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R/C Soaring Digest

Managing Editors, Publishers — B^2 Kuhlman

Columnists
Chris Boultinghouse
Jay Decker
Lee Murray
Tom Nagel
Mark Nankivil
Dave Register
Jerry Slates
Gordy Stahl
Peter Wick

Contributors
Don Bailey
Gregory Ciurpita
Dave Garwood
Brian Kloft
Phil Pearson

Photographers
Dave Garwood
Dave Beardsley
Mark Nankivil

Contact
rcsdigest@themacisp.net
Web: http://www.rcsoaringdigest.com
Yahoo! group: RCSoaringDigest
AIM screen name: RCSDigest

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In the Air!

You are now reading one of the largest issues of *RC Soaring Digest* ever published. This is an incredible milestone, given that until recently a portion of the magazine was devoted to advertising.

Producing a PDF this large is not at all difficult or time consuming once the magazine layout is completed, but the produced file will always be sizable, and readers without access to broadband internet will spend a lot of time downloading the PDF.

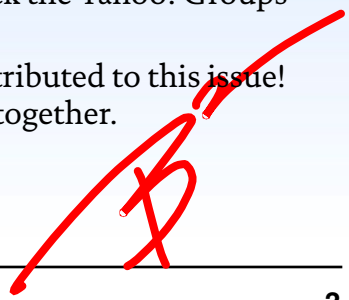
For this reason, a compressed PDF, roughly half the size of the original, of this and all future issues will be available to members of the RCSoaringDigest Yahoo! group within the Files section. These compressed PDFs lack the high image quality of the original, but are substantially quicker to download for those with dial-up access only. The February, March, and April 2006 issues are already posted in the Files section.

While there's a daily download volume limit for Yahoo! files, and you may have to wait for a restriction to lift before downloading a compressed issue, the PDFs will remain available for about four months after publication.

You must be an RCSoaringDigest group member to access the Files section. If you're not a member of the RCSoaringDigest Yahoo! group, it's free and easy to sign up. Go to the *RCSD* home page, enter your e-mail address in the blank below where it says "Subscribe to RCSoaringDigest," and click the Yahoo! Groups Join Now! button.

Our sincere thanks to everyone who contributed to this issue! We had a grand time putting everything together.

Time to build another sailplane!



Blackie the Eagle

by Evan Shaw, <evshaw@telkomsa.net>

This composite photo shows Charl Viviers launching the Black Eagle during the Black Eagle Slope Weekend at Volksrust, South Africa.

Phase 1: The idea, the design, the building and setting up

Originally, I started the project of building the Black Eagle because of the "Black Eagle Slope Weekend" that I organize each year.

I was going to build it with conventional ailerons/drag flaps with cheater fins, etc., as I had seen in old magazines. Then a friend of mine sent me an article from the June 2002 issue of *Model Airplane News* magazine about a Turkey Vulture that Bob Hoey had built using wingtip aileron feathers, as he calls them, so I decided to try that method.

Basically what happens is that the first three wingtip feathers rotate around a longitudinal axis and these act like ailerons causing a turn. According to Bob Hoey it is the most bird like of the directional control methods that he has tried on "model" birds. I won't go into the nitty-gritty of how they work here. Perhaps we could get Bob to do an article on them some time.

I built the model out of foam and glass. The fuselage is a plywood box, in which I put the receiver and batteries, with foam glued to it, and then sanded to shape and covered with glass cloth and painted.

The stab is a balsa built-up frame covered with Solofilm, and the elevator is actuated by torque rod, so no control rods are seen on the outside. I made up the connector to the servo myself by soldering a brass strip to one of those brass thingies from an electrical "chocolate block" and then screwed it to a servo output arm.

The wing itself was made up in nine sections and cut using a total of 12 templates. The section is the MH46 at the root and MH49 at the tip. Once cut, the sections were then glued together and blocked up on scrap foam to create the classic dihedral/anhedral shape that I wanted.

I installed the servo for the wingtip feathers right at the tip before I bagged the wing. Not the best option, I know, as it completely encapsulates the servo. If one needs to do repairs, then it is definitely going to be a problem. But I wanted a strong, lightweight method, so I figured that I would take the chance that I won't need to be doing any repairs to the servo. I used the small Hitec HS55 servos.

I had serious reservations about how the wing was going to turn out with all those angles and contours of the rather thick reflexed sections. I spent several hours cutting and fitting the Mylar sheets to the foam so it could take all the shapes, and spent a lot of time aligning the core into the outers while in the bag.

I was extremely happy with the final result once it came out of the bag and I had finished trimming all the bits and pieces.

The total span with feathers is 1500mm with a wing area of about 27sqdm and weight of about 950grams when balanced.

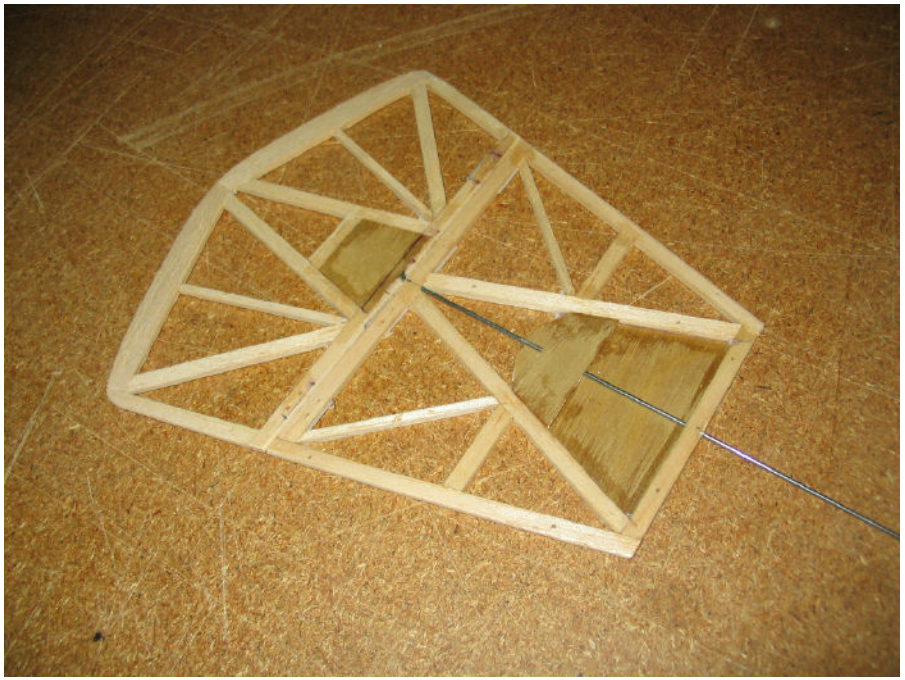
I used my normal bagging technique, with carbon tows glued to the leading edge. The end result is a very strong and lightweight wing.

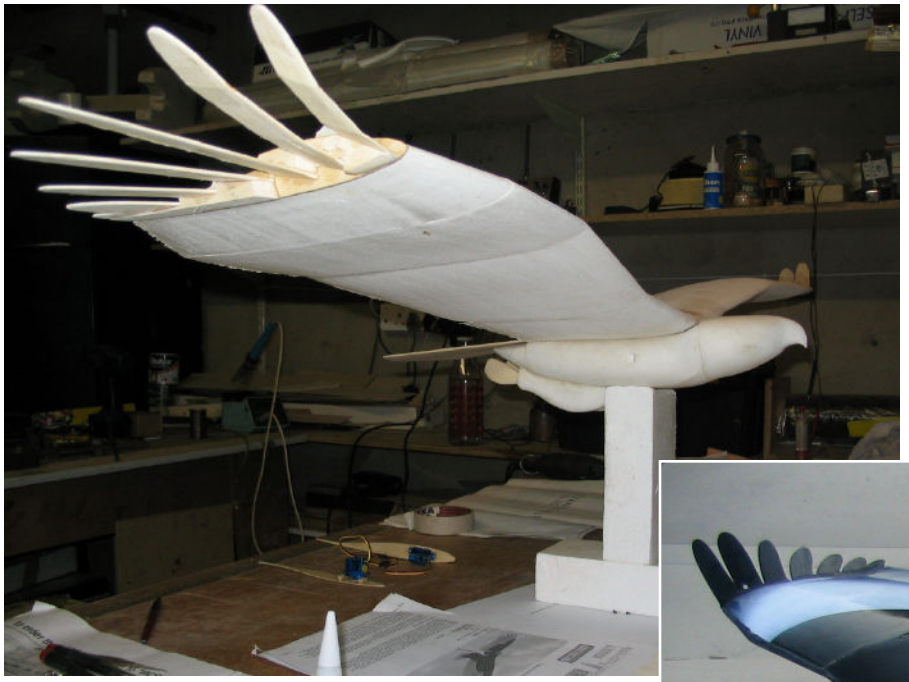
The wingtip feathers are made from 2mm balsa, as suggested by Bob Hoey in his article. I am not very happy with them, as they seem to be very flimsy and break too easily for my liking, so I will be making up a set of carbon ones soon.

To determine the CG location, I used the rule of thumb of $1/6^{th}$ MAC that has served me well for all of my flying wings. Of course this may change a bit after more flight tests have been performed, but on the initial flights it seemed spot on.

The program I use calculate the Mean Aerodynamic Chord is one that I downloaded from
<http://www.jean-claude.etiemble.com/tracfoil/>
years ago and it makes finding the MAC on a multi taper wing a doddle. It's freeware and the link still works.

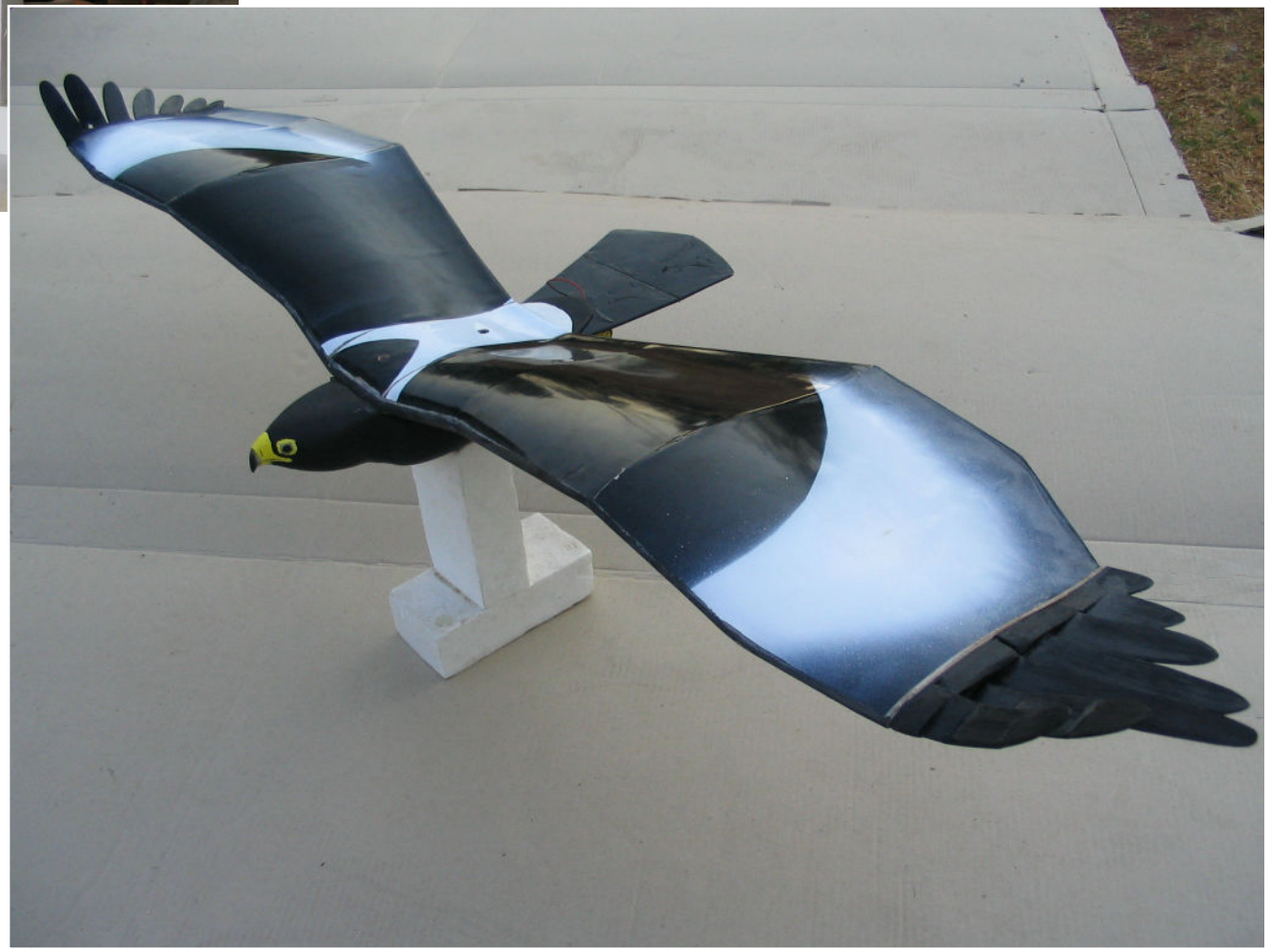
Upper left: The major parts completed, ready for finishing and final assembly. Right: Evan trimming the wing. Lower left: The specially built fixture that connects the servo output shaft to the elevator torque rod. Right: The stabilizer and elevator assembly, prior to balsa sheeting.





Left: All that's lacking is a bit of paint. This view shows the tip feathers very well. Note the change in angle from the first to the last feather. The first three are mounted to a single balsa block and are rotated in unison by an HS-55 servo.

Below: Painted and ready to fly! The size and color scheme precisely match those of the South African Black Eagle (*Aquila verreauxii*). See <http://www.joburg.org.za/2005/jul/jul21_chicks.stm> and <http://www.worldbirder.com/photo/thumbs.asp?SID=785>.



Phase 2: The Eagle' s first flights

I had taken my Eagle with me to the annual Black Eagle Slope Weekend at Volksrust, and been ignoring it, as I wasn't sure if it would fly. But Piet and the boys were not going to let me get away without trying, so it was now or never.

Directional control is by tip feathers which I had never tried before. I wasn't even sure which direction they should go. It was such a long time since I had finished the building that I had forgotten.

With Mike Summers help, off we went to give her a maiden flight. We didn't go too far forward on the slope to launch, as I wanted enough ground in front of me to put her down if there was a problem. As soon as Mike launched her, she shot up and I was just able to push in enough down to stop her being blown downwind. Of course the controls were the wrong way around, and right just made her go even more right. I was sort of expecting this, so full left was applied with full down and she just recovered enough to pancake in fairly hard. Luckily there wasn't too much damage, and I was able to get her fixed with a bit of epoxy and cyano.

Charl Viviers was the next to launch the Eagle. This time the controls were working in the correct direction, and I had dialed in some extra down trim to compensate for the wind. We also went a bit further down the slope. As can be seen in the pictures, Charl put every effort into the launch, and she sallied up and away. I was amazed at how effective the wingtip feather worked (a bit too effective, actually) and was able to keep her more or less straight into the wind. The problem was that the wind was just too strong, and I couldn't penetrate to get her into nice clear air. It was all I could do to just keep her from being blown downwind. However, she did fly, albeit a rather short flight.

All in all, the biggest problem was the tip feathers. As per Bob Hoey's suggestions, I had made them out of balsa, but each landing broke some of them off. Finding the bits and pieces in the grass wasn't easy, either. So, I will be making a set of tip feathers out of carbon, and they'll be attached to the bird with magnets so that they can pop off on landing without causing damage.

Now that I know what sort of wind she will fly in, I feel a lot happier. Also, knowing that she is controllable is a relief. Before now I was just hoping that the concept would work. There is still plenty of development to do before she flies perfectly. I'll keep you posted and as they say in the classics, "Watch this space!"

Let's Build a Genie!

Or "How to Get an Open Class Glider the Fun Way, Not the Buy-N-Fly Way"

Part 2: Rudder, Stabilizers, and Shaping. Oh my!

by Chris Boultinghouse, <caboultinghouse@yahoo.com>

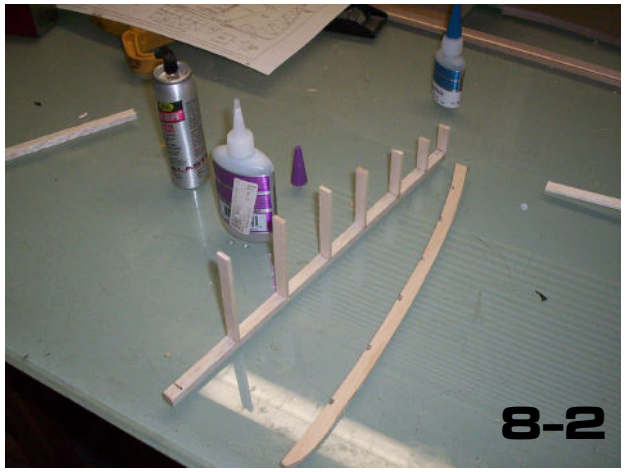
In Part 1 of this article we had the basic fuselage side structures complete and joined, the vertical fin assembly was cut to shape, and the stabilizer bellcrank was installed. Now it's time to build the rudder and stabilizers, and give the fuselage some curves!

The rudder and stabilizers are traditional balsa open-bay structures, but Harley has cleverly designed them to be easy to build straight and strong. These structures can be essentially built "in your lap," with no need to pin them to the plans. Neat!

A complete set of photos, some of which do not appear within this *RCSD* series, are now available from my *Genie* album at <http://genie.justplanechris.com>.

Construction of the rudder begins by making a kit of parts consisting of the leading edge, trailing edge, and ribs made from strip stock. The trailing edge is notched per the plans to increase the gluing area as well as allowing "eyeball alignment," as you can see in the pictures. Ribs are glued to the leading edge first, then the trailing edge is visually aligned and CA'd in place.


