Radio Controlled Soaring Digest

December 2012 Vol. 29, No. 12

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Front cover: Benjamin Clamaron's 5 meter Nimbus 4D doing a fly-by at Le Col du Glandon in the French Alps. Photo by Pierre Rondel.
Canon EOS 10D, ISO 400, 1/1500 sec., f8.0, 135 mm

Back cover: Mass launch of the Competitor Class at the Seattle Area Soaring Society Radian One Design Contest held at Camp Korey, Carnation Washington, June 2, 2012.
Photo by Jeremy Fursman.
Canon Powershot SD4000 IS, ISO 125, 1/1000 sec., f2.8

R/C Soaring Digest

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

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In the Air

Vincenzo Pedrielli introduced Zögling 436 to RCSD readers in February 2010; included were a 3-view drawing and archive photos which provided a point of reference for the original. At that time the restoration of this full size primary glider was at the mid-point of a multi-year process. In early November of this year, Vincenzo wrote to let us know that the restoration process was complete, and we were able to entice him into taking "walk-around" photos for those enticed to create a scaled replica.

Speaking of walk-arounds, this issue features a number of photos of the Niedrauer NG-1, a one-of-a-kind sailplane based on the Briegleb BG-12. Tony Condon, the current owner, just completed a declared 300 km triangle in it <http://soaringcafe.com/2011/06/diamond-goal/> and seems to be fairly ecstatic over its performance. The NG-1 should make a good large scale aerotow project.

Marc Pujol received quite a bit of positive feedback about his Genoma² F5J machine and we've made coordinates for the four airfoils available as digital files on the *RCSD* web site. The coordinates can also be easily copied as text files from this PDF using the usual "copy and paste" routines.

An article by Pete Carr in a late-1992 edition of the National Soaring Society's *Sailplane* and a recent column in *Flying Models* magazine had us asking Pete to write an update based on contemporary technologies. See page 69 for the result.

And Chris "Nodd" Evans' original thread on the rcaerotowing.com web site has got us thinking about converting a Great Planes ElectriCub in similar fashion.

Time to build another sailplane!

A restoration project

Zögling 436

Vincenzo Pedrielli, vincenzopedrielli@gmail.com
Photos by Roberto Martignoni

The Zögling number 435, with mark I-TRAM was built in 1951 by a group of model builders of Rovereto (GAR: Gruppo Aeromodellistico di Rovereto) and flew in Trento in the gliding school at the airfield of Gardolo, where the GAR was carrying out its flying activities together with the other Zögling 428 I-GVTA and 433 I-GRILL.

From Trento it moved to Padova and in 1970 it was sold to AVAL in Varese, today renamed .ACAO. We do not know exactly when and why it ended up to the Museo della Scienza e della Tecnologia in Milano, where it was stored for over 30 years in dreadful conditions under a porch outdoors. For space reasons the Museum was going to get rid of it, when a consultant suggested to find some volunteers who could have restored it at no cost. Said and done!

The wrecked wings and...

... the wrecked fuselage.

Roberto, Lino and Vincenzo, the restoration team.

A group of five person was formed with Lino Del Pio as restoration project leader and in January 2008 we started working at the Centro Studil di Volo a Vela Alpino in Calcinate del Pesce, Varese.

No one single rib was saved and the wings were completely destroyed. The skid of the central support was heavily damaged. Only the tail-plane was in relatively good condition. The project lasted four years for about a thousand working hours. Last October finally the Zögling I-TRA was taken out of the workshop to take pictures.

Now that the restoration is over we hope to see the Zögling I-TRAM displayed at an important museum in Milano.

For additional information on Zögling 435, including a 3-view, archive images, and details of the restoration process, see *RCSD* February 2010.

Ready to be covered.


435


GAR


GAR
435

Piper Cub Sailplane Conversion

Chris “Nodd” Evans, <http://www.scipie.com>

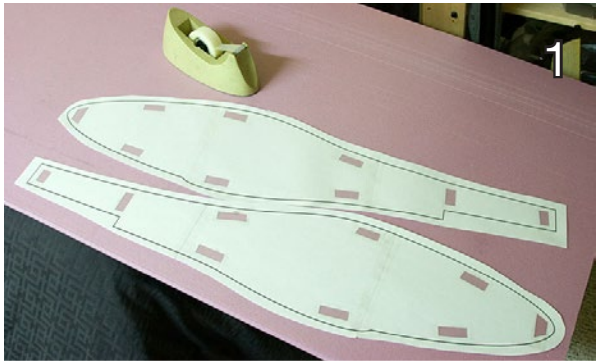
Compiled and edited from the thread at <http://www.rcaerotowing.com/forum/showthread.php?1781-Piper-Cub-Sailplane>

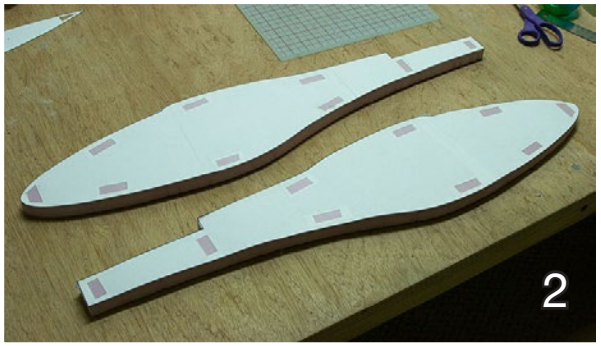
I wrecked my foamy Cub the other day... So I got to thinking what can I do with these? Then it hit me, what would it look like if the Piper Cub was a glider...

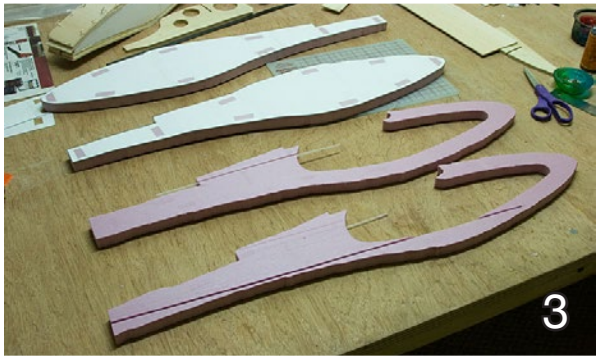
So although not an entirely serious project, I thought it might be fun to build a little glider out of my poor old Cub.

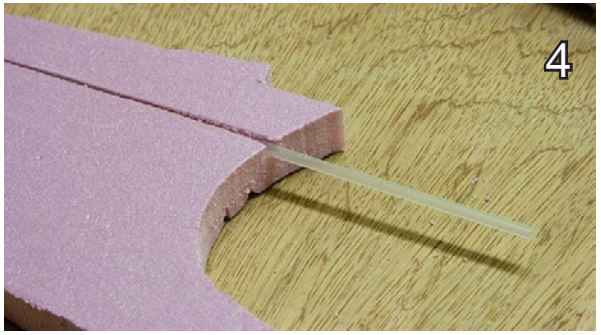
Note this is not a Piper TG-8 (a glider loosely based on the Cub used mostly as a trainer). Instead my project is a fantasy-scale, kinda what-if sorta thing. Again this is not by any means a serious project, just having a little fun.

I’m thinking a tow hook for high-start/winching. An aerotow release for towing. Possibly add a center









section to the wing to increase her span. Maybe add flaps. Primary construction will be foam which is new to me (usually work with balsa-wood).

Construction Begins

(1) I printed up some paper templates, cut a few holes here and there so I could tape them to some Home Depot foam board...

(2) Cut the fuselage sides out using my scroll saw...

(3) I then cut another two fuselage pieces, these with interior space for the radio gear. These I only rough cut, will sand them smooth once the fuselage is assembled...

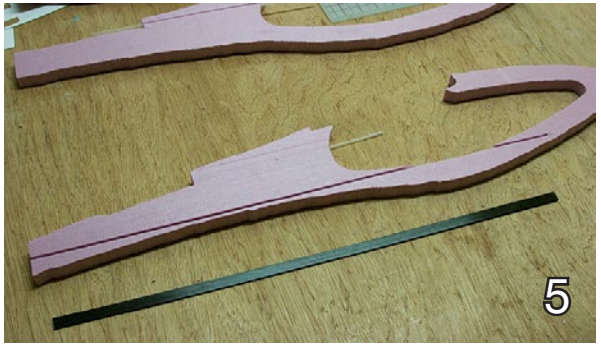
(4) Cut slots for the rudder and elevator push-rods...

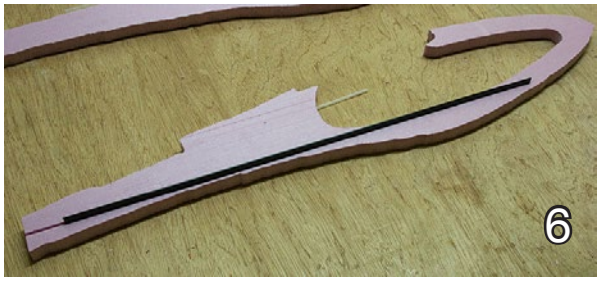
(5) I also cut a slot for a carbon fiber bar that'll run the length of the tail...

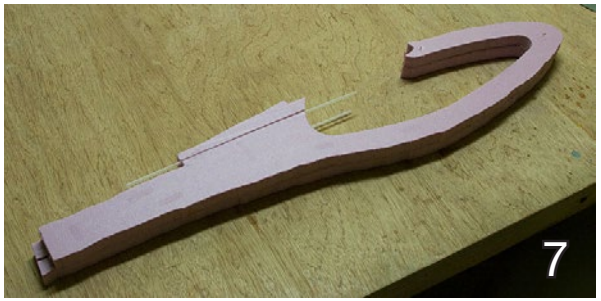
(6) Test fitting the carbon fiber bar...

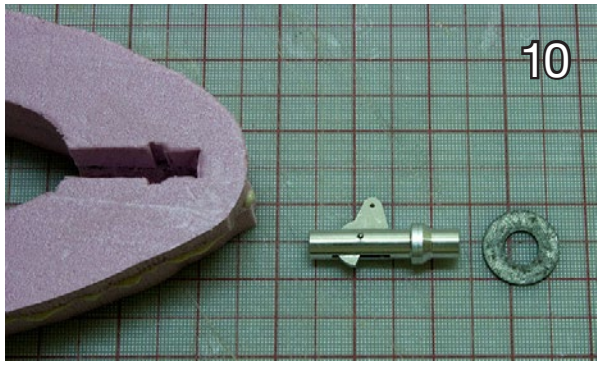
(7) Glued the two interior halves together with the carbon fiber sandwiched inside...

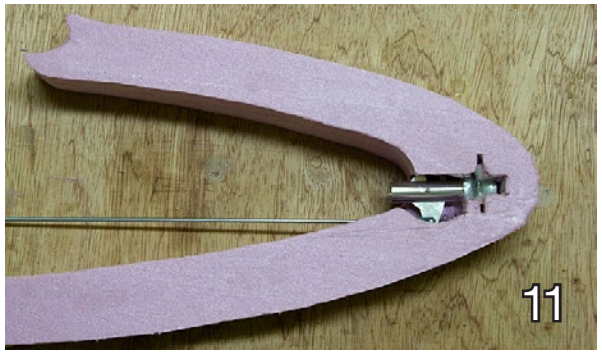
(8) Added some weight, time to take a break and let the glue dry...











Aerotow Release

This'll be my third aerotow sailplane. My first has the release mounted way up under the nose, the other centered in the nose. I like the way the glider rides nice and high above the tow-plane using the under nose option but you have to flip the glider over on its back to insert the tow-loop. Whereas my other glider, with the release mounted in the nose, has much easier access.

(9) For that reason alone I prefer a nose mounted release...

