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R/C Radio controlled Soaring Digest

THE JOURNAL FOR R/C SOARING ENTHUSIASTS

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

ABOUT *RCSD*

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

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Bookshelf Listings - A listing of recently published books of interest to aeromodelers.
Complete RCSD Index, 1984-1999

The Soaring Site

Murrysville Area Soaring Society

We received the following from Neil Rossi in Pennsylvania, President of MASS.

"The MASS club is planning to participate in a local community day event here in Murrysville, PA. This event draws several thousand people thruout the day. The event is June 2nd.

"As a local sailplane club, we will have a booth set up to display our sailplanes and electrics for the public and local government to have a first hand look at this type of R/C model airplanes.

"The dual purpose for us is to inform the public who and what we are and the same for the community managers who are planning a community park, which we are requesting a section set aside for R/C sailplanes.

"The crowd of people will represent all ages from children to retired senior citizens. Most people heard of model airplanes, but not many are familiar with R/C sailplanes and electrics. Our aim is to show how quiet our models are, especially in a public park.

"My request is if you have any magazines, old or new, that you could donate us to be used as give-aways for the public to read and learn about our hobby, we would absolutely appreciate (it).

"Thank you for your consideration.

(signed) Neil Rossi

"P.S. Do you know where I can find plans for the Ka-6 or ASK-13 scale sailplanes (balsa type construction). Size: 2m to 100" or so?"

First, as you can see Neil, we missed the date for your request. We hope everything went well, and perhaps we'll be able to help out next year. Let us know a few months ahead, if your club plans to have a booth next year, and we'll let all the readers know, in case any of them have extra magazines, as well.

Can anyone help out Neil with the scale plans request? If so, please let us know.

Yes, we're running pretty late getting *RCSD* out the door; every time we think we're gonna catch up, something else happens.

This last couple of months has been extremely hectic due to a family medical emergency, and we found ourselves at the hospital daily filling out forms or simply providing caring support. For any of you going through withdrawal symptoms because of the lateness of *RCSD*, hang in there and bear with us! Or, better yet, go fly, and enjoy the summer months!

Happy Flying!
Judy Slates

OBLIQUE WINGS OF DAVID FREUND

Quite a sight in the air, and sure to elicit comments from fellow slope flyers, "On the 'Wing" columnists discuss David's design in this issue.

Photography courtesy of David Freund.

Jer's Workbench

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Spoilers 101 - Part 2

Last month, I talked about spoilers and their use. This month, I'll show you how I install my spoilers. But, first, let's review the evolution, or development if you will, of spoilers that has occurred during my years flying gliders.

I built my first glider in 1961. The radio used at the time was an Orbit-12 reed set. The receiver, battery pack, and four servos weighed over a pound, and were they ever big! I had to shoehorn the receiver, battery pack, and two servos into that first glider. I sure wish that I could get my hands on an Orbit-12 reed set, along with a set of Bonner servos, just to be able to show you how big they really were!

I later upgraded my radio system to a Bonner-8 with matching servos, but even this system was too large to be able to install a third servo for spoiler control.

It wasn't until about 1970 that the radio manufacturers started producing radio sets that were well suited for gliders. Photo 1 depicts the 1970 model: a Kraft 3-channel radio set.

The 1970 Kraft radio with its smaller servo size allowed for the installation of the third servo. While the new servos were still too big to fit inside of a wing, the third servo could be installed in the fuselage. I used a pull string to activate the spoilers (See figure 1.) To lower the spoilers, I simply moved the servo in the other direction, which caused the pull string to go slack, allowing gravity to actually lower the spoilers.

While this system is very crude by today's standards, it worked OK, although there was one problem with the pull string. It needed to be strong with no stretch, otherwise the spoilers would be soft. At the time, the best string I was able to find was called Dial-Cord. What's that? Well, back in those days, Dial-Cord was

Photo #1 - Kraft Radio 1970

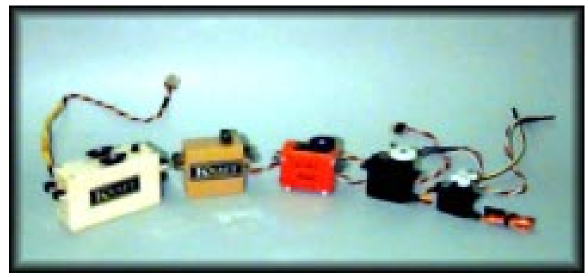


Photo #2 - Evolution or development of servos from 1960 through present day. 1970 servo second from left.

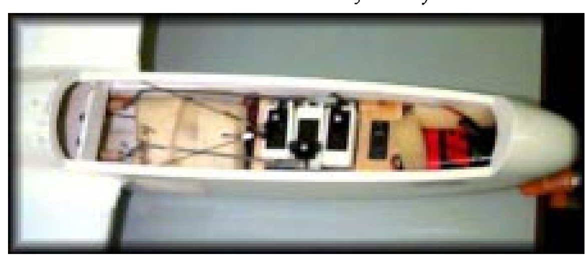


Photo #3 - Pull strings inside of my Aquila Grande. May be crude by today's standards, but the pull strings work quite well.

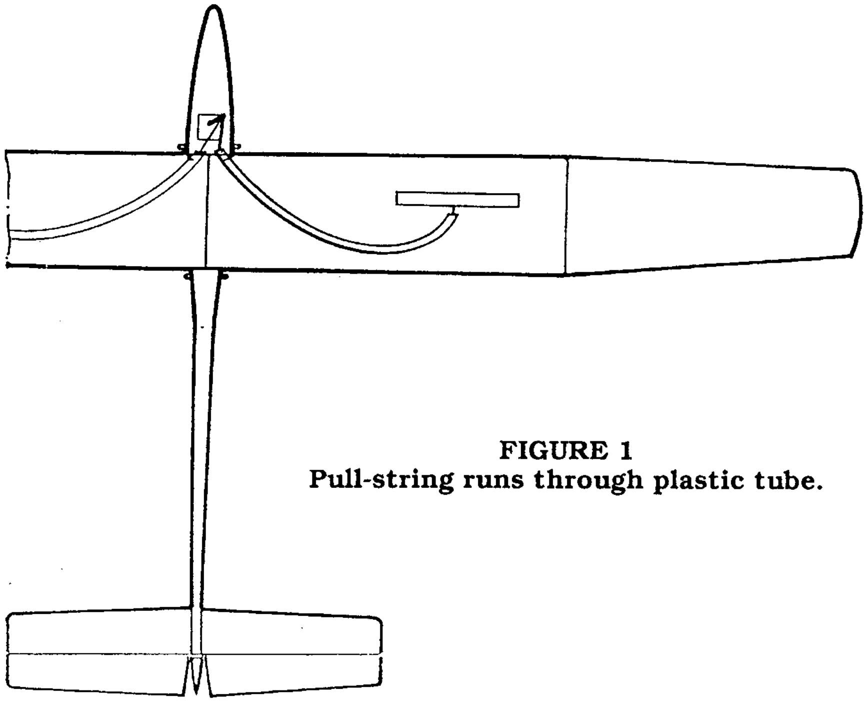


FIGURE 1
Pull-string runs through plastic tube.

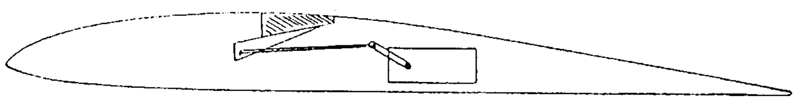
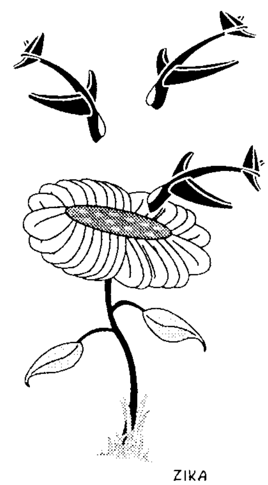


FIGURE 2
Sub-micro servo installed inside of wing.

used to move the dial when you turned the tuning knob on an old fashioned AM radio. Since today's radios utilize electronic tuners, Dial-Cord may be hard to come by. It's possible that an electronic supply store that still sells radio tubes may carry it, however.

With today's Sub-Micro servos, hooking up a set of spoilers is easy. Note figure 2. With a Sub-Micro servo installed inside of a wing, a simple push rod can be used to activate the spoilers for positive up and down movement. And, that's it! ■



R/C *Radio controlled* SOARING DIGEST

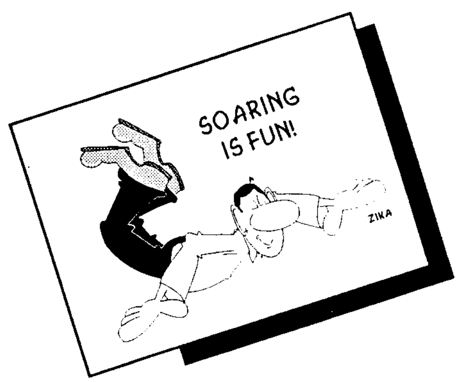
THE JOURNAL FOR R/C SOARING ENTHUSIASTS

A MONTHLY LOOK INTO THE WORLD OF SAILPLANE ENTHUSIASTS EVERYWHERE

R/C Soaring Digest (RCSD) is a reader-written monthly publication for the R/C sailplane enthusiast. Published since 1984, *RCSD* is dedicated to the sharing of technical and educational information related to R/C soaring.

RCSD encourages new ideas, thereby creating a forum where modelers can exchange concepts and share findings, from theory to practical application. Article topics include design and construction of RC sailplanes, kit reviews, airfoil data, sources of hard to find items, and discussions of various flying techniques, to name just a few. Photos and illustrations are always in abundance.

There are *RCSD* subscribers worldwide.



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The Oblique Wings of David Freund

OK, so why is there a powered airplane at the start of this month's column? Read on, soaring enthusiast!

The last time an oblique wing appeared in this column was back in November of 1992. That 'wing was Dieter Pfaff's PN11. As can be seen from the included diagram, the PN11 was essentially a constant chord wing with 16 degrees of sweep and a fin mounted on the tip of the trailing wing. Despite its unorthodox planform, it flew very much like a conventional plank design. The only flight control idiosyncrasies of note were a slight tendency to climb during right turns and an associated tendency to dive during left turns.

David Freund has been designing, building and flying various tailless models for a few decades. About five years ago he decided to build a three channel oblique wing for RC slope flying, roughly based on Steve Morris' 20 foot span powered NASA testbed — the photo at the start of this column. (More information about Steve's aircraft is at the end of this column.) The results of Dave's skills are in two "free form" models which fly extremely well, despite their unorthodox planform and variable sweep. Modern radio equipment, with multiple mixing capabilities and adjustable rates, makes it all possible.

The fin is not used for steering, only for adjusting the sweep angle. Huge amounts of mixing are required to maintain hands-off control, but you can shift the sweep from 25 to 55 degrees using only a rotating knob above the right stick. The rudder input is used to directly trim the elevons.

P-1

The first of Dave's variable sweep oblique wings, the P-1 uses a relatively open structure using ribs and a single spar. All of the wood aft of the spar is 1/32" sheet balsa, and there is some carbon fiber in the trailing edge to add stiffness.