8-1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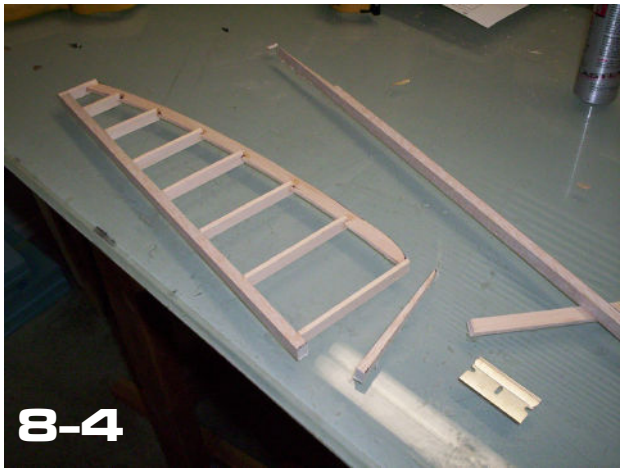
8-3

Next comes the bottom piece, followed by diagonals and gussets. The weight of my still-square rudder was a svelte 13 grams. After sanding to a nice airfoil shape, the weight dropped to 11 grams! It picked up 4 grams when the plywood drive horn bits and a spruce tip were added.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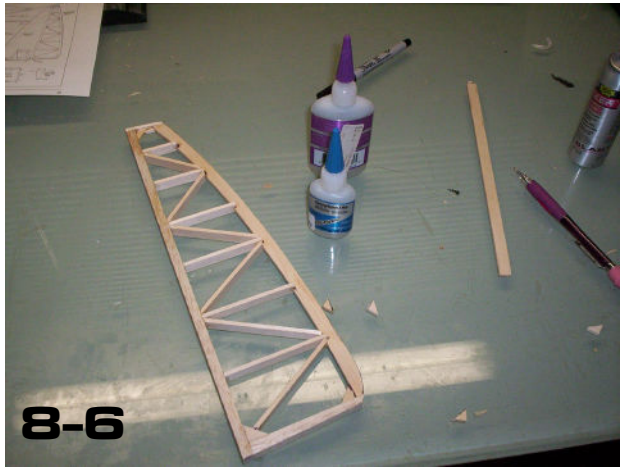
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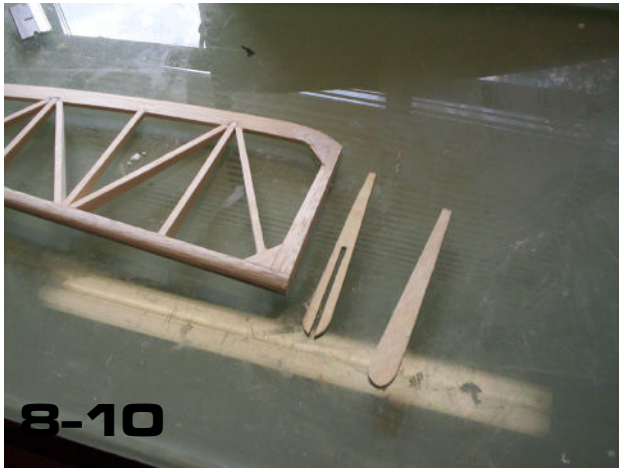
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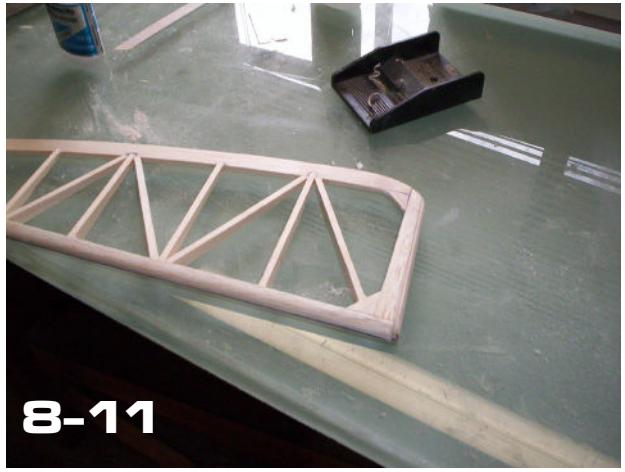
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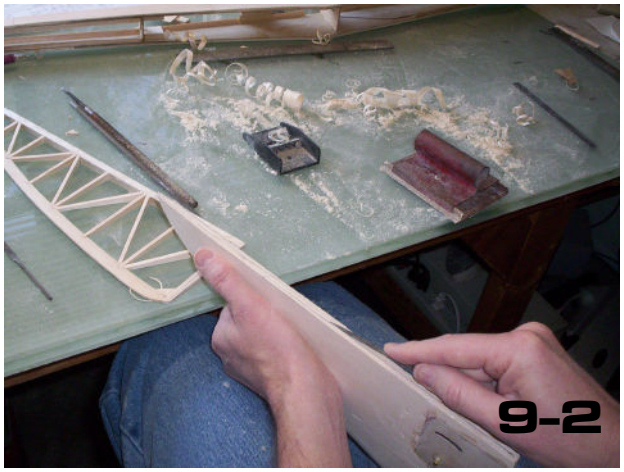

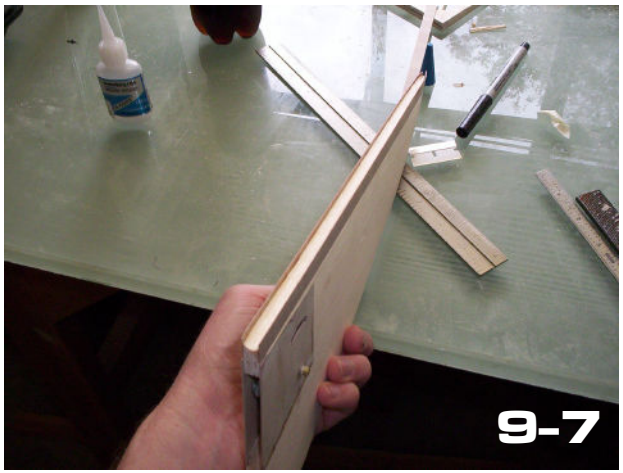

It is now time to hinge the rudder. The first step is to form a hollow "cove" on the trailing edge of the fin. The usual (and recommended) method is to simply use round files to concave the back of the fin. My fin, however, is very soft balsa. The resulting trailing edge was much too fragile, even after soaking with CA. I decided drastic measures were called for, and inlaid 1/64" plywood pieces to form a very nice and sharp fin trailing edge. If your fin is of firmer stock, the method depicted in Harley's documentation will work fine.

Harley's documentation has instructions for using Fourmost "knuckle" hinges that allow the rudder to be removable. While Harley has had good results with these hinges, I have used them in the past and wasn't crazy about them. I consulted Harley about using my old favorite Klett brand removable-pin hinges, and he approved. By running one long music wire pin through all the hinges, the rudder remains removable in case the drive horn needs to be repaired or replaced. Were I to do it all over again, I might just stick with Harley's recommended hinges, as it is not much fun to fish the hinge pin wire through all hinges. It does make for a nice looking installation though!


10-1


10-2


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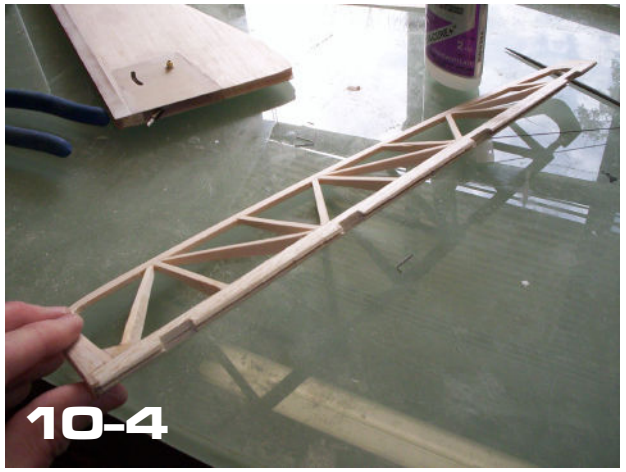
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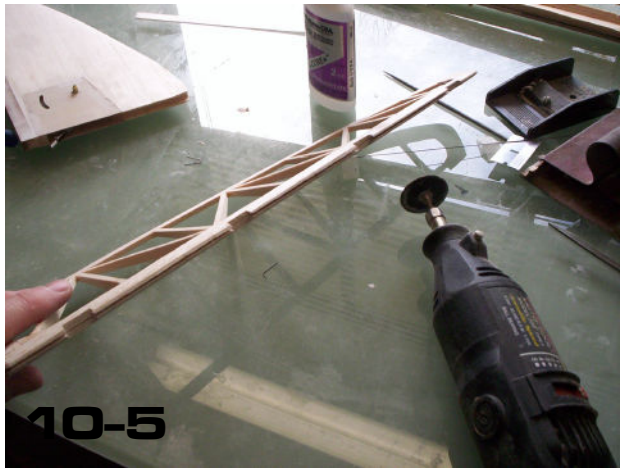
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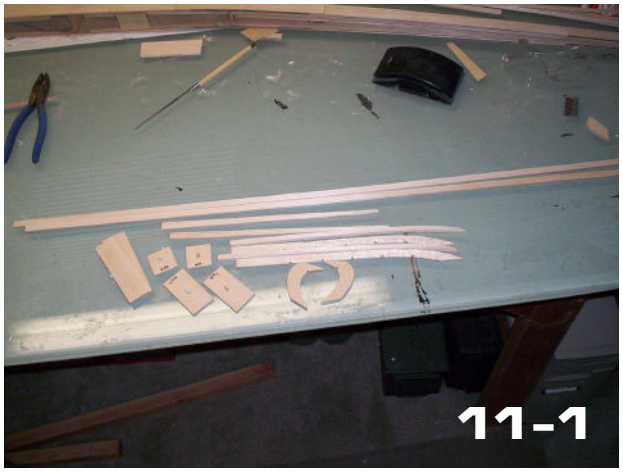
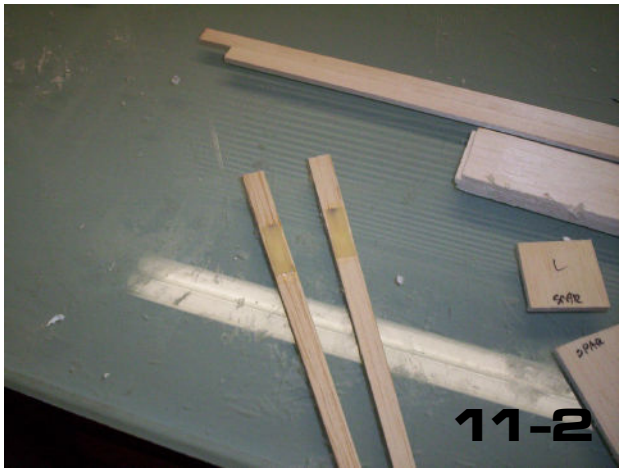
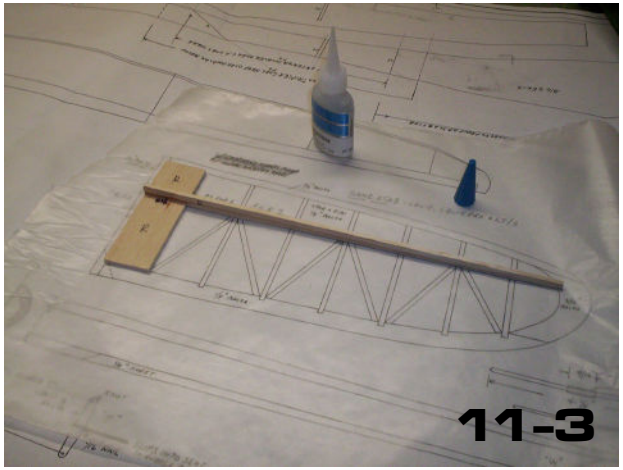
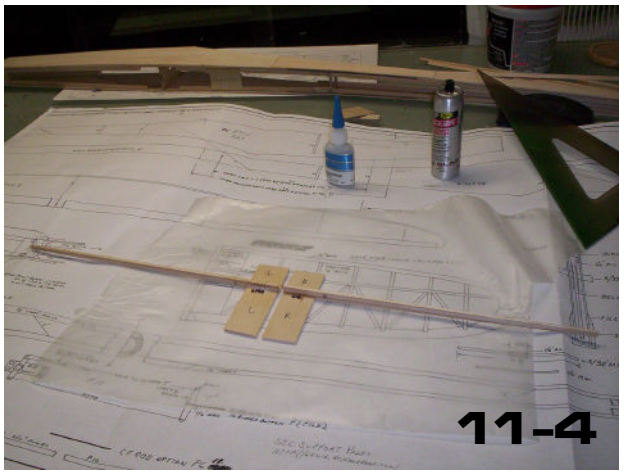
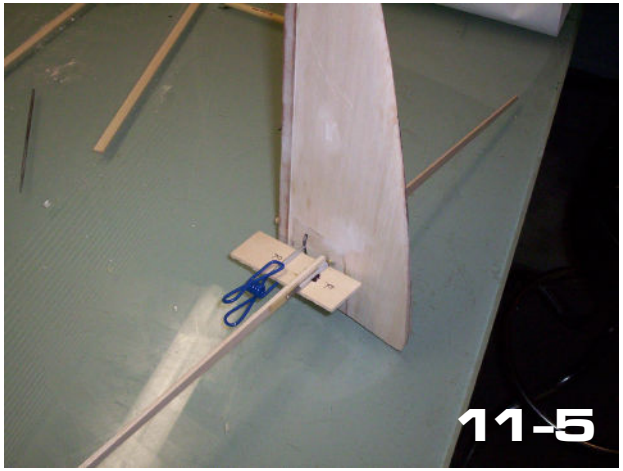
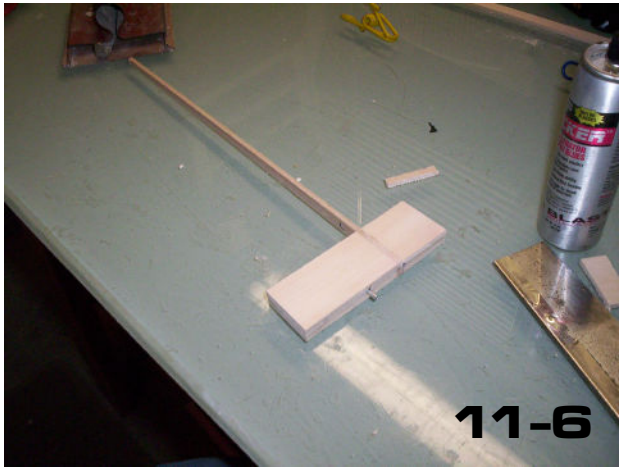


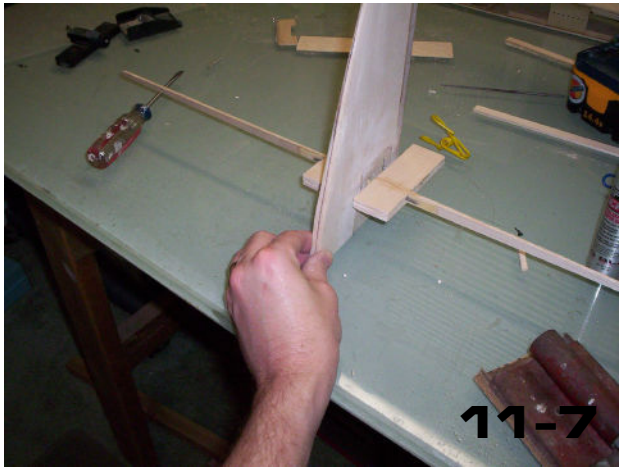








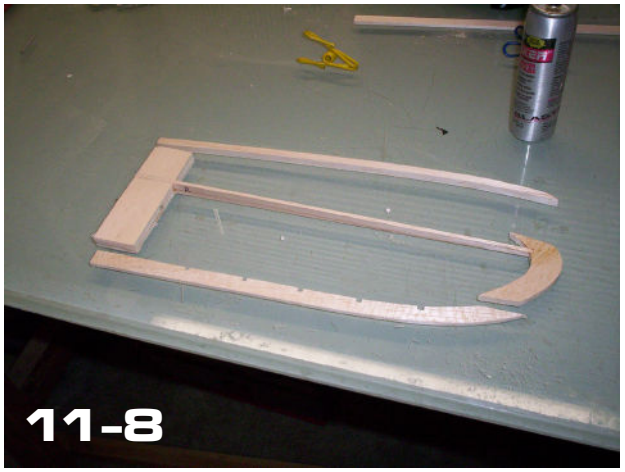


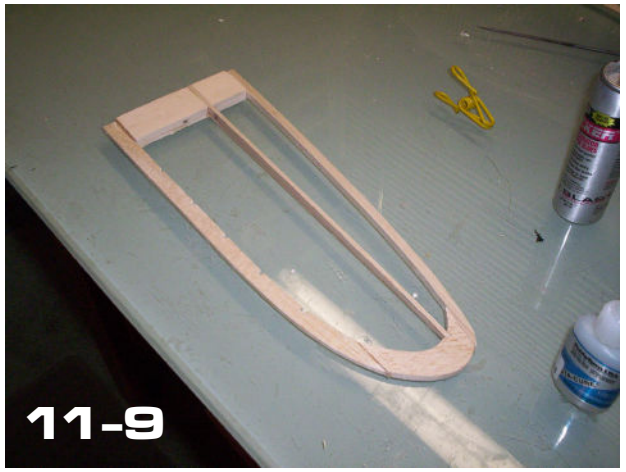


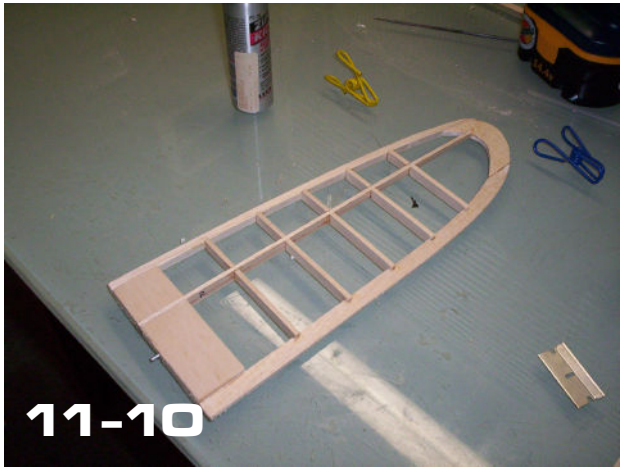
Next up: Stabilizers! Again, Harley has come up with a clever and simple construction method that yields strong, light, and symmetric stabilizers. Construction is very similar to the rudder, with the exception of the main spar and joiner tube assemblies. Cut out your kit of parts, and start building! The plans and instructions make this construction process very easy and enjoyable. One unique feature of the stabilizers is the latex rubber "grippers" that retain the stabilizers on the pivot wire.

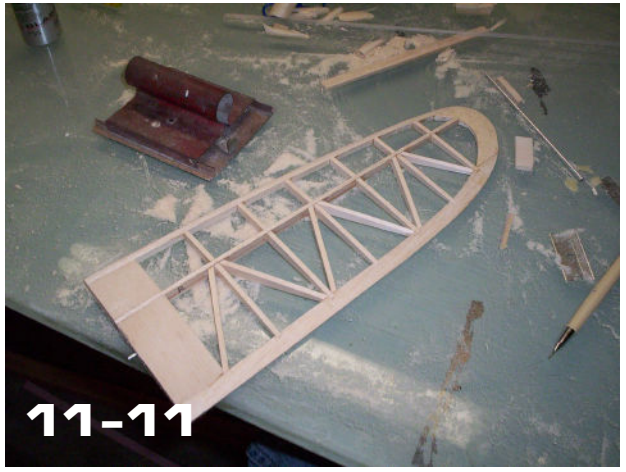
The initial assembly of the joiner tubes and spars are done over the plans, but no pinning is required.

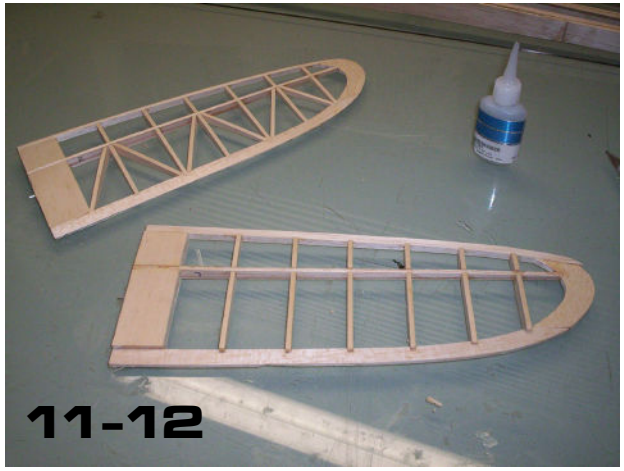
Once the roots, tips, and spars are in place, the rest of the assembly is done off the board with visual alignment. It may sound scary to those of you used to pinning things down, but trust me. It works! Each of my stabilizers weighed an identical 13 grams.

