reynolds numbers ranging from 60,000 to 300,000. The results will be covered in Soartech 8 published by Herk Stokely.

The results indicate that modern airfoil theory does predict in at least many cases the performance of

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MARCS ...continued

LJM Associates Lee Murray & John Hohensee share the magic of sailplane performance analysis on PC clone & Macintosh.

model airplane wings which are constructed precisely. The day of arbitrarily created airfoils is past. While they might fly satisfactorily, they can never approach the performance of computer derived airfoils. The models produced for the test were profiled for accuracy. The best models were within a few thousands of the correct value. The areas most frequently out of specification were the point where the leading edge was joined to the main part of the airfoil and the trailing edge. The performance improvements on modern airfoils are being built into some new generation kits. To get the optimum performance from a model you will probably want a foam core wing. The Falcon 880 from Mark Allen is such a model and is available in either a kit form or "almost ready to fly" form. The Phoenix by Competition Products of Apollo Beach FL. was advertised at the show as being produced with laser cut parts. My experience with this technique indicates that it should be very reproducible and if engineered correctly, very accurate in dimensions.

Tim Renaud was present to describe developments at Airtronics. The very successful introduction of the Vision radio will be followed up with lower and higher cost radios with features corresponding to the price. Higher priced systems will support pattern and sailplane pilots, there will be a frequency synthesized option. Not only will the user be able to charge frequencies but the radio will indicate on which channels there is interference present. The user can select which channels are best to fly on. There will also be a count down timer and a tachometer. A lower cost 6 channel Vision system will be introduced in April which will be compatible with current systems. One disadvantage of computer radios is a higher use of battery power. Airtronics does not recommend use of the radio on a single charge longer than 1.5 hours (2 hours absolute max). The safe thing for sailplaners to do if you want to fly longer is to have a second battery module to change during the flight.

The use of Airtronics 401 servos on flaps results in gear failures. The short term solution is to raise the flaps before touchdown. A stronger gear train is being pursued but don't look for a solution for the next year. The use of "interference traps" in servo leads shorter than 4 ft. is not recommended for PCM systems. If used the traps should be located close to the servo. People with Futaba servos can change plugs and run them on the Airtronics receivers.

Terry Edmonds, member of the 1989 US Soaring Team, gave a report of soaring activities at the world championship in France. There were stories and pictures of notable people and the latest designs in sailplanes and winches.

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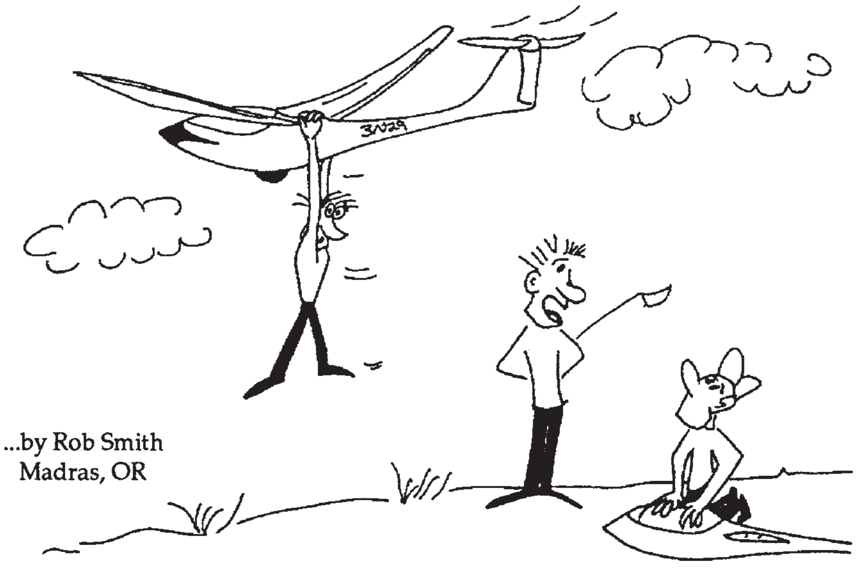


...by Rob Smith
Madras, OR

Frank needed ballast so he improvised!

MARCS...Continued

Micro-meteorologist Ed Eloranta gave more information about locating and using thermals most of which are not symmetrical but irregular. Look for the best lift from dark and dry ground cover. Green plants will be giving off moisture and should not be as good as ripe wheat. Trees will not be as bad as growing corn or other corp fields. Look for patterns of clouds in the sky and they will often indicate where the lift will be found. New or growing clouds should be good locations. Pay attention to changes in wind direction and velocity.

