Radio Controlled Soaring Digest

June 2009 Vol. 26, No. 6

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Front cover: A RealKits Medicine Man rests after another successful flight. This one was built by *RCSD* Managing Editor Bill Kuhlman and his nine year old granddaughter, Anna Pylman. Check out the kit review in this issue, starting on page 28.
Photo by Anna Pylman
Konica Minolta Maxxum 7D, ISO 100, 1/300 sec., f8.0, 70mm

Back cover: Pablo Calás captured this Standard Class glider, spoiler open, a very small fraction of a second and a couple of centimeters before hitting the center cone of the landing spot at the Argentina Nationals in early May.
Canon PowerShot S5 IS, ISO 80, 1/1600 sec., f3.5, 25.2mm

R/C Soaring Digest

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In the Air

This issue of *RC Soaring Digest* is not very large, but we hope at least one of the projects outlined will stimulate readers into some sort of construction project.

Morten Enevoldsen, Denmark, has been working on his version of Dave Jones' R-2 design for quite a while. It turned out to be a beautiful airframe that flies extremely well. Morten's article gives a detailed project history and describes the minor difficulties, easily rectified, that he experienced during the test flying.

Antonio Carlos Martins, Brazil, submitted full size plans and accompanying articles for two of his own designs, the Frigate and the Ax. The Frigate is a lightweight soaring machine influenced by the Frigatebird, while the Ax is designed to accept a brushless 400 motor and a 3-cell Lipo battery pack. See the articles for download information.

The project we were working on in conjunction with our granddaughter, a RealKIts Medicine Man, was finally test flown just before the deadline for this issue. Putting together the Medicine Man kit and flying it was a totally wonderful experience for all of us.

The Contents page backdrop was taken on the drive back from the 2008 Visalia Fall Fest by Alyssa Wulick.

Time to build another sailplane!

Correction: The picture on the cover of the May issue of *RCSD* was attributed to Greg Potter when in fact it was a picture taken by Chris Adams of Tasmania. Our sincere apologies to Chris for the error.

FRIGATE
the glider

Antonio Carlos Martins, acarlosarq@gmail.com

This model is inspired by the Frigate, the most beautiful BIRD I've ever seen.

About the Frigate concept

For many years I've loved to see Frigatebirds on Brazilian shores. They are capable of flying on light thermals and in strong winds; they seem to watch for thermals and any ascendant air around.

I love to design gliders, and I did not see any logical solution in white bright and polished wings for our models. The Frigate tries to emulate the "real bird concept" design.

With this wing planform, the leading edge is curved until the trailing edge on the tips, there are multiple panels with low dihedral angle, and a last panel on the tip acting like a winglet, and seeming to provide a keel effect for the wings.

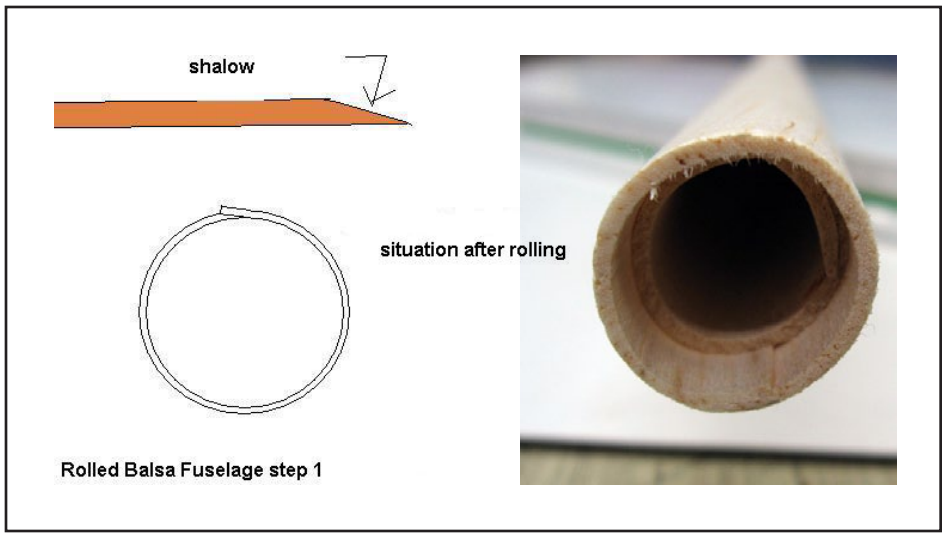
False ribs all through the wing span are spaced at 1" to avoid the covering sag between the ribs with a spacing of 2".

For many reasons, but mainly because of good and reliable design, the S 4083 was my choice for the wing airfoil.

The spars are of hard balsa 3/8" x 1/8" with carbon fiber reinforcement laminated inside. Webbings of vertical grain 3/32" light balsa complete the spars.

Above: The author gives his Frigate a strong throw.

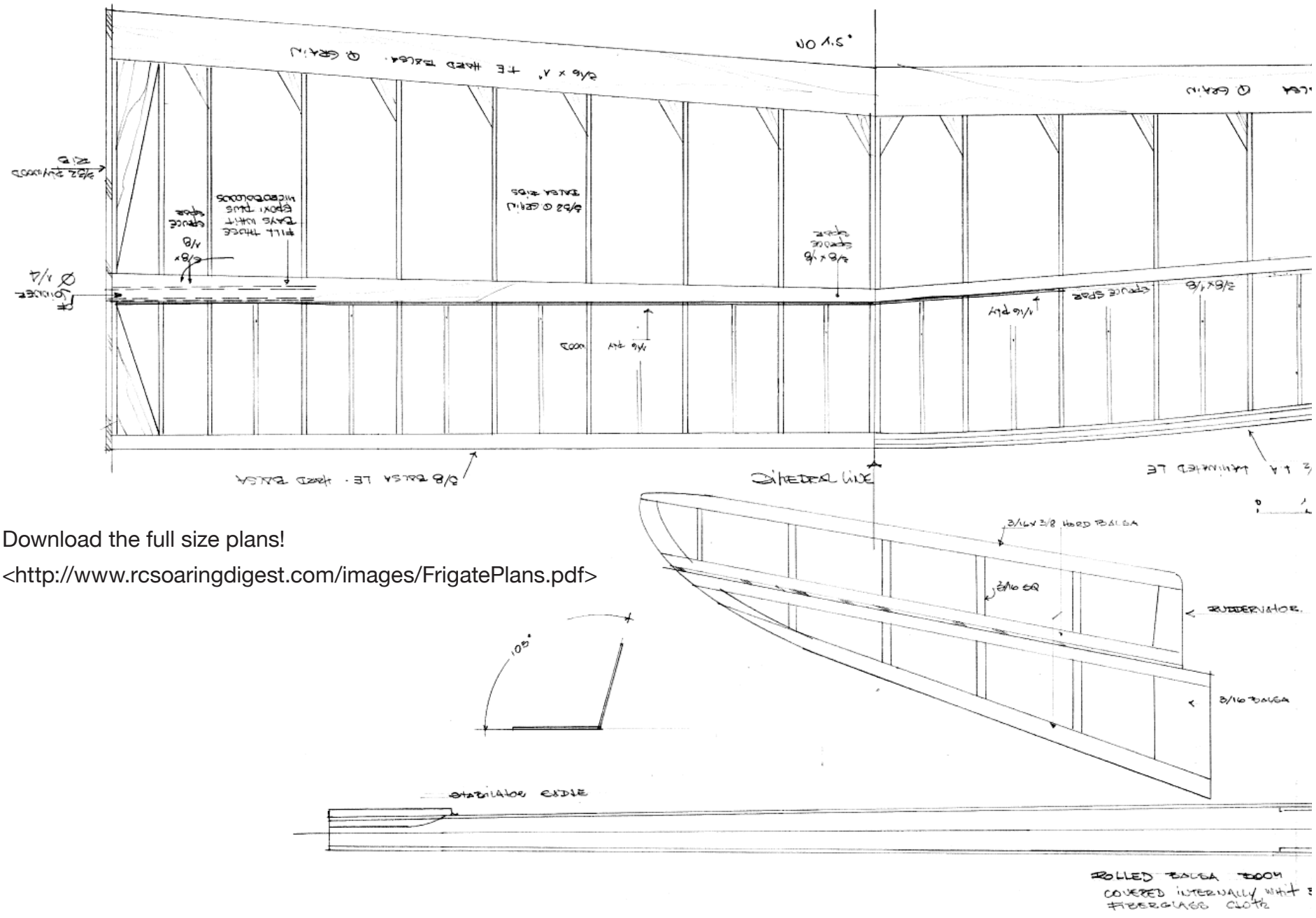
Opposite page upper left: A Frigate bird in flight. Photo by wildlife photographer Herb Houghton.