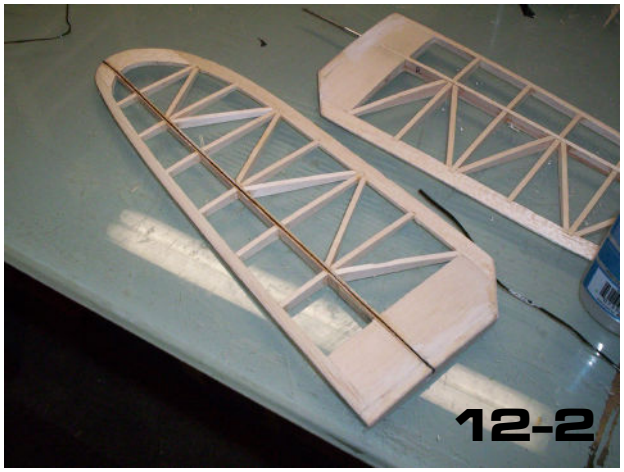


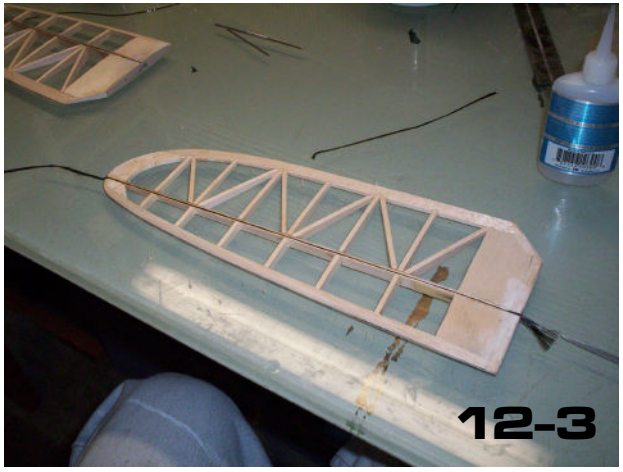


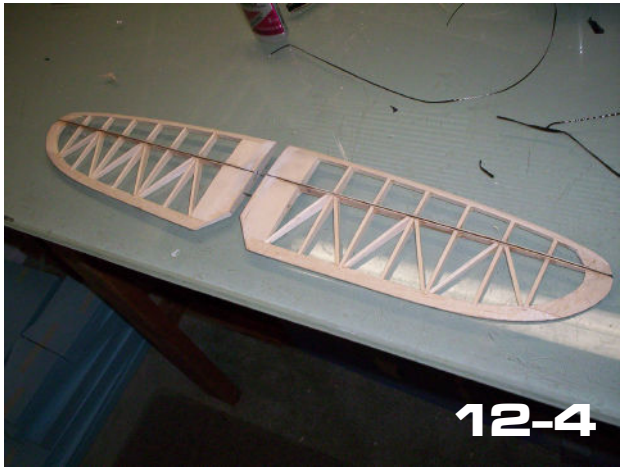


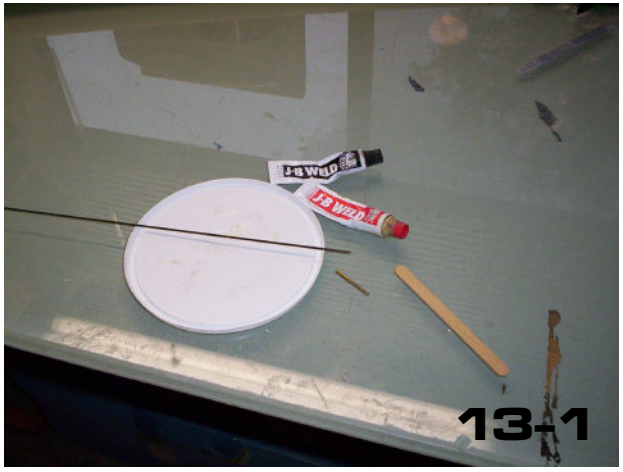


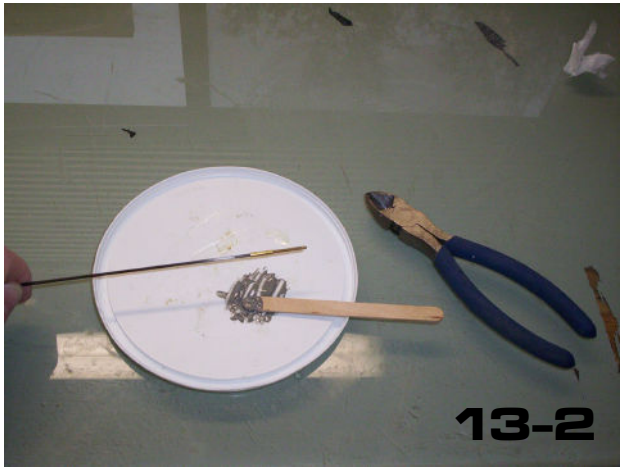


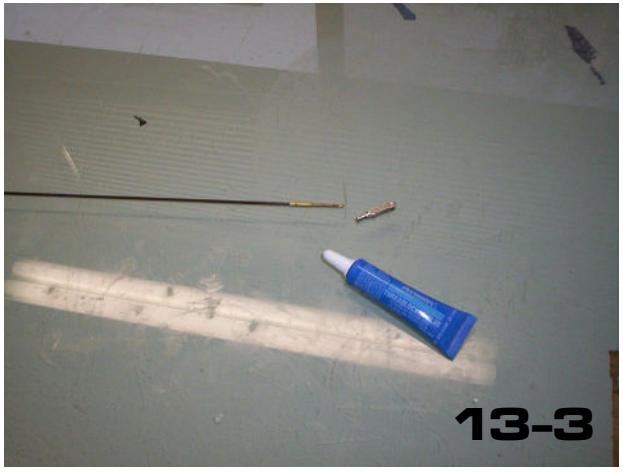












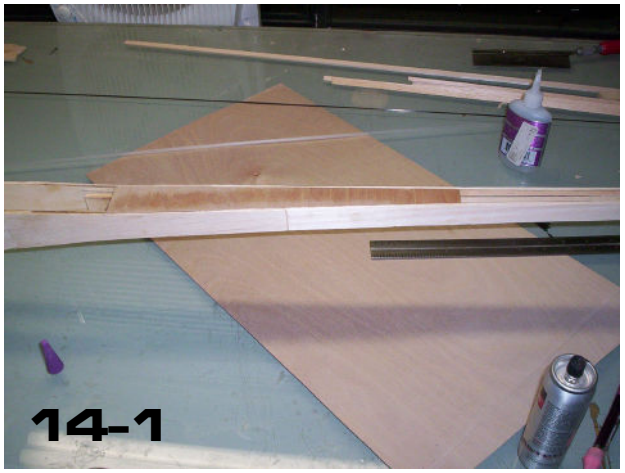
Not one to leave well enough alone, I did make one modification to my stabilizers. I want to make it clear that this modification is not needed, rather I did it simply because I know myself, and I know how I'm going to fly this airplane.

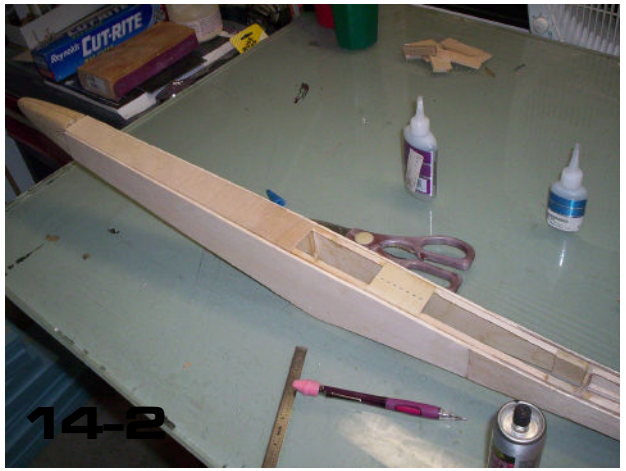
That said, here's what I did: I used a tiny triangle file to carve a groove into the top and bottom of the stabilizer spars. Into this groove I CA'd a strand of carbon roving. The additional stiffness is noticeable, but (again) not necessary as the stock stabilizers are quite strong when built per the plans. My modification added one gram per stabilizer.

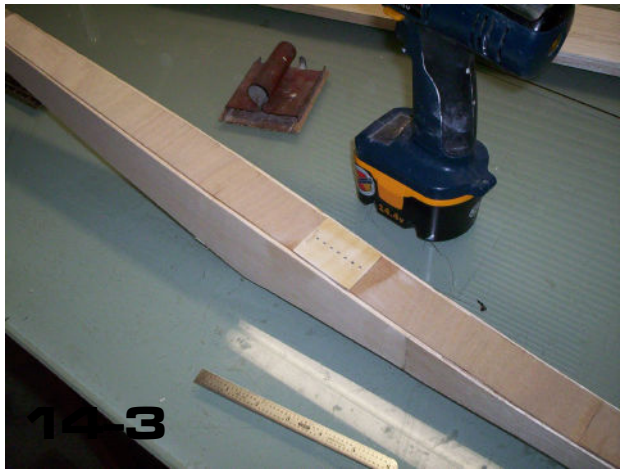
Now we get back to the fuselage.

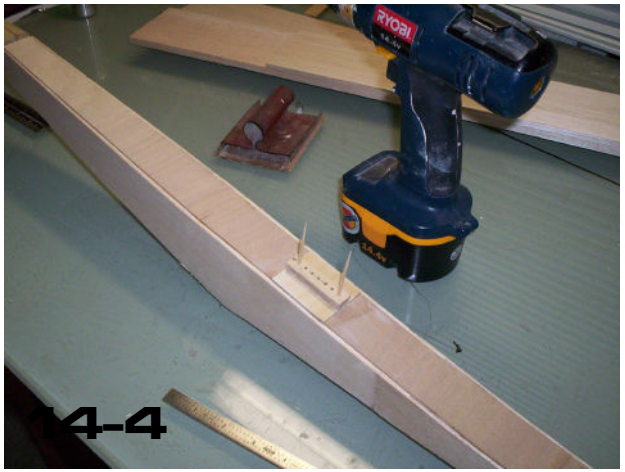
It's time to install the fin and pushrod. A 0.070" diameter carbon pushrod is used. I installed a plastic guide tube, but according to Harley it works just as well with a couple of simple eyelet-style guides in strategic locations.

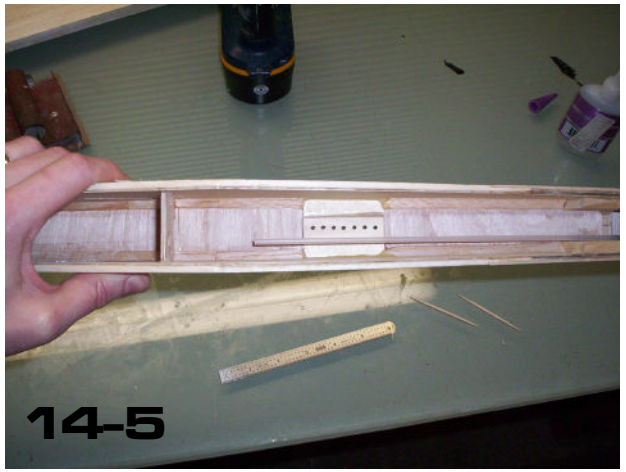
It's time now to box it in, add the balsa blocks, and make it curvy! The process is simple, and self-explanatory. Cut, glue, plane, and sand. You simply carve away everything that doesn't look like what you want.









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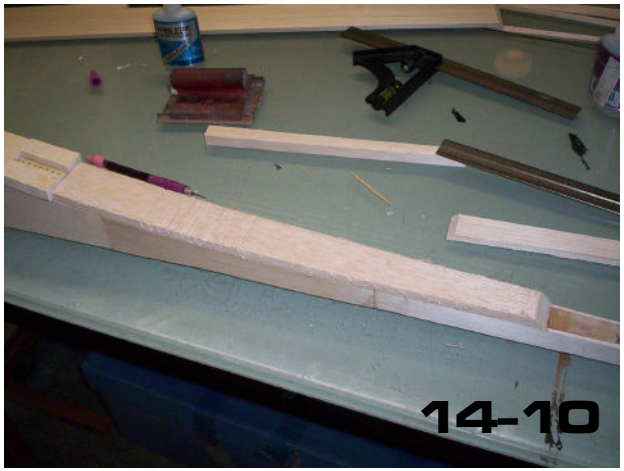
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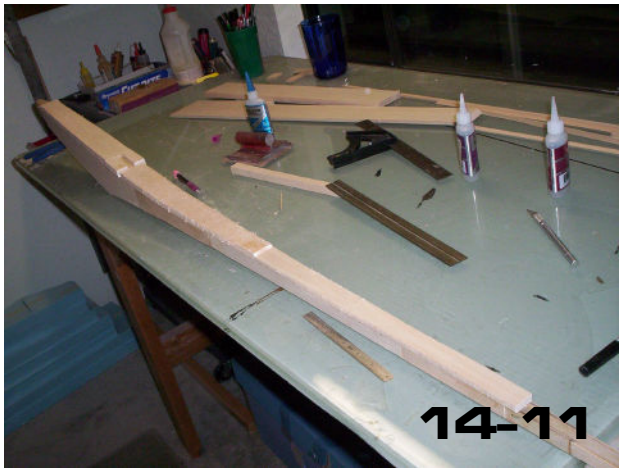
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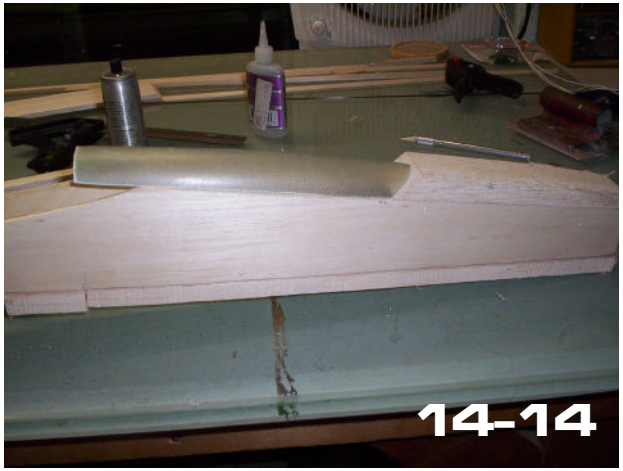
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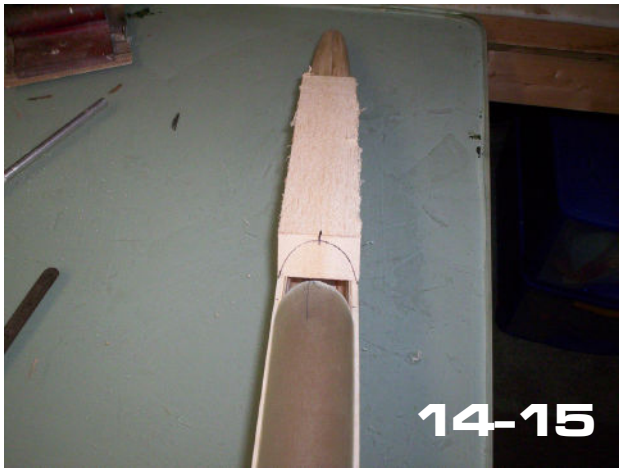
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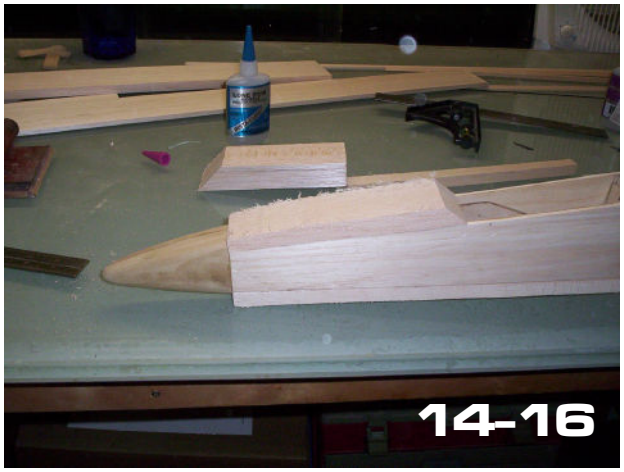
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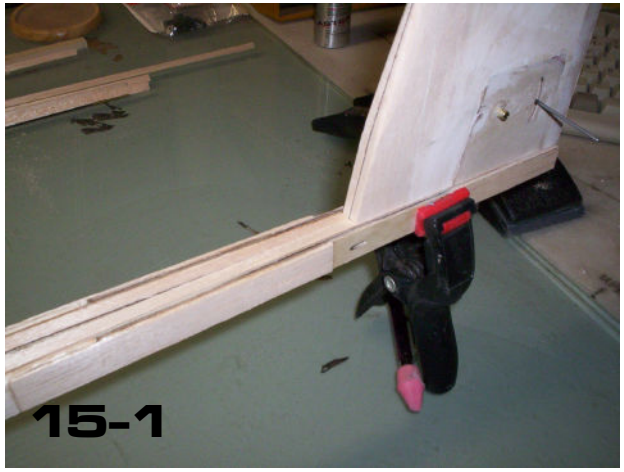
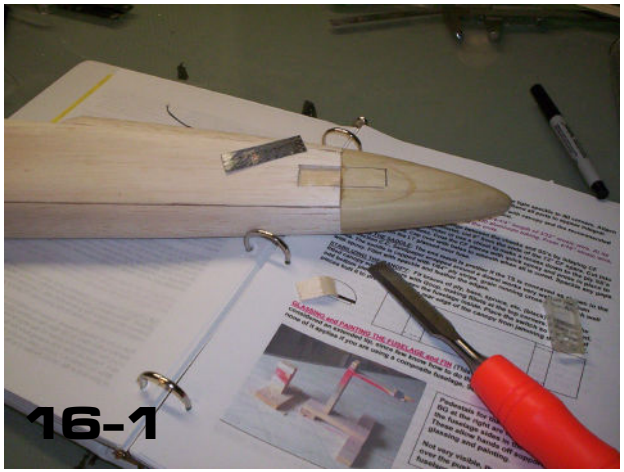

15-1


15-2


15-3

Finish off the aft end of the fuselage by mounting the fin and sub fin.

The last two items to add before glassing the fuselage is a carbon noseblock reinforcement, and the wing saddle fairing. The carbon noseblock piece is inlayed into the fuselage side and noseblock, then covered with a strip of balsa. The wing saddle fairing is made from balsa triangle stock and cross grain 1/64" plywood. Simple, and light.


16-1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16-3


16-4


16-5

And finally, we'll wrap up with the fuselage (pun intended).

The carved and shaped fuselage receives several layers of 1.4 oz. fiberglass cloth, with the layering clearly specified in the documentation. The fin is covered with a single layer of 0.6 oz. cloth.

Harley prefers to use SIG polyester finishing resin, applying the glass in stages. This is then finished with a "flow coat" of resin to smooth things up. Harley has perfected this technique, and covers it in detail in his documentation pack. It obviously works well.

I have a severe aversion to the odor of polyester resin, so I took a slightly different path.

I cut and applied the layers of cloth to the fuselage using a light mist of 3M 77 spray adhesive. All layers were then wet out with epoxy resin. When cured, it was given a good inspection. There were a few small areas where the fiberglass had lifted from the balsa, and these bubbles were pricked with a T-pin and thin CA was flowed in. Pressure was applied to hold the glass against the wood. Then it was block sanded to remove the high spots, and it was ready for the fill coat.

Rather than using pure epoxy, I mixed a filler coat comprised of West Systems 410 Fairing Filler and epoxy blended to a very light consistency. It looks very much like chocolate mousse, but I doubt it would taste like it!

The mixture was applied with a scrap of 1/64" ply, making sure to cover the entire surface. The only exception was the fin, which received only a light scraping with the mixture. After curing, most of the mixture was sanded away leaving it only in the low spots. Weight of the fuselage was tracked through the process:

Bare fuselage/fin	458 grams
After 3M77 and glass	490 grams
After epoxy was applied	533 grams
After sanding the epoxy	530 grams
After applying the filler	551 grams
After sanding the filler	540 grams

Doing the math, the glass/epoxy/filler added a total of 82 grams, or 2.9 ounces. Please don't skip the glassing procedure to try and save weight. It is an integral part of the fuselage structural design and adds a lot of strength! The final results are stunning, and well worth the time and effort.

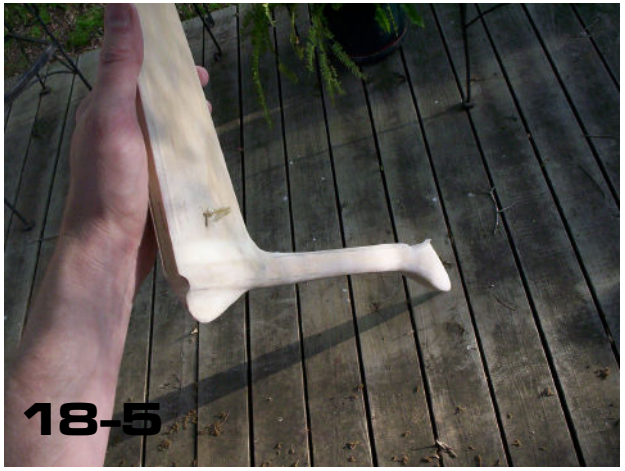
That's it for this month! Next month we'll start the wings.