Lee Murray & John Palfery
c/o LJM Associates
1300 N. Bay Ridge Road
Appleton, WI 94915-2854

Square-Cube...Continued

distance of one wing span.

Finally we can compare the "speeds" of a 2M and XC sailplane by forming the ratio

$$\frac{t_1}{t_2} = \sqrt{\frac{b_1}{b_2}} \quad (7)$$

If the wing span of the larger plane (denoted as 1) is twice the smaller (2), then the time it takes the larger plane to travel one wing span is 41% longer than the smaller. Although it is actually flying 41% faster (see equation (4)), it looks 41% slower. That is a big difference.

Michael Selig
PENN STATE
233 Hammond Bldg.
University Park, PA 16802

Return to Harris Hill
...by Pete Carr

On November 4th and 5th, a group of model sailplane pilots returned to fly a contest on Harris Hill, New York for the first time in ten years. No doubt the late time of the year limited the number of entries, but the 22 pilots who attended were treated to two fabulous days of soaring.

On November 4th and 5th, a group of model sailplane pilots returned to fly a contest on Harris Hill, New York for the first time in ten years.

It all began about a year ago in discussions with Jim Sonnenmier and Roman Paryz, of the Clarence Soaring Society, and Dr. Ed Granger of the Rochester Soaring Club. These two fine groups pooled their resources and approached the Harris Hill Soaring Club to obtain a date for the contest. Due to scheduled full size Region 3 contests at the Hill, we were only able to select the November dates. As you well know, weather in Southern New York State can be a chancy gamble, but luck was with us...for the most part.

Dr. Granger had done a huge amount of preparation for the contest including a separate trip to test the radio spectrum with a scanning monitor. It was found that Channel 34 was jammed by a pager which was clearly audible on the receiver. He also supplied a travel trailer and conversation van for use as impound shelters at the two flightlines.

Saturday morning was cold, with 25 degree temperature warming to the upper 40's and brilliant sunshine with calm wind. As the day progressed, a very light south breeze came up which killed any chance of slope lift off the northwest face of the hill. However, lift conditions were very excellent and many models circled to altitude over the runways, then circled downwind out over the valley. The sight of planes making lazy circles with the valley and Route 17 as a backdrop, made all the effort worthwhile.

It had been intended to fly two groups: one at the face of the hill in slope conditions and the other at the far south, but the wind did not cooperate. The slope group had no trouble finding thermals along the edge of the field and followed them out over the valley, where the lift blossomed to hat sucker quality. The task was ten minute percentage slot and landings were the deciding factor in the scores. Meanwhile, the thermal people were working 7 minute Novothon task near the sailplane hanger and running consistently late returning to the circle.

In the middle of this organized lunacy, several spectators came out on the flightline to watch. Among them was Dick Pike and Ernie Hayworth, both members of the old Harris Hill Lift Over Drag Club. It was great to see that neither Dick nor Ernie have aged a day since they wore those ugly yellow jackets and passed out transmitters at the impound tables.

Sunday was similar to the weather of Saturday, but the south wind freshened. The air was warmer, but lift was harder to find. Landing was a challenge in the tuck and roll of the lip of the hill. We also found some heavy radio interference, which caused some wild aerobatics, but didn't claim any ships.

The Harris Hill Club has a new pilot's lounge next to the hanger where we ate lunch amid hundreds of photos and magazines of the local soaring society. The Club carried out flight ops from the grass field at Chemung County Airport down in the valley and, on both days, we were treated to Twin Grobs sharing our lift high above.

Al White won the contest by over 900 points with his antique Windsong which only improves with age. He did not ballast and still managed to scoot around the sky working lift and nailing the spot. His display of flying skill was truly awesome.

Dr. Granger, Jim Sonnenmier, the Rochester and Clarence New York clubs deserve nominations for sainthood for the wonderful job they did in organizing the contest. We can only hope that a date can be arranged at a warmer time of year in which to continue this event.

Pete Carr
326 Little Ave.
Ridgway, PA 15853

Ground School
...by Gordon Jones

Over the years I have taught a fair number of people to fly various types of model aircraft...and, even to this day, I notice a number of other instructors who make the process harder on themselves than it needs to be. One noticeable omission is that they seldom bother first to instruct the new flyer in the basic principals of aerodynamics, control movements and their effects and other essentials prior to launching the aircraft.

In most instances, the new flyer, regardless of his/her age, does not have solid knowledge of lift and drag, or their effects on the craft they wish to fly. If they are taught to fly without this knowledge prior to flying, they will encounter many difficulties. For example, they will not understand why ground speed is different on an upwind track compared to a downwind track. The experienced flyer has come to learn the difference through trial and error, but the new flyer doesn't have an inkling that there is a difference.