shalow
situation after rolling
Rolled Balsa Fuselage step 1


EMBRAER
SKYDIVE

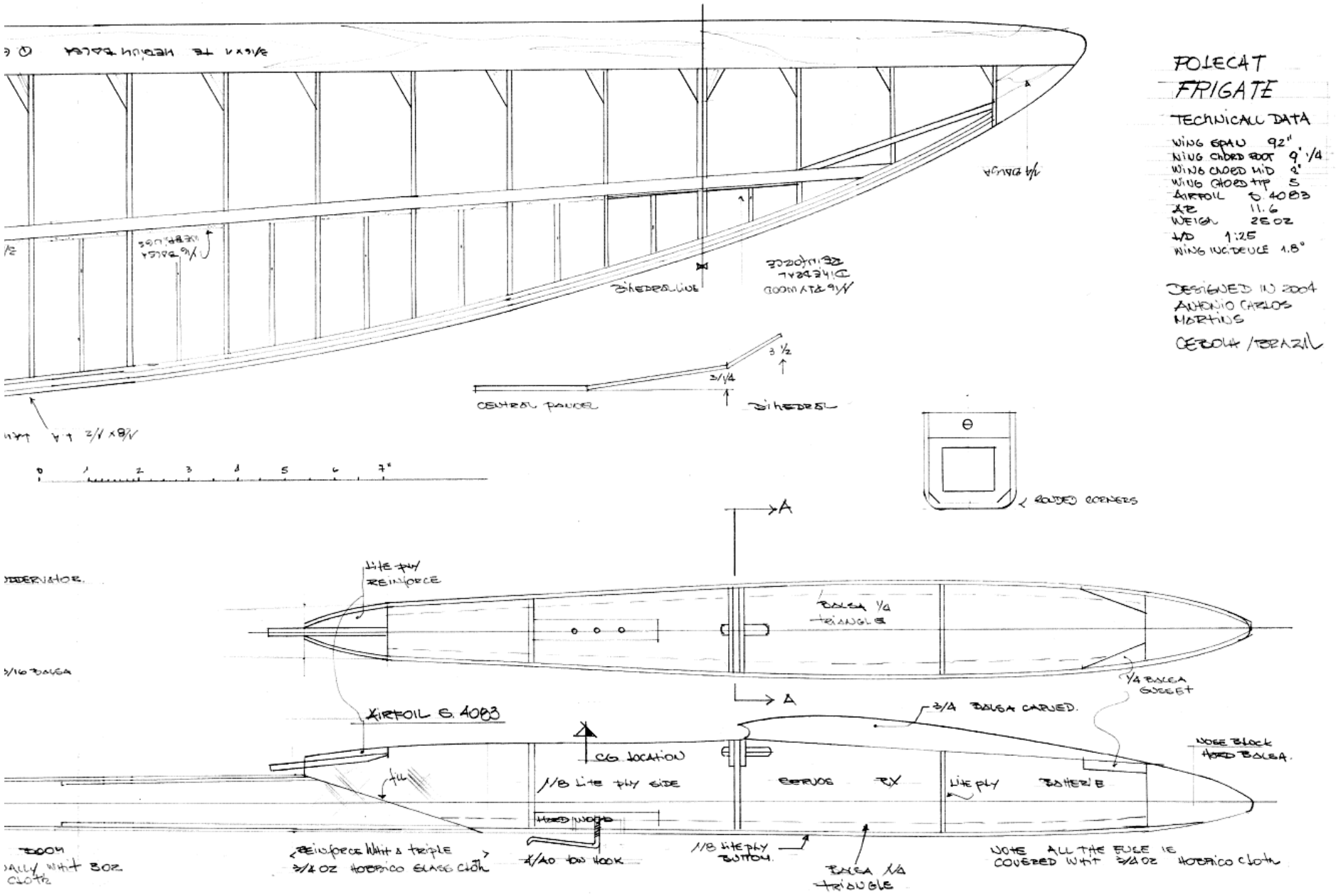
Opposite page — Upper left: A simple sketch shows the basic boom formation method. Right: The finished fuselage and the snooker baton used as a mold. Lower left: The forward end of the finished fuselage, looking from the year, after finishing.

This page — Left: The wing tip structure is lightweight yet strong. Super Monokote is used as covering to provide additional torsional stiffness. Below: On the flying field before assembly. Pieces are of manageable size and things go together quickly without tools.



Download the full size plans!

<http://www.rcsoaringdigest.com/images/FrigatePlans.pdf>


POLECAT
FRIGATE
TECHNICAL DATA
WING SPAN 92"
WING CHORD ROOT 9" 1/4
WING CHORD MID 2"
WING CHORD TIP 5
AIRFOIL S 4083
A/E 11.6
WEIGH 25 OZ
L/D 1:25
WING INCIDENCE 1.8°
DESIGNED IN 2004
ANTONIO CARLOS
MARTINS
CERQUA / BRAZIL
ROUDED CORNERS
LITE PLY REINFORCE
BALSA 1/4 TRIANGLE
1/4 BALSA SHEET
AIRFOIL S 4083
3/4 BALSA CARVED.
CG LOCATION
1/8 LITE PLY SIDE
NOSE BLOCK HARD BALSA.
LITE PLY
BALSA 1/4 TRIANGLE
1/8 LITE PLY BUTTON.
1/16 DOWN HOOK
REINFORCE WITH A TRIPLE 3/4 OZ FIBERGLASS CLOTH
NOTE ALL THE FUSELAGE IS COVERED WITH 3/4 OZ FIBERGLASS CLOTH

On the Frigate prototype, I chose to cut the wing ribs one by one, also the false ribs, with the help of Profili2. The principle is simple and easy.

I made some copies of the ribs and glued them on cardboard. After that I cut the cardboard templates and applied some thin CA glue on the edges, then I sanded all of the templates using a #600 sand paper.

I stick and glue some pins through the templates and cut the balsa ribs using the template as a guide.

The central part of the Frigate wing is flat, so I installed a wing joiner - a blade of stainless steel and a rectangular tube as a guide - inside the main spar.

For the other wing panels I chose to use 3/32" plywood as a dihedral joiner, glued with epoxy.

For the fuselage, I chose 3/32" lite ply for the sides and balsa block for the canopy and fuselage bottom.

The boom was made using balsa sheet and a snooker baton as a mold. The balsa is in two layers of 1/16" sheet, soaked with alcohol so it would have some flexibility. I curved the balsa sheet around the mold.

On this part I don't recommend the use of quarter grain balsa. I prefer sheets with parallel fibers, and of medium density.

For a good result, you take the perimeter of the snooker baton and transfer that to the balsa sheet. On one side using a razor plane you cut a shallow angle to keep the tube straight.

Be careful and use saran wrap to cover the snooker baton so the balsa tube doesn't glue to the mold.

I used white aliphatic glue on dry joints, applied to the balsa with the baton inside.

Since the baton has a conic shape, I can pull the balsa tube against the large part, to be sure of a round section.

To hold the balsa around the baton, you can use rubber bands, or also 3M duct tape.

If the tube is twisted before you glue it, you can use a little force and make a parallel joint just using good sense and some care.

After drying, I apply #180 sand paper to the tube, and after that #240 sand paper.

Using the baton and the balsa tube as a mold again, I repeat the process to obtain a second layer, or a second balsa tube, but glue at this time.

When dry, I remove the second tube and apply a generous layer of aliphatic white glue, and then the second tube is placed over the first one.

After drying (four days later), I remove the balsa tube from the baton mold to see if it's straight, then put the tube of two balsa layers on the mold for the final sanding with #320 sand paper.

Then I use a layer of Hobbico 3/4oz glass cloth and Pacer finishing resin.

Keeping the fuse on the mold, I applied the final layer of cloth and sand everything using #600 grit.

To glue the tube on the pod, a shallow cut and some epoxy works fine, and then some sanding to be sure that you have a good alignment. Apply some Hobbico 3/4 oz glass cloth and Pacer finishing resin.

Well, the fuse is ready for painting, or in case you like only apply lacquer and polish. I painted the boom black and the pod with lacquer, but keep in mind to keep the extremities light, mainly for the boom and stab.

About the stab... It is a very conventional system and no comments about it except to build it as light as you can.

For covering I strongly recommend using Super Monokote. The wing does not have a D-box and the only way to avoid warps and also flutter is to use a resistant material.

The Frigate glides well, and I presume a glide ratio about 25:1. It is very docile, climbs well in light thermals, and behaves like a trainer. It climbs well on a hi-start, but maintain the hook 3/8" ahead the CG just in case.

For any doubts you can send me a message - acarlosarq@gmail.com

Good luck and have nice flying!

Full size plans for the Frigate can be downloaded at no charge from the *RC Soaring Digest* web site: <http://www.rcsoaringdigest.com/images/FrigatePlans.pdf>


Ax
easy to build, easy to fly
BL
Antonio Carlos Martins, acarlosarq@gmail.com

The premise of the Ax design was an inexpensive model that could use any 400 brushless motor and a Lipo 3S 1300mAh battery. This means any motor and any battery pack which meet those criteria.

Another premise is a very light model - the target weight of 25oz ready-to-fly seems good for a fast climb.

For the model design I chose very conservative lines on an all balsa strips structure for the fuselage, and a conventional rib and spar structure with no D-box for the wings.

For the wing spars I used 3/16" spruce dowels that pass inside the wing ribs, and webbing of 3/32" vertical grain balsa.

The Ax airfoils are the HQ 3.0-10 at the wing root and the HQ3.0-9 at the wing tip.

There are some reasons for using the HQ3.0-X airfoil. It is fat enough to give good strength along the wing span and resist torsional loads, and finally because of its good performance and low drag.

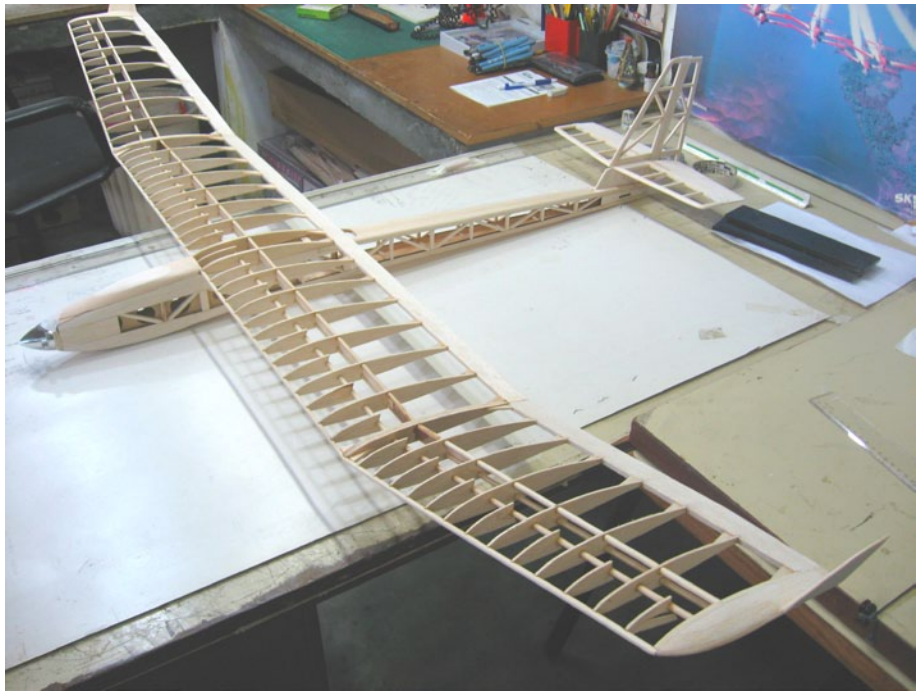
Ax uses false ribs in the wings to reduce covering sag between the ribs, and has a one piece wing, considering its low wingspan of 78".