18-1


18-2


18-3


18-4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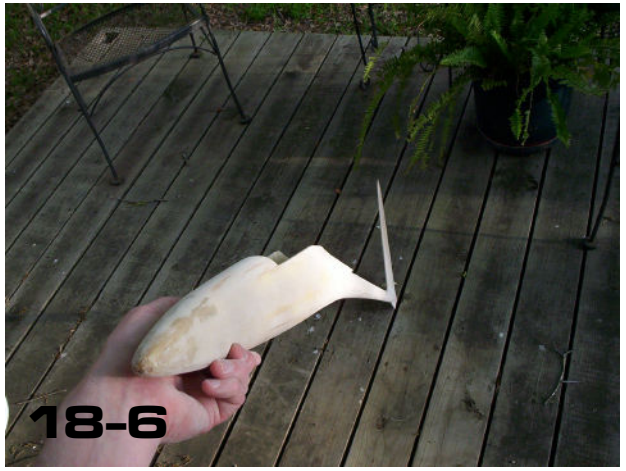
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Maple Leaf Design *Encore*

Fabrication walk-through, Part 2

by Phil Pearson

The *Encore* features a nose cone that slips over the main fuselage pod.

In this installment, we'll show how the nose cone mold is created, then how the resulting mold is used to make specialized parts for the creation of a second fuselage plug and the final fuselage pod molds. Lastly, we'll lay up a matching pair of nose cone halves and explain how they're joined into a single part.

The second plug, made in thick walled fiberglass, really allows one to modify areas easily. Easy-to-sand fillers can be used against the harder fiberglass plug. Areas such as fillets on a balsa plug are difficult to fair into the wood, but can be easily shaped with dremel tools or large grit sandpaper and the low areas or tooling marks filled with any number of easily sandable fillers.

While the photos in this and the previous installment are quite descriptive of the processes involved in making molds, it should be noted that they are also examples of highly compressed time-lapse photography. The creation of four sets of working molds took two solid months of twelve hour days. That's right, seven days a week!

The next installment, Part 3, will cover layup of the main fuselage using the master pod mold.

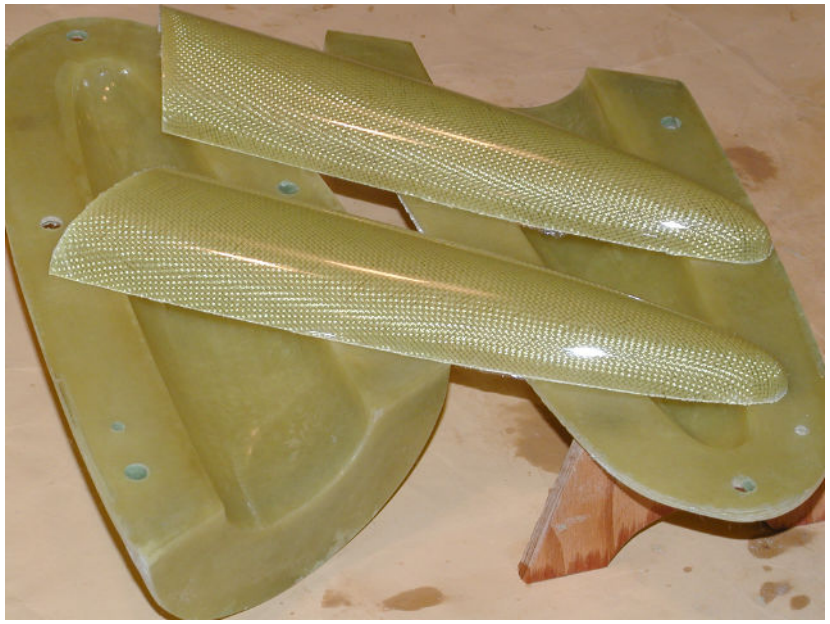
http://www.mapleleafdesign.com/encore.html

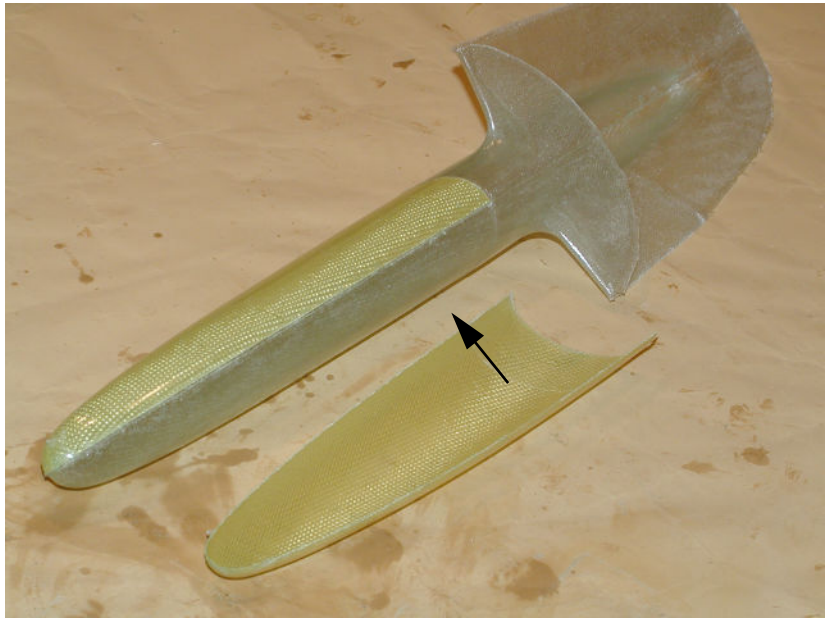
The photos on the next page show the preparation for forming the first half of the nose –cone mold, using the first master pod plug and one half of the first master pod mold.

The aft edge of the nose cone will be trimmed flush to the nose-cone mold flange. The flange is located by the position of the brown phenolic separator board. The second half of the nose-cone mold will be cast against the first half with the master pod plug inserted and the phenolic separator locating the aft edge.

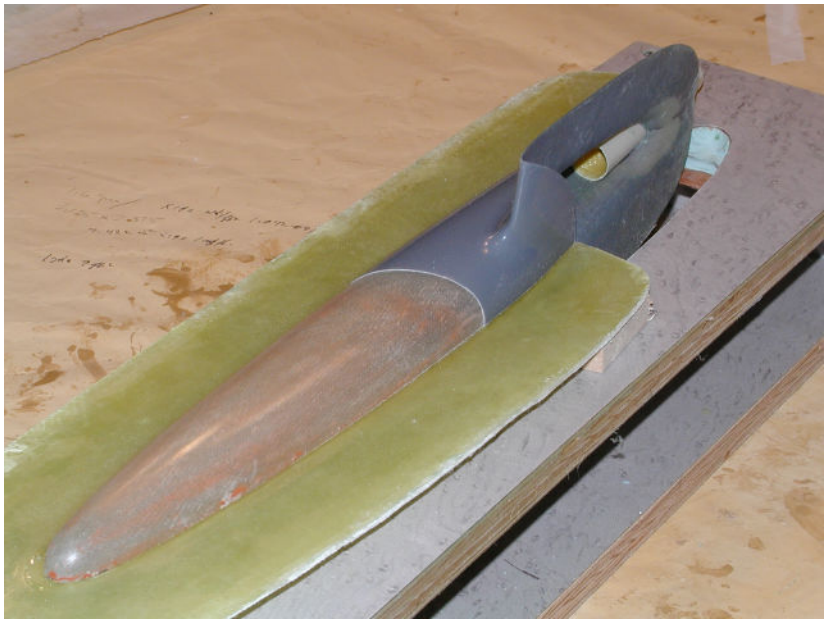
Left: The separator board is fitted close to the plug and temporarily, but firmly clamped.
Right: Modeling clay is used to fill any voids preventing resin from leaking out

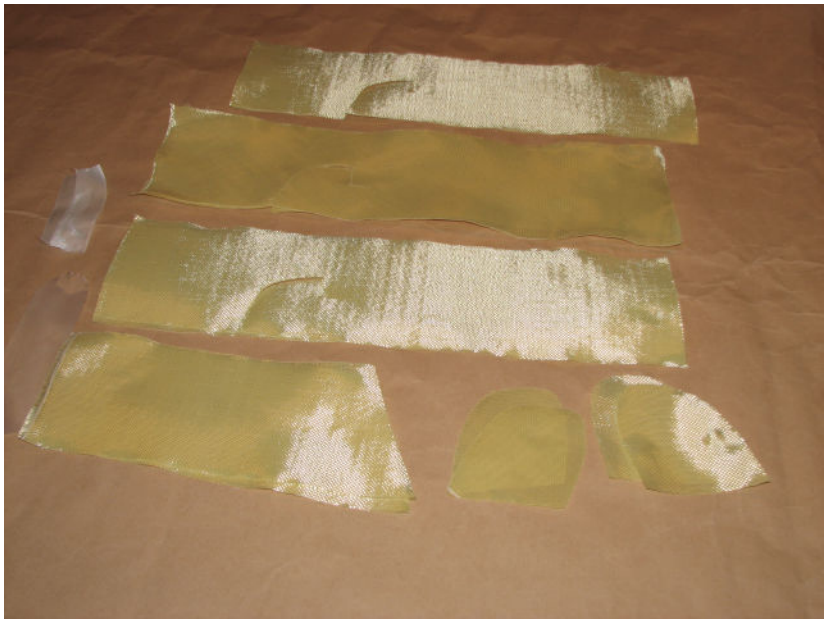
Opposite page, top left: Finished nose cone molds and nose cone parts. Half nose cones are made with the same exact layup as the final part. These are trimmed flush. These parts will be used as spacers to provide a step in the formation of a second fiberglass master pod plug that is used to make a second master pod mold. This second master pod mold with the reduced cross section in the nose cone area will be used for lay-up of the final Kevlar pod.
Opposite page, top right: The nose cone molds and placement of a nose-cone half lay-up part in the first master pod mold. The parts and mold are waxed thoroughly.



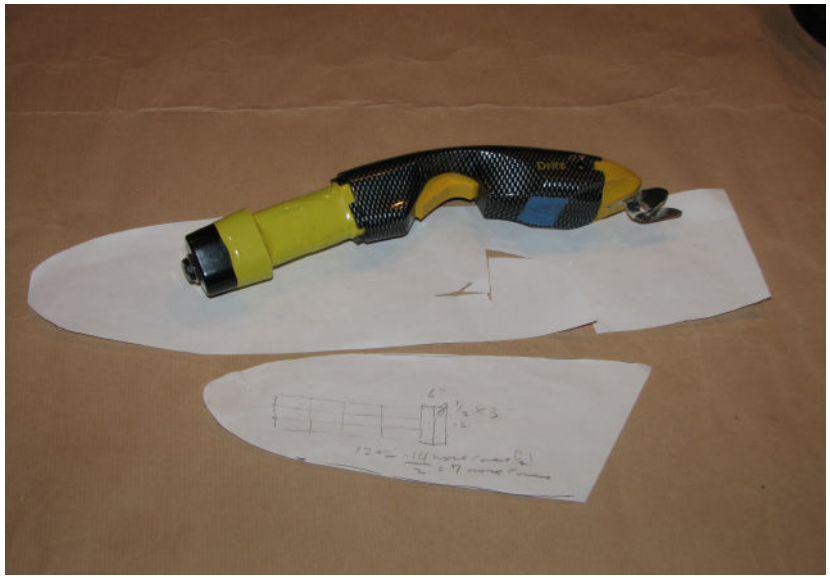


Bottom left: The second master pod plug, shown in the foreground, is formed against the nose-cone half and is made of fiberglass. The first master plug molds are in the background. An overlapping wet seam is used to join the pod plug. Shown is the plug before the nose-cone half is removed. Bottom right: Removal of the nose cone halves reveals the characteristic step to allow a flush surface blend into the pod. The fiberglass plug shown is the second master pod plug and will now be used to form master female mold halves for the final pod lay-up. Molds made from this plug will have the step and reduced cross-section to allow for the flush fit of the nose-cone.

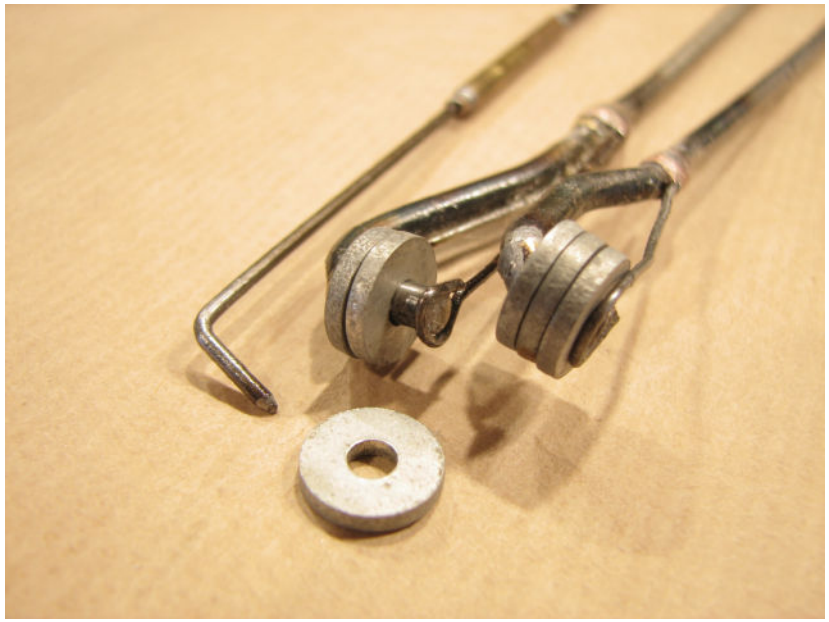




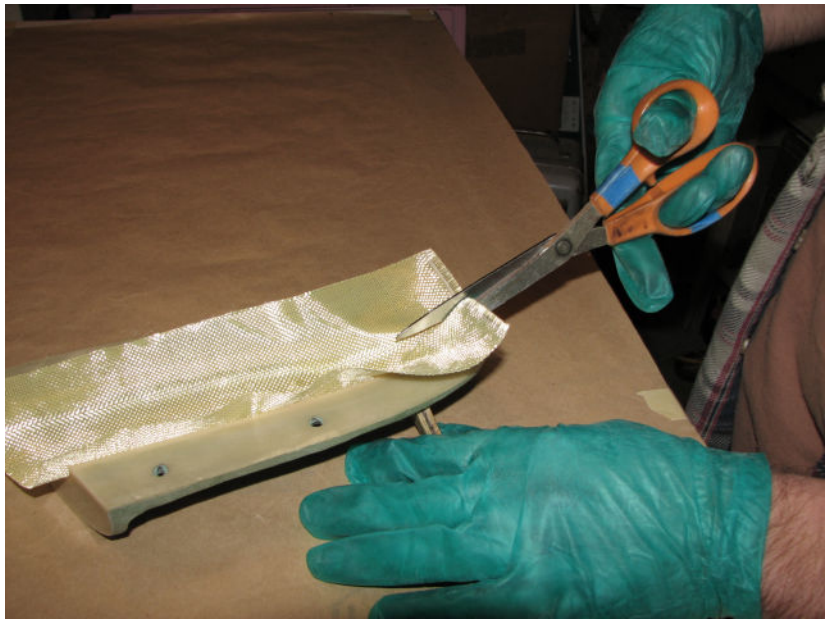
Left: The second master pod plug has been painted and rubbed out to polish. In order to not disturb the fit, The nose cone area is left unpainted. This plug is shown in the first half of the final female mold used to produce the kevlar pod, a second half will be cast against this combination. Right: Two oz/yd2 schedule 220 Kevlar is used in the *Encore* pod. Three layers, middle layer biased 45 degrees, others parallel to the longitudinal axis are laid by hand to form a tough, easily-repairable light pod.



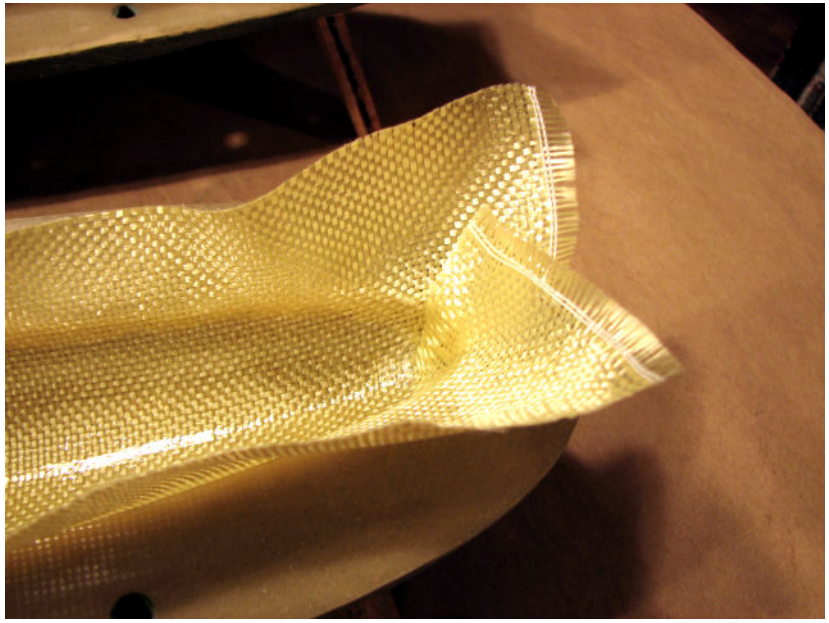
Left: Custom modified Dritz electric shears (edges are rough ground with a sanding belt) cut Kevlar around paper pattern.
Right: Tools used during pod fabrication. Curved scissors, sold for deboning chicken.



Left: Barrier lotion and vinyl gloves are used to prevent resin contact with the skin.
Right: Assorted homemade rollers are used to press the wet seam after bolting the mold halves together.



With all of the necessary molds now finished and waxed, we'll start by laying up a nose cone. Left: Silica thickened epoxy is painted in the waxed mold. Right: Kevlar is placed in the mold and trimmed so the excess cloth overlaps at the nose.

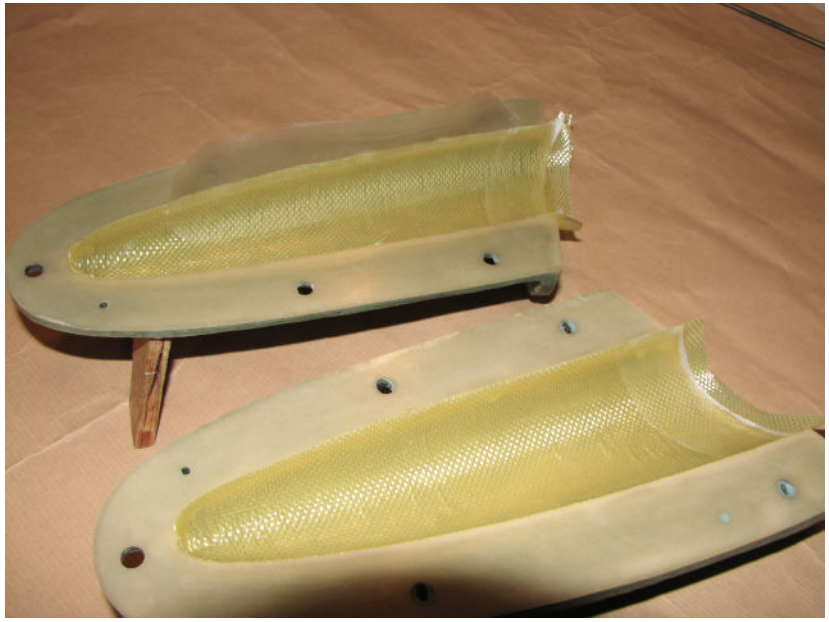


Left: Close up of the cloth overlap in the nose area.

Right: Resin is worked up through the Kevlar by stippling with the brush tip.

Left: The nose-cone is one layer of cloth and reinforcement is added to the aft edge to increase hoop strength.

Right: Wetting out the reinforcement.