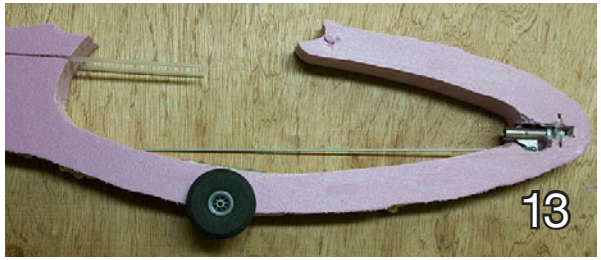
(10) I'm used to mounting these in fiberglass or balsa, this is the first foam instillation I've attempted. Given the softness of the material I opted to place a washer in front of the release to help distribute the load some...

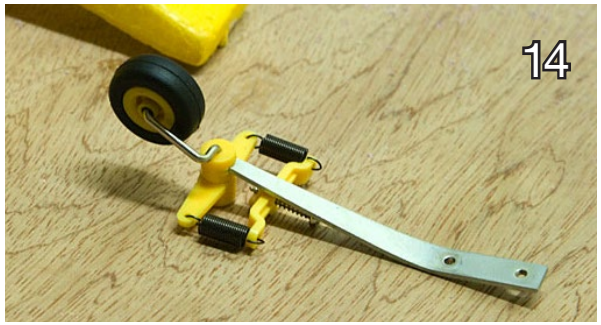
(11) I should probably have installed this before gluing the foam together. That would have reduced the amount of surgery required. No biggy though, once I add the fuselage sides all this ugliness will be buried inside...

I'll likely add reinforcing either side of the release before I add the fuselage sides. Fingers crossed I never need to service the release as it'll be a nightmare to get at later on.

Tundra Tires

As any fan of the Piper Cub knows, big fat tires for off field operation are where its at. I'd like to include a wheel,



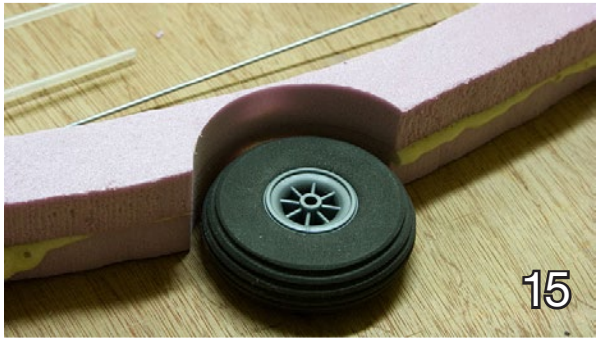


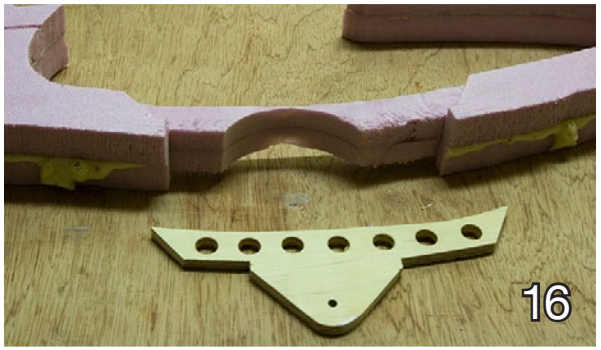
especially if I'm going to aerotow this puppy. (Thanks for the idea there Josh and Gunny). Ideally I'd like a BIG honking wheel in there but I've run into a problem. The carbon fiber bar I ran down the inside of the fuselage is in the way.

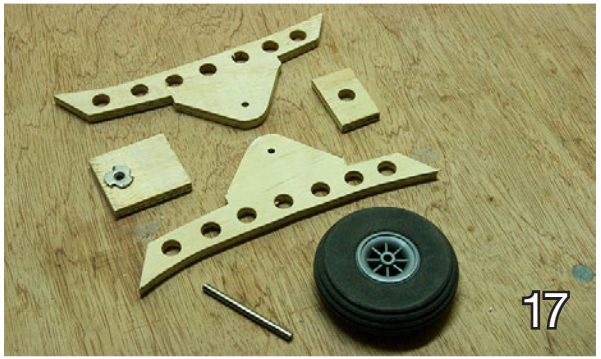
(12) Here's a big three inch wheel where I'd like to put it...

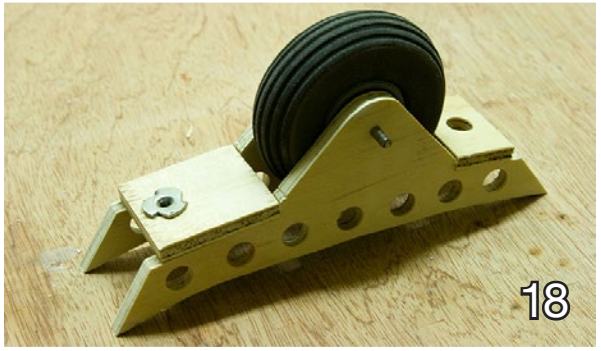
(13) That's not going to work though, the CF bar is in the way. This dinky two inch wheel fits though... I have a couple of ideas how to get a big wheel in there without compromising my carbon fiber keel.

(14) While we're on the subject of wheels, I suppose there's no reason why I shouldn't reuse the nifty scale tailwheel. I've never had a glider with steerable gear, fun fun...









The Wheel

Okay well after sleeping on it I believe I have a solution for mounting a “tundra-sized” wheel in there. Best of all it doesn’t involve me cutting into my carbon fiber reinforcing.

(15) First thing was to carve out a wheel-well...

(16) So here’s what I came up with...

(17) I made a wheel “cradle” from 1/4" plywood...

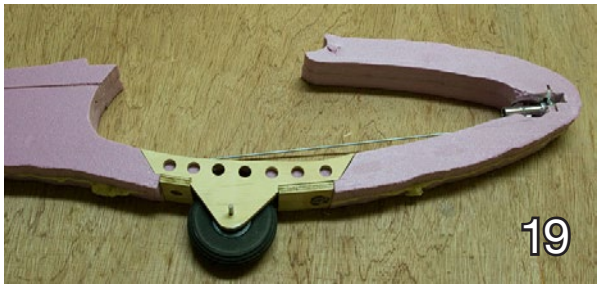
(18) The blind-nut on the left will be where the tow-hook for winching will be screwed into (it’ll be on the other side of the wood for final assembly)...

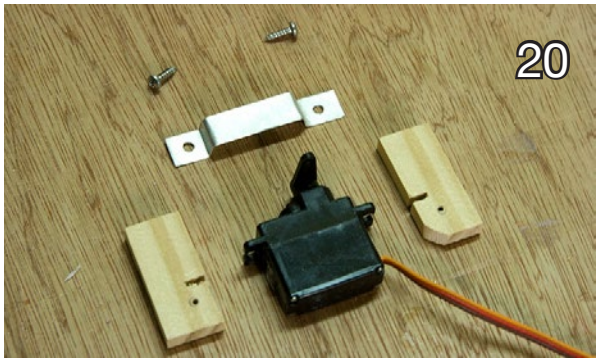
(19) Test fitting everything... Well that looks plenty strong to me. It’ll be even more so once the fuselage sides are glued in place. The winch tow-hook position is a tad forwards of ideal but I figure she should tow well enough.

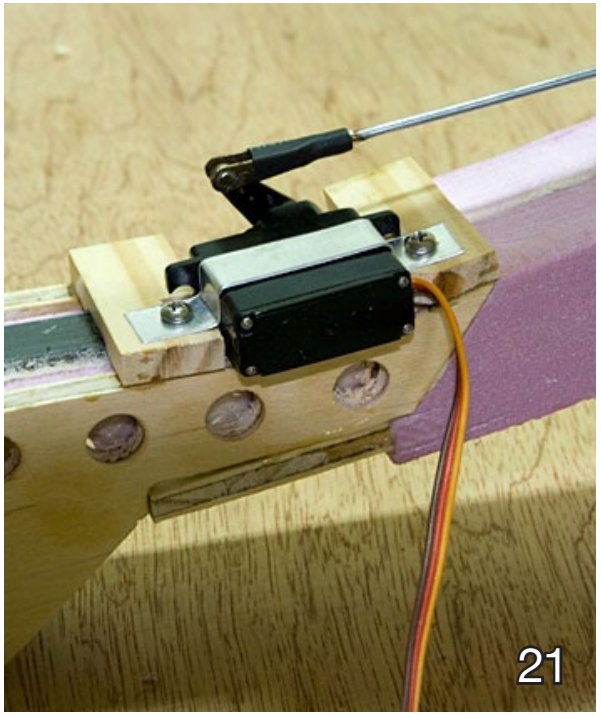
Guts-n-stuff

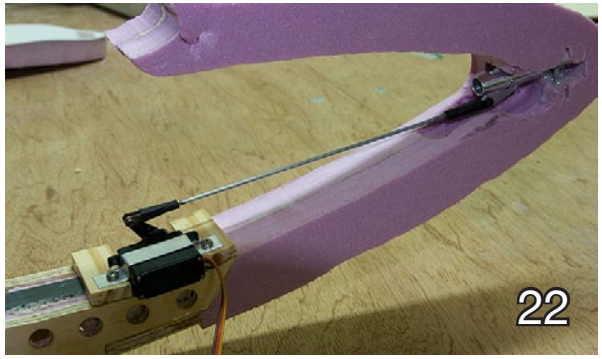
(20) I figured now was a good time to get the aerotow mechanism hooked up while I still have easy access. I made some mounting hardware for the servo...

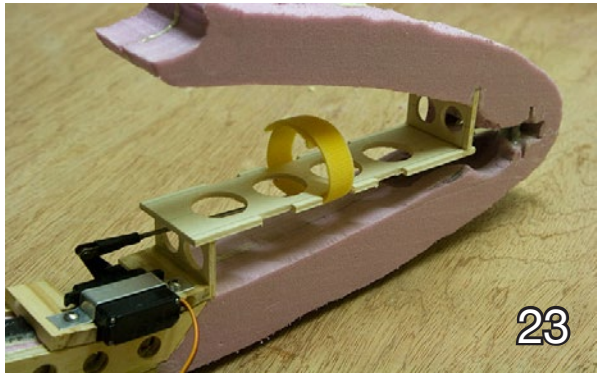
(21) The aerotow servo is mounted slightly off center so that the control arm is somewhat centered. The butt of the servo will protrude out into the right side a tad but it should be plenty thick enough to accommodate it...











(22) Hooked up, adjusted and working like a charm...

(23) I plan to place the battery up in the nose but I don't want it interfering with the aerotow release pushrod. The solution was to add a battery tray.

As I'm not sure where the CG will end up I added several notches for the battery tie-down Velcro...

Time to add the sides

(24) The rest of the radio instillation will be attached to the fuselage sides. So before I can proceed the sides need to go on...

(25) On goes the other side...

(26) Added some weight, will let the Gorilla Glue do its thing for a while...

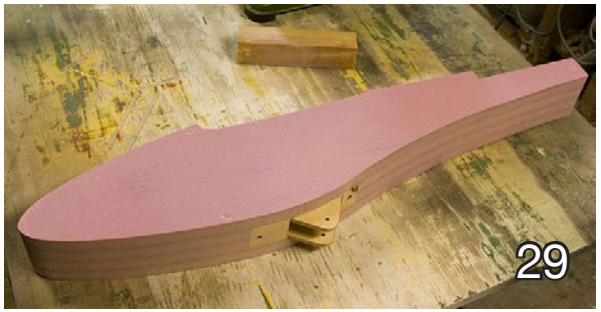
Lightening Holes

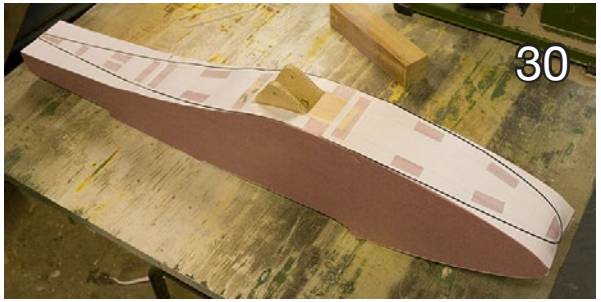
I've been asked how I'm cutting such nice neat lightening holes.