An important point is the use of Super Monokote for all model coverage. This material is very resistant and avoids flutter of the wing and tail group.

I do prefer to use small winglets on my model. I really don’t know if it works or not, but the truth is my Ax performs tight turns better than others.

In flight, the Ax has a good speed range, can easily go up wind, climb in light thermals, and most important it’s very easy to fly, docile and gentle.

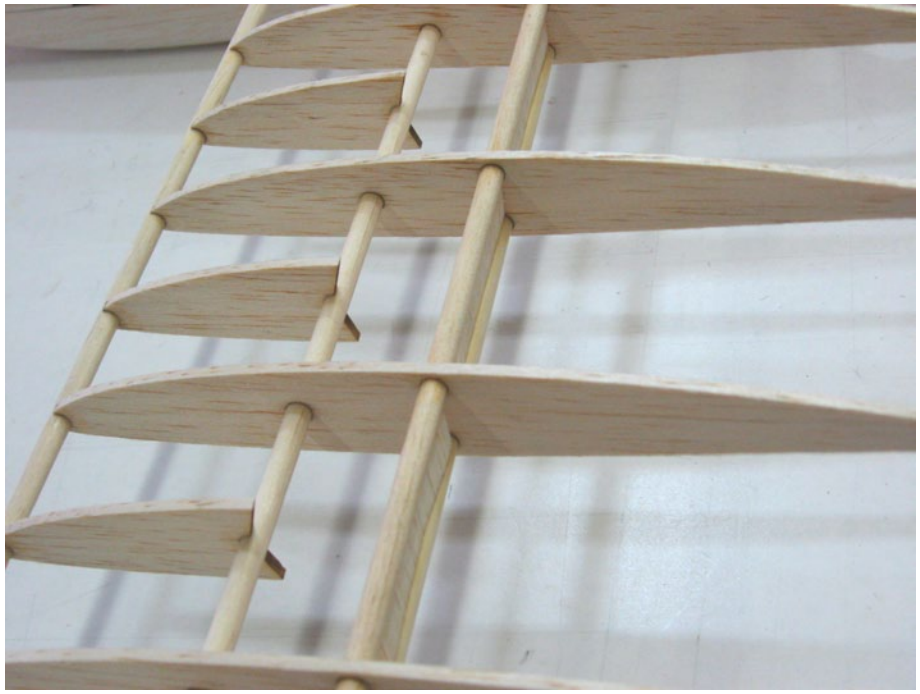
My Ax is a three year old model, with more than 200 flights, and still is in very good shape with no structural fatigue.



Above: The front end, ready for installation of a 400 brushless motor, prop and spinner.

Above right: The completed AX skeleton, ready to cover.

Right: Dowels and webbing make up the AX spar system.



In case you have some interest in building an Ax, you can count on me, and in case of doubts contact me by my email: acarlosarq@gmail.com

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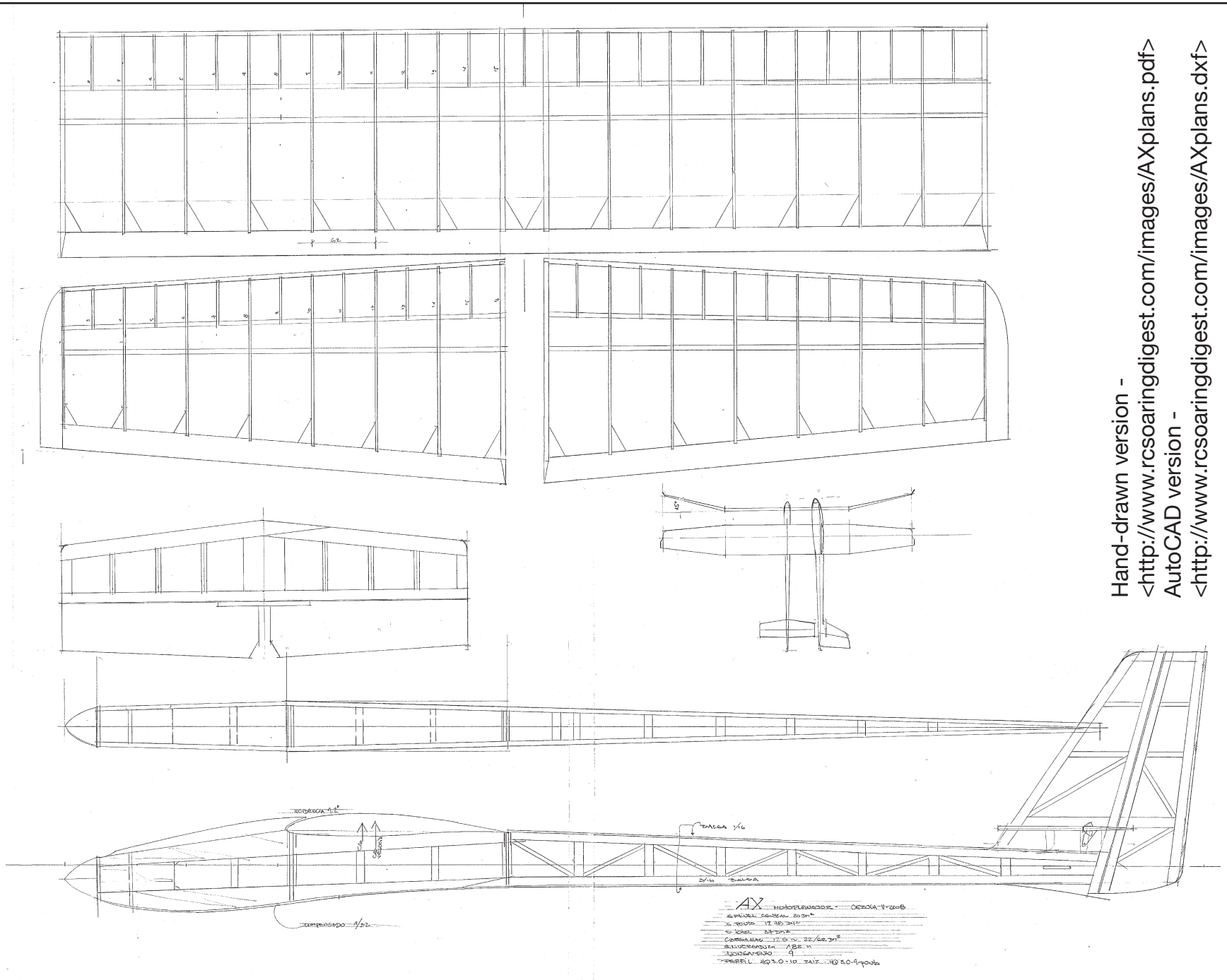
Full size plans for the Ax can be downloaded from the *RC Soaring Digest* web site:

Hand-drawn version - <http://www.rcsoaringdigest.com/images/AXplans.pdf>
AutoCAD version - <http://www.rcsoaringdigest.com/images/AXplans.dxf>



Hand-drawn version -
<http://www.rcsoaringdigest.com/images/AXplans.pdf>
AutoCAD version -
<http://www.rcsoaringdigest.com/images/AXplans.dxf>

Construction of

Dave Jones' R-2

Flying Wing Thermal Plank

Morten Enevoldsen, m.u.enevoldsen@gmail.com

In this article I refer to Bunny and Bill Kuhlman as B&B, my inspiration for the R-2, and I thank them for sending the drawing halfway around the world to me in Denmark so I could make a copy of my own. (I had no luck in finding the drawing commercially).

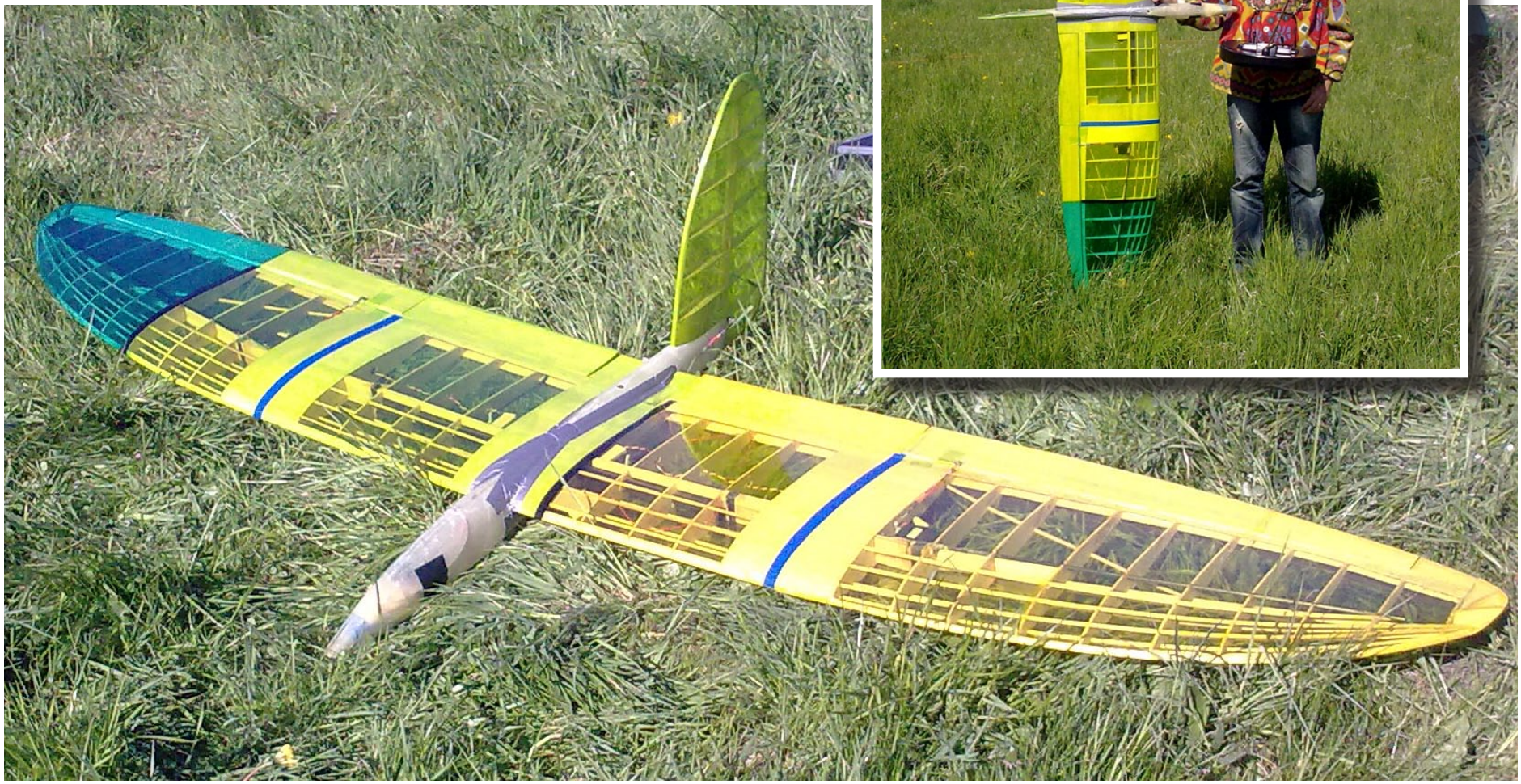
Like B&B, I instantly fell in love with this planform upon seeing it in an OTW article (151-154). You may find much more information on the plane here: http://www.glide.net.au/on-the-wing3/index.html. Scroll down to R-2 for a four volume great story from B&B.