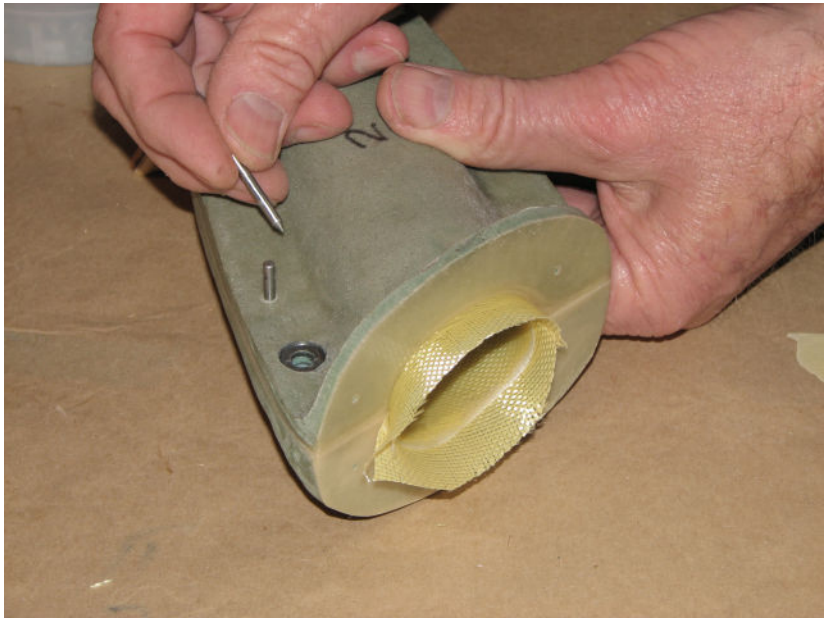


Left: Trimming with curved scissors. One side is cut flush and the other has a small lip for the wet-seam overlap.

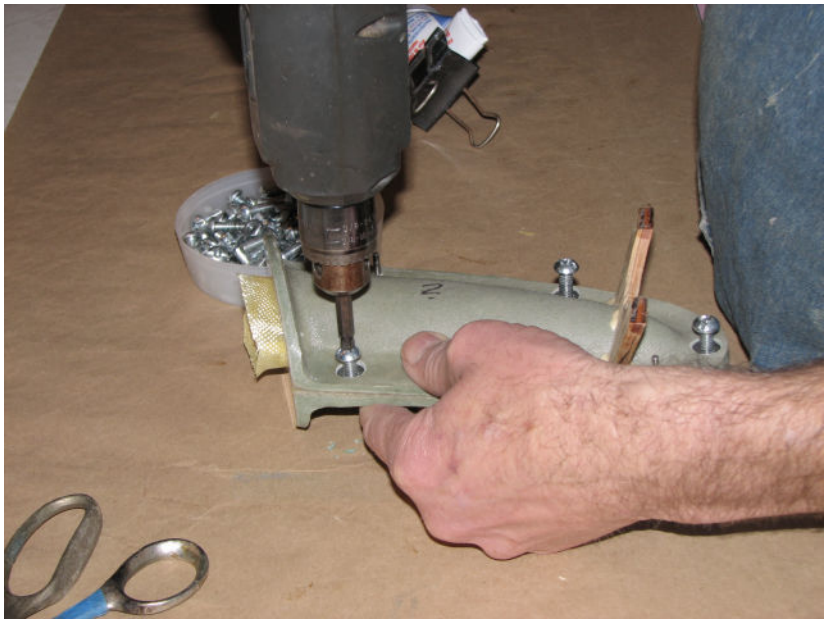
Right: Trimmed parts ready for joining.

Left: The resin is allowed to partially cure to help prevent movement in the mold, which may result in a void along the seam line. The halves are positioned off-sides to allow closing without distorting the Kevlar lap.

Right: A piece of mylar and patience are used to fit the nose overlap before closing the mold.



Left: The mold halves are registered with 1/8 inch pins and the seam is checked for folded areas. Preliminary rolling of the seam is done at this time. Right: This close-up shows the registration pins used to align the mold before joining.



Left: Bolts are used to clamp the mold halves together during the cure time.

Right: Final rolling of the wet seam overlap compresses the layers together and allows a very strong joint.

Peter Wick on Planks

by Peter Wick, <and-wi-pep@parknet.dk>

Part 5: The Future

Finally, something exciting!

Which way do I think we have to go to get even more performance out of planks?

Well here some guesses - qualified guesses:

Airfoils

Airfoils for planks or for flying wings are always airfoils which should be suited for flap deflection. In this respect, Joe Wurts and his airfoils for planks have shown one way to go, and his airfoils actually fit very well with my thoughts.

- An underside designed for fast flying and without any contour changes, and with long attached laminar flow at low angles of attack.
- This should be combined with a moment coefficient at higher Reynolds numbers of around zero, because this will trim the plank into this flying state, the design-C_L.
- The moment coefficient should also be quite constant, otherwise gusts or wind shears will lead to unpredictable flying characteristics, a kind of "rodeo ride."

As an example of an airfoil which was designed with these points in mind, you can look at the "moment – curve" of the PW51 airfoil, and compare it to the curves of the EH 1.0/9 and the HS522 (Figure 21).

You can see that the EH does not show the wanted constant behavior. The HS522 shows a little bit too much negative moment coefficient, which means the airfoil is not very well suited for use on planks. It is actually made for swept wings, where it is an advantage to have an airfoil with some moderate negative moment coefficent.

The upperside of the airfoil, and especially the nose, should be made in such a way that positive and negative flap deflections do not largely affect drag or lift.

A very good example for this kind of nose design is the HS522, or its pretender the HS520, which is more suitable for planks.

Joe Wurts has made a kink (Figure 22) in the upperside contour, as you can also see on several airfoils made for side arm launch (F3K) models, like the series of Mark Drela.

If the flap chord matches, and the pivot point is on the underside of the airfoil, you get a harmonic upperside contour at a particular flap angle, and thereby low drag with positive flap deflection.

You will maybe ask, "What the use is of positive flap deflection for plank designs which only use negative flap deflection for slow flying as suggested?"

Well I think that this kind of airfoil will help to counteract adverse yawing while the ailerons are deflected. As you do not have very long laminar flow on the upperside of planks airfoils anyway, you don`t have to fear any disadvantages.

The main design issue is to get a moment curve which exhibits a rather constant value (Figure 23). This I think is very important if you want to fly with very low static margins and still want to have a stable airplane.

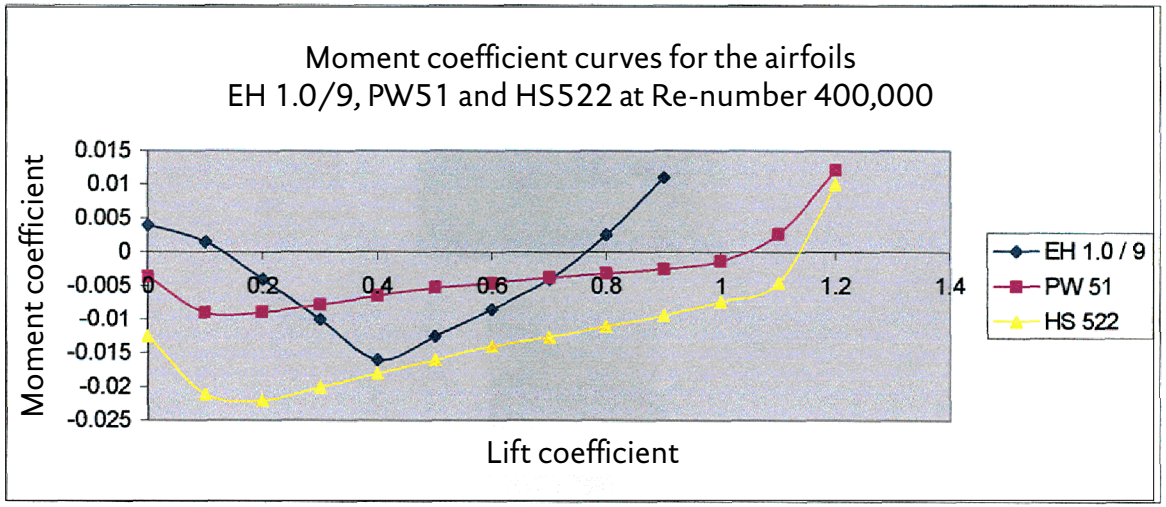


Figure 21. Moment coefficient characteristics for the EH 1.0/9, PW51, and the

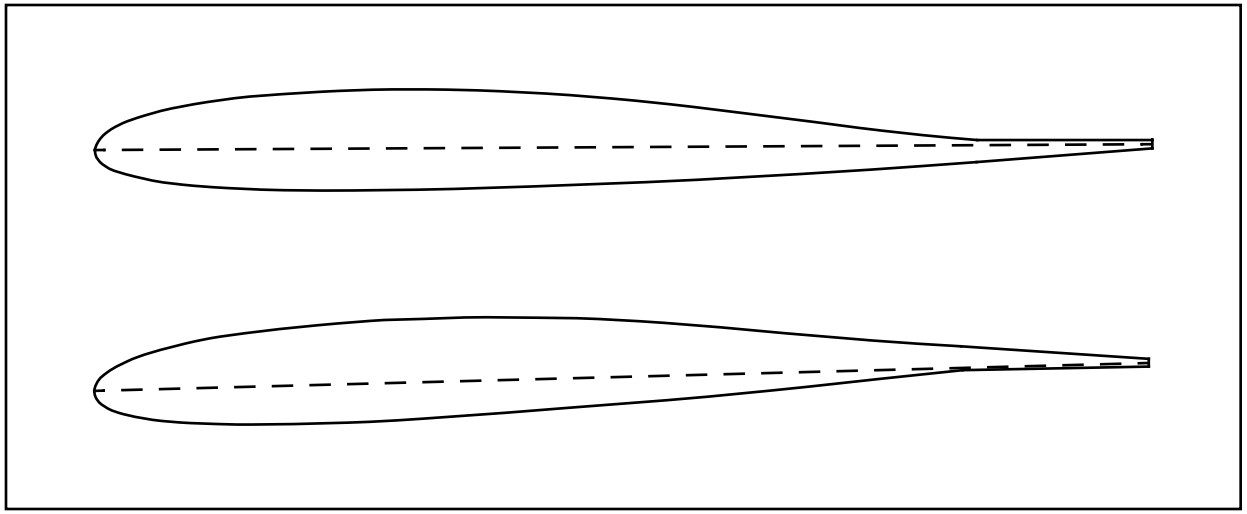


Figure 22. Joe Wurts airfoil rtyr2b with a kink in the upperside contour which allows a harmonic contour with 18% flap chord and 6 degree positive flap deflection, as shown in the lower illustration. The airfoils were also made to fit together with a standard balsa trailing edge.

You may have to make use of trips to get this behavior. Some experiences in this direction has shown a remarkable effect on the flying characteristics.

These trips can also be in the contour of the airfoil, as Werner Pfenninger suggested (See Figures 24a and 24b). That kind of trips showed an interesting effect on the pitching moment of the airfoil at different flap deflection. If the use of this kind of trip is incorporated in the initial design of the airfoil, you might be able to extend the laminar flow and get a better pitching moment characteristic as well. But this means a lot of testing and designing, and calculation will be rather difficult.

Static margin

It is, in my view, very important to fly with a static margin as low as possible. This means that all parts of the plank which contribute to a negative pitching moment should be minimized as far as possible, especially the fuselage.

As an example, you can leave off the whole fuselage, as a design such as the NCFM Bluto shows.

Or you can try to fly with a lower static margin by increasing the stability artificially through the use of a gyro, thereby increasing the damping of oscillations.

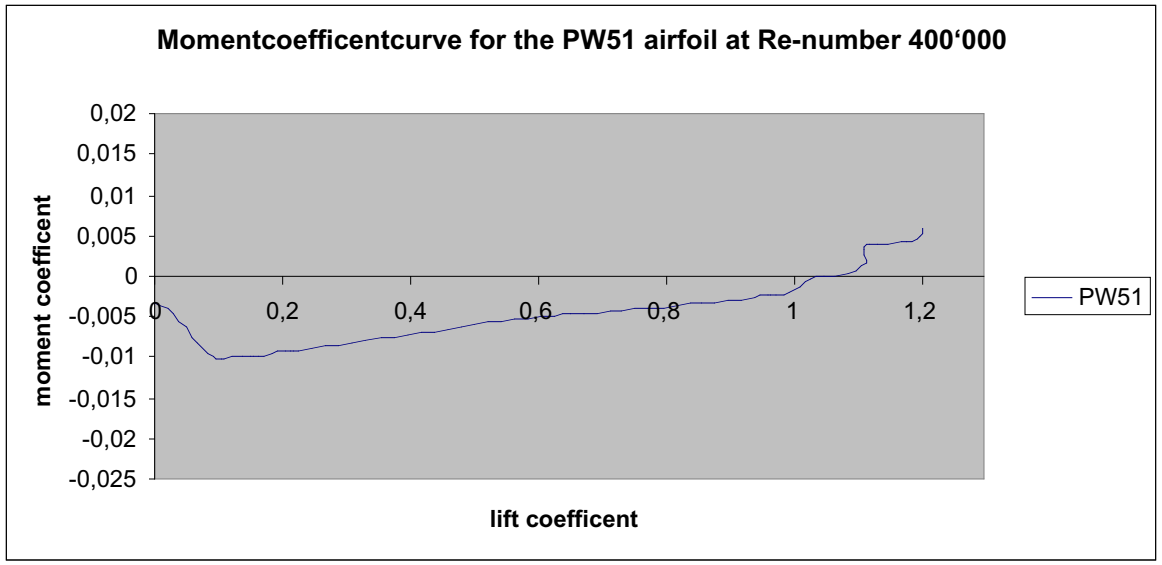


Figure 23. Moment coefficient curve for the PW51 airfoil at Re-number 400,000.

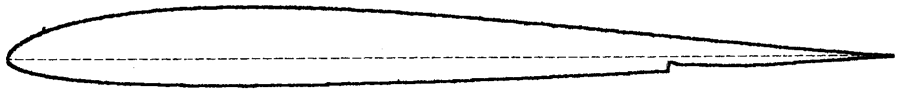


Figure 24 a. An airfoil with a trip in the contour on the underside of the airfoil. Pfenninger called it “einspringende Ecke,” which can be translated as “re-entrant angle.”

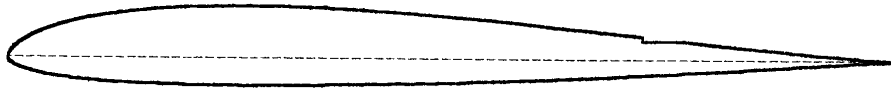
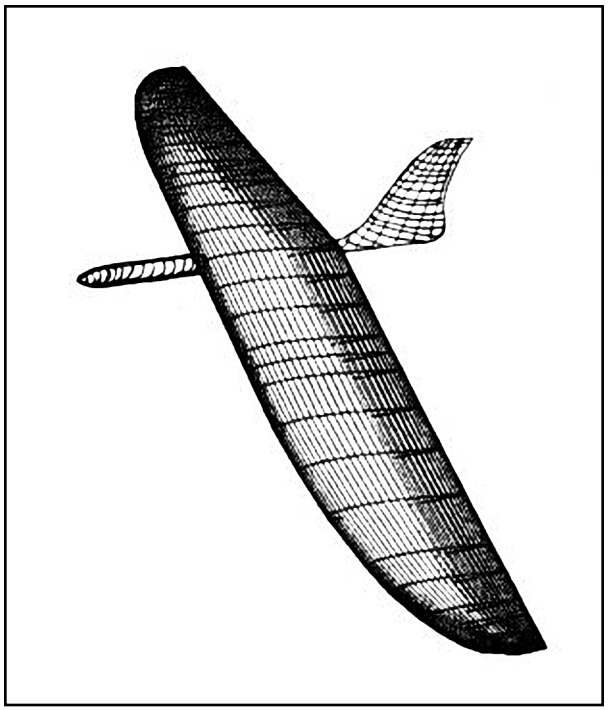


Figure 24 b. An airfoil with a trip in the contour on the upperside of the airfoil

Next month, in the final installment of this series, I will describe the development of my PW series of airfoils, introduced.in the December 2005 issue.



My current project, along with some friends, is called AMOKKA. It will have a hollow core wing, created with CNC machined aluminum molds, and is designed for high speed and F3F-like flying. It will have a two meter span and, because of the use of accurate molds, will incorporate five new airfoils to take advantage of the Reynolds number at different locations along the span. The hollow-core wing will have low roll inertia, allowing better and faster turns.

The Natural Side of Thermal Soaring

by Lee Murray, <lmurray@athenet.net>

A review of the Secrets of Thermal Soaring *DVD by Radio Carbon Art Productions*

Since 1999, this column has largely been descriptions of weather related processes that give rise to good or bad soaring. My personal goal in taking on the subject was to be able to predict the best days to attempt altitude records or a two hour thermal flight, as well as when to launch and where to fly in contests.

During the time of writing the column, internet resources developed for predicting the height and strength of thermals, wind speed, as well as looking at the recent history on days you want to fly.

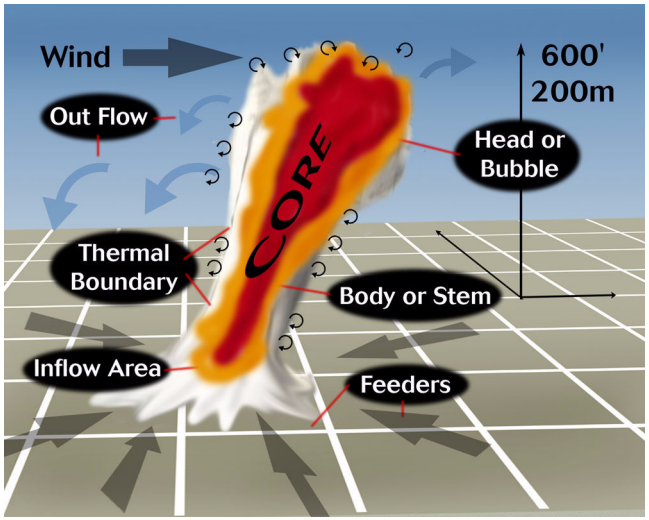
Thanks to Radio Carbon Art Productions, I think I can probably retire this string of columns and get you in touch with a powerful resource that can teach you to relate local conditions to thermal soaring.

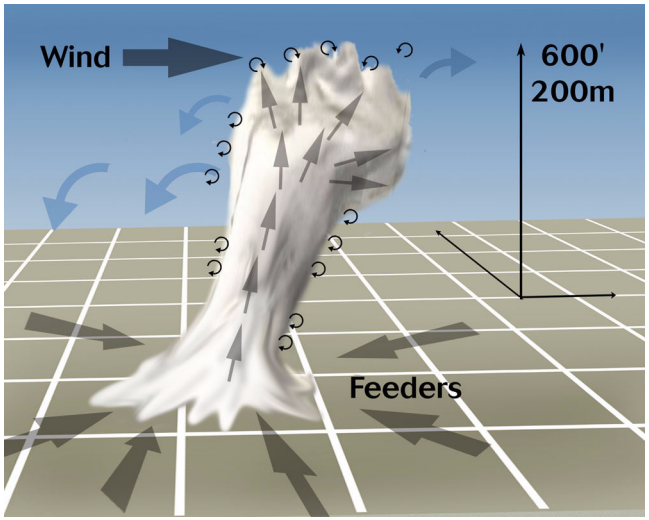
The video *Secrets of Thermal Soaring* includes much of what I have been writing about in this column.

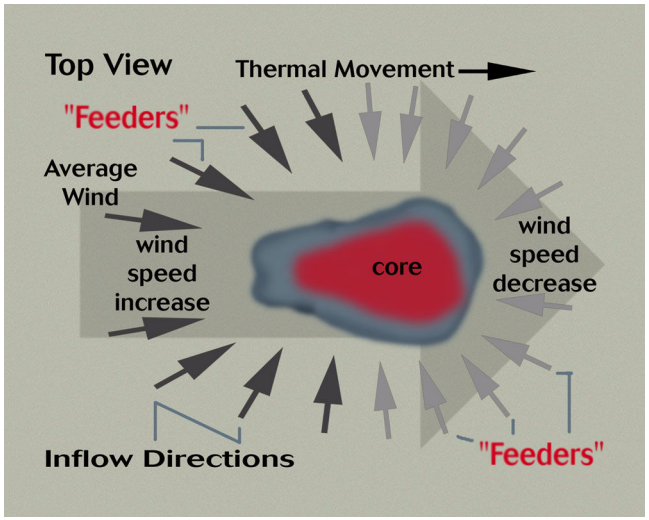
Paul Naton's *Secrets of Thermal Soaring* video is the best single source of thermal soaring information I have ever seen.