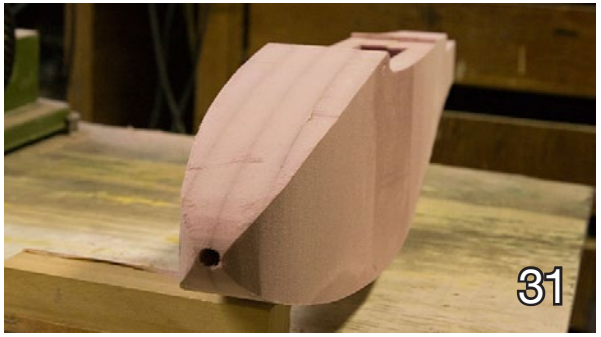
(34) I use a set of forstner bits, they don't chew up the wood like a large diameter drill bit...

(38) Used with a drill-press they produce a nice clean hole (a hand drill will work too).

Be sure to place a piece of scrap wood underneath what you're cutting. That greatly reduces splintering when the bit exits the other side of the wood...







Sanding

(29) Okay time to make this ugly pink box pretty. First I sanded the top and bottom even...

(30) I printed up another set of templates, this time for the top-down profile...

(31) Sanded to the lines...

(32) Then the magic starts, time to round things off...

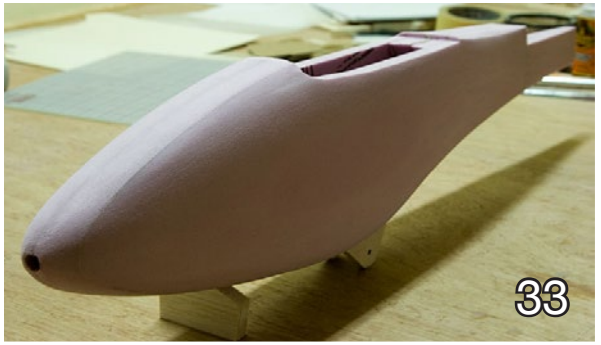
(33) Remove just a little material at a time, eyeball, then repeat...

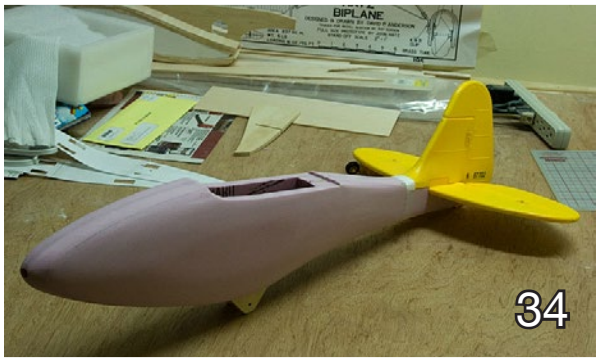
(34) Test fitting the tail feathers...

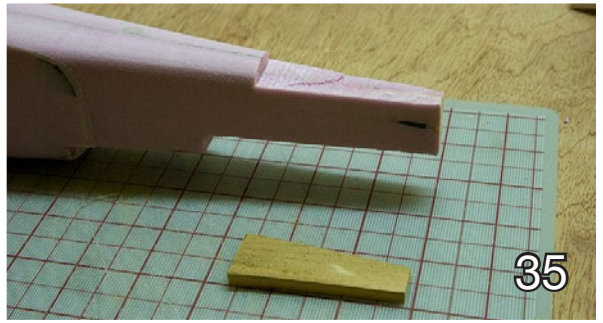
Tail Wheel

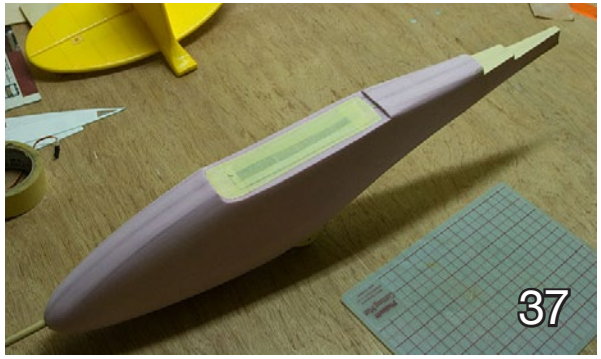
(35) I needed a solid area to mount the tail wheel so I notched out a spot for a piece of scrap hardwood...

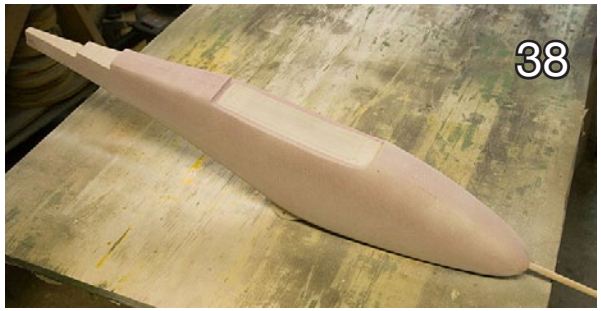
(36) Glued the block in place, shaped the block, then test fit the wheel assembly...

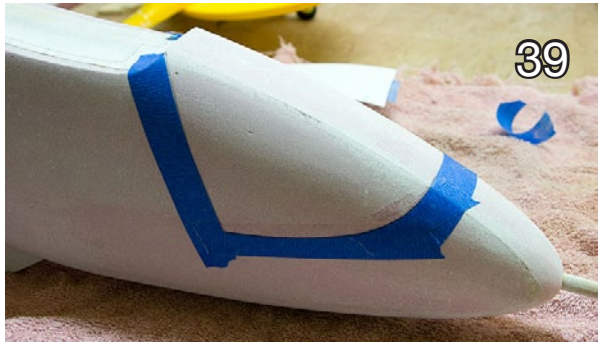


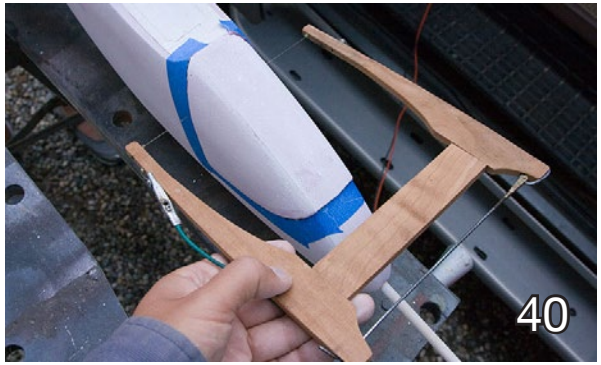












Paint

This being my first attempt at foam construction I'm not sure exactly how best to finish her. I could glass the whole thing.

I've heard about gluing strips of brown paper on there. I've also heard that its possible to use spray paint directly on the foam but there's always that worry the paint will turn all my hard work into a pile of goo.

(37) I said screw it, lets go with paint so I masked off certain areas and prepared to take the plunge...

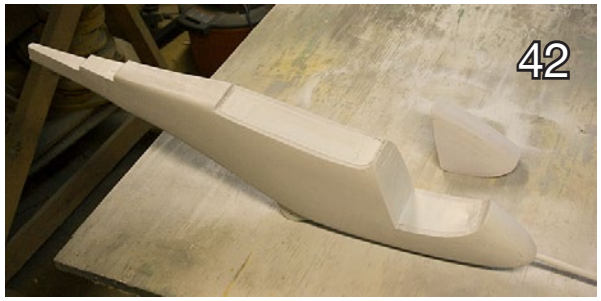
(38) After testing a can of Rustoleum primer on some scrap foam I was confident enough to lay down a first coat...

From what I've read, you can get away with spray painting foam as long as you apply just a dusting at a time. Everything was going great until I ran out of primer. So that's a wrap for today. Pretty pleased with how she's looking.

Are we forgetting something?

I was so eager to get her painted I plum forgot about the battery hatch. It's just as well I ran out of paint yesterday. My plan is to make the front canopy removable giving access to the battery tray.

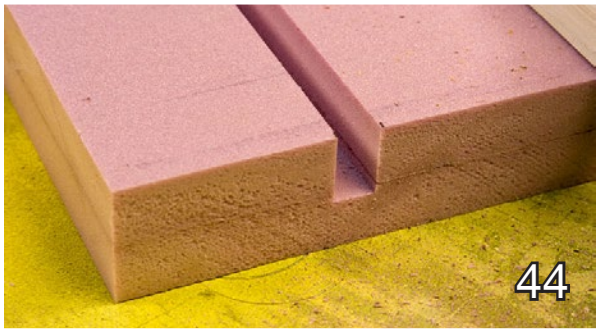
(39) Using masking tape I outlined the hatch...

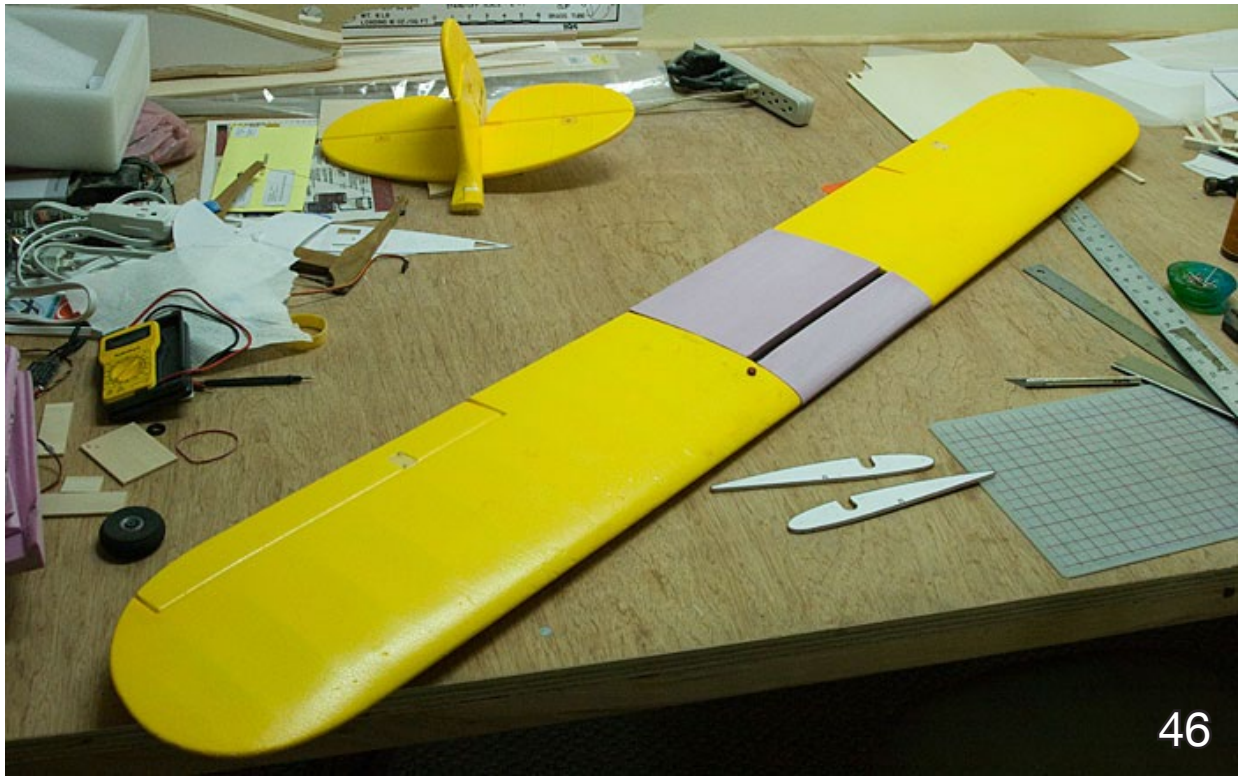


(40) A buddy loaned me a hot-wire foam cutter. Using the tape as a guide I cut the hatch free...

(41) That looks like plenty of access to the battery area...

(42) Now I can get back to painting her... That's enough primer, I'll let that dry overnight.