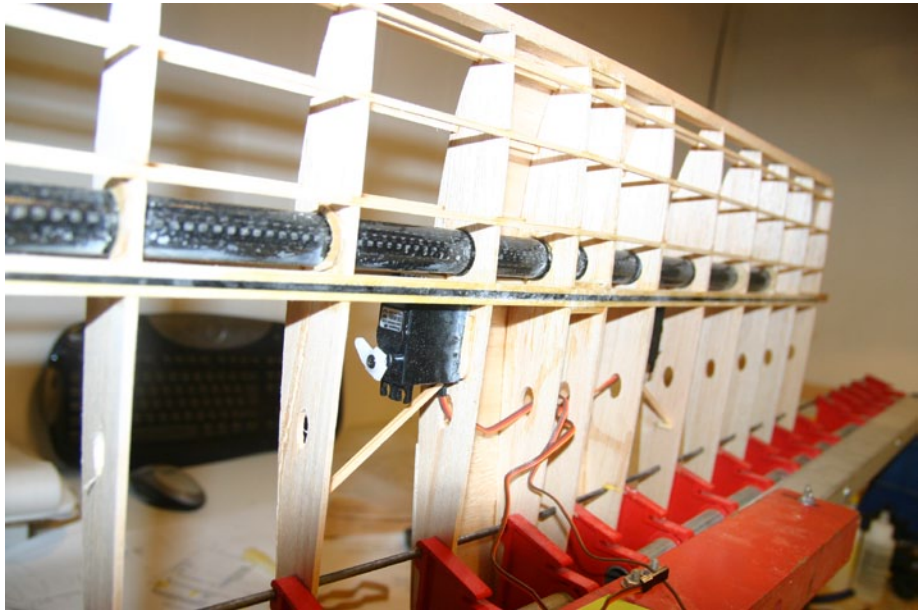
I love the parabolic ribbed open bay wing looking - like a Jurassic flying dinosaur (Raptor) - and contemplated changing its name to a name more dino-like. I never got around to it, though.

My R-2, in contrast to B&B who kept their design variant of the R-2 true to the original building materials, is built to exploit many modern developments in materials like composites and carbon as well as modern computer radios like my Multiplex Royal Evo. I hoped to be able to alter my R-2 without sacrificing the major characteristics from the original Dave Jones' model's features, which I love.

Most of the changes made from B&B Kuhlman's R-2 are carried over into mine, as I appreciate their ability to exploit the model's full potential as a thermal soarer/light sloper. Only in a few ways have I deviated from their proven path (and changes);

1. I was early on informed by B&B that their R-2 was prone to severe wing bending the during hard winch launches. I wanted to eliminate/minimize this tendency and addressed this with the following change to the wing design: I put in a 22mm thin-walled carbon tube in the innermost 1.5 foot part of the center section (less the outer 2 ribs in the center section, where I use cab-spars instead - here I need the space for the wing joiner to the tipsections). The CF tube doubles as a ballast tube when needed. My ballast slugs fits in this diameter. I do not, however, foresee any need to ballast this bird. It is pretty sleek





The center section carbon fiber tube is inserted near the top of the ribs at the center, near the bottom of the ribs near the tips. This provides the slight dihedral angle required for this wing which is mounted high on the fuselage and incorporates ailerons.

in both the airfoil and the finishing of the elevators and ailerons and the trailing edge is almost razor sharp. Efficient airfoils have either sharp or square trailing edges, never rounded as most folks seem to build...

2. Airfoil changed from the CJ section used and praised by B&B and everyone that has flown their R-2. My good friend Peter Wick, by some known for his airfoil work for the Swiss F3B team, designed a new airfoil for my R-2. I let him know that

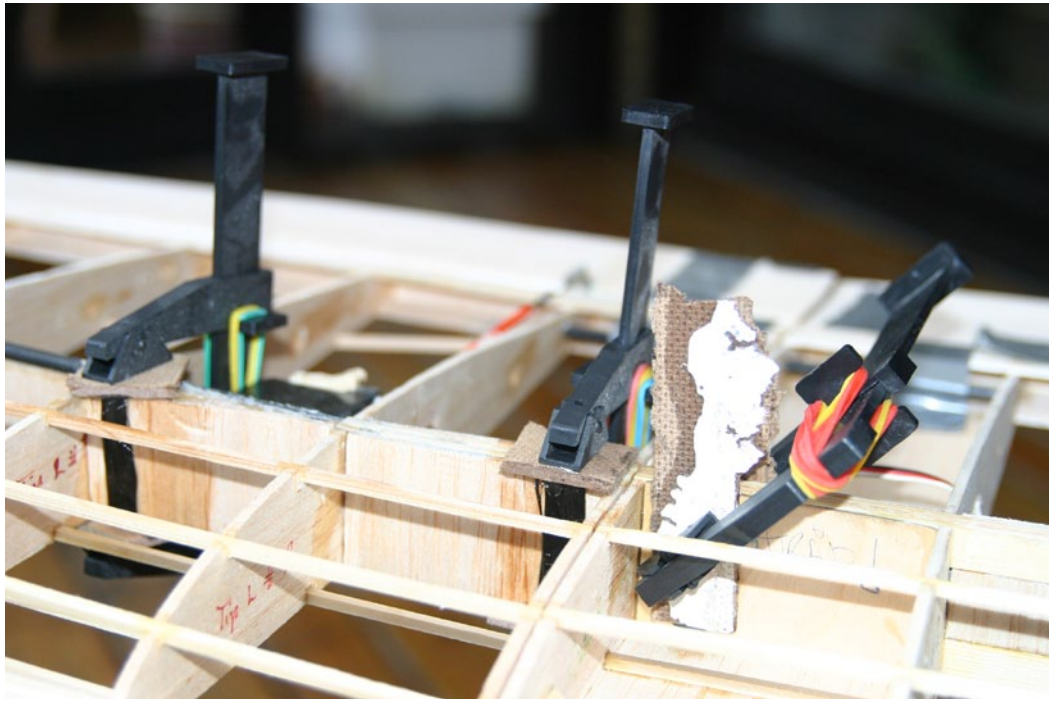
a. I like “floating” around in a quiet and graceful manner
b. Simple aerobatics
c. Instant braking capabilities known from DLG gliders
d. But I also needed good penetration to get back upwind from those far away thermals.

Peter came up with a new airfoil that actually has less drag than the CJ section used by my American friends. At this time I am not at liberty to give out any specifics about the airfoil. I have made an analysis with the Nurflugel program by Frank Ranis where I get a projected glide ratio of 23. This is very attractive performance. This even takes into account the relatively low aspect ratio of 6.6.

So I got another buddy of mine to help me with CNC milling of the ribs from files I created in Profili2. This worked wonderfully as I after a lengthy global search for a person who could CNC my ribs, I at last found him locally in Copenhagen!

One flaw was introduced in CNC milling of the ribs, however. The chord is 1/2" shorter than the original design and B&B’s version. This has little effect and only affected the location of the CG.

The ribs where cut so they cater to the straight carbon tube in the dihedral/V-placement of the ribs. This will help



Construction of the wing joiner boxes showing the carbon fiber wrap, and a rough test fitting of the various parts just to get an impression of the size of the R-2.

strengthen the more highly loaded part of the wing root section as it is winch launched. (see photos)

3. Separate servo each flying surface. This enables crow braking and mixed elevator and aileron deflection on both surfaces on each wing, mixed together in the transmitter. I believe this makes the controls more accurate and with less throw/drag.

Furthermore, this will give me a more evenly distributed lift along the span of the wing. An added bonus of using separate servos for each surface is that I can balance the load on the elevator surface more efficiently, which B&B saw some problems with.

I changed the elevator servos to separate digital servos with an enormous torque. Hence these should hold much better than with one analog servo managing both elevators. B&B mentioned their servo "giving" a little instead of a strong hold in the last strenuous zoom of a hard winch launch. This should pose a minimal problem with my setup.