Because the fin/rudder controls the angle of sweep, a very sturdy servo is needed for that function. Add the skeg which tends to grab on landing, and you get the idea for what's needed. Dave reduced some of those loads by making the lower part of the fin automatically fold on landing.

The hard part of flying these aircraft is retaining visual orientation in the air. When you decide to come out of a turn is very much dependent upon the sweep angle. Even so, Dave's girlfriend learned to fly ailerons on this airplane!

Fast Banana

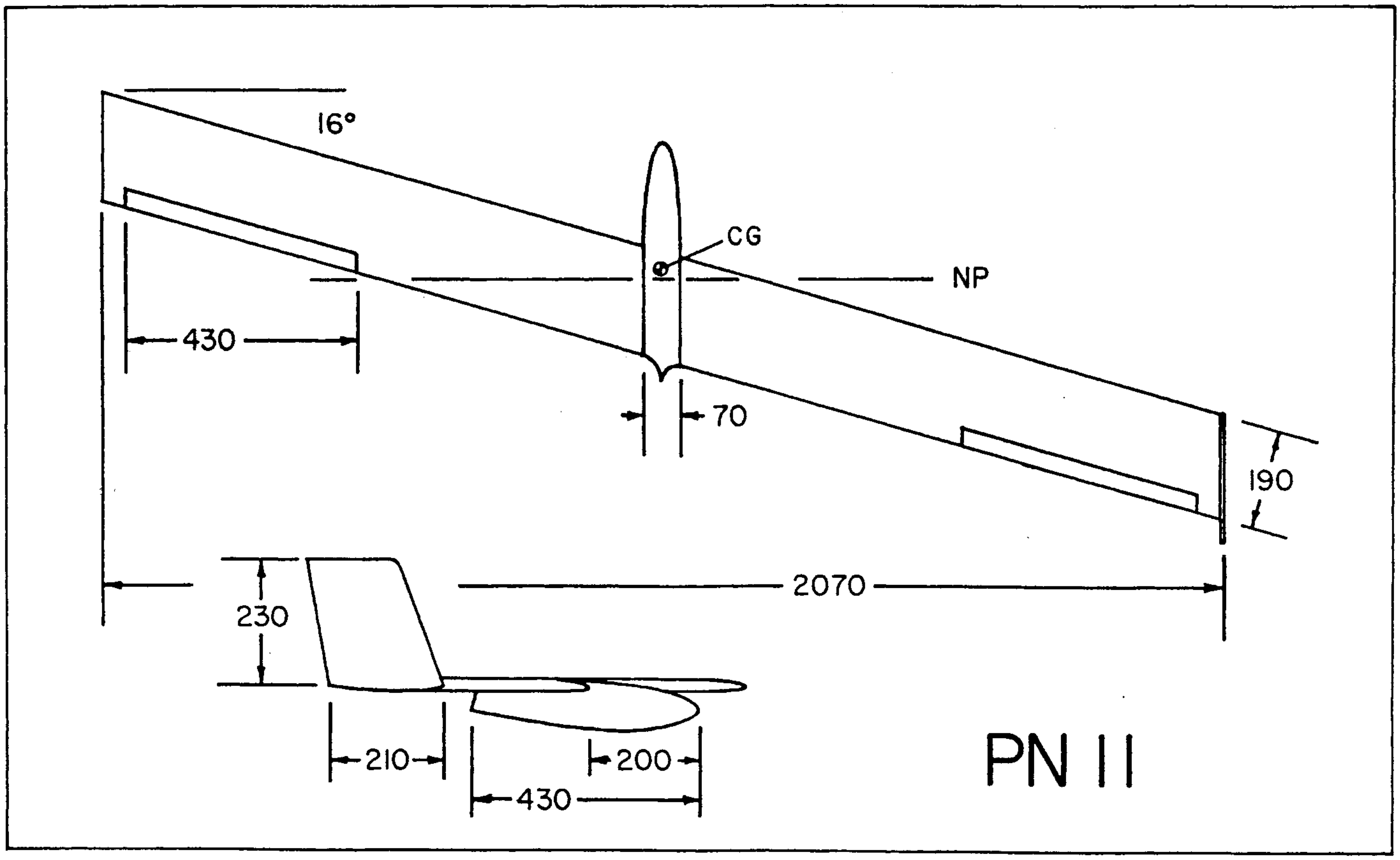
The Fast Banana has a wing loading twice that of the P-1, and the planform is compressed into a smaller airframe. It uses the Selig 5010 and 5020 airfoils and is fully sheeted. The name gives an indication of its flight regime and appearance in the air. The primary goal with the Fast Banana was to better balance the roll stability and trim changes with sweep changes. This includes not only the fore-aft CG, but the lateral CG as well.

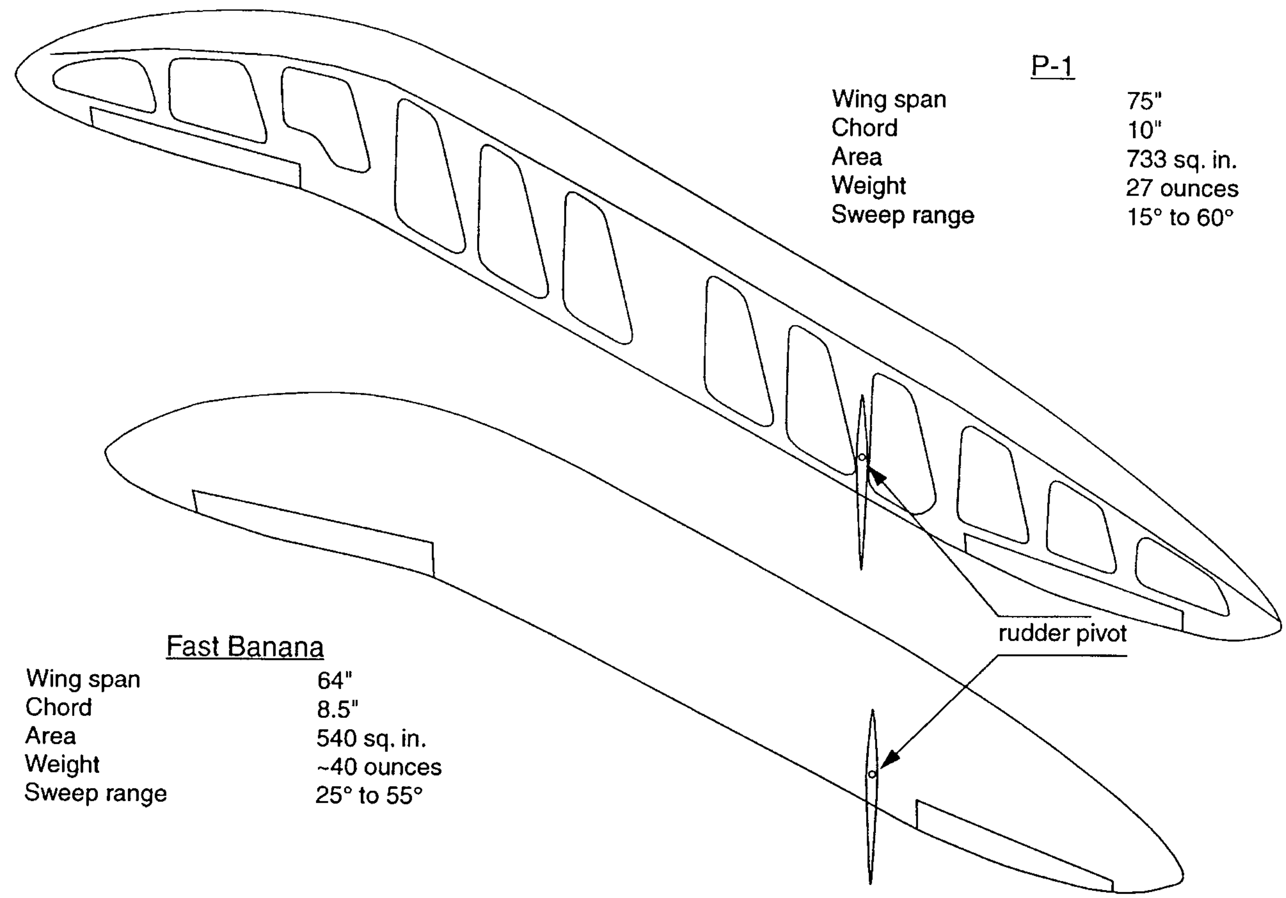
Concerns, hints, tips, etc.

Dave used a rather novel method of arriving at the correct elevon trim during the sweep change. First, the transmitter is set up to switch between two initially identical models. Small up or down trim changes are made to one elevon or the other using one model setting. Good adjustments are then copied to the other model until one set of model presets is correct. Both the P-1 and the Fast Banana will loop straight and have no bad habits upon stall.

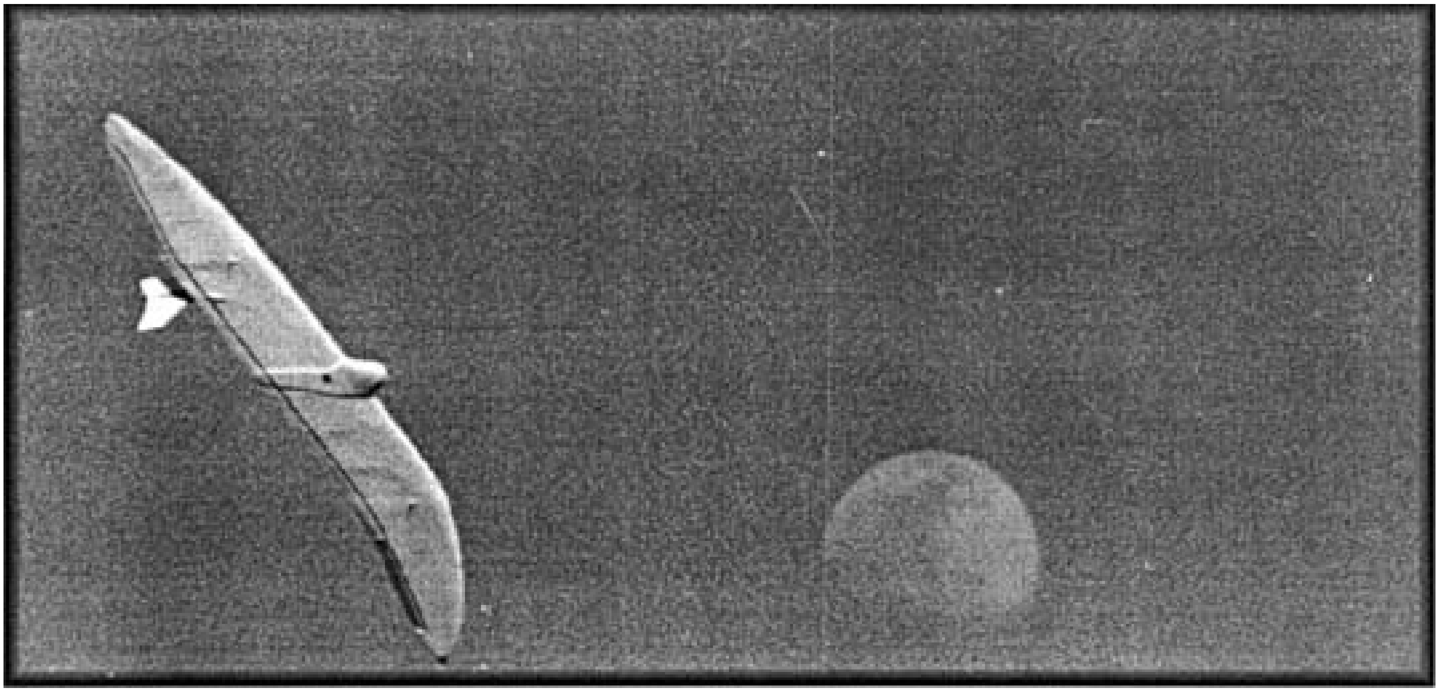
These models are quite easy to fly after the trims are set up properly. Before trimming is complete, a lot of distract-

Dave and his variable sweep oblique wing.