The Wing

Plan A

Well after my success carving out the fuselage battery hatch I was looking forward to trying the hot-wire gizmo again. I pinned balsa template ribs to both ends of a block of foam...

(43) This was the unfortunate result...

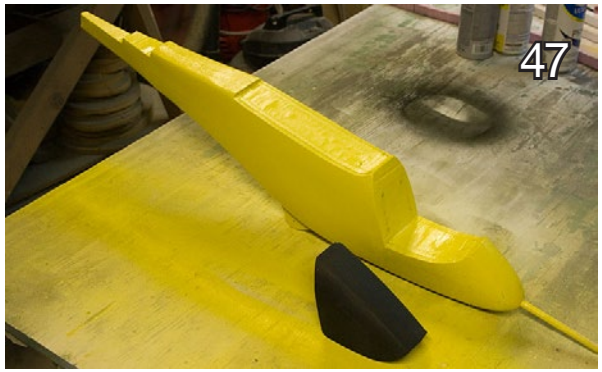
Apparently this isn't as easy as it looks. I'd love to play with this more, definitely want to master this process but in the interest of getting this bird done I switched to...

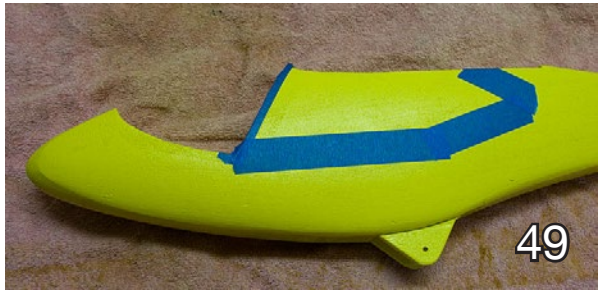
Plan B

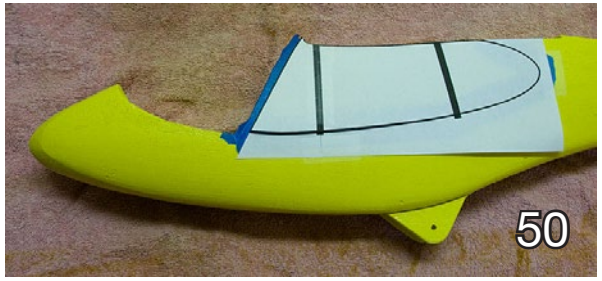
(44) Starting with a new block of foam I broke out the router and cut a slot for the wing-rod... Now /that's/ a nice clean slot, MUCH better...

(45) Then it was back to my trusty belt-sander to shape the airfoil...

(46) So here we are test fitting the sanded center section. Looks pretty good to me...







Yellow and Black

(47) Meanwhile back in my wood-shop/ paint-booth more progress was made...

(48) While the finish is far from perfect its about what I expected having painted directly on foam. Its certainly plenty good for this silly project...

I'm going to let this paint dry overnight then I'll mask out the rest of the windows and the lightning-bolt graphic and lay down a couple of coats of black.

Graphics

(49) The funny thing about spray painting is you spending hours on end masking and then about 30 seconds spraying...

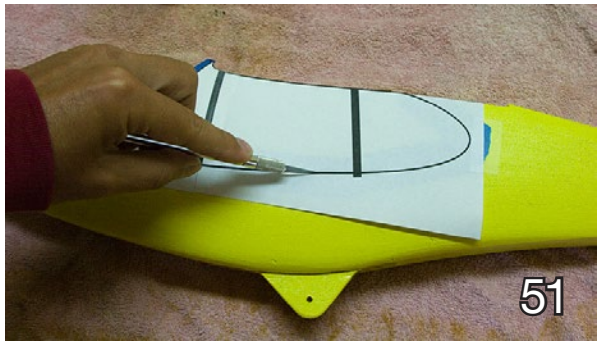
(50) Yet another template, aren't computers great?..

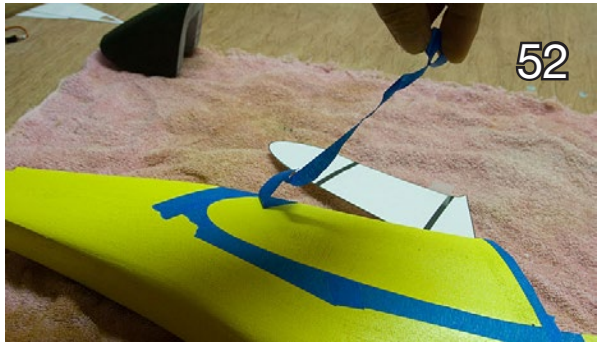
(51) The idea here is to carefully cut through both the template and the masking tape below...

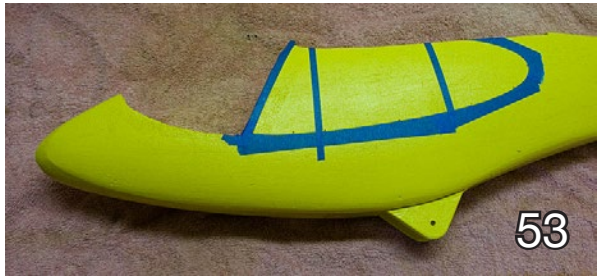
(52) Peal away the excess tape...

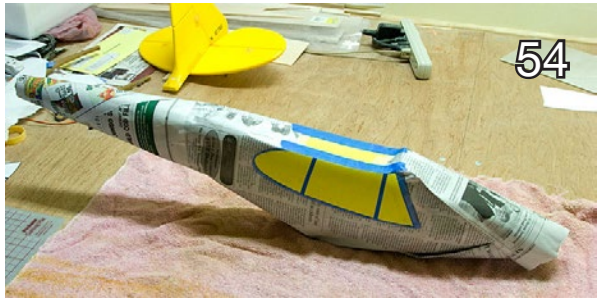
(53) Add the window lines...

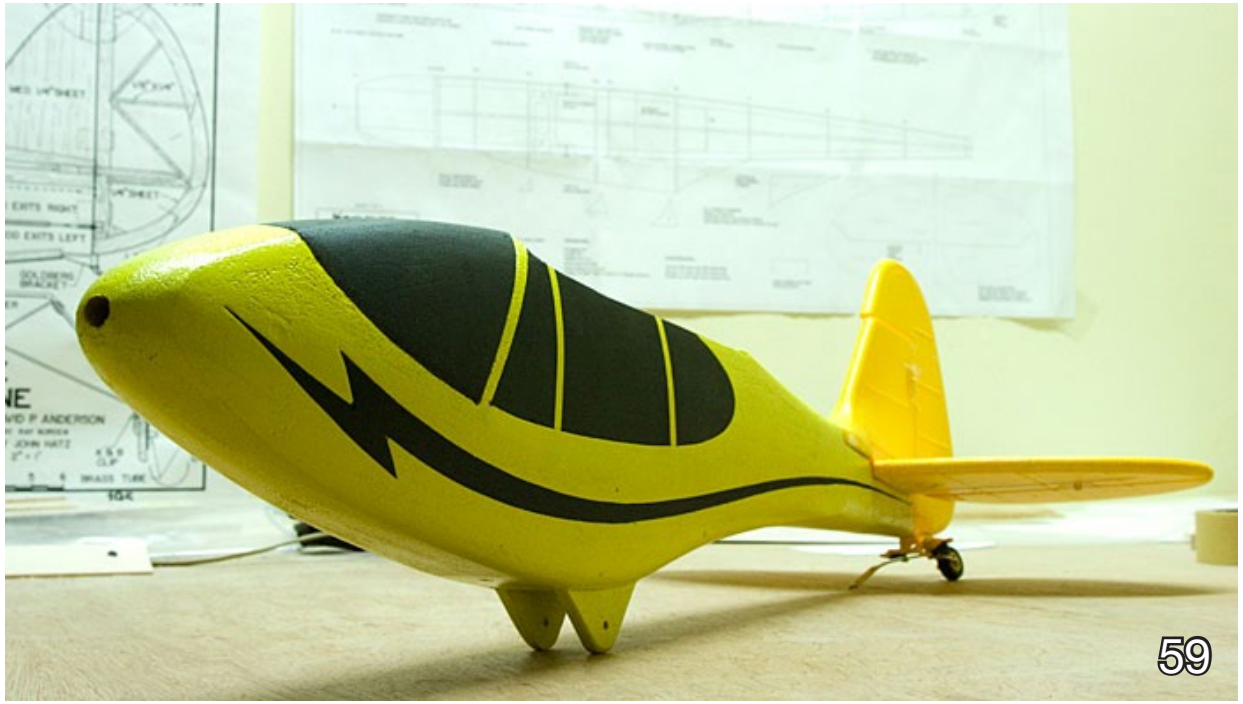
(54) Then wrap her up like a last minute birthday present...











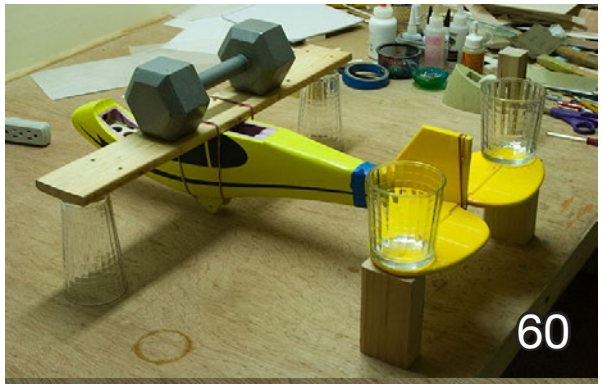
(55) 20 seconds of spraying...

(56) And we have windows!..

(57) We're not done yet though. Next is the signature Cub, Flash Gordon lightning bolt...

(58) There we have it (the yellow doesn't quite match but what can ya do?)...

(59) Looking pretty snazzy in a Cub sorta way...



The Tail

(60) After a little head-scratching I came up with an effective way of squaring up the fuselage to my workbench before attaching the tail... This should result in a nice level tail that should align with the wing once that's done (waiting on a longer CF wing-rod to

arrive)...

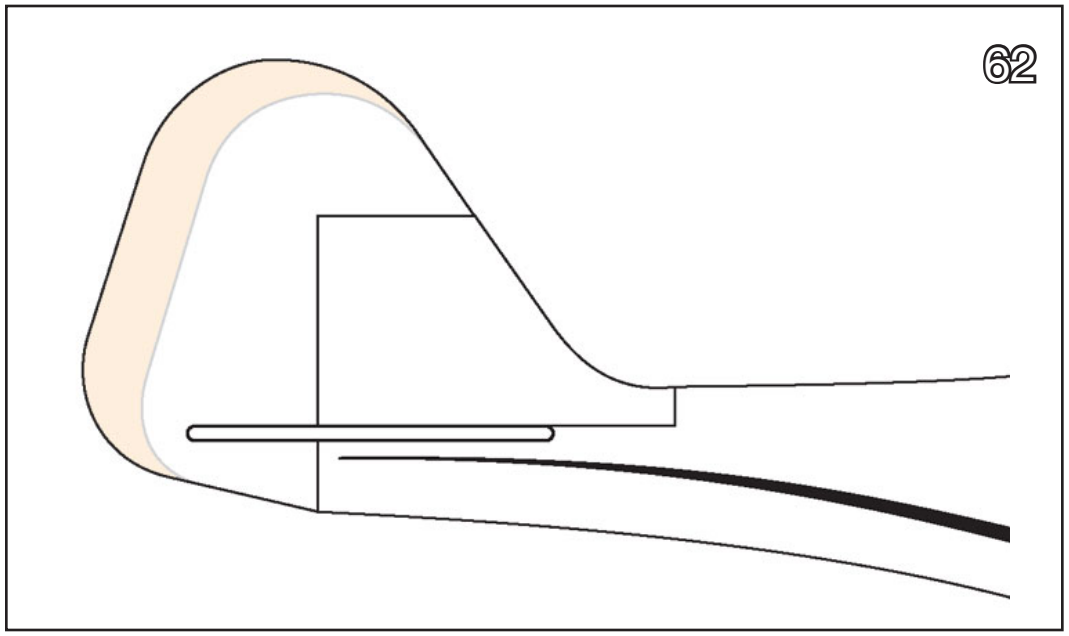
BIG Rudder

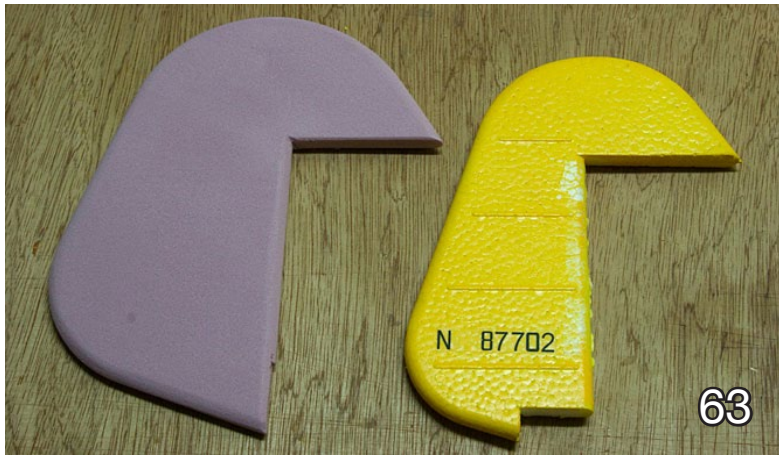
(61) The rudder hinge was damaged in a nose-over a while back. I removed it so I could make a proper repair but having it off of there got me to thinking, maybe I should take this opportunity to enlarge the rudder a little...