The DVD has been on the market more than a year. A couple of guys in my club even had the video, but were keeping it as a secret – a personal competitive edge;-). The lessons are easily absorbed, although the information comes so directly and quickly at times that you will want to back up the video and replay sections a few times to thoroughly understand the concepts.

There are several places where the information is summarized to help you learn the information.







Representative illustrations from *Secrets of Thermal Soaring,* printed with permission of Paul Naton, Radio Carbon Art.

The DVD includes the following chapters. I have added my description of the topic.

1. Layers of Air - The mixed boundary layer

2. Sun: The Source of All Lift - An explanation of the solar energy budget

3. Atmospheric Basics - What happens to the atmosphere during the day

4. Air Goes Up, Air Goes Down - The life cycle of a thermal

5. The Thermal Cycle - The birth, growth and death of thermals

6. Anatomy of a Thermal - The shapes and dynamics of thermals

7. Secrets of the Wind - How the wind affects and is affected by thermals.

8. The Invisible Revealed - How to recognize the presence of thermals

9. Flight School - Enhanced videos of thermals forming and moving

Questions answered include:

- What are thermals?
- How are they formed?
- What do they look like?
- How does wind effect thermals?
- How do thermals effect wind?
- How do thermals move and evolve?

The DVD is divided into three parts: Part I deals with Chapters 1-6, Part II with Chapters 7-9. Part III contains previews of other products and graphics used in Parts I and II.

The DVD is full of great illustrations, both slides and movies, showing the effects of thermals and in-feeds to thermals, and how ground debris of dust and vegetation get pulled up into thermals and dust devils.

I believe Paul has excellent credentials for being the author you should listen to and respect because he has impressed us for years on how he can fly RC sailplanes in about every situation in his Endless Lift series: sloping off low ridges at the beach, flying the lift of a building, thermalling with beach birds, thermalling his TD ships, and flying full size gliders.

Thanks for providing this excellent resource, Paul.

You can check this and other excellent DVDs by Radio Carbon Art at:

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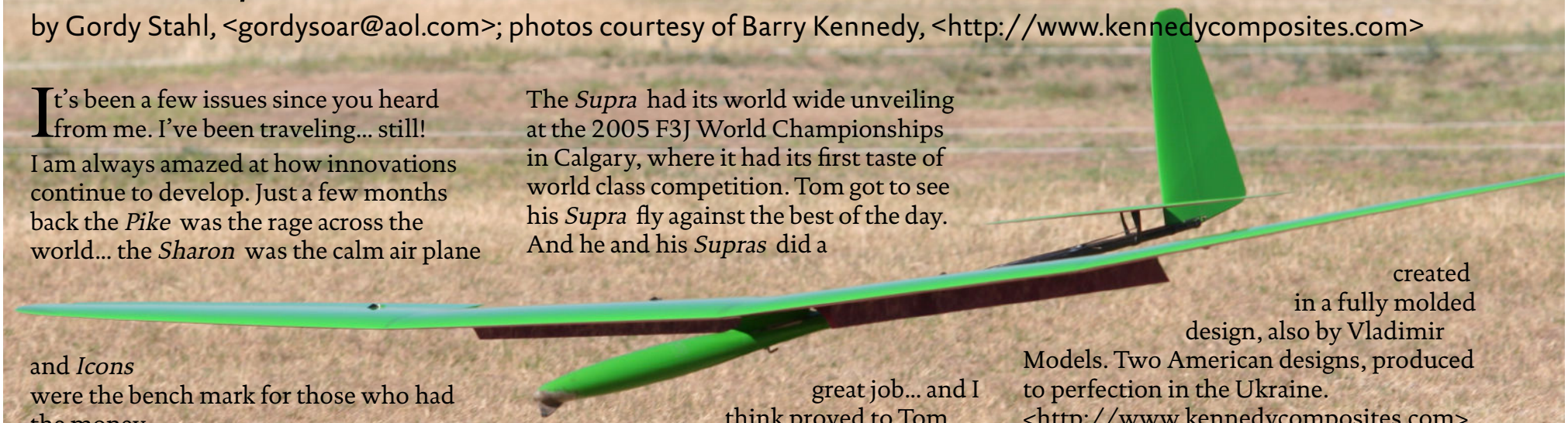
Radio Carbon Art
P.O. Box 2311
Corvallis, OR 97330-2311
USA

Phone: 541-752-9661

Gordy's Travels

Supra - the latest "Silver Bullet"

by Gordy Stahl, <gordysoar@aol.com>; photos courtesy of Barry Kennedy, <http://www.kennedycomposites.com>



It's been a few issues since you heard from me. I've been traveling... still!

I am always amazed at how innovations continue to develop. Just a few months back the *Pike* was the rage across the world... the *Sharon* was the calm air plane and *Icons* were the bench mark for those who had the money.

However, in the background was looming a new ship... the *Supra*. Well sort of new that is. Tom Kiesling's *Mantis* series evolved into the *Aegea*, and then the Supra, with the help of his and our friend, Dr. Drela. I'm pretty sure Mike Lachowski had his hand in there, as did Phil Barnes... And I guess at its roots was Frank Weston's *Magic* series...

Tom refined and worked the design and his ideas, and then into the mix came Dr. Mark Drela. An avid RC pilot and aero-scientist who really got excited about the hobby and who has brought about many innovations and new ideas, and most important was willing to share the ideas with the RC soaring public and manufacturers.

The *Supra* had its world wide unveiling at the 2005 F3J World Championships in Calgary, where it had its first taste of world class competition. Tom got to see his *Supra* fly against the best of the day. And he and his *Supras* did a great job... and I think proved to Tom that both were up to the task.

Scratch builders around the country were getting excited about the Kiesling/Drela designs, both in full house planes like the *Aegea* and *Supra* and in others that used Drela airfoils and construction techniques.

Phil Barnes was bagging wings as fast as he could, and it wasn't fast enough. Barry Kennedy, of Kennedy Composites, took the Drela RES Bubble Dancer and had it kitted in "organic construction" - balsa, carbon, Kevlar, Oracover - in the Ukraine by Vladimir Models. The resulting sailplane, the AVA, has had enormous success. Demand got so high that it made sense to create a molded kit. Barry got together with the group and had the *Supra* created in a fully molded design, also by Vladimir Models. Two American designs, produced to perfection in the Ukraine. <http://www.kennedycomposites.com>

As soon as word got out that a very light molded *Supra* was to be available, the waiting list began to grow. Overnight the list read like a who's who of USA RC soaring... and once word got out about that list, the mark of validation was on the new molded *Supra*. The *Supra* became the most wanted ship in the world... and that was without anyone ever having seen one!

Finally, the first kits arrived, but they came in the dead of bad weather across the USA. Even California didn't have good flying weather! Joe Wurts decided to give one a try and flew it at Arizona's Southwest Classic to place second, and that with likely less than three hours of flying time on the airframe! That really put the stamp

of validation on the new molded *Supra*... one, that JW decided to fly the airframe at all, and two, that it could perform well in the midst of great pilots and planes.

"Light, clean and strong, launches to the moon and covers ground like a hungry vulture"... well that's the way the current threads read.

Every season it seems there is a new 'ship with a new 'foil, new span or tail arrangement that's going to insure "wood" for any pilot who owns one. The *Icon* was that, so was the *Pike*, but only once in a while does a design inspire the soaring world to kick off into a new direction, and the *Supra* did that.

New designs across the world are now using similar planforms and airfoils, and ideas are popping up monthly.

The *Pike Giant* uses similar planform, and the new *Pike Perfect* takes it a step further with Drela stab airfoils, etc. The new idea behind these changes? A plane that is lighter, yet strong, with a big span, but with lighter tips; a plane that can get up to good launch height via a two man tow (F3J), but in under four seconds; a plane that can move around the sky without ballast, and yet hang in that light evening air, and land without skegs on the 100 spot.

After having flown the *Supra* and *Giant*, I can say that many pilots are going to be surprised at first. These planes are not carbon *Gentle Ladies.* They are thoroughbreds that have the ability to fly faster, with more agility, than anything ever before. It is going to take a more sophisticated pilot to get the performance out of these airframes. It is going to be the "thinking/practiced" pilots who will be "in the wood" with these planes in the season to come. We'll see more preset camber use than slider use on transmitters. The new planes are very particular about things like camber, and will spank the pilot who doesn't take time to figure them out. I think because of that, we will not see a dominance of these new planes at contests. Pilots who know their *Pikes*, *Icons*, *Sharons* and the rest will still be taking wood on a regular basis from those flying the new Silver Bullets.

Remember, *Excalibur* needed a King to remove it from the stone. The new *Supra* needs a great pilot to earn wood.

See you on my next trip!

Joe Wurts and his *Supra* at Arizona's Southwest Classic

Notes on the Supra #16 Build

by Dave Corven, LSF #254, AMA 878

16 was a straightforward build using a machined ash plank with foam core bulkheads to line up the pod and boom.

The push rods were kept inside of the pod and boom for exterior appearance and reliability. Only one foam disk in the boom just behind the end of full length ballast tube is required to support the push rods in the boom. Long exit slots for the elevator and rudder push rod tubes at the rear of the boom insure smooth push rod exit paths. The push rod tubes are also anchored under the pylon as wide as possible to provide room for the removable ballast tube and the Hoopes wiring harness and finally at the 45 degree wall at the rear of the radio area.

I used the Kennedy supplied 1200 mAh NiMH battery, Volz Micro-Maxx servos for elevator, rudder and flaps, and the Wing-Maxx servos for the ailerons.

I made the wing servo mounts from 1/4" model plywood. Delete the Wing Maxx servo mount frames and cut a strip of soft aluminum with offset ends to hold the servos in place with shortened #2 screws. I use 4-40 threaded rod and clevises for the wing pushrods, soldered at one end, threaded at the other.

The ballast tube is held in place with a 6-32 flathead bolt, threaded through the tube, the front birch dowel spacer and a ply spacer system that sandwiches the fuse structure securely and allows removal of the ballast tube for weight reduction or access to the tow hook.

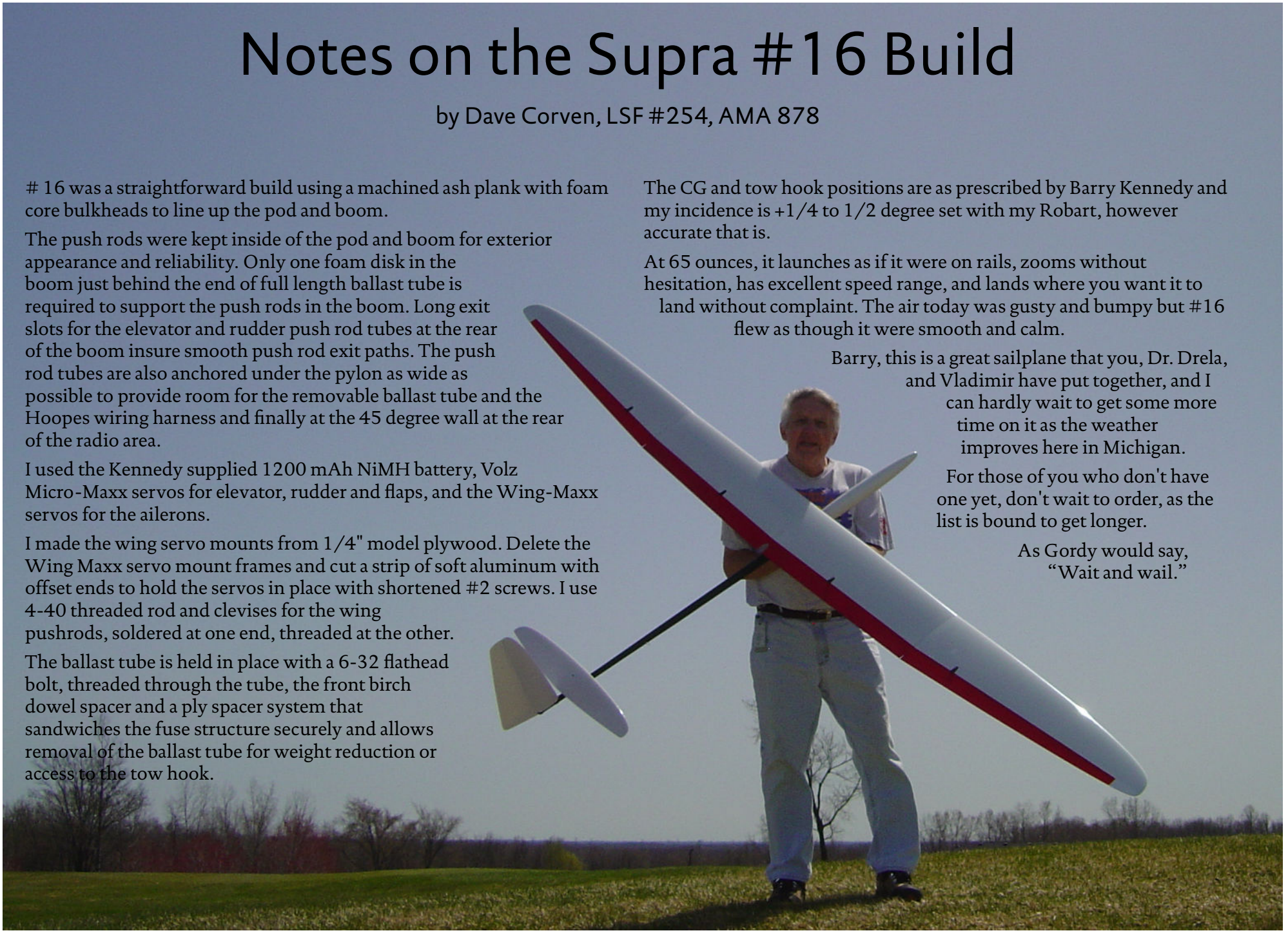
The CG and tow hook positions are as prescribed by Barry Kennedy and my incidence is +1/4 to 1/2 degree set with my Robart, however accurate that is.

At 65 ounces, it launches as if it were on rails, zooms without hesitation, has excellent speed range, and lands where you want it to land without complaint. The air today was gusty and bumpy but #16 flew as though it were smooth and calm.

Barry, this is a great sailplane that you, Dr. Drela, and Vladimir have put together, and I can hardly wait to get some more time on it as the weather improves here in Michigan.

For those of you who don't have one yet, don't wait to order, as the list is bound to get longer.

As Gordy would say, "Wait and wail."



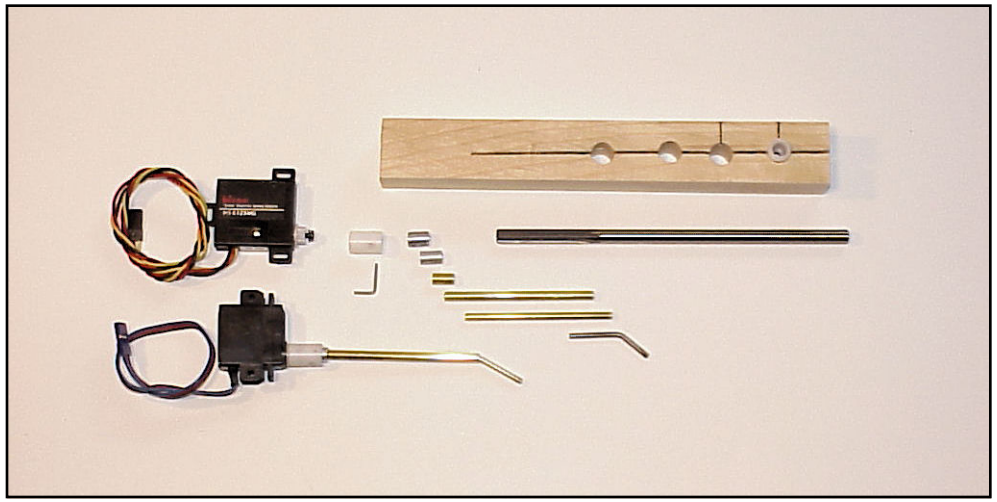
Modifying the Rotary Drive System (RDS)

by Winston Okerlund, <sinoker@charter.net>

The following is a modification of the Kimbrough Products servo accessory used to install the Rotary Driver System (RDS) developed by Harley Michaelis. See <http://www.kimbrough-products.com/>.

These modifications allow the use of stainless steel hypo tubing for robust installations and K&S brass tubing for less demanding sailplane applications, including DLG. The modifications came about when designing my new 120" Tabasco sailplane. I wanted more torsional rigidity than available through a solid stainless steel 3/32" rod for drive shafts.

This photo below displays the different things involved.



The modification is simple and easily completed by any builder. Required are the Kimbrough couplers, K&S telescoping aluminum in 1/4" and 7/32"; brass tubing in 3/16", 5/32", and 1/8"; stainless steel 3/32" welding rod; 1/16" music wire; rosin core solder and low temperature silver solder (Stay Brite kit # 1100 that melts at 400 degrees) and a wooden jig. The most costly item is the straight chucking side reamer under the jig in the picture.

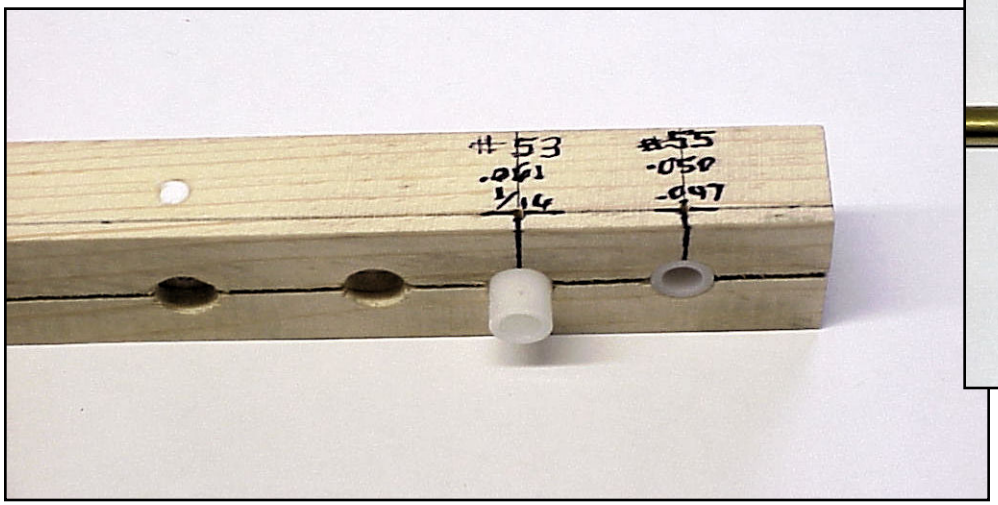
The reamer is used to open the coupler so it can receive 1/4" aluminum tubing but be removable. It should be 0.001" larger than the actual 1/4" aluminum tube to be used, which may or may not mike at 0.250". The reamers are available at Small Parts <http://www.smallparts.com/>, Grizzly Tools <http://grizzly.com/>, or wood or machine shops.

An alternative would be to find a 1/4" drill bit that mikes out at 0.001 more than the aluminum tube. Drill bits can vary considerably from specified diameters. Grind the tip end of the bit to flatten, but leave a little side chamfer. The inside of the coupler on which the servo screw bears must not be damaged.

TABASCO or *GENIE*-SIZE TD SAILPLANES

The photos should be self-explanatory. The coupler itself is to be opened to receive the 1/4" aluminum tubing and drilled for a pin that holds the drive shaft in the coupler.