Dave Freund's Oblique Wings Planforms



The open structure is beautiful in flight, and belies the technology involved.

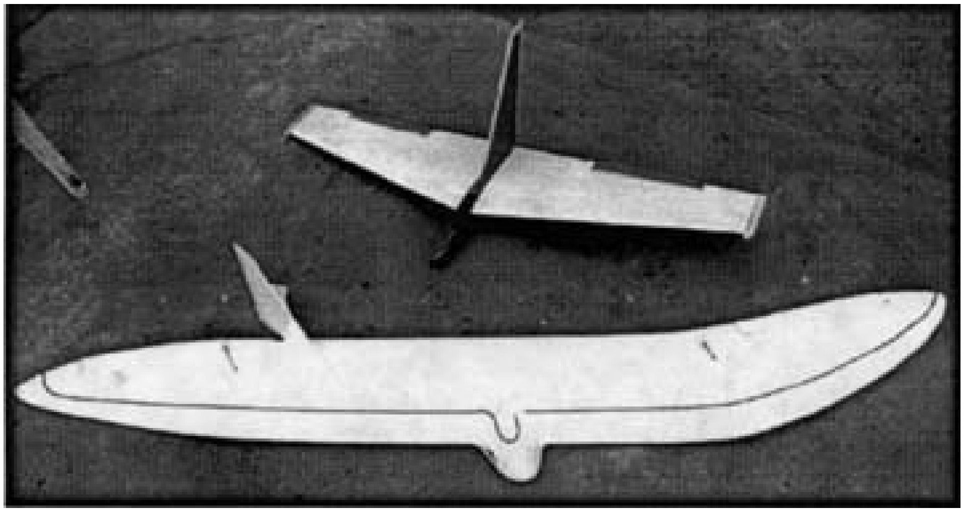
ing manual tuning is required to change the sweep angle by any appreciable amount. After proper trimming, involving mixing both elevons to the fin function, the wing can be swung back and forth with the fin knob, hands off the stick. Sometimes when the glider stalls at the top of a slow loop, it will straighten out to less sweep until flying speed returns.

Dave placed the fin somewhat inboard. Placing it further outboard would give it a better moment arm. Because of the totally enclosed structure, access to the fin end of the control system is quite limited, and the whole control system is a maintenance headache. Make sure it's built strong the first time, and be sure to use a steel clevis inside. A nylon clevis will shear or open when exposed to heavy loads and will be nearly impossible to fix.

For mounting the fin, Dave made a square brass vertical fin post which was silver soldered into a round brass bushing about 0.5" tall with a control horn 0.75" of an inch long soldered to it. At first this assembly was captured in small light plywood counter bored covers in the top and bottom of the wing with the horn inside. Later he added small lightweight RC car bearings top and bottom, again captured by plywood covers. Either a straight music wire rod or nyrod is okay for the fin drive system, and a more flexible system isn't necessarily a bad thing. The square fin post fits a matching square brass sleeve in the fin so the fin is easy to remove for transport.

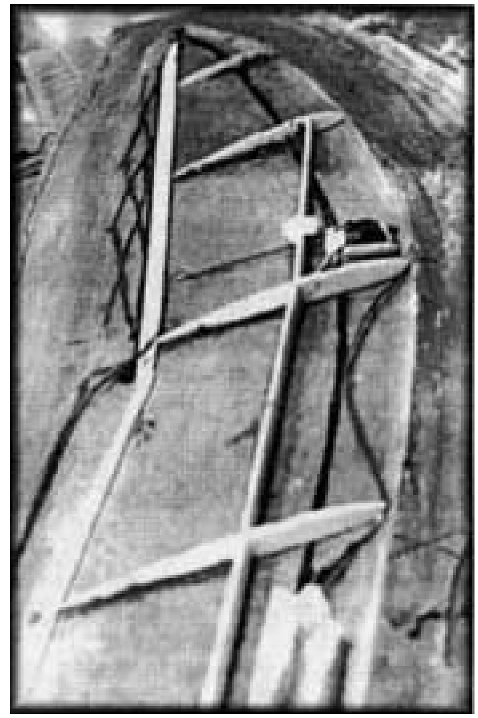
The fin shape doesn't seem to matter too much, but the outline should be of a low aspect ratio and the surface area should be larger rather than smaller. Make sure that the fin rotates on the quarter chord point of the mean aerodynamic chord.

Everything behind the spars should be as light as possible. Dave says, "Don't add anything unless it removes weight!" All gear is as far forward as



On the ground with another of Dave's creations. Note the folding sub fin, barely visible to the right rear of the main fin.

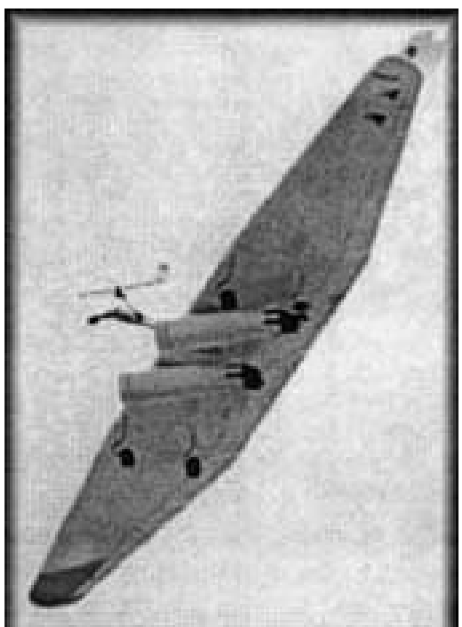
possible for the same reason.

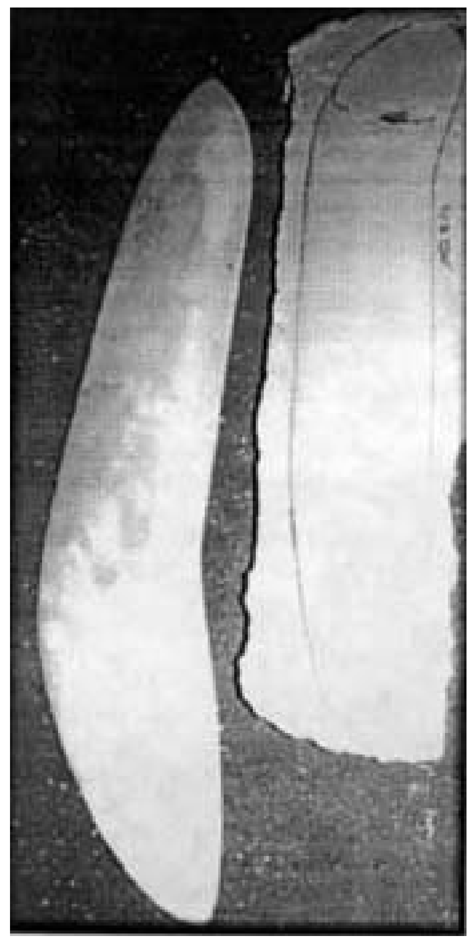


Interior of the Fast Banana during construction. Note the servo position, well forward in the wing.

More about Steve Morris' oblique wing demonstrator

Steve Morris spent two years designing, building, and configuring the NASA variable sweep oblique wing demonstrator shown at the start of this month's column. The purpose of this model was to study handling qualities, investigate various computer control algorithms for stability augmentation, and to demonstrate the feasibility of an inherently unstable asymmetric all wing design. The sweep angle is variable in flight from 35° at take-off to 68° in flight. The model has a span of 20 feet and weighs 80 pounds. Power is two Viojett ducted fan units, each putting out 12 pounds of static thrust. There are ten trailing edge control surfaces and two moveable fins. Eighteen servos are used to actuate the control surfaces, swing the engine units so they are parallel to the flight path, and steer the landing gear. Construction is molded 1/16" sheet foam and Kevlar with an aluminum spar. The cost of materials was $25,000. The model was mounted on a universal joint at the CG and mounted atop a car to verify the stability and control algorithms. During flight, the aircraft on-board computer reads the radio signals "uplinked" from the pilot and combines this incoming information with information gathered from six onboard sensors to produce control deflections that will both stabilize and maneuver the aircraft. Eleven data channels are recorded ten times per second and stored in the computer RAM. This collected data is then downloaded after each flight for later analysis. The first flight of this variable sweep oblique wing demonstrator took place at Moffett field on May 10, 1994, and was without incident and picture perfect.





The Fast Banana out of its shell.

If you have a tailless project you'd like to share with *RCSD* readers, a suggestion for a future "On the 'Wing..." topic, or a comment, please contact us at <bsquared@halcyon.com> or at P.O. Box 975, Olalla WA 98359-0975.

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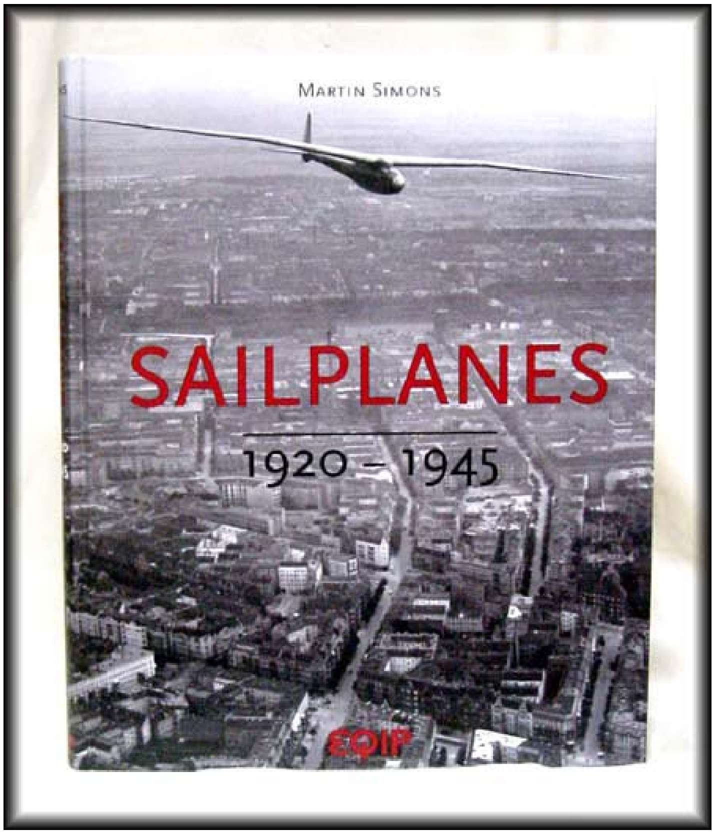

BOOK REVIEW

By Raul Blacksten
Vintage Sailplane Association
Archivist

SAILPLANES, 1920-1945 BY MARTIN SIMONS

In 1986, Martin Simons wrote the bible for the world's vintage sailplane and model vintage glider movements. As a result, *The World's Vintage Sailplanes, 1908-45* has set a high standard for subsequent books on this topic and it continues to sell well.