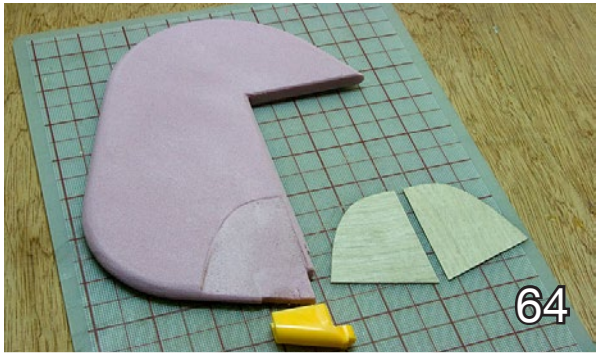
(62) A fat bulbous nose section, a short-coupled tail-moment and an extended wing are all conspiring to make this puppy a little lacking in yaw authority. More rudder area can only help. So I think that's what I'm going to do, make a slightly larger rudder...

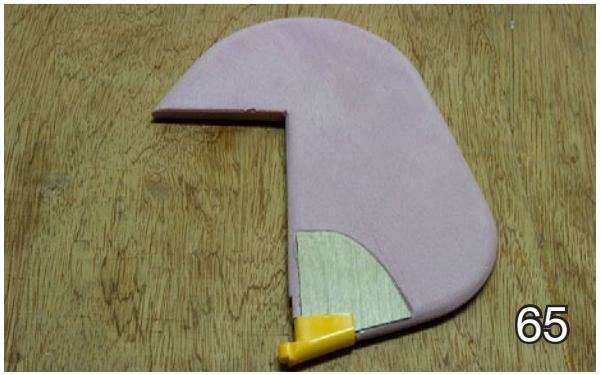
(63) Here's the new enlarged rudder...

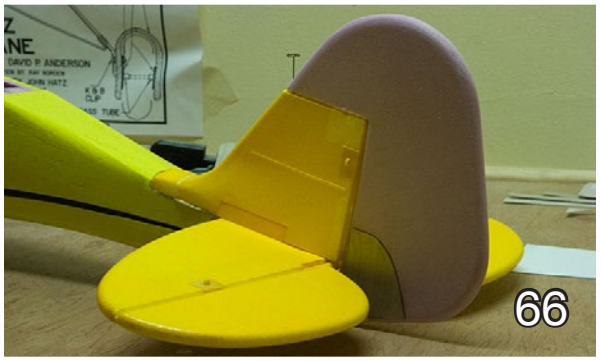
Now that the tail's on I can move ahead and get the rudder and elevator servos mounted and functional.











(64) Figuring a larger surface area will translate into more stress I'm reinforcing the control-horn/tail-wheel area...

(65) Reinforcing glued in place...

(66) Test fit...

(67) I think that should help her track nicely while maintaining the scale tail's looks...

I'll put a few coats of paint on her. Won't bore you folks with that process.

(68) Got the tail-wheel installed...

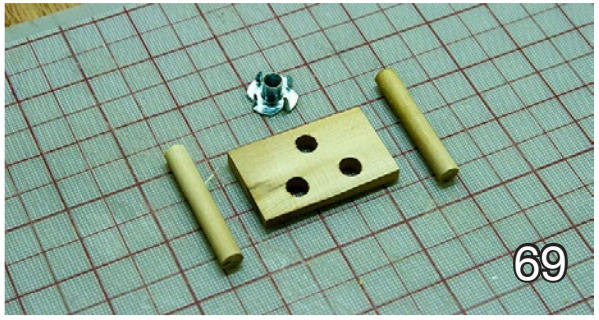
Wing Bolts

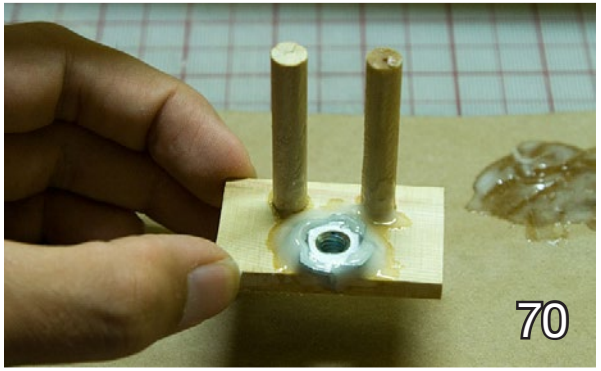
I used rubber bands to hold the wings on for my last scratch build. I'm still getting grief from my subscribers for that decision. So you'll be happy to hear I'm going with nylon wing bolts this time.

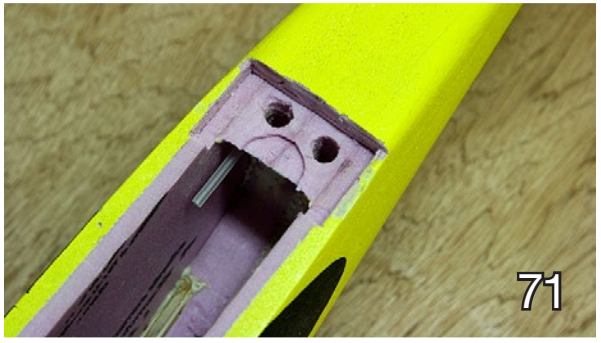
(69) Here's a mounting block I came up with for the rear mount...

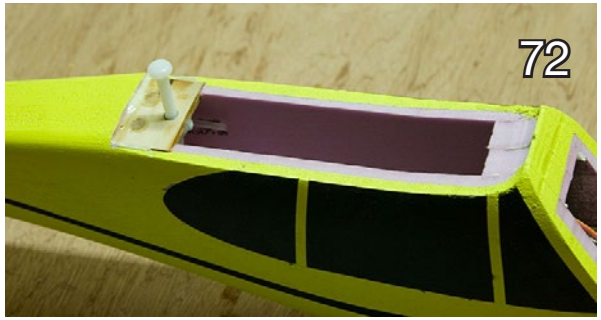
(70) The two dowels will be inserted into holes drilled deep into the fuselage. Its my hope this'll securely affix the block to the fuselage...

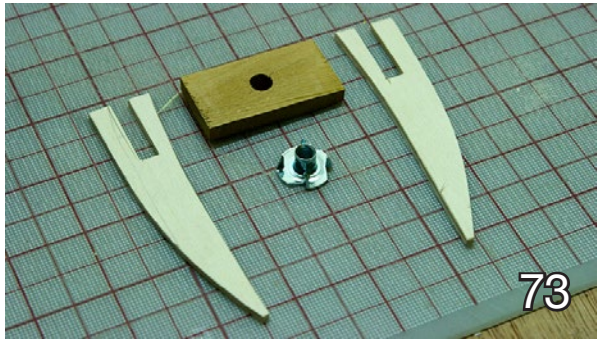
(71) Here's the cutouts in the fuselage, ready to receive the block...

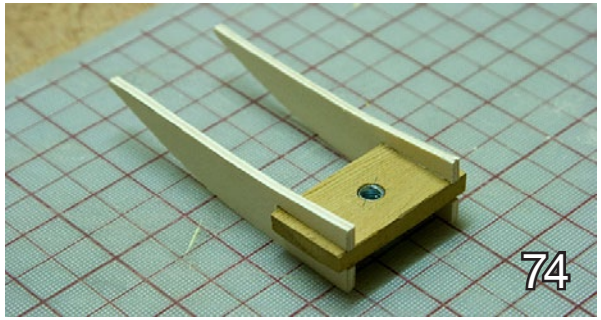


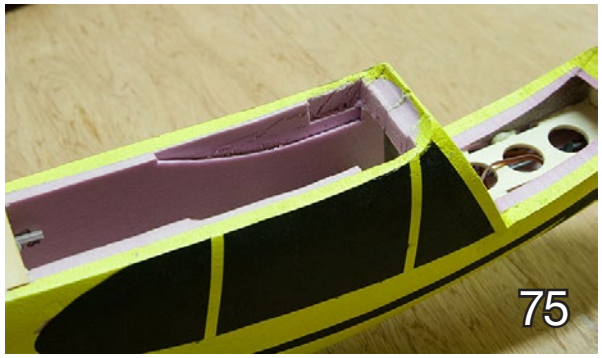












(72) Secured with ample amounts of Gorilla Glue...

(73) I considered using the peg method for the front but decided instead to just go with a second nylon blot. There's not enough "meat" around the front location to use the same dowel setup as the rear so I came up with this interlocking design...

(74) As you can see the two pointy pieces of ply hold the block in place...

(75) I made some cutouts in the fuselage...

(76) And in she goes...

The Wing

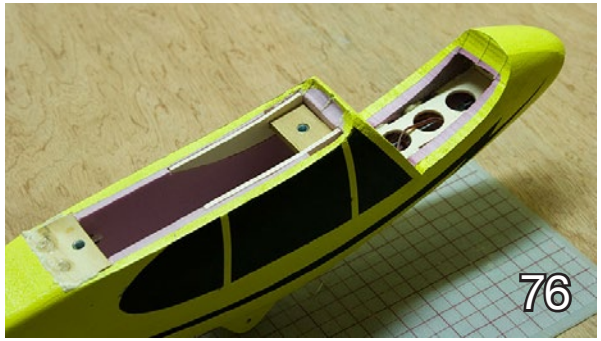
(77) My new, longer wing-rod has arrived from rcfoam.com. *<http://www.rcfoam.com/product_info.php?cPath=94&products_id=812&osCsid=3ea29ac113bdf6acc9e68df8b246623d>*

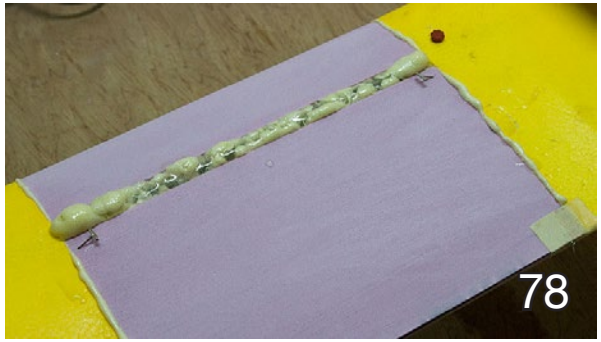
Once again I raided the kitchen cabinets, used these glasses to support the wing, plates on top to weight it down...