By taking a little time with the student prior to starting the flying, the instructor will save a great deal of time by making sure that everyone is "singing off the same sheet of music", meaning that terminology for both instructor and student is the same. One way to accomplish this is by explaining the basic principal of L/D, how it relates to flight, and what will be the cause and effect if it is not taken into consideration. I have found that a little time taken at various stages of instruction to explain the reason for a particular occurrence creates a more knowledgeable student and one that is easier to instruct in flight.

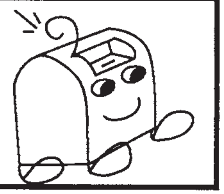
I have found a simple strategy that seems to work very well. Step one in this process is to inspect the aircraft for fitness using a systematic checklist and explaining what you are looking for and why. It also gives the instructor a warm fuzzy feeling about the airplane if he finds that all is well. Step two, after correcting any deficiencies found in step one (such as controls hooked up in reverse — a common error), is to discuss the basic concepts of lift and drag. Included are the various types of stalls that may be encountered (usually a major problem with most beginners). If there happens to be a plane up while you are explaining all this, it is great to be able to demonstrate what you are talking about; or, if it happens to suit your style of instruction, you can launch and put your plane up and go through the various maneuvers while explaining each.

Step three is to explain and demonstrate control movements with the radio while the plane is on the ground. Discuss the proportional movement of the stick and the related control surface, and the difference between up and down. Show what a left turn looks like, what a right turn looks like and a loop on the box. While doing this, also remember to provide the reason for the movement in relation to the earlier L/D discussions.

Now it is time for your student to take to the air. What happens up there will depend on what he/she has learned on the ground, and the flight will be much easier for all concerned.

Gordon Jones
214 Sunflower Drive
Garland, Texas 75041

THE GRAY AREA



Some Tips to Share

Dear Jim,

Last Saturday we had our first SMTS contest. Fifteen entrants and enough interest at this point in time to warrant our doing this twice a year for a while. It was absolutely "open" in every sense. No restrictions except for weight. We had an RO-8, Cumics, an Io, Sagittas, Wind/Lovesongs, Prodigies, and a Gemini. Only one loss and strangely enough it was during duration — went behind a tree line in sink and re-kitted. It was fun for most, but it dragged in the distance and speed events. They took an inordinate amount of time to run since we had only one course laid out.

We used a four minute window for speed and allowed relaunches if you weren't happy with your first launch. I spent most of the day at the far end of the course flagging. We used a red flag and a green flag so two could fly at a time. Learned a lesson — green flags are no good, too difficult to see against rolling farms and woods. We would recommend a red and a white. Although we (far-end flaggers) were consistent in our reaction times in raising our flag to indicate the craft passed Base B, the individual timers were not. It was an extremely calm day — zero wind until about three hours after we started and we could hear the timers yell "turn". We started doing counts from the time we signaled until we heard "turn" and the lag varied from a slow count of three to as much as ten.

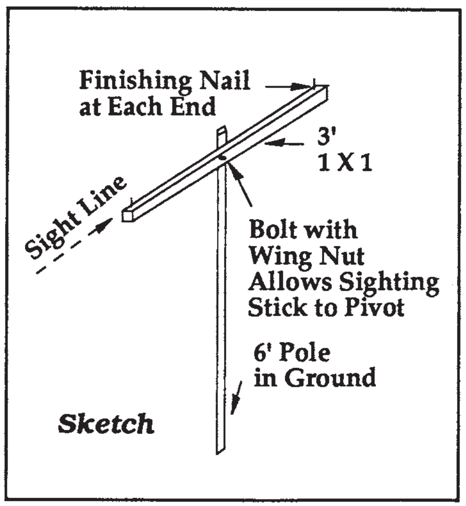
One of the people there had organized F3B in South Africa and he suggested we use 2-pair telephone line for two purposes — one to measure the course and the other to hook up a push button at the far end and a loud buzzer (sort of door bell) at the flyer's end. That way only the far-end flagger's reactions are involved.

We used two classes based on our club classification — Expert and Sportsman. Fastest speed run was by an Expert with the Io. Overall winner was a youngster (13 or 14) who took first in Sportsman with the Gemini.

Another interesting thing from the perspective of the far end of the course was the great difficulty almost everyone experienced flying a straight line. I mean we had what seemed to be great circle routes, ellipses, odd geometric figures, you name it — a bird's eye view would have been hilarious I suspect. Participation in this kind of event has got to improve flying skills.