Well, this year Simons has topped himself and raised the bar.

Although with his new book, *Sailplanes, 1920-1945,* Simons follows his familiar format, it all seems somehow new. Each chapter discusses gliders of particular import to the evolution of motorless flight. It is accompanied with mostly black and white photographs (some are in color) of the glider in question, as well as Simons' outstanding 3-views. Not only that but this time, Simons has added color to his 3-views.

Although he acknowledges what came before, in this book, Simons does not begin at the absolute beginning. He begins with the 1920 Rhon Competition. The reason for this is that with the Rhon meet the sport of gliding and soaring really finds its origins. Here we were introduced to the dreamers and fools, as well as innovators such as Willy Pelzner with his hang glider and Wolfgang Klemperer with his *Schwarzer Teufel* (or in the local Aachen dialect, "*Schwatze Duvel*").

From the 1920 Rhon meet, Simons takes us through the development of the glider up to the end of World War II. More than half of the book is dedicated to glider development in Germany (first 12 chapters) but this is because that is where the most sailplane development has historically occurred. Yet Simons also gives us 58 other significant gliders and sailplanes from twelve countries (from Australia to the USSR) with a chapter dedicated to each.

Discerning readers may notice that many, if not most, of the gliders in this new volume are also found in the older book and may wonder why they should bother. Well, how can you discuss this subject without going over the same significant aircraft? Upon reading, however, anyone initially bothered by this fact will notice that Simons has included a lot of new information. It is not a rehash, that is for sure.

Of particular interest to American readers should be the twelve US gliders Simons has included. Most of these may be familiar to Americans because there are still airworthy examples that have shown up at the Vintage Sailplane Association regattas and at the International Vintage Sailplane Meets. One or two others may be somewhat less familiar, but they are none the less significant in the development of soaring.

The black and white photographs included in this book are magnificent and sharply reproduced. Most have not been published before. Color photographs are used when available to illustrate gliders which are currently airworthy.

As those who are familiar with Simons' other works know, it is with the 3-view drawings that Simons really excels. Each glider discussed has its own 3-view and the size of book was enlarged to reproduce them in a 1:50 scale. Not only that, Simons has added color. These are really quite good, often taken from production drawings, and include the airfoil as well as any modifications.

A retired English college professor and current Australian resident, Martin Simons should know from which he writes. A glider pilot for over 50 years, Simons has about 100 different glider types in his log book, including 20 of those in this book. He has also authored or co-authored five books on sailplanes and model sailplane aerodynamics.

If *The World's Vintage Sailplanes, 1908-45* is the bible of the vintage glider movement, with *Sailplanes, 1920-1945,* Simons has given us the gold standard. Whether they are new to Simons' work or are old fans, all readers should find that *Sailplanes, 1920-1945* is a book to delight everyone with an interest in sailplane development in general and vintage gliders in specific.

Sailplanes, 1920-1945, by Martin Simons. EQIP Werbung & Verlag GmbH, Konigswinter, Germany, 2001. ISBN 3-9806773-4-6

The World's Vintage Sailplanes, 1908-45, by Martin Simons. Kookaburra Technical Publications Pty Ltd, Melbourne, Australia, 1986. ISBN 0-85880-046-2

Both books can be purchased for $64.95 plus $3 p&h each, from Raul Blacksten, PO Box 307, Maywood, CA 90270. Check or money order, only.

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20TH ANNUAL
ROSEBOWL SOARING FESTIVAL AND TRADE SHOW
JULY 28TH AND 29TH, 2001

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TECH TOPICS

Dave Register
Bartlesville, Oklahoma
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HAND LAUNCH GLIDER DESIGN

Last time we took a look at the results of our polar model for a couple of 2 meter designs. Neither of these were optimized but were used simply to demonstrate the way to put the whole thing together. This month we'll take a more serious run at another problem - Hand Launch Glider design.

For a HLG, efficiency over a wide range of operating conditions is the key. You need to have low drag during high speed launch, but good minimum sink and maximum L/D once you're at cruising altitude. We'll start this design challenge by looking at flight conditions for thermals (the low speed end of the curve) since that's where you'll spend the most time. We'll then add a launch estimation and see how trade-offs in design affect the launch altitude and total flight envelope.

First, let's use reasonably realistic assumptions. Having designed and built a modest number of HLG ships, I can put one together that's pretty rugged at about an 8 oz. all-up weight. That's a 2 servo, 5 channel Rx with a 4 cell 110maH pack. I'll add 1/2 oz. to this design for a three servo ship, the reason for which will be apparent by the time we get to the end of the exercise.

Using a pod and boom design and a high modulus 1/4" OD arrow shaft, I can normally get the fuselage weight to come in around 1.5 oz. The 'wetted' area of this design will be ~ 50 square inches.

I also want to keep the boom length down to about 22". I've flown longer tail moments and have found that the launch torque will eventually split the arrow shaft. The advantage of the longer tail moment is good stability with smaller tail surfaces but today's launch speeds argue for a little beefier tail. With ~ 60" span, this gives a tailplane angle of ~ 36 degrees.

For high speed launches, we probably want to increase the vertical stabilizer a bit so we'll design at the high end of the RVC range. We'll pick a value of ~ 0.060 for this example. Pitch stability isn't usually an issue, even at high speeds. So a TVC of ~ 0.45 will be fine.

Now with these general planform parameters specified, we need to make some assumptions about weight distribution. That is, how much do the components weigh and which weights will scale with design changes. I'll make the following assumptions (based on weights taken from several of my own designs):

1) Fuselage and radio weight is fixed at about 5 oz. That's 1.2 oz. for 3 servos, 0.6 oz. for the receiver, 1.7 oz. for the battery and 1.5 oz. for the fuselage.

2) The weight of the wing and tailplane surfaces will scale with area.

a) I've averaged the weight of several wings that I've put together in the last several years (SD7080 type airfoils with 1.5 lb. density pink foam, 3/4 oz. cloth, glass reinforced LE and TE and carbon fiber spars). The average weight/sq. ft. of wing area is ~ 1.63 oz/sf.

b) Most of my stabilizers are V-tails to minimize damage in the weeds and keep the glue joints rugged and simple. The average weight for a number of these surfaces is ~ 0.6 oz/sf.

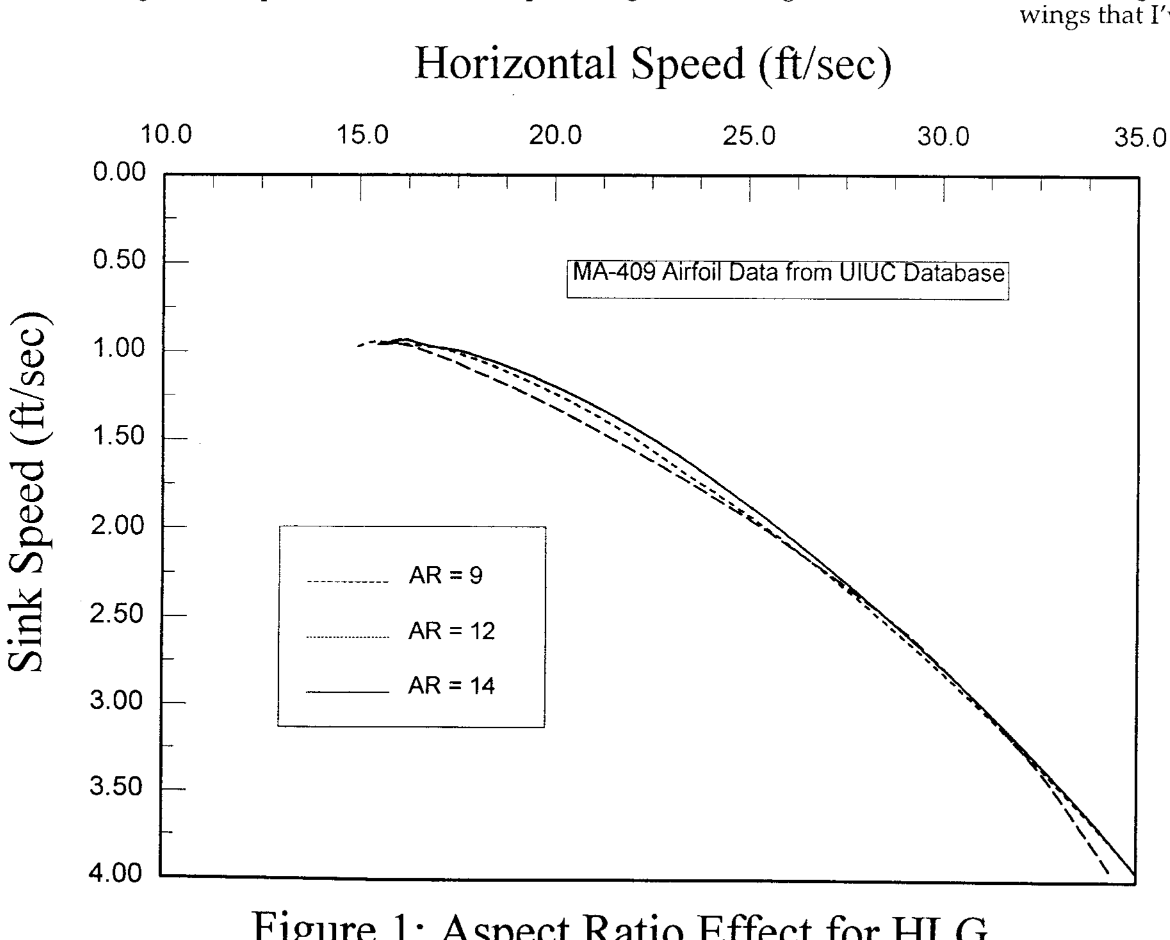


Figure 1: Aspect Ratio Effect for HLG

For our case study, we'll change aspect ratio from a low value of ~ 8 to a high value ~ 15 while keeping the span fixed at 1.5 meters. Using the areas and weights noted above, we find the following:

AR	Weight (oz.)
8	10.56
9	9.91
10	9.40
11	8.99
12	8.64
13	8.35
14	8.11
15	7.89

As a reality check, my last HLG with an AR ~ 12 and 2 servos came in 8 oz. Add the 3rd servo and we have 8.6 oz., which is about right for the calculations we just made.

Now let's run our polar calculation for a few of these aspect ratios. We'll go for 9, 12 and 14 to bracket things. A good performing HLG airfoil is the MA409. So we'll use that for our test case.

In Figure 1, we've run the 3 aspect ratio cases (with corresponding changes in weight and areas) for the MA409 airfoil. Although there are faster airfoils in the HLG arsenal, it's a good, well-behaved performer.

For working really light thermals (typical HLG case), I want a minimum sink of < 1 ft/sec. I'd like to do this at around 15 - 17 ft/sec. so I can turn tight at low speeds. At this point, I'm not too interested in the high speed end just so long as it doesn't suffer too badly.