In making the mechanical linkage to the elevator and aileron I made a mechanical tuning of the moment-arm as the servo-arm at the elevator servo is short and the arm at the horn is longer. This creates a mechanical advantage for the servo that utilizes the full throw at the servo with less travel at the elevator. In a plank configuration like this I really don't need much throw anyway, but it needs to be precise and accurate and have a strong hold.

At the aileron I use 1:1 ratio as I will need normal throws here. And to get some form of glide control I employ spoiler/crow braking where the ailerons move up and the elevators move down. B&B has had requests about this from the friends who they entrusted to fly their R-2. So it should be a welcome add-on when I'm sliding in ground effect and the grass-strip is no longer!

I have also made the length of the balsa wing sheeting interpolate along the length of the chord throughout the tip sections of the wings. This renders a nice "organic" look to the finished wing structure. This further enhances the "organic" expression of the parabolic planform that I love in this design.

4. I decided to go overboard and make a very sexy curvy fuselage in my CAD program, SolidWorks. Then I went to my CNC friend and had him mill two halves of a positive plug in foam for making a mold for the fuselage in dental cast. My fuselage looks a lot like B&B's with subtle variations. I know myself and my carpenter skills are not up to snuff on this one. So I went the high-tech route. Weight was not a consideration here. I'm confident that B&B made a fuselage as light in wood as I can do in fibreglass.

The design is inherently light (when you heed the advice from B&B in constructing the wing). My aim is to get the plane under 2000g ~ 70oz. This will give good performance and a calm flying pattern which is easy to land and control in most conditions. Also, a wing loading of 20g/dm2 fits the amount of camber and should give good performance.

Building

I started the process designing the fuselage in CAD. In parallel I bought an old second-hand Adjust-O-Jig on Ebay. This was quickly set up with the needed dihedral and the center section of the wing took form in a few weeks. Then it was time for the tip sections. These came out quickly as well. But at the end of building them I had other priorities in my life. Hence they sat there looking at me to blame me for not getting on with the project. And finally, after 2½ years, I found time to finish the project. So the tips came off the jig and were finished in a few days.

I started the fuselage production with dental cast, which is much heavier/stiffer than normal cast. This worked great, but I was amazed with the amount of cast needed to make a mold for the fuse halves. But finally they were ready to prepare for molding the fuselage.

I began the outer surface of the fuselage with 49g fiberglass and continued with two layers of 80g fiberglass. Then on

Following some test flying on the slope <http://picasaweb.google.com/m.u.enevoldsen/R2#5336029208030257954>, Morten headed out for some hi-start launching and flat field flying <http://picasaweb.google.com/m.u.enevoldsen/R2#5335984081659992850>.

with two layers of 150g material. “This should be fine.” my good friend Mikael, with extensive molding experience, told me. This adds up to approximately 400g for this wall thickness. As I measured the shell still in the mold, I thought that the thickness of 0,8 mm was too thin for my application and went on with two extra layers of 150g. All in all I effectively made a wall thickness of 1,4 mm with approximately 700g of fiberglass.

Finally, I could pull the parts from their molds and enjoy the pieces. Great. I went on to remove the part through which the center wing should go. After removing this part the fuse weighed only 370g. This was much less than I anticipated. Great looking, and stiffness was very solid. I left the part/fairing running over the wing, so I effectively had a cage construction with a lot of stiffness. I did this intentionally to add stiffness to the fuselage. It takes a beating when speer-landed on a spot.

After making the fin and rudder in one piece on the jig, I separated the fin and rudder. I mounted the fin on the one fuselage side, then assembled the fuselage sides and started installing the radio parts in the wing and fuselage. I decided to mount the receiver in the center section of the wing. This way only two wires (rudder and battery) need to be assembled when arriving for a day of flying at the field. Additionally, I can check receiver voltage on the battery pack via the LED through the transparent covering. If I find myself in a channel conflict with a fellow pilot, I can change

channel with a needle through the covering. This has proven very nice.

I elected to cover the “bird” with Oralight due to the available colour scheme. This actually saved me about 70g in total of the covered R-2 in comparison to a normal Oracover finish.

After having put everything together, my R-2 weighs 1653 g. Somewhat less than B&B’s 1890g version. I am not certain how I did this with an added standard size digital servo. But my best bet is that my fuse is much lighter than theirs. My wing weighs the same.

CG

I had to install 86g of lead to balance the R-2 at the 26,47% at which B&B flew theirs. Their airfoil resembled mine, so I felt comfortable in approximating my CG from theirs. This I did and went to a small slope where the wind was nice and steady on a moderately windy day. CG was later moved forward – see details later.

Flight

The first flight was pretty eventful as the elevator throws mentioned in B&B’s description of their findings on the R-2 were much too big for mine. I have somewhat larger elevators, which might explain this effect. I could easily remedy this effect, though, in-flight with my Digiadjusters that I had programmed to adjust throw of elevator and aileron. These were quickly dialed into the ballpark where I felt comfortable. I ended up with only 36% of full elevator servo deflection and 63% of the aileron servos. After the initial very close call, almost hitting the hillside, I now felt comfortable flying the R-2 and became more daring in hunting for thermals far out from the slope lift.

It was great and I could enjoy my creation from all angles. And I finally came in to try landing the plane. After three attempts placing the R-2 properly, I ended up a little too high, so I thought, “Why not try my Crow brakes?” And so I did - with catastrophic results. The R-2 was not properly set up with precisely the same up-as-down pitch input with my initial crow settings, so it dived steeply into the hill and did a speer landing from four meters and high flying speed! I cried and shouted at myself for doing this stupid maneuver so low on the first flight.

Well, as I picked up the plane, I could see that the damages were substantial, but the most important ones could be fixed on the spot. So with some gaffer tape and some cyano glue, I was determined to get it into the air again. 20 minutes repair work got me back into the air. But in the late afternoon I thought that I was flying with too much reflex on the elevators. So I took out some negative reflex from the ailerons and could then remove some reflex on the elevators, and settled with a much nicer looking trailing edge.

R-2 maiden flight video by Mikael Christensen can be found at <http://picasaweb.google.com/m.u.enevoldsen/R2#5336029208030257954>

After further flights, which included some nasty hyperstalls, I finally decided that I probably was flying with too much nose weight. I started removing more and more of the lead. I ended the day having removed half of the lead. But even though I experienced hyperstalls (normally indicating too much noseweight, or excessive elevator throws) I found that I had a still harder time controlling the speed of the plane. It flew like a bat out of Hell and if I tried to slow down it just stalled on me immediately. And it really was not my intention to use the R-2 this way. I was in distress! At home that evening I balanced the plane and found that I had moved CG 4 mm back from the 26,47% B&B was flying their R-2.

The following day I went to hi-start my R-2 for the first time. It was going well but I still could not slow down to an enjoyable pace. So I invited Peter Wick, the designer of the airfoil that I use, to join me on my next outing with the R-2. We had a talk over the phone and he advised me to take the CG forward to where the plane would not exhibit any

nasty habits, and then take it back just a smidge from there. This was incredibly good advice and worked wonders on the third day of flying. I took the CG forward with another 70g of noselead, and now found my CG to be 4mm forward of B&B's. I'm now fly with my CG at 102 mm from LE. This equals 24,40% of the chord.

A video of the first R-2 hi-start launch and flat field flying session by John Venbjerg can be found at <http://picasaweb.google.com/m.u.enevoldsen/R2#5335984081659992850>

Winch launching my plane shows practically no bending of the wing. This is probably due in part to two major revisions from previous builds of the R-2. I put in the 22mm CF tube in the center section. Additionally, I put in dual tow-hooks in the wings, so I don't get the big flex in the midsection of the wing. These things actually work wonders. Not even a hard winch-launch with an ultimate zoom has proven otherwise. Hi-starting and winch launching the plane is uneventful, with no nasty habits. Furthermore, implementation of dual tow hooks at the underside of the wings puts no big rotation on the plane at the moment of release, as it would if one single hook were located under the fuse. During the first few meters the model just bungee accelerates into a normal climb. I have only tested the most forward location of the tow-hooks just above the CG. In the future I will try to put the tow-hooks further aft to see how much additional height I can gain this way. I now have about twelve launches off the winch, and the rings that I engage the tow-hooks with need to be extremely strong. I have used rings like the ones on a key ring. These rings are simply torn open and thrown away as the plane shoots skyward. In the future more rigid materials are needed for this application. An added plus with the very stiff fiberglass fuselage is that I can hold the plane by the tail just aft of the wing. This is a much nicer grip than on any other plane I have hi-started. Like bungee starting slope wings.

Rationale – A happy ending

I started out with my CG too far back – so I moved it aft! And learned the hard way… Later on I learned that I had flown my R-2 at a stability number of only 0.71%! Usually plank wings are not flown under 3 to 5%. I ended up the first day with a plane much too fast and uncontrollable, and way off the design criteria. I got the CG back to a controllable point (2.7% static margin). From here I moved it forward and now have a very harmonious and enjoyable flying plank at 4.0% static margin and the CG located at 102 mm from LE.

With the new CG I now feel confident about flying and landing the plane. It can be slowed down to running speed and landed on a spot. My Crow brake has been adjusted to suit the plank, and no adverse pitch input is felt as it is applied. This finally put me at the sticks of a wonderful flying plank, that I've started hunting thermals with. On my first flight with the new CG I was coming in to land and on final at 10 m altitude, I found a thermal that extended this flight further by about a minute – steadily circling at this altitude. I knew I was close to a good CG.

So all in all I am ecstatic with the plane. Like the rest of you, now I just wait for the right thermals to come along.

"Hence in this happy way endeth the story from the country of Hamlet."

Happy flying!