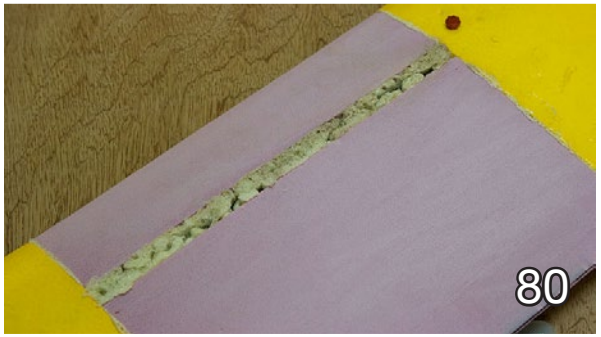
(78) I used Gorilla Glue once again. Not only is it seriously strong glue, it has the added bonus of expanding as it cures. That takes care of what to do about the wing-rod slot...

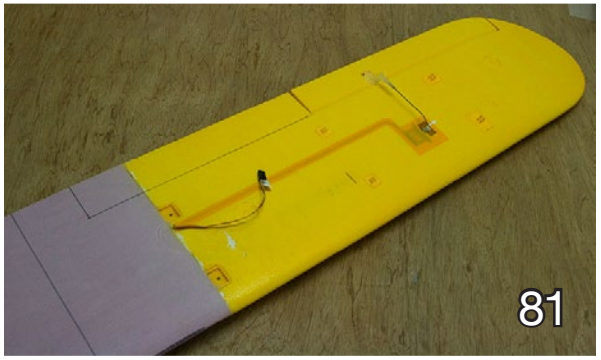
Once that's dry I'll sand the foaming glue flush with the wing.

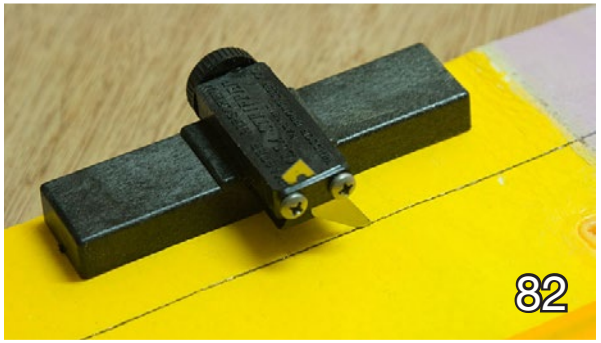
(79) So I'm going to let this sit overnight and let the glue do its thing...

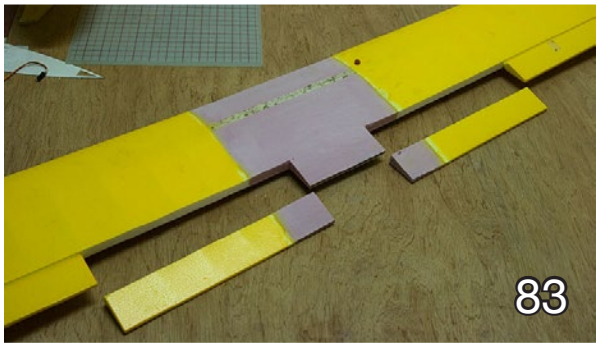












She's starting to look like an airplane

(80) Well the Gorilla Glue filled the wing-rod slot alright, but geesh does that ever look ugly...

We'll address that shortly.

Flaps?

Well, this glider already has everything but the kitchen sink, so why not flaps, too?

(81) I marked out where I figured they might go...

(82) I picked up this nifty tool for cutting strips of balsa but discovered it's also pretty handy for making nice 90 degree cuts in foam...

(83) So here's our flaps. They should come in handy for making precision landings and because this puppy is going to be so incredibly good at thermalling, they'll be essential for getting down out of boomers.

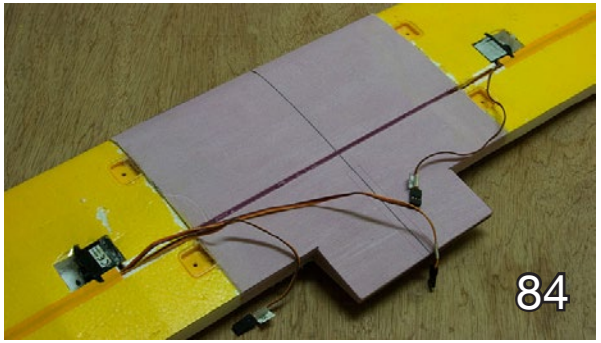
(84) Test fitting the two flap servos...

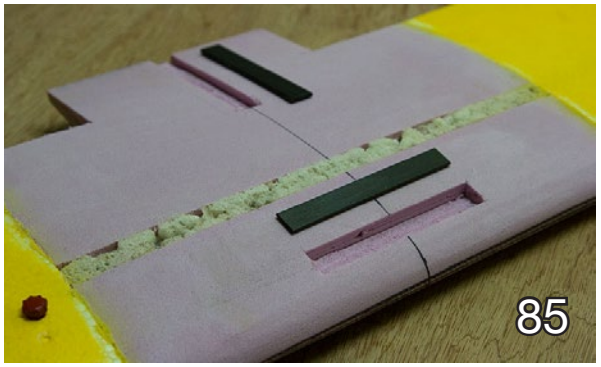
That brings us up to seven servos in this dinky plane. She's a lean mean full-house machine!

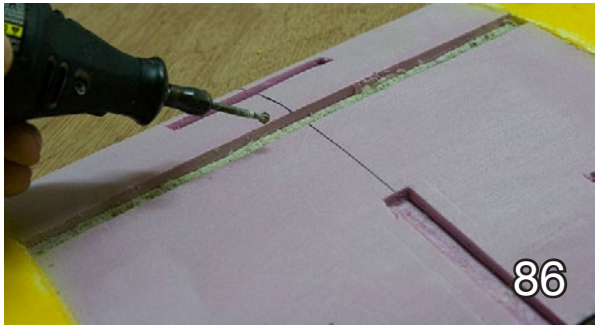
Wing meet fuselage, fuselage meet wing

Time to get this wing mounted up. I needed something more than just Home Depot foam to keep the nylon wing-bolts from ripping through the wing.

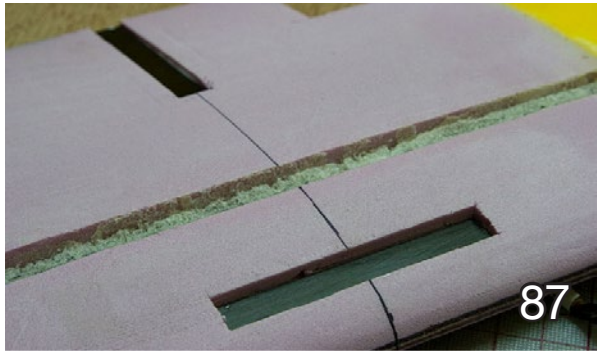
(85) I cut some scrap carbon fiber into short lengths and cut recessed slots in the wing...

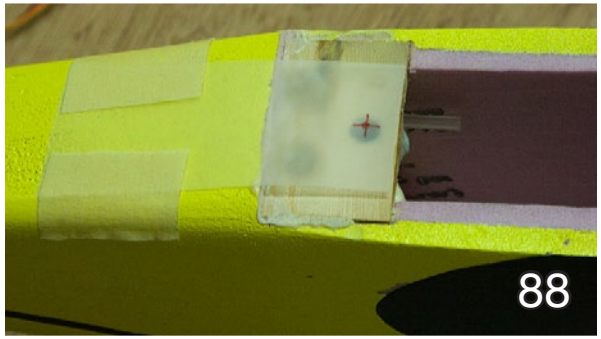


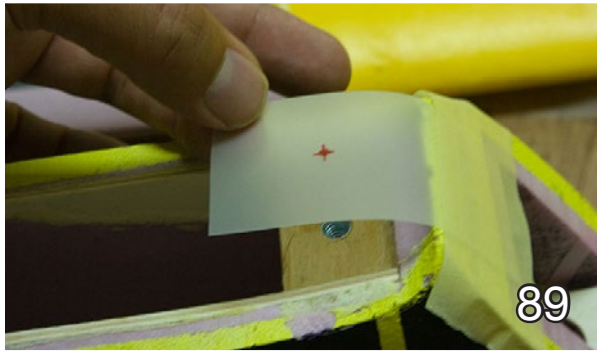


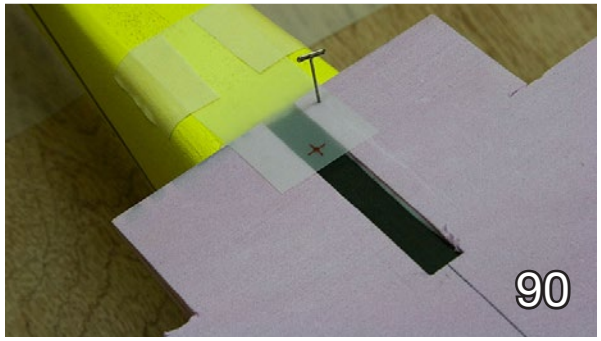


(86) While I had the Dremel tool out I also cleaned out some of that yucky looking Gorilla Glue from the wing-rod slot...







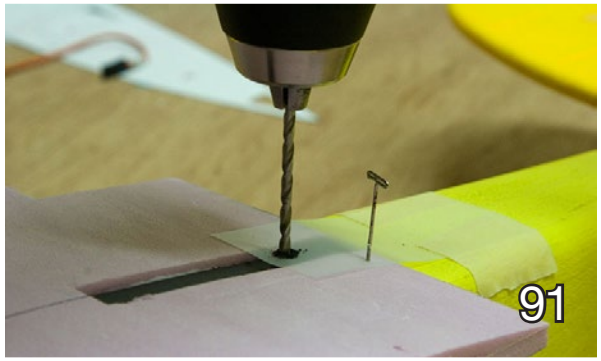


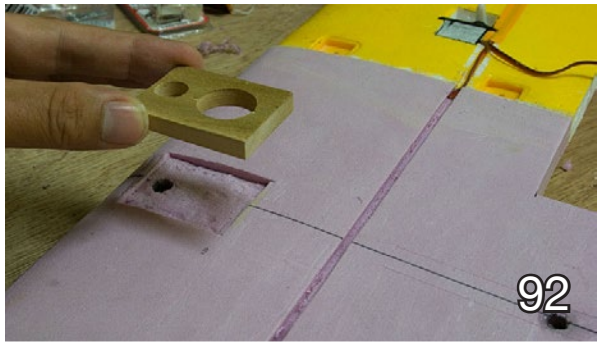
(87) Glued the carbon fiber into their slots... Next I needed to drill holes for the nylon wing-bolts but where exactly should the holes go? Here's a neat trick I learned.

(88) Tape some Mylar or something similar to the fuselage and mark the wing-bolt location with a marker...

(89) Do the same for the forward location...

(90) Flip the Mylar back and install the wing. Measure everything so the wing is exactly centered and square to the fuselage...