As with last month's 2 meter example, my choice from this case would be a modestly high aspect ratio ship. Somewhere in the 12 range looks attractive. Referring to Figure 1, the lower aspect ratio case suffers in the mid-range and high speed end of the polar. Although in principle the 14 aspect ratio looks good, we're beginning to get into some pretty small tip chords for this condition so I'd begin to worry about tip stalls.

I've built several successful designs in 11-13 aspect ratio range and I'm rather happy with how they perform. So right off the bat I'd suggest that many of our HLG designs are carrying too much wing area, provided an optimized airfoil for the higher aspect ratio can be used. The MA409 is not a bad start.

In Figure 2, we've compared 4 airfoils at an aspect ratio of 12. These are the MA409, SD7080, S4083 and S6063. The first three airfoils have been used in a number of HLG designs for 'javelin' launch style. The S4083 was specifically designed for HLG (UIUC program). The S6063 is normally considered a slope airfoil but is characteristic of airfoils showing up in the latest discus launched ships.

This comparison is noteworthy in several respects. First, we see that the SD7080 and MA409 are quite comparable in performance at low to intermediate speeds but the MA409 appears to excel at the higher speeds. I've built at least three ships with the SD7080 and have really liked them all. But now I'm really interested to see if the MA409 shows this difference at the field as well as in the computer!

Based strictly on the airfoil data available, the S4083 looks like it isn't up to the performance of the other sections for this design condition. Although the S4083 is a high lift airfoil, it's also higher drag at the higher lift than any of the other sections. At Re~60,000 there appears to be a separation problem at high angles of attack - about where we need to fly for minimum sink conditions at this wing loading. I know several successful ships have been made with the S4083 so it would be prudent to check this out at the field before accepting the analysis at face value.

Finally, the real surprise (to me) is the high speed performance of the S6063. This is a thin section and the results validate the direction many HLG designers take when they try and run thin airfoils. One of the problems with thin sections is that they tend to stop

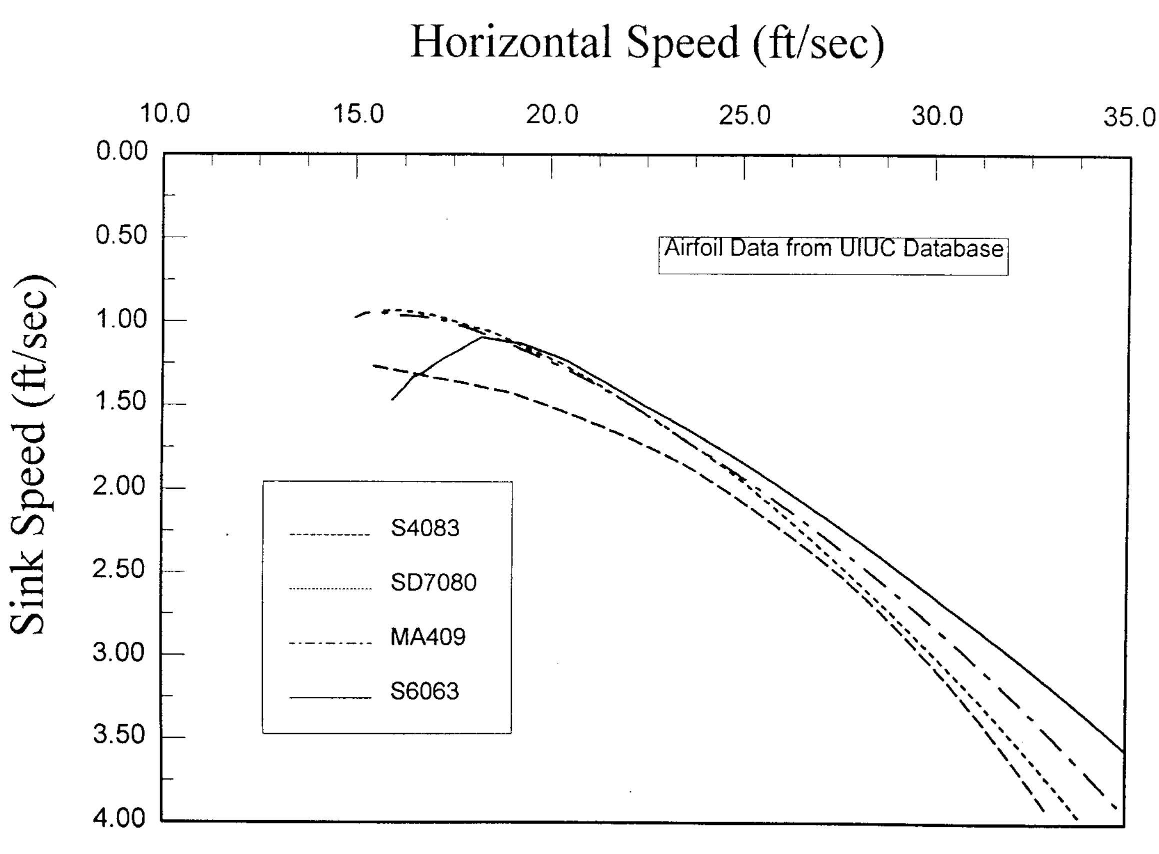


Figure 2: HLG Airfoils at AR=12

flying rather abruptly at high angles of attack. I.e. - really ugly stall characteristics. What's interesting with the S6063 is that the low speed end is constrained by the low lift of the airfoil which forces it to fly at relatively high angles of attack relative to the other sections. Under these conditions, the section becomes rather 'draggy' but it does not appear from the data that the stall characteristics are unfavorable.

This interesting result with the S6063 suggests that we should go back and look at the planform conditions to see if it might respond favorably to a lower aspect ratio design. That summary is presented in Figure 3. As can be seen, there is almost no penalty at the high speed range for a relatively wide range of aspect ratios. Although the minimum sink remains essentially unchanged, the speed at which minimum sink is obtained is more favorable to thermal conditions for the low aspect ratio designs. Personally, I'd pick something in the 8-10 range for this airfoil.

What we have now learned from these examples is that the planform and airfoil interact for different wing loading and aspect ratio conditions to optimize the design. Higher lift airfoils (such as the MA409 and SD7080) benefit from the drag reduction available from a high aspect ratio planform. Low drag airfoils, provided their stall characteristics are

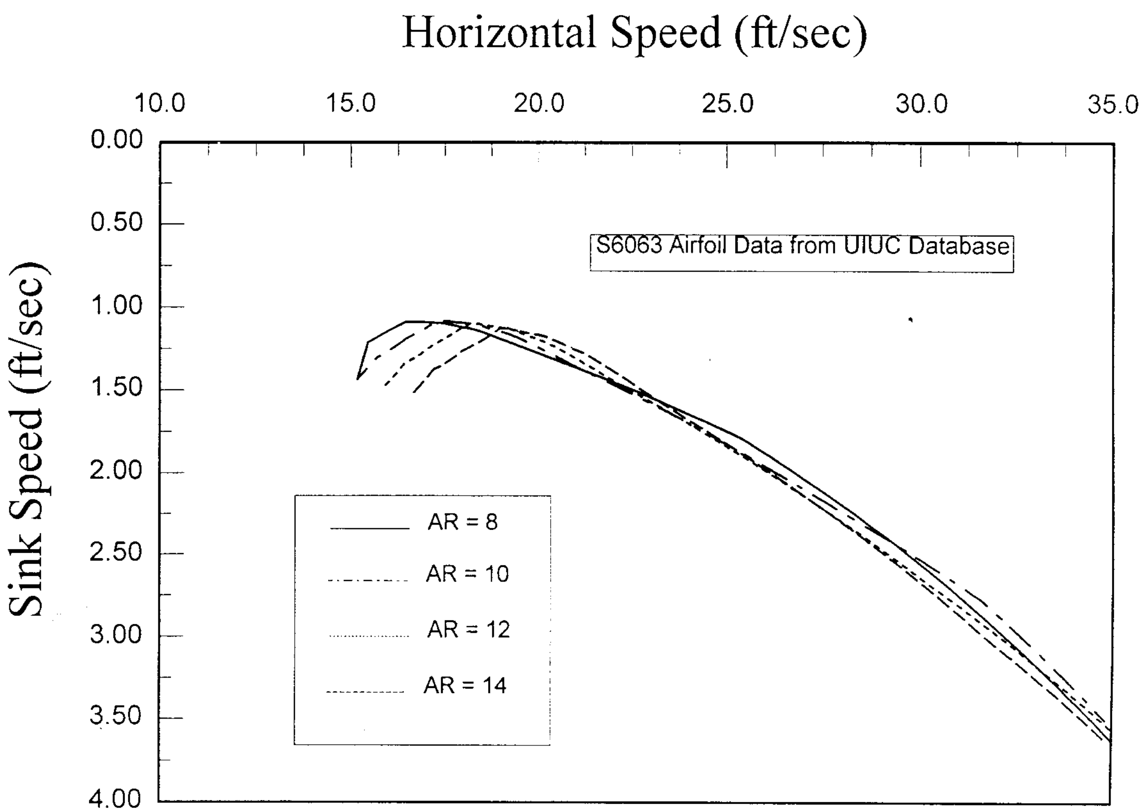


Figure 3: Aspect Ratio Effects for S6063

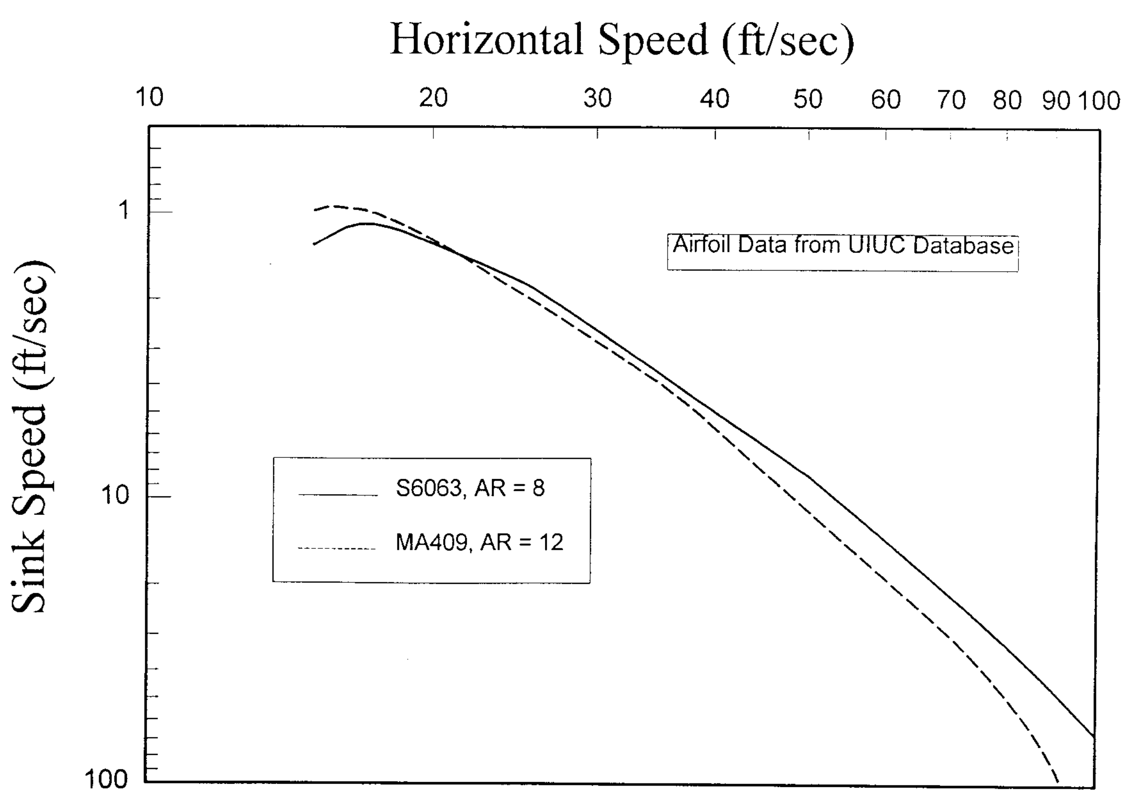


Figure 4: Optimized HLG Polars (Full Range)