Theory

Output from the program "Nurflugel" for flying wings by Frank Ranis which I used to get the CG right after first flight:

- Name des Flügels = R-2_Elliptical.flg
- Wing area - Flächeninhalt (F) = 0,976501 m^2
- Wingloading - Flächenbelastung = 1,689705 kg / m^2 = 16,897052 g/dm^2
- Aspect ratio - Streckung = 6,6068
- Mean wing chord - Bezugsflügeltiefe (lu) = 0,4023 m
- Rücklage des Druckpunktes = Schwerpunkt (XD) = 0,1018 m
- Stability factor - Stabilitätsmaß (SM) = 4%
- Design speed - Geschwindigkeit für den Stationären Flug (v_einsatz) = 6,46099 m/s

Geschätzte Flügelpolare:
- Glideno - Geschätzte Gleitzahl (E_ geschätzt) = 24,30655
- Minimal Sink - Geschätzte Sinkgeschwindigkeit (vs_geschätzt) = 0,269 m/s
- Glide angle - Geschätzter Gleitwinkel = 2.36 degrees/Grad

Sources & credits:

On the 'Wing... R-2 articles 151-154: <http://www.glide.net.au/on-the-wing3/index.html> This was my basic inspiration to build the R-2. Thanks, guys, for your invaluable help and untiring effort to answer my many questions along the way.

Nurflugel program by Frank Ranis: <http://www.zanonia.de/ranis.php>

Troubleshooting the hyperstall performance issues: <http://www.rccanada.ca/rccforum/showthread.php?s=0d61ee2955a7fcd027bac4c043f0c04c&t=56867>

Optimum trimming of final CG: <http://www.rcsoaringdigest.com/Trimming.html>

Peter Wick who helped with initial airfoil design and troubleshooting the stall characteristics.

Mikael Christensen for extensive coaching in building, and tips and tricks for the molding.

Rainer Moosmayer for CNC milling both the ribs and the fuselage plugs.

SLOPING IN THE TEXAS HILL COUNTRY

Lew Adams of the Austin Silent Flyers captured this image of Rick Diaz flying a Combatwing XL just above the climber's area known as "Stranger than Friction" on Enchanted Rock near Fredericksburg Texas. E-Rock as it's called by ASF slopers, is an exfoliation dome rising 400 feet above the ground and is composed of pink granite. EPP ships are the norm here as there are little or no landing sites that are softer than the smooth rock. ASF pilots fly here with the blessing of the Texas State Parks Dept. and follow all safety precautions, do not fly around visitors, retrieve any and all lost aircraft, and leave nothing behind (not even a discarded piece of tape).

Panasonic DMC-FX07
ISO 100, 1/400 sec., f8.0, 28mm

MEDICINE MAN

A review by
Bill Kuhlman
with Anna Pylman

Ryan Grosswiler
RealKits

It's not often that we run into fellow enthusiasts who still build the RC sailplanes they fly. *RC Soaring Digest* readers and RC Soaring Exchange members know of Harley Michaelis and his Genie line, and there's the MM Glider Tech Marauder and others, but the vast majority of RC soaring enthusiasts are purchasing ARFs.

Ryan Grosswiler is a modeler who still builds his own models - and wood models at that - and who suddenly realized that there is an entire generation of modelers who have grown up without ever having built a model.

A few years ago, Ryan was approached by an editor of MAKE magazine <http://makezine.com/> asking for an article to be included in a future issue devoted to "lost knowledge." The editor was looking for an article describing how to build a model airplane, and Ryan went about trying to find an existing model airplane kit that would be suitable. Having no luck, Ryan went about designing an RC glider that could be built and flown by a neophyte, yet be attractive enough to interest the experienced builder and flyer. The result of this project is the Medicine Man.

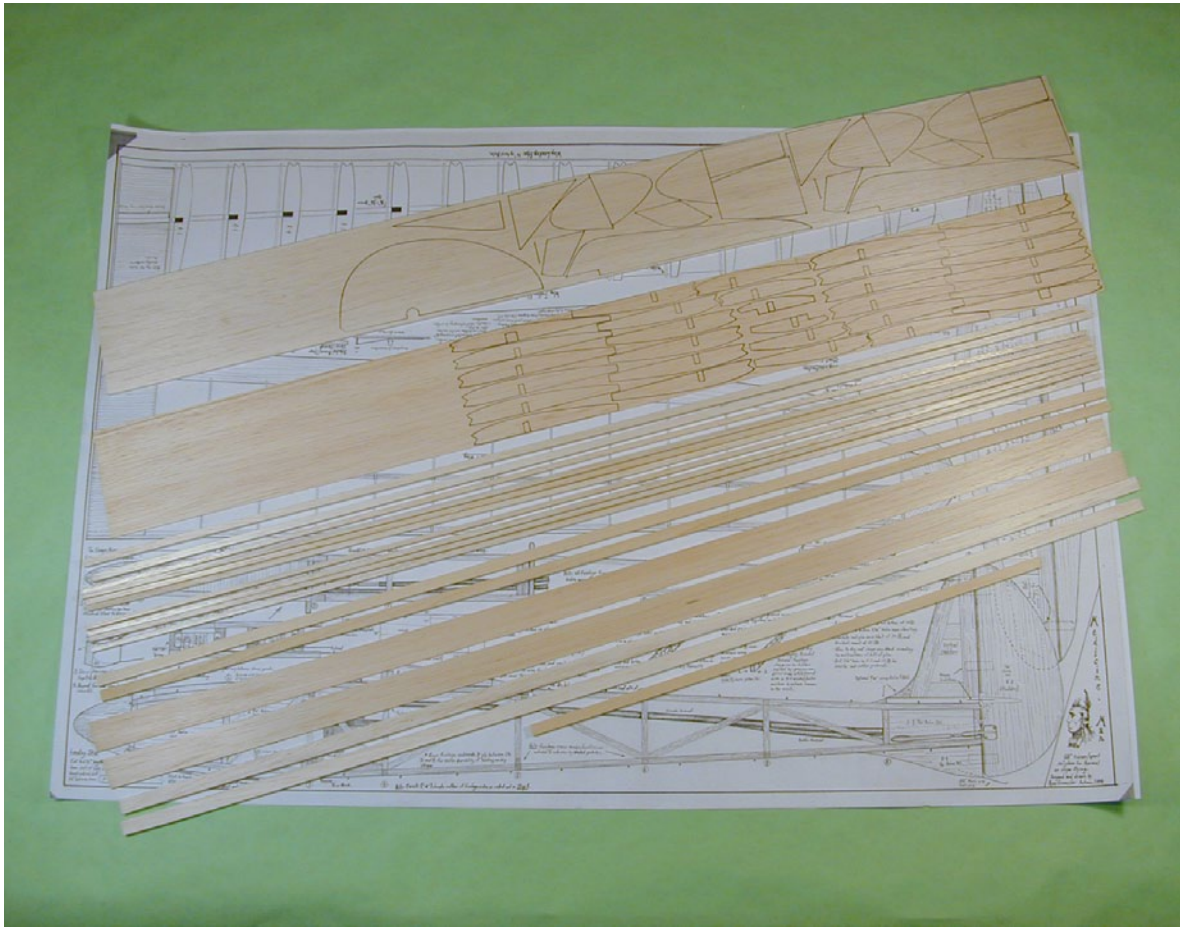
Ben Wilson of LASS (Louisville Area Soaring Society) made us aware of the Medicine Man in early March of this year. Ben has a subscription to MAKE magazine, saw Ryan Grosswiler's design in Volume 17, and decided the appearance of an all wood RC glider construction article in the magazine was noteworthy.

Ryan has taken the Medicine Man concept one step further and is now producing inexpensive kits, as noted in the MAKE magazine article. <http://realkits.com/> There are no die-cut parts; balsa wood sheets have the various parts printed on them, to be cut out by the the builder with a sharp #11 blade and a razor saw.

We contacted Ryan after reading the article and inquired about the possibility of a kit review in a future issue of *RC Soaring Digest*. Ryan, just back from California, immediately mailed out a kit to us and it arrived in the mail a couple days later.

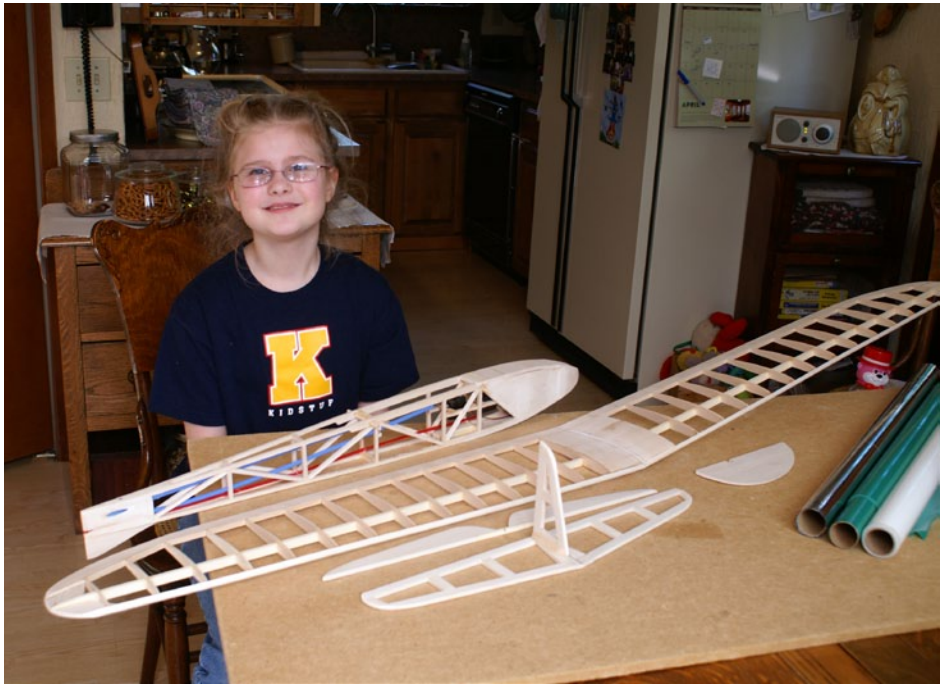
The Medicine Man box is 4"x4" and just over 36" long and holds all of the parts, the full size plans, and two pages of notes for the newbie. Upon arrival, there was no damage to the box or the contents.

Having built balsa model models since around 1950, the contents of the Medicine Man kit, particularly the printwood, brought back quite a few pleasant memories. Anyone owning one of the larger Comet kits probably knows the feeling.