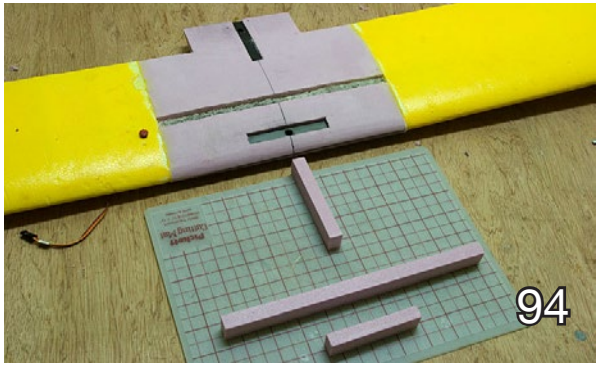


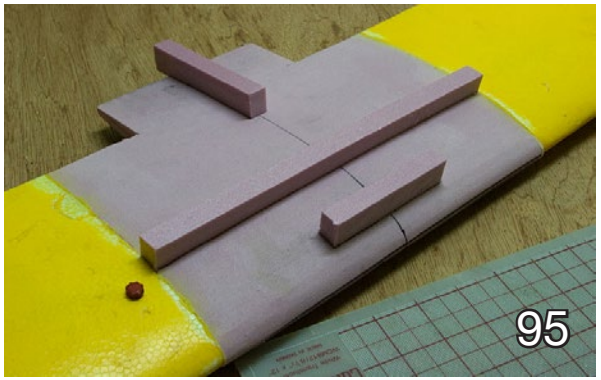


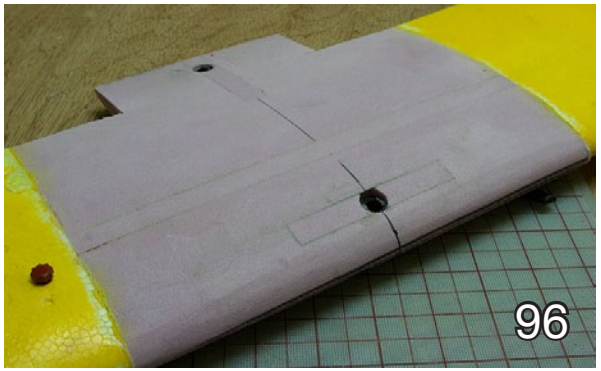
(91) X marks the spot. Drill away... Carbon fiber dust is nasty stuff. I use a mask and clean up the work area with a damp paper towel immediately afterwards.

(92) I wanted a way to locate the wing on the fuselage so that lining up the wing-bolts would be a snap. The solution was to add a small block that'd index the fuselage...

(93) I glued that to the wing, then gave her a test fit...





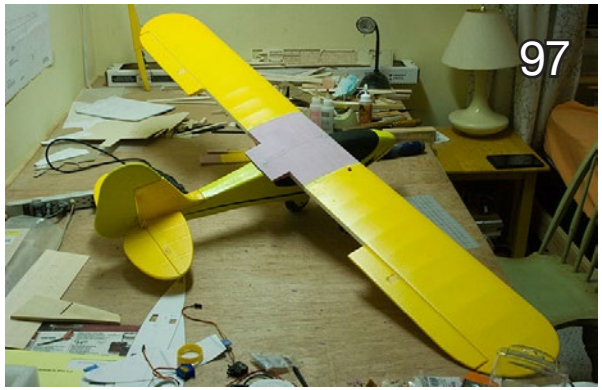


Slots, slots and more slots.

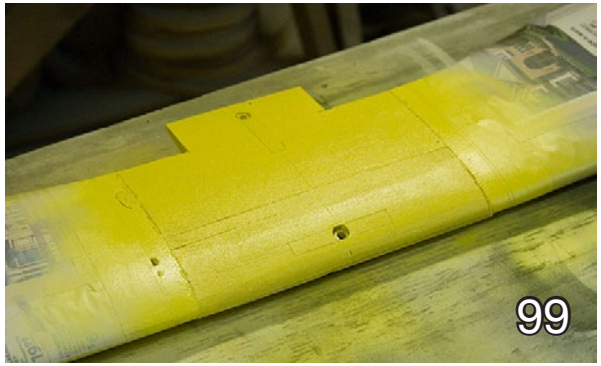
(94) Time to do something about those rather un-aerodynamic slots in the top of my wing...

(95) Glued scrap foam into the slots...

(96) A little sanding and we're looking good...



(97 and 98) Oh yeah, she's starting to look like an airplane alright... A cute goofy airplane that is. Now I'm started to get excited, there's light at the end of the tunnel. She'll be tearing up the sky soon enough!



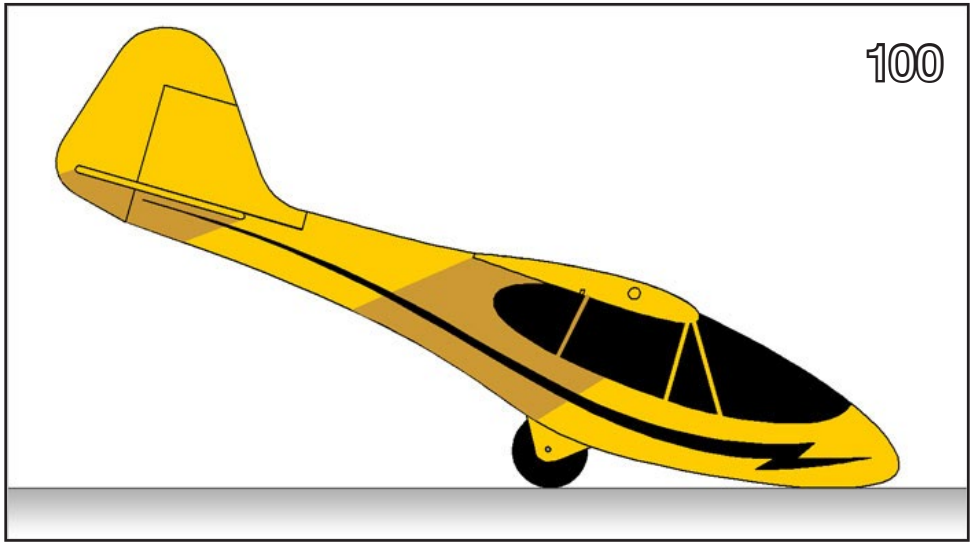
(99) Painting the wing center section...

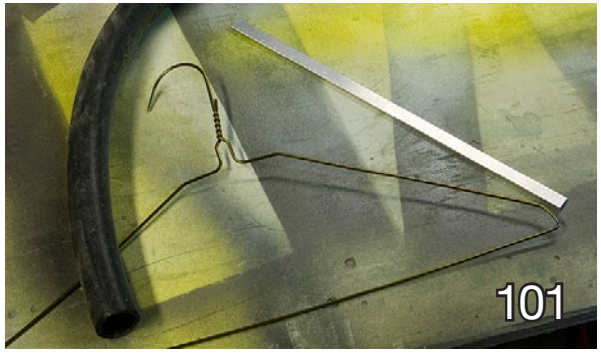
<u>This is no way to start an aerotow</u>

(100) With the wheel more or less at the CG I expect she'll flop forward like this during landings and tows. Not good...

(101) So naturally the solution is an aluminum bar, a coat-hanger and a piece of old rubber piping...

(102) If you've not guessed yet, yeah I'm making a nose skid...

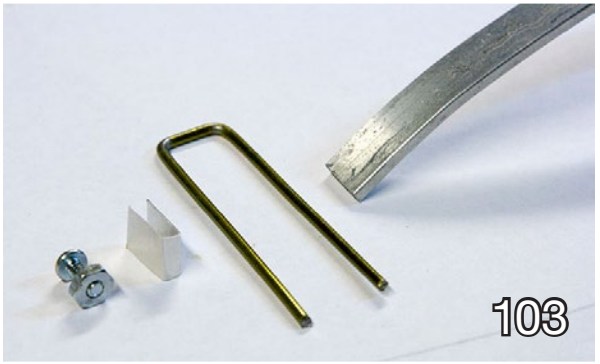


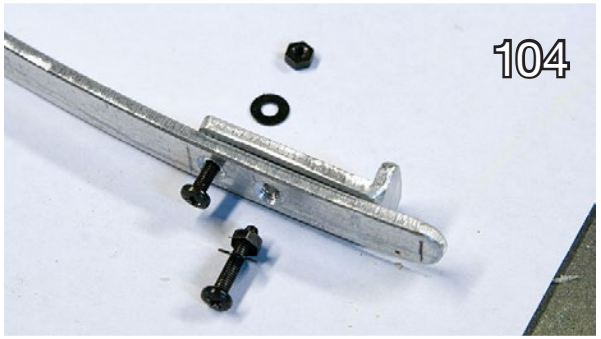


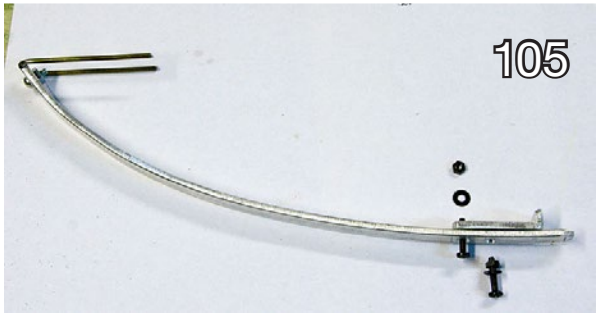
(103) The coat-hanger I bent into a U shape, that'll be inserted into the nose and act as an anchor for the front of the skid. The other hardware will attach the skid to the anchor...

(104) On the rear of the skid I'm bolting this L shaped piece of scrap aluminum...

(105) Here's the skid partially assembled...







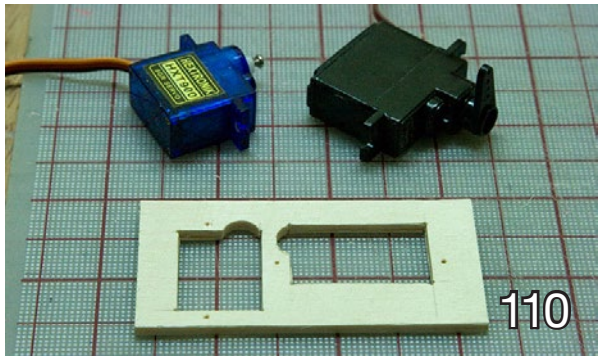
(106) The coat-hanger wires are glued deep into the nose...

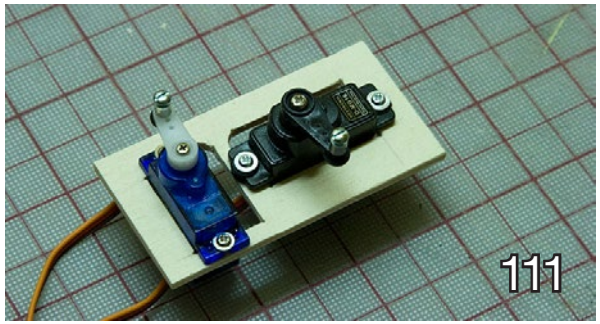
(107) The rear is bolted to a piece of rubber hose...

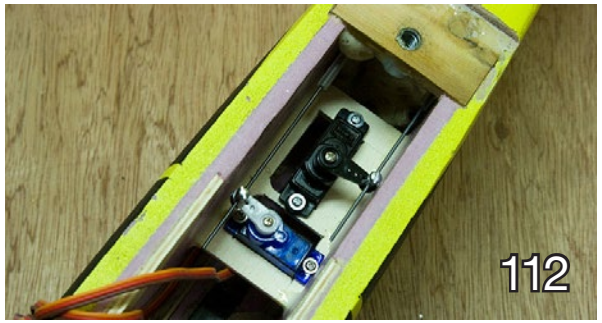
(108) The L-shaped piece of aluminum is to allow a winch line to be slipped over the end of the skid without getting stuck under the rubber pipe...

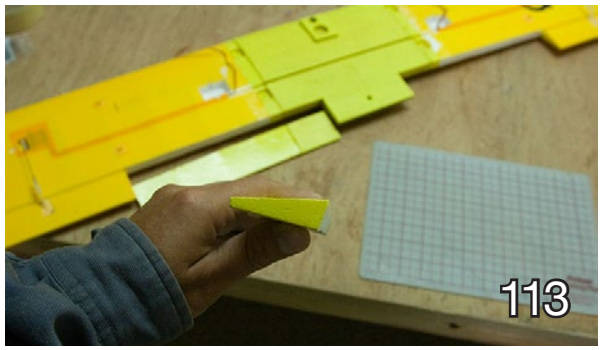
(109) Well that should help with ground handling, no sticking her nose in the dirt... I think it looks pretty cool too, something you don't see every day...