Figure 5: Total Drag Curves for Optimized Designs

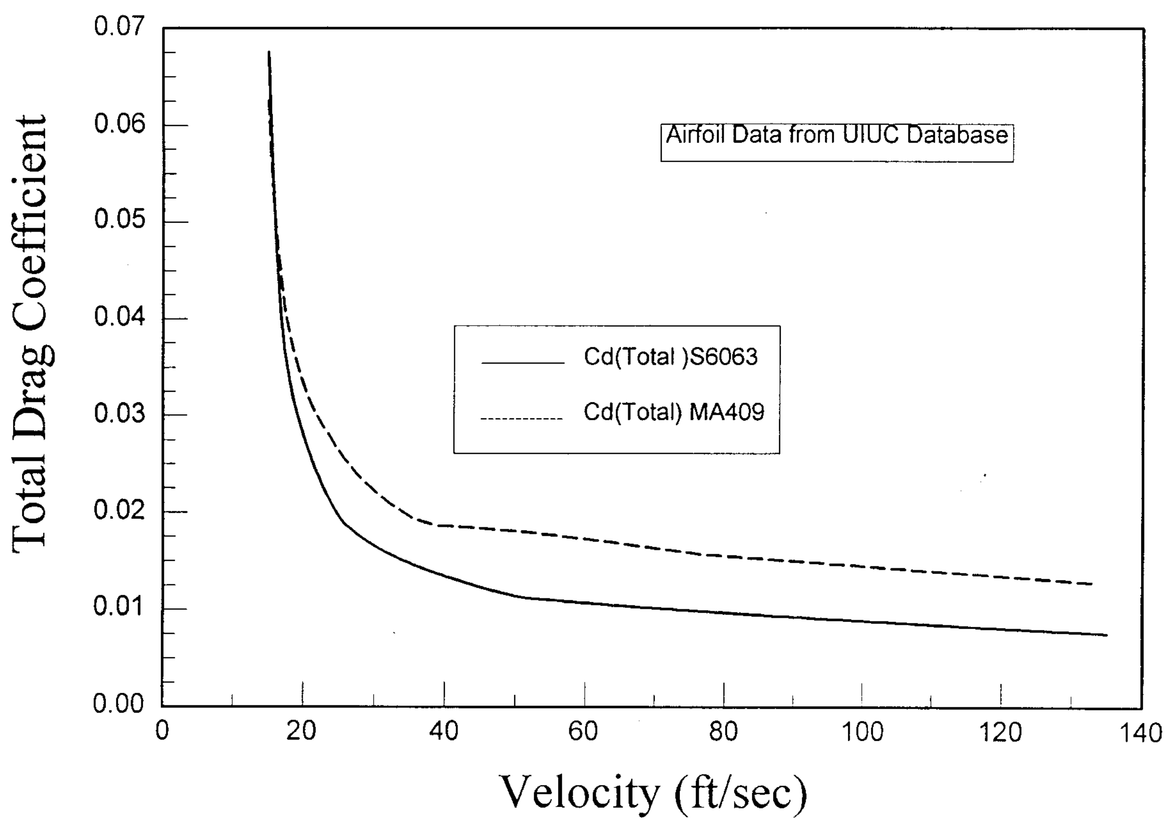
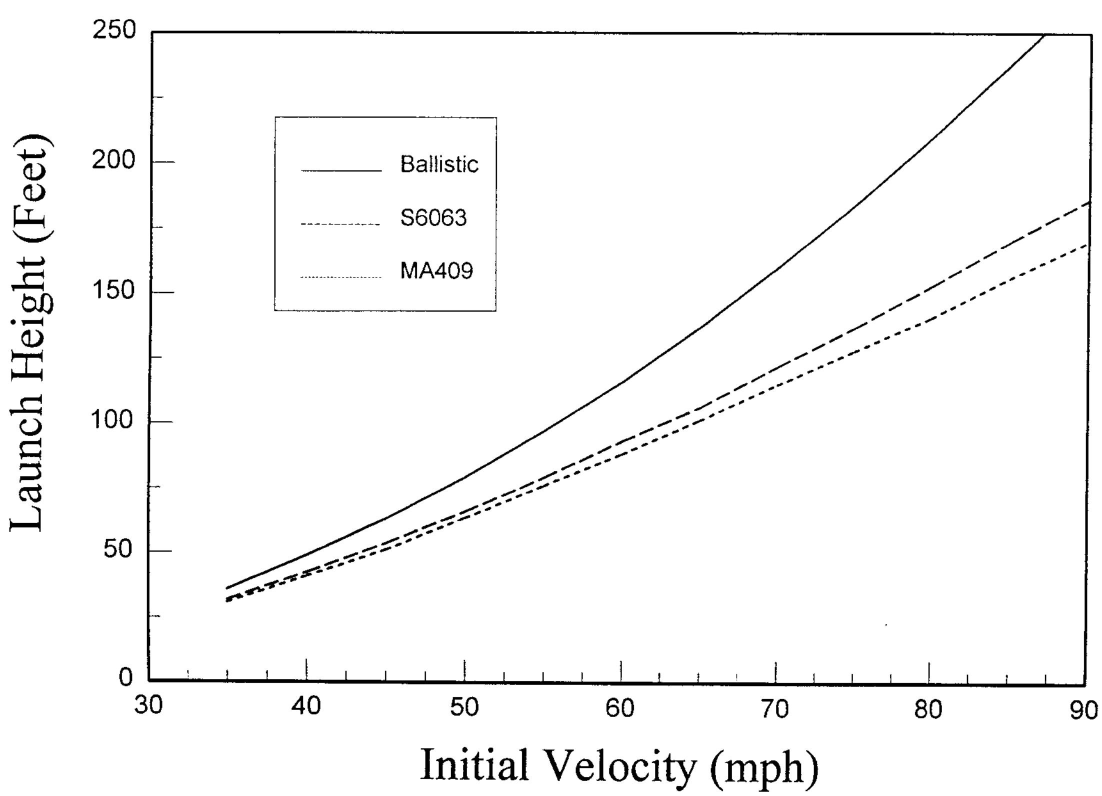


Figure 6: Estimated Launch Height for Optimized Designs



favorable, tend to prefer lower aspect ratio designs.

A plot of the entire speed range for both optimized designs is shown in Figure 4. In this case we've switched to logarithmic scales to capture the picture more effectively. Clearly the MA409 at an AR of 12 is superior in the low to intermediate speed range. Conversely, the mid-range to high speed end of the curve belongs to the S6063 at an AR of 8. The problem we have with the S6063 is that the minimum sink value is pretty lousy. The numerical sink speed for each of these optimized planforms is ~ 1.09 ft/sec. for the S6063 (AR = 8) and ~ 0.95 ft/sec. for the MA409 (AR = 12).

Up to this point we've maintained a pretty tight focus on the thermal and cruise capability of our HLG design. That's great if your ship could just instantaneously appear at final launch altitude. As we all know, however, it has to go through some pretty violent maneuvering to get there. Launch speeds of 50 mph are estimated for the normal overhand throw method but recently speeds in excess of 70 mph at launch have been measured for the discus throw technique. Launch altitudes in excess of 150 ft. are claimed for some of these conditions. Can our analysis also cover the launch phase of the flight?

Well, we've calculated a full profile of the entire flight. From that analysis we've got lift and drag coefficients throughout the speed ranges noted for the respective launch methods. So we should be able to take our drag terms and use them as a correction to a simple ballistic trajectory and see how this works out. As a first approximation to this problem, we need to solve the force equation:

$$M*A = M*dV/dT$$
$$= - M*g - p/2*Cd*S*V\hat{\ }2$$

where M is the mass of the aircraft, A is its acceleration (=dV/dT), T is time, g is the gravitational constant and the last term is our familiar drag equation (p = atmospheric density, Cd = drag coefficient, S = Wing Area, V = Velocity). We can numerically solve this equation using Cd as a function of V from our polar analysis.

In the absence of drag, M*A = M*G. This is the simple ballistic equation which determines the maximum height a frictionless object will reach with a known initial velocity. We can use the calculated drag coefficients for the MA409 design and the S6063 design and estimate an expected launch height based on the force equation, the initial velocity and the estimated drag from our polar model.

A plot of the total drag coefficient for both designs is shown in Figure 5. As expected, drag is comparable at low speeds but clearly favors the S6063 at high speeds. The trade-off is that the wing area is higher for the S6063 design in order to improve the low speed performance. So the advantage based purely on looking at the drag coefficient isn't quite as significant as it might seem.

Using this drag coefficient data, and a numerical solution for the force equation, we can come up with an estimation of launch height as a function of initial launch velocity. That data is shown for our two optimized designs in Figure 6. We also show the altitude that would be obtained using a simple ballistic trajectory (no drag). An assumption in this calculation is that the final velocity will be ~ 18 ft/sec. That gives a little extra speed at the top to avoid a stall and subsequent altitude loss.

Mike Garton has recently reviewed estimated launch velocities and altitudes using the discus throw technique (*Model Aviation*, June 2001). The results of this model are in good agreement with the reported altitudes obtained with the measured discus launch velocities. Let's do a small reality check on some other factors that play into the picture.

With my current HLG design, I can routinely get 45 second dead air time. This is a design very similar to the MA409 configuration we've used here. What I also know is that I can't throw much higher than ~ 40 ft. (estimated from the known height of a few trees at the local park I've come to know very well). Using a minimum sink of 0.95 ft/sec. I can calculate a dead air time of ~ 42 seconds. Counting a few seconds for launch phase, those numbers are quite consistent. Based on the model used here, this suggests my speed at release is probably in the 40 mph range. Now Joe Wurts maxes out at around 55 mph on the javelin launch, so I don't feel too bad about this at all. (I'm 56 with a bum shoulder to boot!)

Now let's look at the discus toss with this analysis. Launch speeds of 70 mph are measured. Using the MA409 simulation, we should get ~ 115 ft. of altitude for a dead air time approaching 2 minutes. That's a HUGE increase from current standards and is a revolutionary change in HLG performance.

It's also noted in Mike's article that launch heights in Europe of > 45 meters are obtained. That would be ~ 150 ft. in english units. Note from our calculations that a launch velocity of 85 mph with the MA409 or 80 mph with the S6063 makes this launch height quite reasonable.

There's one last consideration to evaluate for this month's work. The discus launch provides a significant advantage in launch speed with a corresponding increase in launch height. Based on our polar analysis, the launch heights can be reasonably estimated with the simple calculations we are reporting here in *RCSD*. But let's take one last look at the overall flight performance of the respective designs.