Printwood sheets and the various balsa and spruce sticks over the full size Medicine Man plans. What looks like extra material on the ribs sheet is used to strengthen the center section to support the aerodynamic loads at the dihedral break and the rubber bands that hold down the wing. The kit wood is very good, the printed parts are clear, and the resulting structure is both light and strong.

Anna pulls pins from the wing framework after the CA cures.



The completed skeleton awaits covering.

Nearly all of the directions needed for building the Medicine Man are on the plans, a feature used by kit makers in the 1920-1940 era. Also included with the kit is a page of notes concerning some building techniques and pointers on flying.

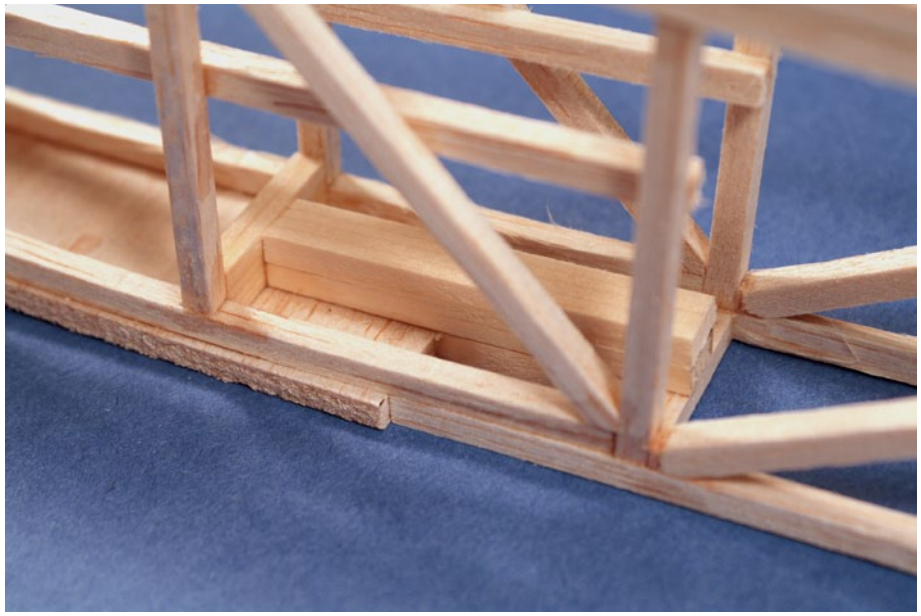
I called my granddaughter, Anna, and asked her if she'd like to build the Medicine Man with me. After some thought and a look at a photo she agreed.

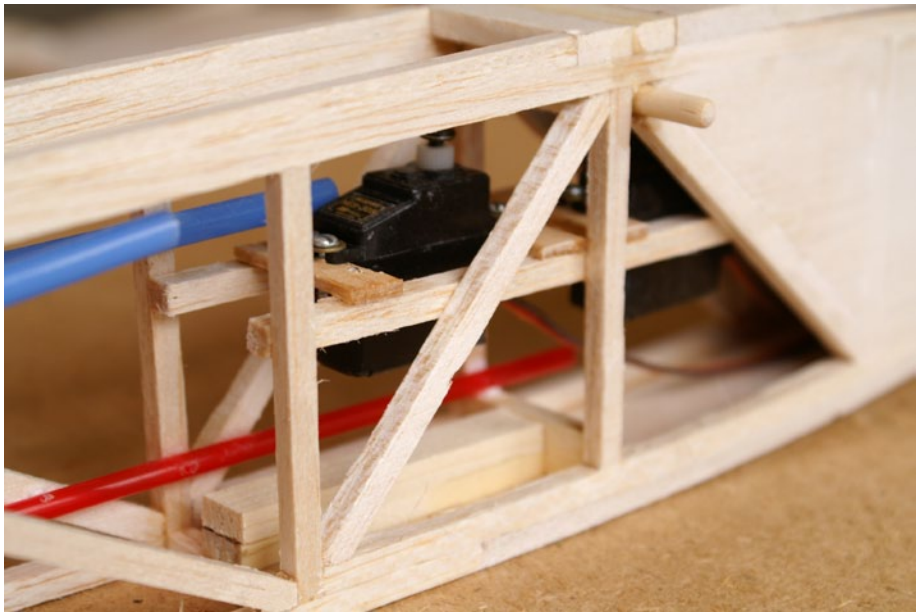
As this kit relies on printwood, the first task is to cut out all of the parts from the balsa sheets. This is easily accomplished with a #11 blade and some patience while working over a cutting surface.

The rudder and elevator halves are of balsa sheet, and quite a bit of sanding is required to get a nice taper into the profile. We did not use the included hinge material, instead simply angling the leading edge of these pieces and using the "Monokote hinge" technique.

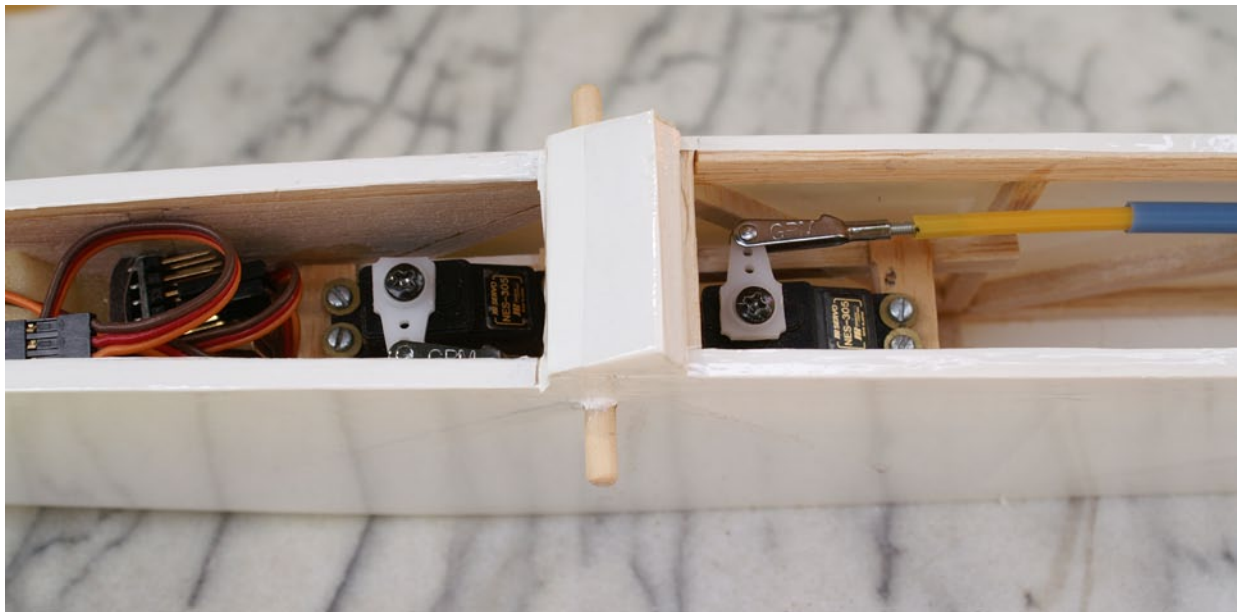
One of the interesting features of the Medicine Man wing is that the trailing edge stock must be notched by the builder to accept the ribs. We used a rigid PermaGrit sanding plate to do this, using the edge of the plate to file into the stock.

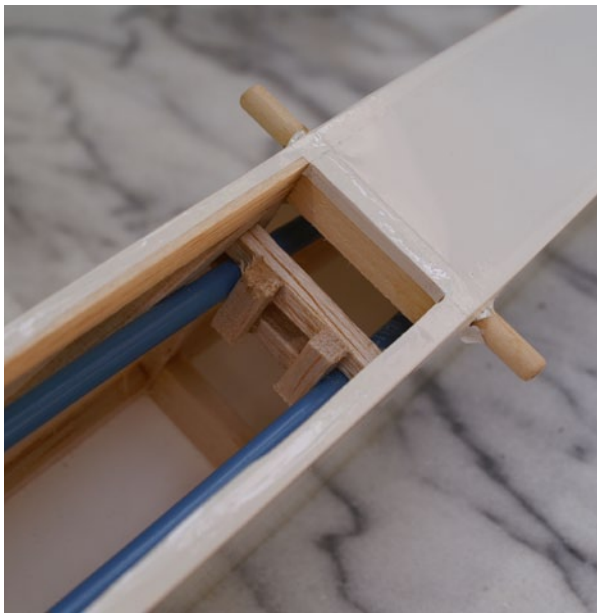
Two very minor "problems" came up during wing construction. First, the slot for the spar is not in quite the right spot on the printwood for Ribs 1 and 2. The workaround for this is to cut out the rib