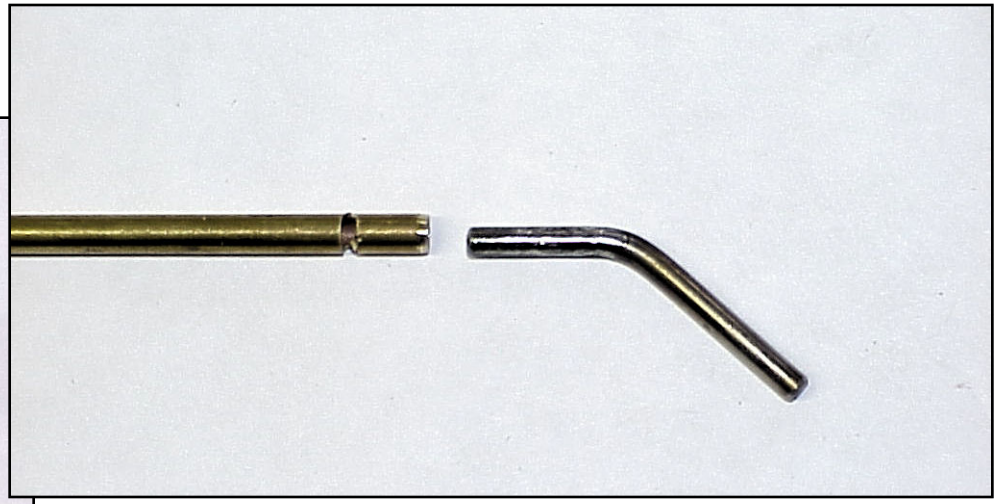
Begin by constructing a multipurpose wooden jig about one inch wide and at least as thick as the coupler is long. Drill a series of centered 3/8" holes in it. Saw down its center. Turn it on its side. Mark the center line of the holes. 1/8" in from the edge of the board mark a line parallel to the edge. Where the lines intersect, drill some perpendicular pilot holes for 1/16" and 0.047" diameter drive pins. Position the couplers so they are flush with the top of the stick and so the setscrew holes align to the saw line. Clamp tightly. Align your drill press table so the reamer or bit is square to it. Drill to the bottom, but do not drill out the inside flat bottom. Be careful on the drill speed as plastic melts or grabs.



When finished, turn the stick on its side to drill through the upper side only of the coupler for the pin size you are going to use.

Assemble the (1/4", 7/32" aluminum and 3/16") brass to make a "shimming sleeve" for the shaft to slip into. Cut the assembled sleeve 1/16" from the end of the coupler when it's fully bottomed without the servo screw in the coupler. It will bear on the servo screw when the coupler is secured to the output gear. Deburr the inside of the brass tube. Remove this assembly and wick CA to glue the three tubes together. Do not get glue inside the brass tube. This assembly must be removable to allow access to the servo screw.

Assemble the 5/32" and 1/8" brass drive shafts and cut to the required length. Deburr each end. Bend the 3/32" stainless steel rod to the required angle for your flap and ailerons installation. Use a file and scratch up the length of the stainless steel rod that is going to be inserted into the drive shaft. Cross cut the drive shafts with a Dremel tool with cut off disc just enough to open a hole in both tubes about 3/8 to 1/2 from both ends as shown in the picture below.



Other than with the Drela setup detailed below, an RDS installation requires that the shaft be movable out of the coupler to remove the servo. For your installation, know how much of the 3/32" bent part must be exposed for it to be slipped back into the pocket. Then insert and apply the stainless steel acid flux through the crosscut hole. Caution Here: DO NOT BREATHE THE HEATED FLUX FUMES, THIS IS ACID BASED!!! Heat with a small hand torch or use a large Weller soldering iron. Heat the rod bend area first, then apply heat to the brass tubes. When sufficiently heated, apply the silver solder. When done correctly, you should have a neat, tight joint. Clean off any excess solder. Then rinse in water as best you can. The acid flux must be neutralized. Dry and then use regular rosin core to solder the other

end with common solder. Stand the tubes on end to fill the cross cut area with solder. Clean off any excess solder so the shaft can easily slip into the shimming sleeve. This solder filling provides reinforcement for the retaining pin.

Play between the shaft and the brass tube in the sleeve is just enough to allow the vertical motion needed during deflection, but it also restrains lateral motion.

For flaps, Mark Drela's "Supra" RDS installation calls for rod bends of 50 degrees with the drive shaft oriented 50 degrees to the hinge line. See SUPRA at <http://www.charlesriverrc.org/articles.htm>. This allows the wiper to be rotated and inserted in the pocket with the flaps already hinged.

Another plus of the Mark Drela installation is the flap servos do not have to be moved any to remove the shaft or the servo. Just remove the retaining pin, move the flap down and rotate the driveshaft and bent pocket rod to align to the hinge line and the flap pocket will clear the rod. Pull out the rod slightly, then remove your servo. This can result in a smaller servo hole in the wing. See Harley's newest updated instructions for hinging and flap rod installation in File 3 at <http://genie.rchomepage.com/>.

Final assembly requires the pockets to be installed, hinging done (Drela or other method), and aileron servos centered. For full throw of 90 degrees down flaps on some radio systems, the servos may need to be offset with your radio neutral sub trim settings to get maximum throw.

Wing inverted, the coupler is to be positioned on the output gear so the setscrew holes point outward like ears. This points the pinning hole straight up to be easily seen. The drive shaft is inserted into the coupler and the bent end into the aileron or flap pocket. If you cut the drive shaft lengths correctly, it should be bottomed in the coupler against the servo screw and put the elbow of the bend at the "sweet spot" for smooth deflection. Radio off, move the ailerons or flaps up and down to find the sweet spot where the drive shafts rotate and move freely. Carefully position your flaps/ailerons in the neutral position for your airfoil. Tape or restrain them and then nicely squared up, drill the 1/16" pin hole through the sleeve, shaft and out the other side of the coupler, but not through the wing! Insert the pin. When ready to install the servo covers, add some silicone or GOOP to retain the pin.

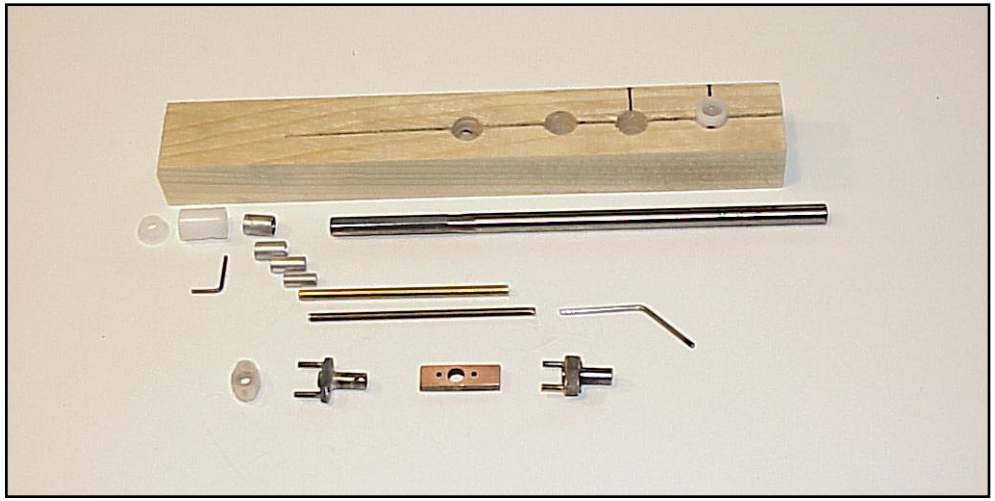
What do these parts weigh? Note the "6" on the scale. That's GRAMS!

MODIFICATIONS for DLG

Read the above material first and then proceed with the following.

The centering sleeve will consist of 1/4", 7/32", 3/16" and 5/32" aluminum tubes, then drive shafts of brass tubes in 1/8" and 3/32". Use 1/16"music wire for the bent wiper. If you want the lightest setup, just use short sections of the inner 3/32" tube at each end instead of the full length 3/32" drive shaft. You may want

to use the smaller diameter 0.047"pin. The photo shows both drive shafts full length.



The same procedures used in the rest of the installation as used in the preceding document. You're finished.

MODIFICATION of RDS for ROBUST INSTALLATIONS F3J/TD SUPRA TYPES USING STAINLESS STEEL TUBES

Refer to the Modification of RDS document, please read that document first, and then proceed with the following.

This modification requires K&S 1/4" aluminum tube and Small Parts <http://www.smallparts.com/> Hypodermic stainless steel type 304 tubing in the following sizes. 5 gauge 0.220/0.189, 6 $^{1}/_{2}$ gauge 0.188/0.168. These are the drive shaft centering tubes. The drive shafts use 8 gauge 0.165/0.135, and inner 10 gauge 0.134/0.106. The wiper rod is stainless steel type 304 0.104" diameter.

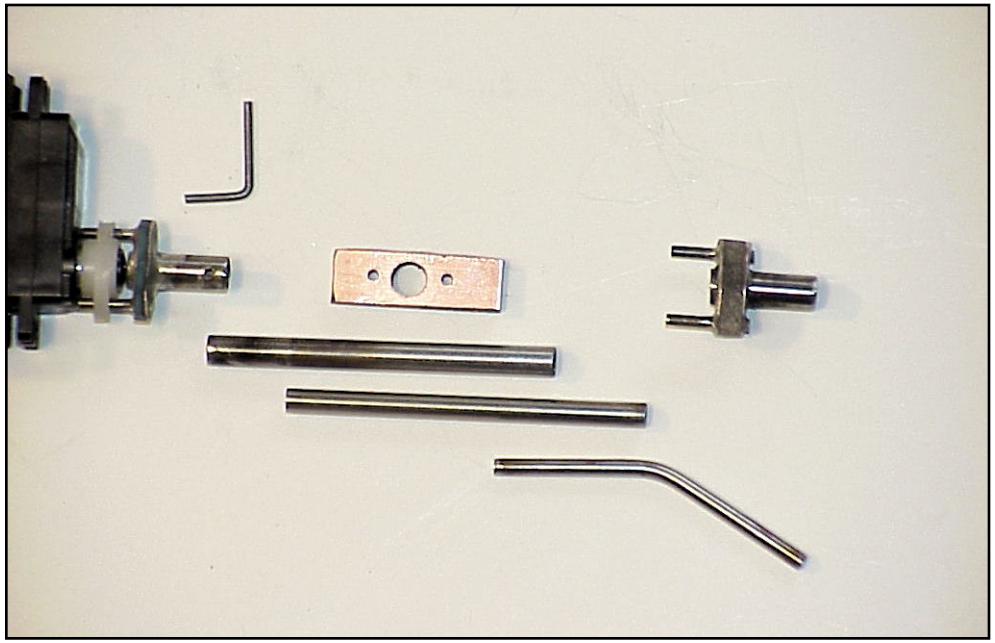
The first part is the same, namely drill the coupler body for the 1/4" aluminum tube using the correct size drill or chucking reamer. Telescope the 1/4" aluminum tube, the 5 and 6 $^{1}/_{2}$ gauges stainless steel tubes inside the coupler, bottom in the coupler without the servo screw and cut off approximately 1/16" from coupler top.

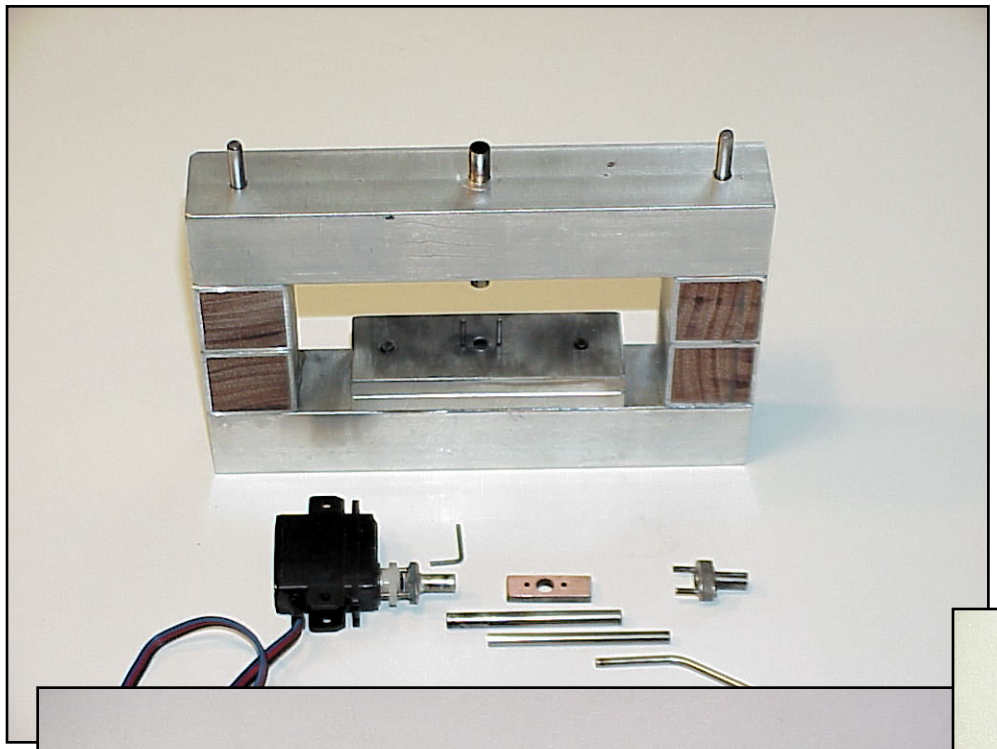
The rest of the procedure is the same as for brass drive shafts, except the servo ends of the drive shafts probably do not have to be filled with solder. Remember to use low temperature Silver solder and flux and Do not breathe the fumes from the stainless steel flux as its acid based.

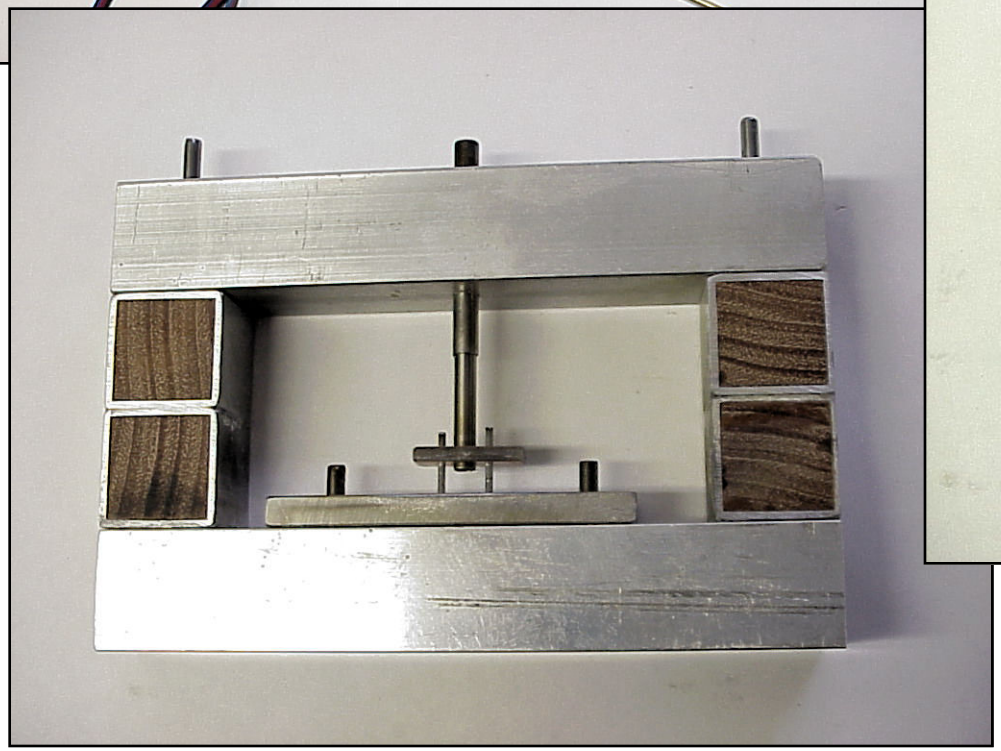
Caution: The hardest part of this modification, is the drilling for the 1/16" retaining pin. Do not elongate the coupler pilot hole. I used a permanent marker pen and using the coupler pin hole as a guide, marked where the pin hole should be drilled. Remove the drive shaft, and insert a drill bit that fits snuggly inside the drive shaft end and center punch that marked point. It will still be hard to drill. I thought about making a steel jig same as the wooden coupler jig, but just didn't get around to it.

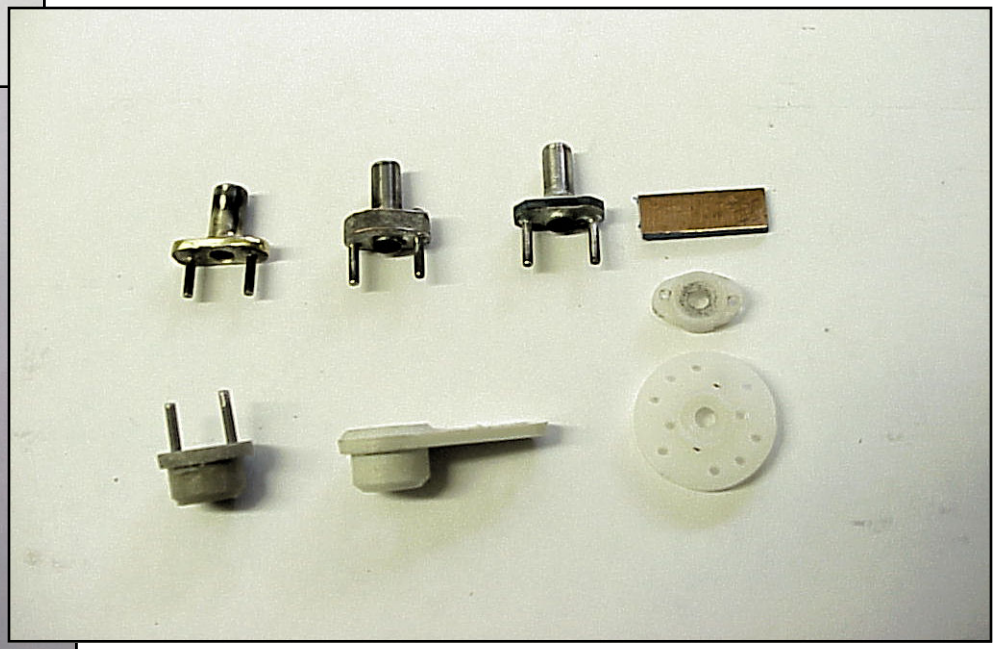
MODIFICATIONS for the MARK DRELA TORQUE YOKE

Here are some photos showing the first attempts at my version of the torque yoke. Successful, but was too much work to build the









jig, and the overall size as compared to the coupler diameter was larger. Take a look and make up your own mind. The jig was square aluminum tubing with hard wood inside. The top and inside plates were removable. Other materials were tried for the basic torque yoke, brass sheet, thick and thin glass printed circuit board with copper on both sides. Actually, the 1/16" printed circuit board was the best, 1/16" music wire drive pins, and the 6 $^{1}/_{2}$ gauge tubing for the centering /drive hole and same 8 and 10 gauge stainless steel drive shafts, with 0.104 rod. Everything was silver soldered. Servo shown is the Airtronics 94761Z

Slope Report:

Chris Erikson's Wild Arsed Mountain Slopers (sans Chris) on (usually) scenic Saddle Mountain, April 8-9, 2006

by Philip Randolph, <amphioxus@juno.com>

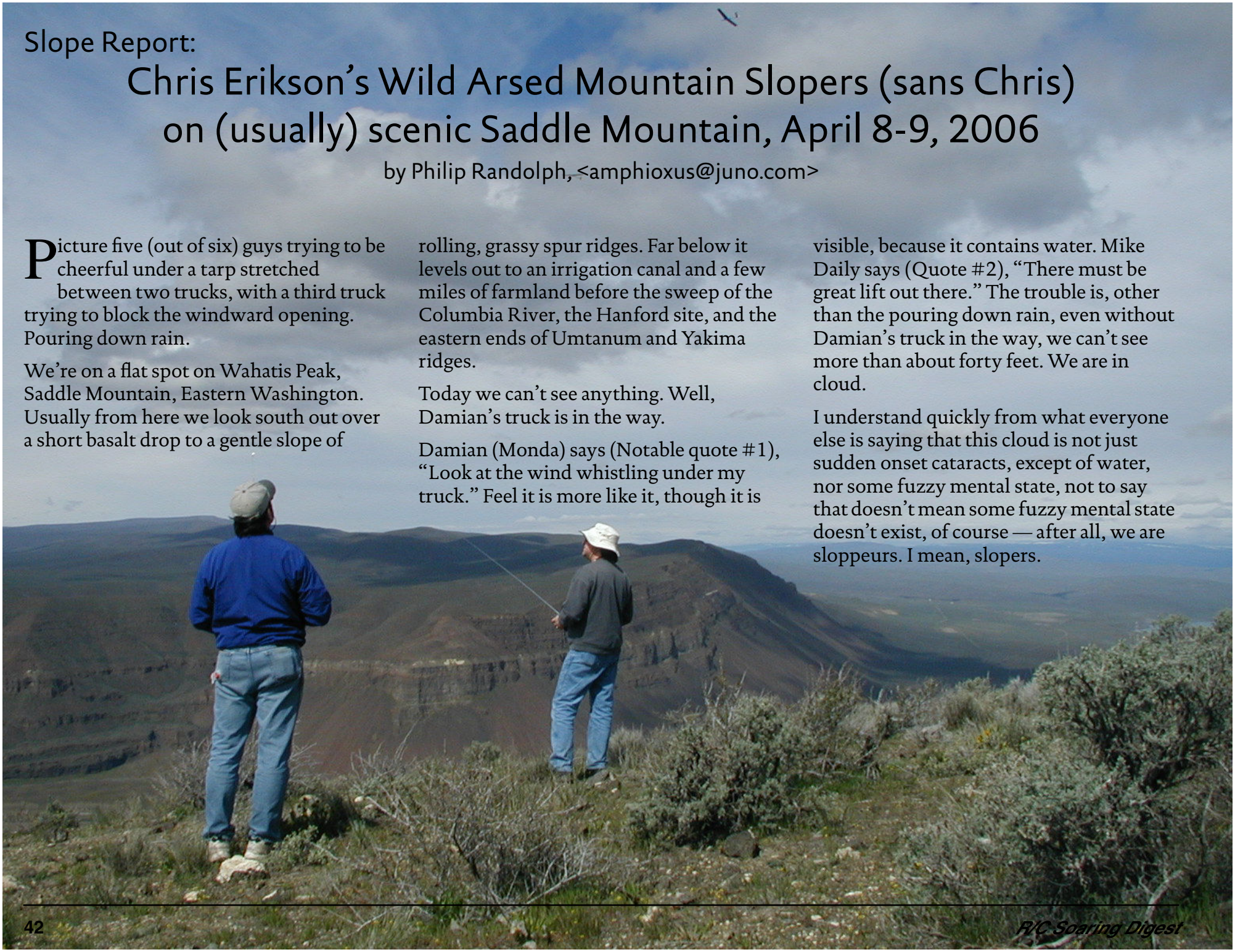
Picture five (out of six) guys trying to be cheerful under a tarp stretched between two trucks, with a third truck trying to block the windward opening. Pouring down rain.