Remember that minimum sink velocities for the two designs we've developed here are ~ 0.95 ft/sec. (MA409) and 1.09 ft/sec. (S6063). Clearly the S6063 has an advantage in launch height, but does it have an advantage in dead air time?

Let's take a 75 mph launch which will get the MA409 design to about 128 ft. The same velocity carries the S6063 design to about 137 ft. But the MA409 planform has a better minimum sink than the S6063 giving it a dead air time of ~ 135 sec. as compared to ~ 126 sec. for the faster ship. In addition, the polars for these designs (Figure 4) demonstrates that the MA409 planform will be more efficient at speeds up to around 20 ft/sec. - more than sufficient to cover a small field under dead air conditions.

So now we've got a dilemma. A well designed ship with a moderate lift airfoil won't out launch an optimized design with a low lift, low drag airfoil. But it will beat it on minimum sink. What's a competition flyer to do at this point?

Well, let's go back to the beginning of this article. We designed around a three servo ship. What if we set this up for flaperons so the camber on the S6063 could be changed once launch height is achieved? There IS data in the UIUC database for the RG-15 under these conditions. Maybe you could tweak the aspect ratio back up a bit for more efficient thermal performance with the flaperons in camber mode. Maybe we can get the launch height AND the minimum sink this way.

But that's a whole new design problem. It looks like the Europeans are headed that way. And it looks like we've got a realistic simulation here that can help us optimize the whole package. So it's back to the drawing boards for me - followed by a little work in the basement to try it all out. The tools are available. The simulation is realistic. The UIUC database provides good guidance for the airfoils. This could be REALLY interesting.

See you next month!

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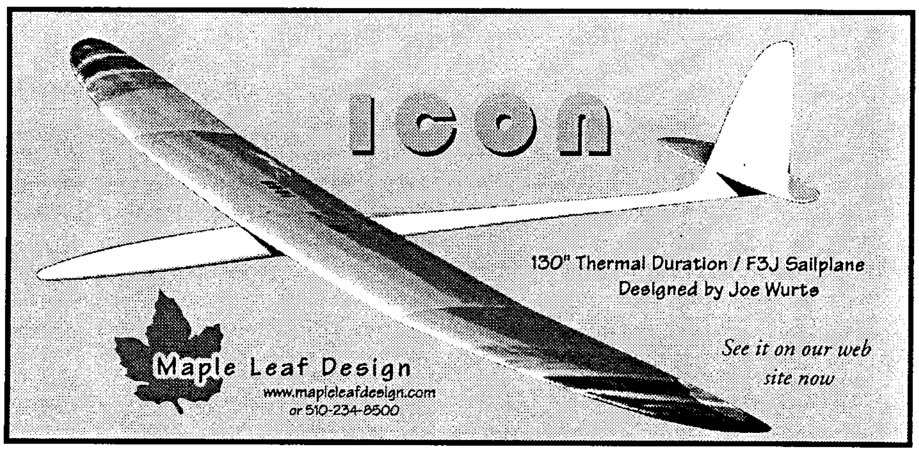

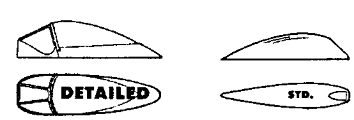

Scott Gradwell
Medford, Oregon
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Ka-6E

First, I have been updating the web site, www.xcsoaring.com, so if you would like to find out about upcoming events, or would like to submit the dates for a cross country event, I will post it. Also, the results of Mike Gervais' contest, the California Valley Cross Country Race, have been posted.

By the time you read this, the Montague Cross Country Challenge will have been completed, so instead of spending time talking about R/C cross country soaring, I am going to write about the Ka-6E that my father owns and I am lucky enough to fly.

He purchased this Ka-6E quite a few years ago and flew it for awhile pretty much the way he had bought it. The sailplane was over 30 years old and needed some updating so, after a few seasons, he decided to restore it. As usual, when you start a project like this, you end up going a lot deeper than you originally thought.

Basically, all the hardware on the fuselage was removed and the gaudy bright red paint was sanded off. All the fittings were either replaced, cad plated, or powder coated as needed. In order to get out one of the control stick torque tubes, a plywood deck behind the cockpit had to be removed. Since there was an underlying structure, the best way we found to remove it was to set a Dremel up with a router attachment and lower it about 1/16", removing the plywood deck wherever it was attached to the underlying structure. Also, one of the main problems with older wooden gliders is the paint cracking as they absorb moisture, contract and expand. He decided to cover the entire fuselage with fiberglass cloth and West Systems epoxy. This seems to have given the paint a good base and there hasn't been any cracking.

Another feature of German wood gliders is the use of tubular rivets. We could find no easy replacements for these and utilized some modern aerospace fasteners in their place. All the instruments were replaced; a GPS and flight computer were added. The wings didn't need much work, as the major project with them was replacing the top skin on the ailerons which required building a special jig. One of the all flying stabilators required a new skin on the leading edge and they were both recovered. All the pieces were taken to a local expert aircraft painter who had painted award winning experimental aircraft before, including an Oshkosh grand champion.

In addition to the sailplane being redone, a new all metal trailer was built for it. The sailplane was then taken down to Tehachapi where it was seen by members of the Vintage Sailplane Association who nominated it for the Frank Gross award, which goes to the best restored sailplane each year. It was voted the best restored sailplane for 1998 and received the award.

While all of this was occurring the exchange rate between the U.S. Dollar and the Deutsch Mark was becoming very favorable and my dad ordered a Ventus 2b. So, after a long wait, the Ventus arrived, and there was an award winning Ka-6 just sitting there waiting to be flown. Of course, I wouldn't let an opportunity slip by me like this and I have been trying to fly it is much as possible.

A lot of sailplane pilots that have moved onto fiberglass sailplanes started out in a Ka-6 and they all comment how wonderful they are to fly. I must agree. It flies as good as it looks.

■

LOW TECH, LOW BUDGET FIELD MAINTENANCE

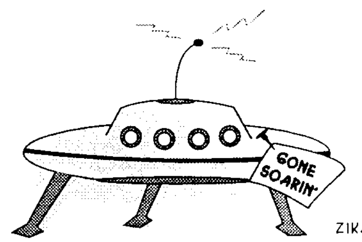
by Pancho Morris
Mesquite, Texas

It has been a long time since I have sent anything to Judy for the magazine. (Possibly not long enough!) This came up and I thought it would fit in with my past series on "Budget R/C". This is more of a club idea rather than an individual one.

The picture shows a very inexpensive way to keep the grass mowed at your field. The down side of this method is the byproduct left behind by the equipment, but then you know what we are very well known for here in Texas.

Actually, this is a scene from our recent TEXAS NATIONAL TOURNAMENT or TNT. I looked up after a brief rain shower had moved through and saw this herd of cattle in the middle of the field about half way down the winch lines. I said that this was planned for our out of state guests. Thundershowers and cattle; NO WHAR BUT TEXAS!

We had a wonderful turn out from around the country. I hope y'all are fixin' to make it down next year. (Boy that's hard for a boy that grew up on the beach in Malibu to say!) ■



ELECTRIC CONNECTION

by Mark Nankivil
7411 Canterbury Ave.
St. Louis, Missouri 63143
(314) 781-9175
nankivil@telocity.com

Koleos 1.8 Meter Electric Sailplane Specifications:

Wing Span:	71 inches
Wing Area:	430 square inches
Weight:	20.4 ounces
Wing loading:	6.83 ounces/sq.ft.
Motor:	Graupner SpeedGear 400 6 volt with 4:1 gear ratio
Prop:	Graupner Cam 11x8 carbon folder
Battery Pack:	7 Sanyo 500AR or 600AE cells
Receiver:	Hitec 555 with the case removed
Servos:	Hitec HS-60 servos
Transmitter:	Hitec Prism 7X

Review of the Icare Koleos Electric Sailplane

Over the last couple of years, my building time has become a more precious commodity, what with work, family and business, and as such, my choices as to what to build have had to become far more selective. I remember back in my "single" days having a derisive opinion of ARFs, especially as 10+ years ago the general quality of the ARFs was not too good. As the years have gone by, the quality has improved dramatically and the variety of ARFs available has improved too.

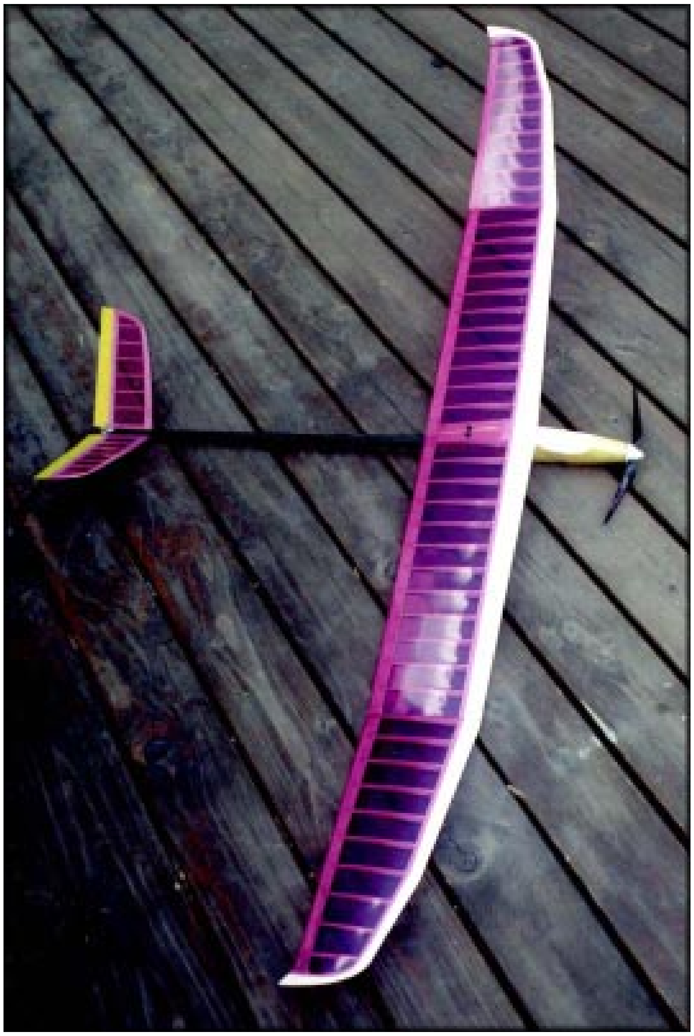
This past April, I shared a couple of tables at the Boeing Swap Meet with Tim McDonough who is the proprietor of Electric Flight Products. Tim had brought along a couple of Icare's new Koleos electric and hand launch sailplanes. I was looking for a new Speed 400 size electric sailplane and decided that the Koleos electric sailplane with a 1.8 meter span, polyhedral wing would make an excellent choice. The fact that the wing and tail feathers were already built, covered and ready to mount, along with the reasonable price and apparent quality, made it pretty easy for me to shell out the dollars and take one home with me.