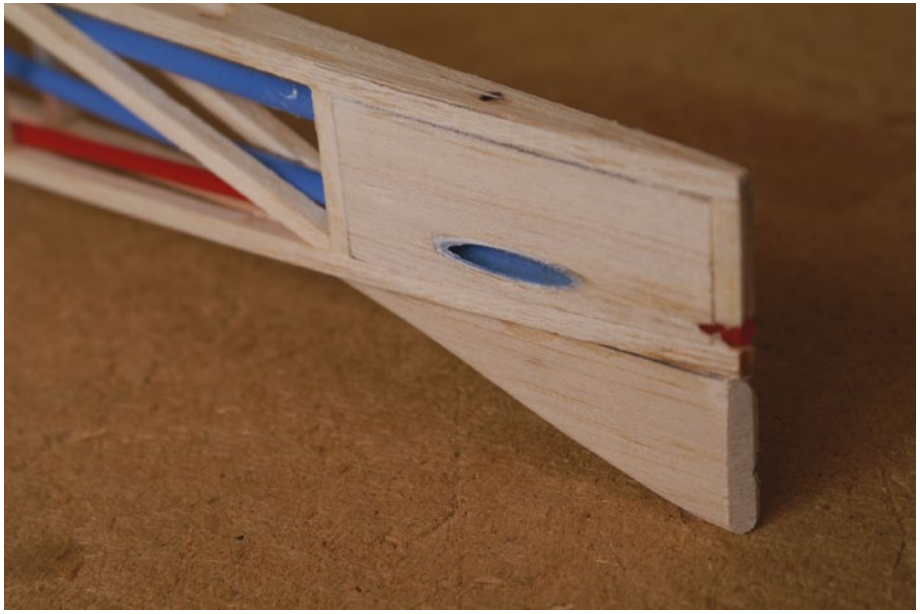


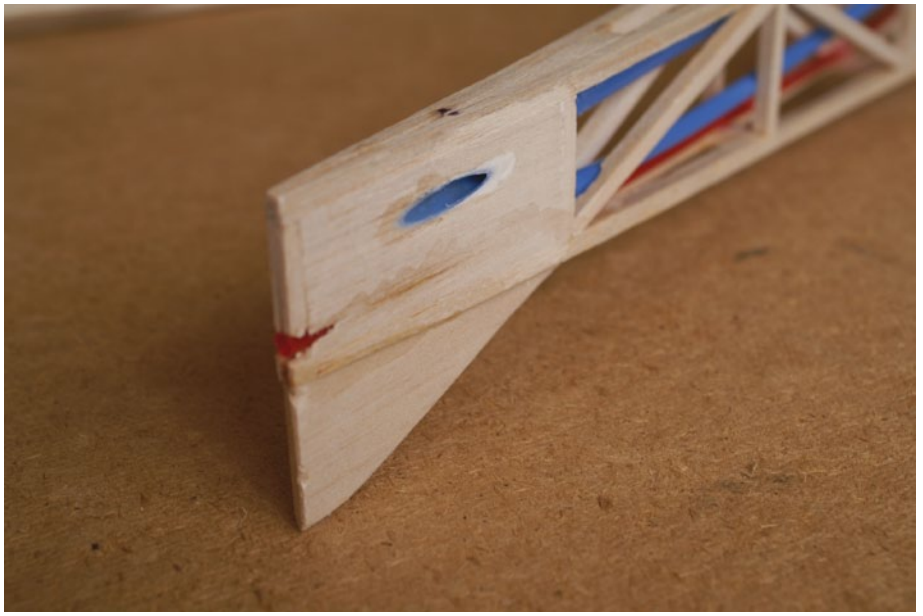


Upper left: The spruce tow hook block was extended back to the next cross-piece. Upper right: The two servos are mounted on rails attached to the fuselage sides, red straw antenna tube is at the bottom. Lower right: Pushrods are supported by small balsa stick pieces. Below: The servos are mounted close to the fuselage side so the arm reaches across to near the opposite side.









The rudder pushrod exits the left side of the fuselage, the elevator pushrod exits on the right. Notice the red "soda straw" antenna tube at the bottom of the fuselage. The antenna is threaded through this tube and hangs free from the rudder hinge line.

outline and cut the slot after the spar is in place and held by the other ribs. The second difficulty came when it was time to insert the dihedral brace. Because the spars sweep slightly forward, the back of the dihedral brace needs to be trimmed for a good fit.

The fuselage sides use a Warren Truss type of construction with balsa sheet fill near the nose to resist landing forces and at the tail to support the rudder and elevator pushrods. Construction went fairly fast, and a bit of sanding smoothed the outsides for covering.

We mounted the two small JR servos so that one side was as close as possible to the fuselage, allowing the arm to go across the fuselage to near the opposite side. At the rear, the rudder pushrod is mounted lower and on the left, the elevator higher and on the right. The pushrods attach to the servo arms on the side opposite their exit side. This set-up prevents the pushrods from interfering with each other and the various fuselage parts. At the servo end, the pushrod housings are held in place by short balsa sticks and the fuselage side structure.

Lightweight "soda straws" were connected together to form an antenna tube which starts under the forward (elevator) servo and exits the fuselage rear so the antenna comes out of the rudder hinge.

The position of the tow hook is very far forward relative to the CG. Our experience told us that the towhook would eventually have to be moved rearward to get a steep climb, so we extended the spruce tow hook block rearward to the next cross-piece.

We also added a small balsa block to the fuselage directly in front of the wing leading edge to better seal that area.

The brass skid under the nose is a nice touch. Rather than using wrapped masking tape as spacers, we rummaged through our small parts bin and found

Ready to go flying!

some old rubber servo grommets. Glued in with thin CA, they do look good.

The RealKits web site and the Medicine Man labeling note the flying weight to be between 13 and 14 ounces. Ours came out at exactly 13.5 ounces after putting 1.5 ounces (42g) of lead in the nose to get the CG located, giving a wing loading of 5.5 oz/ ft^2

Test flying was postponed for several weeks while we waited for Anna's school schedule, good weather, and other life activities to coincide, but we were finally able to head out to the flying field with the Medicine Man.

A few hand tosses from the top of a small gently sloped hill went extremely well, and it looked like the CG was right on, exactly where the plans had shown. The glide angle seemed to be fairly flat, and the glider responded to controls with predictable results. Anna and I set up the hi-start so we could have some altitude before checking out more dynamic maneuvering.

The hi-start we used is an old one, but is still more than strong enough for the Medicine Man. It was immediately obvious that hi-start tension was going to have to be very limited.

The first launch was a good one, but the wing flex was quite severe - actually, a bit frightening. But as the wing survived that first launch, further launches were made with the same tension and all went well.

With the additional altitude provided by the hi-start launch there was an increase in flight time and the opportunity to go looking for lift. The Medicine Man is rather buoyant in flight, as would be expected from a glider weighing less than one pound, but had no problems penetrating into the slight breeze. Lift was very light during our time on the field and the Medicine Man easily turned inside the upward moving air and took advantage of the very slight slope lift present on one side of the hill where the hi-start stake was placed.

Papa asked me if I wanted to help build the Medicine Man and I thought about it for a few days before saying "Yes." I wanted to build the Medicine Man because I thought it looked like fun. I had never built a radio controlled airplane before, but I would have Papa to help me.

Papa cut out all of the parts before I started building. It looked like it would be hard to put together, but it turned out to be easy and we built it in about three days.

The CA glue looked scary, but I learned that it's easy to use if you don't squeeze the bottle. I just let the glue come out of the tube by itself.

I learned how to use an X-Acto knife, a sanding block and the razor saw. I also learned how to pin down wood parts without putting the pins through the wood and how to use small pliers to pull pins out of the building board.

We covered the Medicine Man with Monokote pearl green for the wings and tail, white for the fuselage, and chrome for a band around the right wing.

We took the Medicine Man to the EFLAPS (Environmentally Friendly Little AirPlane Society) field in Gig Harbor for flying. The EFLAPS field is beautiful, with a small lake in one corner and two small hills. There were two horses out on the field while we were there.

We used one hill for the first few flights, then Papa set up the hi-start. The Medicine Man always flew gracefully.

I took a lot of pictures of the Medicine Man at the EFLAPS field.

We saw a Hawk while we were leaving the field. He was following a swallow and I took a picture of him. I hope you like it.

— Anna Pylman, age 9, AMA 924698

We utilized both the rudder and elevator Rate switches on the transmitter, finally settling on 1.5" each way (about 30 degrees) on the rudder and 3/8" up and down on the elevator.

The CG, located per plans, was right on.

Turns seemed somewhat flatter than we expected, the result of the relatively shallow dihedral angle. This makes thermal turns a lot easier, at least for us. One thing we noticed is that the amount of required up elevator is reduced by the flatter turn, and it's possible to be heavier on the controls than needed. Too much up elevator will cause the inner wing to drop, but the reaction occurs in a predictable manner and the Medicine Man never entered a spin.

We never did move the tow hook rearward, instead keeping it where the plans said it should go. With a lighter hi-start (and less stress on the wings) we might consider moving the tow hook back a bit, but that would have to be done carefully, if at all.

Despite its 60" span, we had no trouble at all keeping the Medicine Man in sight and properly oriented.

All of our flights took place over tall grass, so we didn't get to see the brass nose skid in operation.

We packed up the Medicine Man and drove back home after a couple of hours of flying.

There's nothing like a series of successful test flights on a brand new airplane you've built yourself to provide warm fuzzy feelings and the desire to do some more building and flying.

The Medicine Man kit is inexpensive (under $25), goes together fairly rapidly once the printwood parts are cut out, flies well, and is compact enough to haul along in the car and fly in smaller areas.

We highly recommend the Medicine Man for those who want to tackle a rewarding RC sailplane construction project.

For those of you who like the looks of the Medicine Man but want a larger airframe, Ryan has 78" (2m) and 100" versions in the planning stages.

Medicine Man

Span: 60"
Wing area: about 350 in^2
Wing airfoil: Modified Selig 3016 at root, progressing to 15% Clark Y at tip
Flying weight: 13-14 ounces (5.5 oz/ft^2)
Functions: Rudder, Elevator
Suggested radio: 2-channel mini or micro equipment (FMA Direct M5 receiver, two JR NES-305 micro servos, JR 270 mAh "flat" battery pack)

Kit price: US$23.95
Packing and shipping: US$8.95

MAKE magazine <makezine.com>
RealKits web site: <www.realkits.com>

Mississippi Valley Soaring Association and the SkyTraceGPS

A few of the guys in the MVSA are using the SkyTraceGPS. The system collects data and produces very impressive presentations of the information.

"The SkyTraceGPS is an interesting device to track where you think you are and where you actually are, not only for depth perception but also to determine what geographical features generate lift. I'll be especially interested to see what it can reveal about wave lift on windy days. Flying long enough may generate a track log that defines the boundaries of wave lift and possibly give clues as to what causes it."

— Chris Lee

"This was a 30 minute flight Saturday after the contest. Wasn't too worried about the time and kept going back and forth checking l/ds on different camber/ trim settings. As you can see by the shadow of the red line, only briefly the plane was off the sod farm boundaries."

— Glauco Lago

Magellan Technologies
http://www.magtechinc.net/SkyTraceGPS.htm