We're on a flat spot on Wahatis Peak, Saddle Mountain, Eastern Washington. Usually from here we look south out over a short basalt drop to a gentle slope of rolling, grassy spur ridges. Far below it levels out to an irrigation canal and a few miles of farmland before the sweep of the Columbia River, the Hanford site, and the eastern ends of Umtanum and Yakima ridges.

Today we can't see anything. Well, Damian's truck is in the way.

Damian (Monda) says (Notable quote #1), "Look at the wind whistling under my truck." Feel it is more like it, though it is visible, because it contains water. Mike Daily says (Quote #2), "There must be great lift out there." The trouble is, other than the pouring down rain, even without Damian's truck in the way, we can't see more than about forty feet. We are in cloud.

I understand quickly from what everyone else is saying that this cloud is not just sudden onset cataracts, except of water, nor some fuzzy mental state, not to say that doesn't mean some fuzzy mental state doesn't exist, of course — after all, we are sloppeurs. I mean, slopers.



Technically, we are part of a non-organization oxymoronically founded by intrepid slope explorer Chris Erikson. Since it isn't an organization, it can't stop me from calling it "Chris Erikson's Wild Arsed Mountain Slopers," or CEWAMS. Chris, well, he keeps suggesting slope dates that turn out to be his daughter's birthday or his anniversary, so he ducked out of this one, leaving us out here, leaderless, sitting under a tarp with the wind whistling around our legs. Talking about how we should put ski bibs over jeans, but not doing it.

Damian, beer in hand, says, "I'm glad we're out here. It should clear up after a while." But then he says, "When I got into this sport, I thought there would be lots of us. I see why there aren't." Mike says (Quote #3), "Steve," (Allmaras) "have you noticed the tarp is banging up and down, on your head?" Steve says, "I perceived that." Mike says (Quote #4), "I wonder if that puddle of water on the tarp is going to spill down your neck?"

Dave Carey (number six), the only one with half a brain, is snoozing in the passenger seat of Eric's Cherokee.

Philip (me, last time I checked) says (Quote #5), "Every year I swear that when the weather report says seventy percent chance of rain, I'm just going to stay home." Eric Utter says, "Maybe it will clear up after a while."

After a while arrives slowly. That is, it takes an hour or two. I say, "The weather report claims it will get better sometime between five and eight o'clock. We can wait here while it's wet, or we can find some establishment down in Mattawa and come back when it clears up." Damian says (Quote #6), "I always think Phil is going to say something profound, and then I realize that's all he's going to say." Eric says, "I want to wait here for a while more." Three minutes later, Eric says (Quote seven): "Okay."

Somewhere in there Damian asked me, "Phil, you're going to camp out in *this?* No wonder you wanted to head back to Mattawa." I say, "Well, I have a tarp for the tent."

The tires leave tan, muddy tracks in basalt grit till we get to the remains of the asphalt road up to the old Nike site. I'm riding with Steve Allmaras, Ph.D., aerodynamics, which makes for erudite and lofty discussions en route about winglets and elliptical versus bell-shaped lift distributions.

Thirty miles back to Mattawa. In musical terms, "DC al fine" (repeat the above scene exactly), but in El Jato, a Mattawan Mexican American Restaurant. I have tongue (lengua) flat tacos. We look out at the rain. The wind whistles, not under Damian's truck, but through the front and side doors, which are mysteriously propped open, and down from the ceiling fans, what? I close the front door. A couple more hours. Dismal.

Geography lesson: Mattawa is roughly in the middle of Washington State. It's about a hundred miles east of the Cascades, and a mile or so east of the Columbia, which flows all over the place. (The Columbia makes a giant S through the state. Mattawa is in the left end of the upper Swirl.) The Columbia flows south around here. A bit further south it curves east around this flat.

Finally: Rain relief! Sentinel gap becomes visible, just to the north. That's the west end of the east half of Saddle Mountain, which is the ridge containing Wahatis Peak, twenty crow-fly miles east of here.

At Sentinel Gap the ridge is 1400 feet above the river, but before resuming its march westward it courteously parts to allow the Columbia through. Lots of ridges do that sort of thing around here. Even the Cascades let the Columbia through. The best theory is that the rivers were here first. The ridges folded up more slowly than the river cut its channels.

We go out. The rain has slowed. "Great!" we all say, in our slightly different ways. "Back to Wahatis!"

First we all head off to the building that holds a Hooch Houtlet and an espresso bar. This is a stop of interest because Eric has explained his subjective perception,

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Philip Randolph and Mike Daily, looking West from Sentinel. Photo by Dave Carey.

Looking south from Sentinel Gap.
Dave Carey photo.

"When you get espresso there, the barrista glowers at you." Damian has had a similar experience in the Hooch Houtlet. They have figured out that the same personage runs both businesses, and shuffles back and forth. Great! More fun.

Mike goes into the hoochlery. Steve and I go into the Espressoir, while Eric and Dave pull up at its window. A guy tells us, "She'll be right here."

Later we find out the barrista was telling Mike she doesn't have whatever hooch he is looking for, and doesn't know much about whiskey anyway.

She arrives. Great character! She looks irritated. She sighs, in an irritated manner. She asks us, "What do you want?" But I ask her how her day is going, "Started work at six o'clock, and after I'm done here, I have to go work at Desert Aire." (That's a resort and unassisted living community on the river, with a golf course.) So we talk some more, and by the time we leave, probably not because we leave, she's smiling. Cheered her up. She tells us, "You ate at El Jato? You should have gone to Desert Aire. They have *American* food! There is a lounge, *and* a tavern." At some point I get the feeling that the Mexican Americans live in Mattawa, and the gringos mostly live in Desert Aire. (?) Ah, well.

Two miles out of town, it's raining hard again. Via cell phone, Dave, our atmospheric

scientist, explains that as the low is moving from the southwest, the rain should pass. So we keep going.

But for once I get a constructive notion. I call back. I say, "Dave, this slope up and away from the river reminds me of the west side of Whidbey Island, where the winds come in off the Straits. It's usually dry there, even if a couple miles east there's a line of clouds. The winds off the straits hit the island's upslope, and after a mile or two, they start dumping their moisture. I bet this upslope from the Columbia acts the same, so it rains a lot to the east, as in, here. It's probably still almost dry back at Mattawa and Sentinel."

About that time, we get to the turnoff up into the missile site bird sanctuary, from Highway 24. Eric jumps out of his Jeep and passes me a little handheld radio. Great. More toys to play with! In 1966 the one I carried on an Explorer Search and Rescue team was bigger than a lunch pail, weighed about ten pounds, and cost $600, the equivalent of about $6000 in 2006 post Vietnam war inflated currency. We turn around.

Driving back, we look up at Wahatis peak. It has a line of clouds, a few hundred feet below the ridge. I radio Dave, "Why?" Dave explains that, and why it's dryer near the river: "When the air rises up the side of the ridge, it expands and cools adiabatically, by Boyle's law (P = 1/V), with temperature

Mike Daily with his Queen Bee, and Eric Utter with a Red Herring. Photo by Dave Carey.

inversely related to pressure. The moisture laden air gets to the altitude where you see the stripe of clouds, cools to its dewpoint, and condenses."

Two round trips have made a hundred miles between Mattawa and Wahitas. Up the ridge toward Sentinel we see some little blue flowers. Steve claims they are bluebonnets. I say, "That's because they grow in what the cow does." "What?" "Blooponit. Everything grows better with Blooponit on it." A guy substitute for humor.

We get up to Sentinel a bit after six. It's raining lightly, and chilly, but we start flying

It's half mile of steep talus slopes and sheer basalt cliffs down to where the Columbia sweeps around this prominence, Wanapum Dam and the I-90 bridge at Vantage off to the north. Gorgeous spot. Olive gray-green sage. Those big yellow, dark centered, surrogate daisies, arrowroot balsam, are just beginning to blossom. Western meadowlark males are establishing what good feminists call male hierarchies by the inventiveness of their songs, and what female meadowlarks apparently reward with connubial bliss. Hearing one meadowlark is enough to make me feel good, so there is at least some interspecies aesthetic commonality in romantic operetta and serenade. Please understand that at the clock rates of small birds' short and simple nervous systems (120 MHz), what we hear as high pitched must sound like a baritone. Hearing their competitive, male, baritone voices transcribed to trans-alto trilibettos by my rather slow cerebral processor (4.7 MHz) also makes me start imitating them, at which I'm not bad. Steve says, "Are you attempting to confuse their mating rituals?"

The lift is pretty good, but bumpy as all. We get six planes in the air. Damian and I have Javelins, 60" EPP light slopers (bowmanshobbies.com). This is the slope plane I recommend most. Because they can fly under such a range of conditions, and are pretty tough, the Javelins (and similar planforms) get the most air time on fickle winded, Washington slopes. Mine has a vee tail. (See photo on opposite page.) But the other favorites, because they are such a blast to fly, are the Red Herrings (34" EPP flying wings, liftworx.com), lofted by Eric, Dave, and Steve. They'll fly in quite light lift, but when the wind comes up, with a teaspoon molded bit of lead ballast they zip like nothing else. Except things similar, perhaps; Mike is flying a Weasel Pro (dream-flight.com, 36"). The heavy stuff stays in the trucks. But there is plenty of lift for even medium weight flying wings, so the Boomerangs come out. The rain stops. The sky lightens, to weaving and twisting silhouettes.

Here are my two favorite few minutes of the weekend, for flying, anyway: Half an hour before the 7:45 sunset, the air calms, and lift becomes smooth. After all that bouncy lift, the smoothness feels blissful. And a bit later, when it's time to go camp, I drift my Javelin behind the hill, and circle to bring it down for a landing. About twenty feet off the sage, it stops going down. It happily makes tight, moderately fast, horizontal circles. Great. Airscapes are full of surprises.

One of our favorite camp spots is among the lower, basalt cliffs up near WannaWhupUpUponEm dam. Picture four trucks, six guys, a couple tents, in a hollow of sandy soil and sage, surrounded by basalt crystal cliffs, a gorgeous scene punctuated with discarded refrigerators, washing machines, and dead microwave ovens, each appliance punctured with bullet holes, which is how we can tell we're in Eastern Washington. Well, there are also the dirt bike trails eroding sage hillsides. To go into beautiful places is also to note the destruction of our environment. We can be proud our sport is low impact. And at least this year the big tub of rotting duck guts is reduced to a scattering of white bones next to Steve's Subaru that he doesn't notice in the dark but that he observes the next morning. The bones are just fine. Last year, well, you know how dead things smell.

So we all fry up steaks on propane stoves, and Dave lays out a little smorgasbord of salamis, cheeses, crackers, and great chili. We dine around the fire, with its three-sided windbreak he fabricated from a dead Maytag's sheet metal, oddly

Philip and Damian at Sentinel during a 2005 CEWAMS slope trip to Sentinel. Photo by Chris Erikson or Eric Utter.

without bullet holes. The moon shows through the thinning cloud cover, like midday sky through a bullet hole in a tin roof.

We drink a few beers, swap stories. Mike brought something seventy-proof called Cyclon that is flavored with lime. I have some sips, but my mistake comes when I head for my tent. I pop an antihistamine, because though two weeks ago I got over that silly cough that has been making the rounds, my histamines haven't got the word that the war is over, are still in defensive mode, holdouts in a steamy, post-nasal jungle, creating something like this day's rainstorm a couple inches east of where the incoming winds hit the upslope of my soft palate.

Up briefly at dawn, the antihistamine plus beers make me so dizzy I fall on my tent twice. A pole breaks. I have to lean to the right to stop from falling over to the left. Scary.

After hours more sleep, when I bend over my cooler, and then straighten up, Dave watches me stagger to the right. Well, breakfast is pretty good. I munch some of Damian's eggbeater, sausage, onion, and pepper scramble. I make some decaf in a French press. And!: The sun is out! The forecast was for eighty percent cloud cover. It's about thirty percent. As we head back to Mattawa, and then up to Sentinel, I start hydrating. A quart of fizzy water later and my balance is nearly normal.

Great day of light air flying. Steve breaks out his newly finished, 60" Spinner XT (laserarts.com), a sleek EPP cross between a discus launch and a sloper. He runs the flaperons with rotary drivers (RDS), so the wings are absolutely clean. He chucks it out over the cliffs. My immediate impression is of very low friction. It slides effortlessly through the wind at the lip. It catches lift when even the two Javelins are down.

We've been waiting for Mike to test launch his hundred-inch wing, an EPP Queen Bee. The trouble with light lift days is that often, when the wind comes up, it means a thermal is behind you, sink ahead. Today I find lift a few minutes after a sink cycle sends everyone walking, by launching after the wind dies, into calm. But it's a risky business. Mike watches, bides his time, waiting for lift.

Finally I'm back by the trucks when Steve says, "Turn around." The Queen Bee is flying, and flying well, but it needs a stronger lift day. Mike has a pleasant walk down through sage, which never smells better than in the spring.

I do a swell nap, get this, in SUN! during which I hear buzzing sounds. Naw, not more antihistamine reactions playing with my inner ear. Just Eric buzzing me with his brushless powered, Gryphon micro-wing (unicornwings.site.yahoo.net). I'm not worried. Eric has amazing control. I've watched him cruise it at thirty miles per hour a foot above grass, repeatedly. I stay asleep.

I'm a bit more awake and peeling an orange by the trucks when Damian, whose Javelin is way up in light winds that have shifted to the north, yells, "Hey, Phil, what are you doing way down there?" That's sort of an invitation to put my plane up, which is sitting under a card table. I yell back, "What are you doing way up there? Your usual modicum is to be barely keeping it up." That's sort of a backhanded compliment to the lift he's found.

SUN!: The sun does this strange thing: It seems to erase memories of huddling under a tarp in the rain, memories that only make temporary intrusions into today's warmth when one of us impolitely but appreciatively reminds the others, "What a contrast from yesterday."

Well, that's typical spring sloping in the Pacific Northwest.

Most of us stop for Mountain High burgers in Easton, a bit east of the Cascade Divide, about six.

> Wanna see a map? More pictures? Want to get there?
>
> Aforementioned intrepid slope explorer Chris Erikson has posted many of Washington and Oregon's slope sites on slopeflyer.com. Click on "Flying sites." Click "Washington." Read all about it.

Jeret Lemontt (L) and Don Thuren (R) fly their *Weasel-pros* at The Ruins, Santa Barbara, California.
Photo by Steve Lange. Canon PowerShot S500, 1/80 sec., f 2.8, 7.4 mm

Brian Kloft's *Alula*

Brian Kloft, <bdk127@yahoo.com>

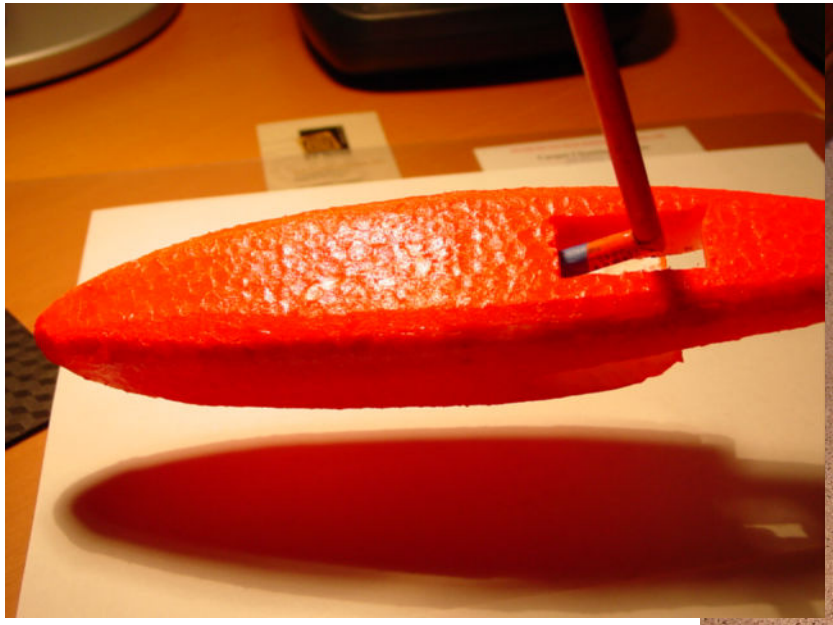
Some notes of interest

I've started travel again for the year, which looks to be another character builder!!! The good part is I will probably hit a few nice soaring sites along the way. I do have a few planes ready to travel with me... Including the *Alula*. <http://dream-flight.com>

I did make a few modifications to the basic kit instructions.

I decided to cut slots and insert the carbon reinforcement strips below the surface. I put about 3-4 coats of Goop on the fuselage, then cut the slots. I used a syringe to get goop into the slots and on the carbon. I then used foam safe CA and kicker to seal the slits. After I sealed the slits I put on two coats of thinned goop, then thickened it up a bit. I usually put on three coats an hour. You could probably do four if the environment is warm enough... I work in my basement and it was winter while I was building. You can see in the pictures that the carbon is completely invisible.

You can also see the 1/4" dowel I used for handling the fuselage... very handy. It slips into the pre-cut wiring tunnel.



Also, I used a new empty quart can for the goop, and it will keep indefinitely if sealed well.

I have not really had time or good weather to do much with the *Alula* other than some trim throws and some initial flying so far. One thing I really do like is the colors I selected (fluorescent). Not only are they bright, the stripes on the bottom really help to keep your orientation straight when you put the *Alula* through some aerobatics.

I bought a Pelican case (#1700) that will ensure safe arrival even if a gorilla throws it around! It is probably a bit of overkill for the *Alula*, but I inflict enough damage without more from a baggage handler!