So what do you get with the Koleos? The Koleos appears to be an evolutionary development of the Carbon D-Light electric/hand launch sailplane. The primary change from the D-Light to the Koleos is the change from a molded fuselage to a pod and boom type fuselage layout. The pod of the Koleos is a 'glass/Kevlar layup and is both light and very stiff. The pod comes with a separate canopy that overlaps the leading edge of the wing and is already finished to a white color. For the electric version I purchased, the nose is already cut off and a laser cut bulkhead for the motor mount is supplied for the builder to install. The wing is mounted to the pod by two nylon bolts at about 70% of the root chord and the holes are already drilled and threaded to accept the wing (more later on this). The tailboom is a a tapered carbon fiber boom that is very lightweight and stiff as well. The rear of the boom comes pre-cut to accept the V-Tail and the pushrod housings are already aligned and mounted in the boom itself.

The wing is primarily a two piece, built up balsa structure that uses a carbon fiber D-tube leading edge to create a very torsionally stiff wing. The wing tips are hollow molded and have a slight sweepback with curled up tips. The D-tube leading edge appears to be painted and the open structure is covered in Oracover Lite. My Koleos is covered in a transparent purple/violet that looks great in the air and gets two thumbs up from my wife (purple happens to be her favorite color). The airfoil used is a modified Selig S4083.

The tail feathers are pre-built balsa structures that are also covered in Oracover Lite and the center section of each half of the V-tail is already beveled and ready to be joined at the correct interior angle of approximately 110 degrees. Once joined, it easily slips into the rear of the tailboom which is slotted to accept the V-tail.

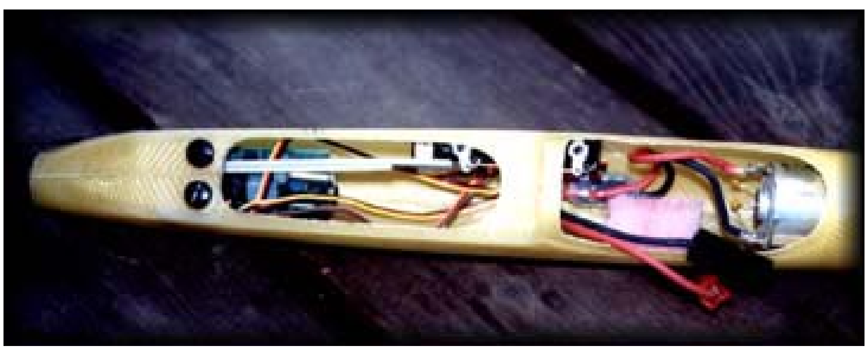
Assembly is quite straightforward. I decided to mount the wing to the pod first and had only to clean up the holes in the pod that accept the alignment dowels located in the leading edge of each wing half. When I mounted the wing to the pod, it looked to me that the pod was a bit askew so I slipped the tailboom on and made a couple of measurements. This confirmed that something was out of line which turned out to be the placement of the pre-drilled mounting holes in the pod itself as they were offset to one side about 1/32+ of inch which threw the tailboom out of alignment by a couple of degrees - not good. I decided to correct this by drilling the holes out to 3/8" diameter and gluing in some 3/8" wood dowel. Once the glue had cured, I remounted the wing and after assuring that everything was in proper alignment, drilled out new mounting holes and threaded them to accept 8-32 nylon screws in place of the supplied



metric screws. Much better now!

Once the wing was mounted, I permanently glued the tailboom to the pod making sure that the V-tail was properly aligned with the wing. The motor bulkhead was glued in place and the motor and radio equipment mounted in the pod. Take some time mounting the equipment and make sure that you use micro servos and a small receiver to save space and allow for some room to work with. I used two Hitec HS-60 servos to drive the ruddervators and a Hitec 555 receiver with its case removed. Power for the Koleos is provided by a Graupner SpeedGear 400 6V with a 4:1 gear ratio, Castle Creations Pixie 14, all turning a Graupner Cam 11x8 folder. This is all juiced by either 7 - Sanyo 500AR cells or the more readily available Sanyo 600AE cells.

Very important - getting the CG where it needs to be will require you placing the battery pack as far back in the pod as it physically can be. This means the receiver and servos will need to be arranged either forward or to the side so that the battery pack can be inserted and pushed all the way to the back. I chose to mount the servos on the left side and forward (in tandem) with the receiver immediately to the rear so as to put as much room between it and the motor as possible so as to minimize interference. By doing this, I can then place and pull the pack out of the pod through the canopy and not have to remove the wing. Even so, I had to add about a 1/4 ounce of lead between the tail feathers at the rear of the tailboom to get the CG where it was recommended to be set. In my mind, the only negative design feature of the Koleos for electric use is the short tail of the pod - if it were only an inch further back, all would be well in getting the CG right using readily available components such as the Graupner products I used. You might even be able to use an 8 cell pack for added power.



Once assembled and ready to fly, I found my Koleos weighing in at just 20.4 ounces which I found to be excellent for a 1.8 meter electric sailplane. With a wing area of 430 square inches, this gives a wing loading of just 6.83 ounces per square foot. Ruddervator throws were set to the recommended measurements.

I was itching to get out and fly but it took a few weeks to get both good weather and free time to match up. The Ste. Genevieve E-meet turned out to be that day. The first flight started out as a power off hand toss which showed an excellent glide ratio. So instead of walking to pick it up 30+ yards away, I powered up and started a shallow climb to about 300 feet. After shutting the motor off, I did a bit of checking on whether the recommended throws were adequate and found the Koleos to be rather nimble, especially being a V-tail polyhedral model. The air was excellent and soon I had a thermal cored and the model headed to speck height. With the

Koleos getting quite small, it was time for a dive back to the field which found the trim and CG to be well set and the model showing a good turn of speed. Back to 200 feet of altitude, I did this three more times before landing with a flight time of 48 minutes. Not bad for a first flight! Further flights on other trips to the club field have found that the first flight was no fluke - this model performs and does so quite well. I'm kind of surprised at the nimbleness of the Koleos as I have flown a number of other V-tail polyhedral models and none of them seem to be as light on its toes as the Koleos has been. For those of you who would prefer, there is an aileron equipped version of the Koleos available.

In the near future, I plan on experimenting with a direct drive set up either with a Speed 400 6v motor or even better yet, an Astro 020 brushless motor I have that's looking for a home in an airframe. In summary, the Koleos is a keeper!

The Koleos is available from:

Tim McDonough
at Electric Flight Products
127 S. Oaklane Road
Springfield, IL 62707
http://www.tim.mcdonough.net/

or direct from:

Icare
381, Joseph-Huet
Boucherville
Quebec, Canada J4B 2C5
http://www.icare-rc.com

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Please send in your scheduled 2001 events as they become available!

SCHEDULE OF SPECIAL EVENTS

June 30 - July 1, 2001
SKSS UNL Thermal Duration — Newark, DE
& RES (Aerotow & BBQ on Saturday)
Jim Faassen, (302) 239-4923
jfaassen@dca.net
http://www.silentknightssoaring.org

July 7-8, 2001
CRRC RES Contest — Sudbury, MA
http://www.charlesriverrc.org
Pete Young, (617) 484-0640
pwyoung@ix.netcom.com
Dick Williamson, (781) 981-7857
williamson@LL.mit.edu

July 21-22, 2001
Gerry Knight Memorial — Ontario, Canada
Scale Aerotow Rally Y2001
Phil Landray, (905) 468-3923,
linden@niagara.com
Don Smith, (905) 934-7415,
donsmith@mergetel.com
Charlie Rader, (905) 563-4108

July 28-29, 2001
Rosebowl Soaring Festival — Pasadena, CA
Richard Burns, (626) 857-0024

August 11-12, 2001
Pacific Northwest HL Regional — Redmond, WA
SASS R/C HLG
Adam Weston, (206) 766-9804
red@tgworks.com
http://www.reddata.com/SASS

August 11-12, 2001
CRRC Soar-In Contest — Sudbury, MA
http://www.charlesriverrc.org
Dave Walter, (978) 562-5400
dwalter@ultranet.com
John Nilsson, (978) 368-7136
nilssonj@rd.simplexnet.com

September 1-2, 2001
Tangerine Soaring Championships — Orlando, FL
www.orlandobuzzards.org

September 14-16, 2001
Last Fling of Summer — Broken Arrow, OK
Dave Register, regdave@aol.com

Reference Material

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

BBS/Internet

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

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DesignAire: EASY TO USE AIRCRAFT DESIGN SOFTWARE (PC). 3-D sketch, performance, Wt/Bal, inertias, color graphs, panel analysis, static stability, airfoils, FAR 23A loads and envelope. Runs "airfoil ii". $119. JammAero POBox 69, Wallops Island VA 23395. www.jammaero.com.

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RnR XBSC cross country ship with low milage. Install receiver, trim and fly. Includes 6 Airtronics servos and battery pack, plus original RnR shipping case. $550 UPS COD. Bob Sowder, Memphis, TN, 901.751.7252 eve., or e-mail <bsowder@wmctv.com>.

Father retiring from sport and my wife will kill me if I don't clean up my shop. Built models are outstanding craftsmanship and in mint condition. Price listed or P.O., plus shipping cost. Sagitta 900 built with spoilers and Futaba radio... $300.00. Pulsar 100" w/S3021 w/5 servos... $300.00. Gentle Lady w/Futaba radio... $200.00. Windspiel Kestrel 19 kit in box, glass fuse., 134.5"... $200.00. Electra kit in box w/elec. motor... $60. John, (860) 651-9126, Connecticut.

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Craig Christensen, (952) 435-7406, after 4:30pm CDT, MN.

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

T.W.I.T.T.

(The Wing Is The Thing)

T.W.I.T.T. is a non-profit organization whose membership seeks to promote the research and development of flying wings and other tailless aircraft by providing a forum for the exchange of ideas and experiences on an international basis. T.W.I.T.T. is affiliated with The Hunsaker Foundation which is dedicated to furthering education and research in a variety of disciplines. Full information package including one back issue of newsletter is $2.50 US ($3.00 foreign). Subscription rates are $20.00 (US) or $25.00 (Foreign) per year for 12 issues.

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The League of Silent Flight (LSF) is an international fraternity of RC Soaring pilots who have earned the right to become members by achieving specific goals in soaring flight. There are no dues. Once you qualify for membership you are in for life.

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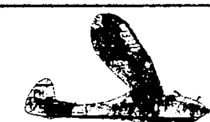
Sailplane Homebuilders Association (SHA)

A Division of the Soaring Society of America

The purpose of the Sailplane Homebuilders Association is to stimulate interest in full-size sailplane design and construction by homebuilders. To establish classes, standards, categories, where applicable. To desiminate information relating to construction techniques, materials, theory and related topics. To give recognition for noteworthy designs and accomplishments.

SHA publishes the bi-monthly ***Sailplane Builder*** newsletter. Membership cost: $15 U.S. Student (3rd Class Mail), $21 U.S. Regular Membership (3rd Class Mail), $30 U.S. Regular Membership (1st Class Mail), $29 for All Other Countries (Surface Mail).

Sailplane Homebuilders Association
Dan Armstrong, Sec./Treas.
21100 Angel Street
Tehachapi, CA 93561 U.S.A.



The Vintage Sailplane Association

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

Vintage Sailplane Association
1709 Baron Court
Daytona, FL 32124 USA

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

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

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

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ESL Web Site: http://www.eclipse.net/~mikel/esl/esl.htm
ESL President (99-00): Tom Kiesling (814) 255-7418 or kiesling@ctc.com

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