Lots of room for improvement in all kinds of ways. Our sighting device was rather simplistic, but it worked and even if the course may have been some inches off, everyone flew the same course. I've enclosed a sketch of the sighting device. The CD is doing a write-up, so look for more in the next issue of CASA Comments.

Best Regards, (signed) Gus Peleuses, 10741 Marlborough Road, Fairfax, Virginia 22032



PC-Soar & MaxSoar Upgrades

Dear Jim,

John Hohensee and I have included the Princeton Wind Tunnel data into our respective programs and we now have well over 200 airfoil polars to share with our customers. In addition to the expansion of our libraries, there have been some improvements in the products. PC-Soar will be available in Versions 2 and 3. Version 2 is an extension of the present format with some additional features to handle the vast amount of polar data available and to display "on screen" comments about the airfoils with references to Soartech 8 figures. Version 3 brings color EGA and VGA graphics as well as Hercules graphics for PC-Clones to PC-Soar along with a host of features that customers had called to our attention as being needs. No longer will a person without typing skills have to struggle with typing file names. Help screens at your finger tips. Version 3 comes as a cooperative effort with Allen Halleck (PASS) and Dan Rynearson. I'm excited with the improvements.

Best wishes, (signed) Lee Murray, 1300 N. Bay Ridge Road, Appleton, WI 54915-2854

♣ ♣ ♣

Dear Jim,

My activities in BARCS have now drawn me into committee work and I anticipate being installed as the editor of "Soarer" in December, at the AGM. Since I am donning a new hat and taking on a considerable responsibility, I hope to hear from a great many of your readers about the American soaring scene. I hope to contact those who have written to you and I see there are many useful addresses in the current issue of the "Digest". I welcome any comments and information about RC gliding and would remind everyone that next year (1990), BARCS will be hosting Interglide. There will also be more to mention about F3J (International recognition of our type of flat field soaring) once it is all finalized.

(signed) Jack Sile, Box 2069R, APO NY 09755

Behind the Scenes with Dave Acker

...by Greg Vasgerdsian

Dave's been carving balsa for some time now, with his roots planted firmly in free flight gliders and rubber powered models. Never becoming too excited about R/C powered planes, Dave's free flight experience led him naturally to R/C soaring and, once again, to dealing with those sometimes elusive thermals.

About four years ago Dave began cutting foam cores for friends and fliers who were led his way by word of mouth. Since these humble beginnings, Dave's garage has become an official foam cutting factory, with foam as well as obechi wood stacked all around. Besides being an all around nice guy who has some great stories, Dave does a fantastic job of cutting cores.

When getting a set of Tailored Foam Cores you can specify white foam or blue foam (The blue is stronger, but a little more money.) as well as airfoil, span, chord, and anything else you can think of. Dave is computer equipped to plot any airfoil whether it's an E374, E205 or the latest Selig 3021 used on the Falcon 880. If he doesn't have what you need in his airfoil library, with the proper co-ordinates he can still plot out your dream foil. Currently, his prices range from a reasonable $25.00 for a 2 meter white foam core to about $45.00 for something with a dimension of 118".

...continued on page 22

Behind The Scenes...continued

Anything bigger or unique... just give him a call.

Dave has also launched the "Buzzard", a generic glider fuselage. On hearing the word generic you might think, "Is it yellow with black numbers?" Well, no, it's a sleek and very good looking pod and boom fiberglass fuselage. The beauty of the Buzzard though, is in it's versatility. The boom arrangement allows you to not only make the fuselage any length you like, but also put any type of tail on, as well. The wing mounts on top, allowing for maximum versatility. You chose your own method of mounting (bolt, rubber, etc.). To date, the Buzzard has been successfully used for 2 meter slopers on up to large cross country ships. It would be a perfect step up from an OLY II by simply using your existing wings and new empennage, as well as being a nice home for a Schuemann wing planform.

Dave wished to emphasize his debt of gratitude owed to Don Chancey for the concept and basic fuselage shape, as well as Gordon Jones, Jay Burkhart and Dan Doyle who did the "gorilla testing" of the prototypes.

Greg Vasgerdsian
31 Lenelle Ct.
Moraga, CA 94556

Classified Advertising

Wanted

Fuselage for SCHREDER HP-18; any size, any scale...but must be fiberglass. Contact Ben Trapnell, 4201 University Ave., Box 8009 University Station, Grand Forks, ND 58202; Tel: (701) 775-8362 (home eves.) or (701) 777-4766 (work days).

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