Tempting to say I had planned the nose skid, but the truth is it was kinda an after thought. The wheel is back further than I'd have preferred. The location of the winch hook kinda dictated its location. It also didn't help that the carbon fiber bar inside the fuselage forced me to mount the wheel sticking out so far. Still I'm actually quite happy with the way things turned out. As much as I try to think five moves ahead when building, there's always that design-as-you-go element. That's part of the fun though, solving problems.









What's with the $3 servos?

(110) If I could afford good servos, I probably wouldn't be working with an old wrecked Cub...

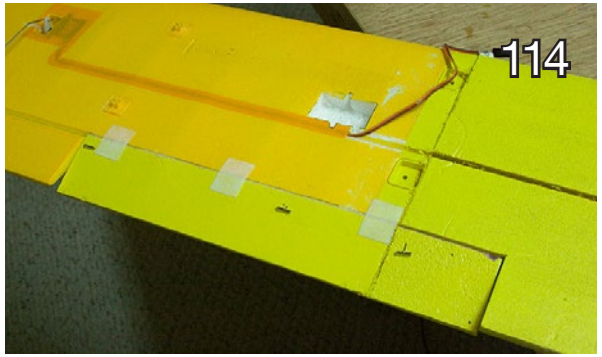
(111) These are kinda oddball mismatched servos that I had laying around...

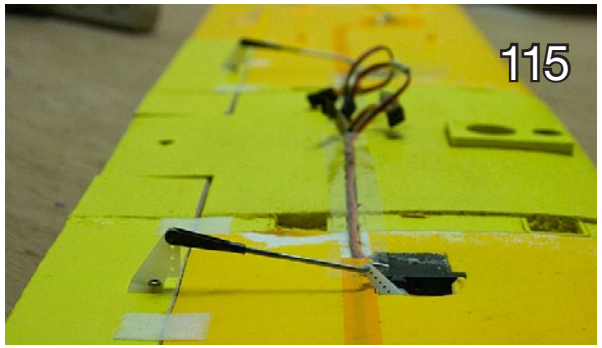
(112) Cool, the tail is functional and working nicely...

Flaps

I've always wanted inboard flaperons (the flaps also move with the ailerons). So basically I have full-span ailerons with the inboard section pulling double duty as flaps.

(113) To achieve this I needed to bevel the flaps a tad so that they could move upwards as well as down...





(114) With the hinges on the bottom of the wing the flaps have unlimited downward travel. And due to the slight bevel they can also move upwards a few degrees...

(115) Hooked up the two flap servos...

(116) I still need to mess with the mixing but the wing's four control surfaces are all working...

This should be a fun wing, lots of opportunity to mess with flight modes, flaps, crow and other unnecessarily complicated stuff...

(117) We're getting close now, not much more to do.

The last 10% takes 90% of the time

While that's generally true, wrapping up the last odds and ends went smoothly today.

(118) The first order of business was to install the radio spaghetti...

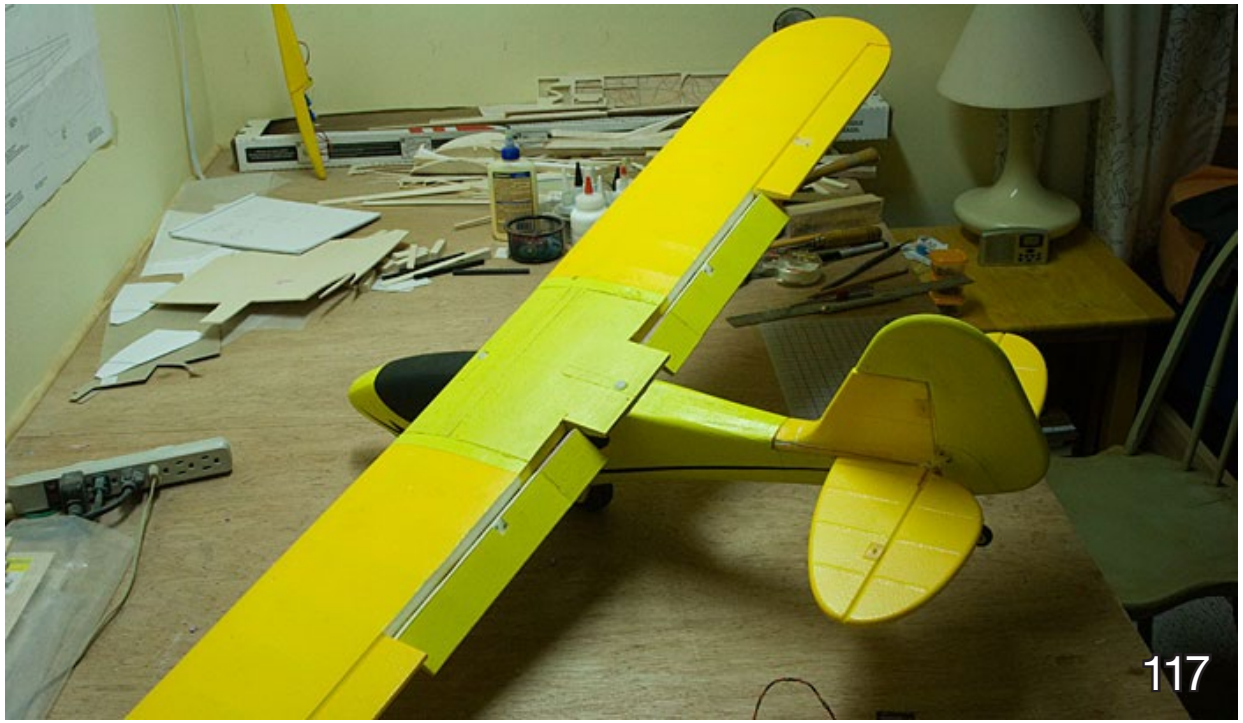
http://www.scipie.com/rc/cublider/20121009_0007.jpg

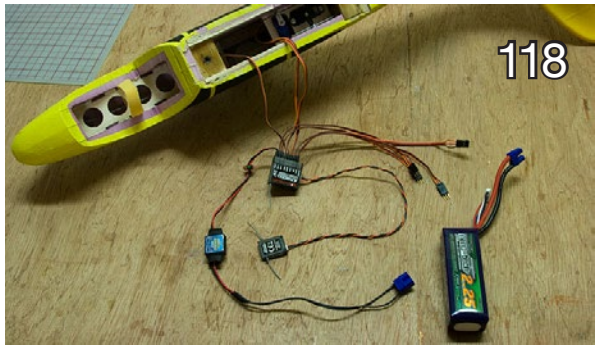
(119) I hate disturbing the receiver by plugging/un-plugging wires when removing the wing, so I made a bunch of servo extensions.

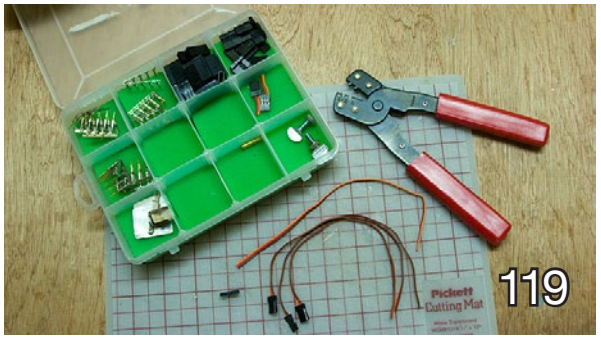
(120) This allows me to plug the wing into those instead of messing with the receiver each time...

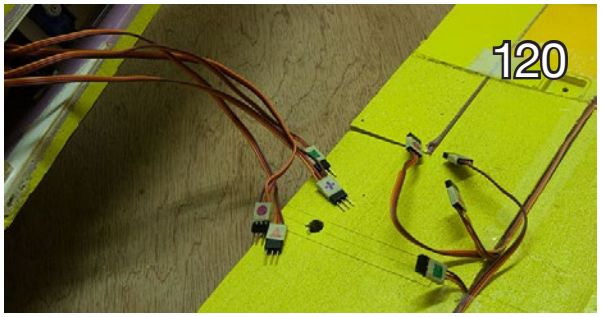
With all these wires I color coded everything so I don't have to think at the field. We should all avoid thinking whenever possible...

(121) A couple of rare-earth magnets hold the battery hatch in place...









(122) She was tail heavy when I first stuck her up on the balance stand, needing 6oz to level her out at 10% static margin...

To better help balance her I removed the (123) nifty steerable tail wheel. It was useless anyway as the plane rests on the nose skid, with the tail up in the air...

(124) That translated into a few less ounces needed in the nose. I also moved the CG back to 5% static margin and she balanced with just 3 ounces. Much better...

(125) Added a custom Cub logo to the tail...

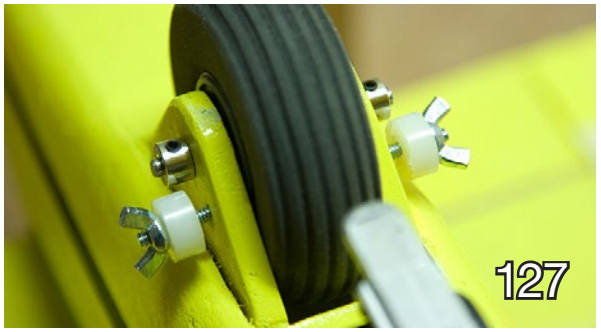
(126) Maiden flight coming soon! Woohoo! Wish me luck.

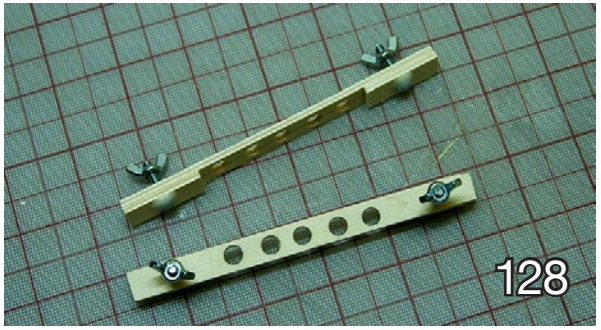
Almost forgot

I know you folks probably want a few stats...

Wingspan: 60.25 in / 1530 mm
Weight: 40.9 oz / 1159 g
Wing Area: 465 sq.in
Wing Loading: 11.9 oz/sq.ft / 36 g/sq.dm
Cubic Loading: 5.93 oz/cubic.ft
Stall Speed: 17.1 mph / 27.5 km/h

She's about what I expected, not exactly a floater but not a lead-brick either. Somewhere in the middle for a sailplane.





Struts

(126) It wouldn't be a Cub without the wing struts. I figured the wheel support was a good strong spot to start with...

(127) For the wing mount location I created these hard-points...

(128) Cut a slot...

(129) Glued and mounted. The struts are lightweight aluminum struts available at most hobby stores. The blue tape is there temporary to keep the glue from getting all over...

(131) Now that's looking more Cub-like...

Maiden flight video

YouTube video, click to watch... <http://youtu.be/b2zyT40GP7A>

Flight Report (spoiler alert - watch video first)

Well as you can see that didn't go as well as I'd hoped although not a big surprise either, given the deliberately compromised design. Here's my thoughts...

Issue 1

The placement of my ridiculously big wheel sticking way too far out below the fuselage and positioned right at the CG doomed the aerotow. The nose-skid helped but not enough to keep the plane level and stable while towing. A lower profile wheel positioned properly would let her roll smoothly without generating gobs of drag for the poor tow-plane.

Issue 2

Everyone who picks her up is surprised at the weight. She's a heavy bugger, that combined with the short-coupled tail moment makes for some "interesting" flying. I think she'll be manageable if only I can get her in the air and moving along at a good clip.

Issue 3

Watching the alarming angle of attack during the high-start launch, I'm wondering if maybe moving the two-hook location further forward would help. Other factors such as CG and elevator trim may have contributed to the problem too.

The Next Step

After I make the repairs I think I'm going to remove the wheel and nose-skid and just let her slide along on her belly. I'll see if that helps with the ground handling. I may also remove the wing-struts at least until I have a few more test flights under my belt. With the nose-skid gone I can also try moving the tow-hook location forward a little.

Seriously this isn't Serious

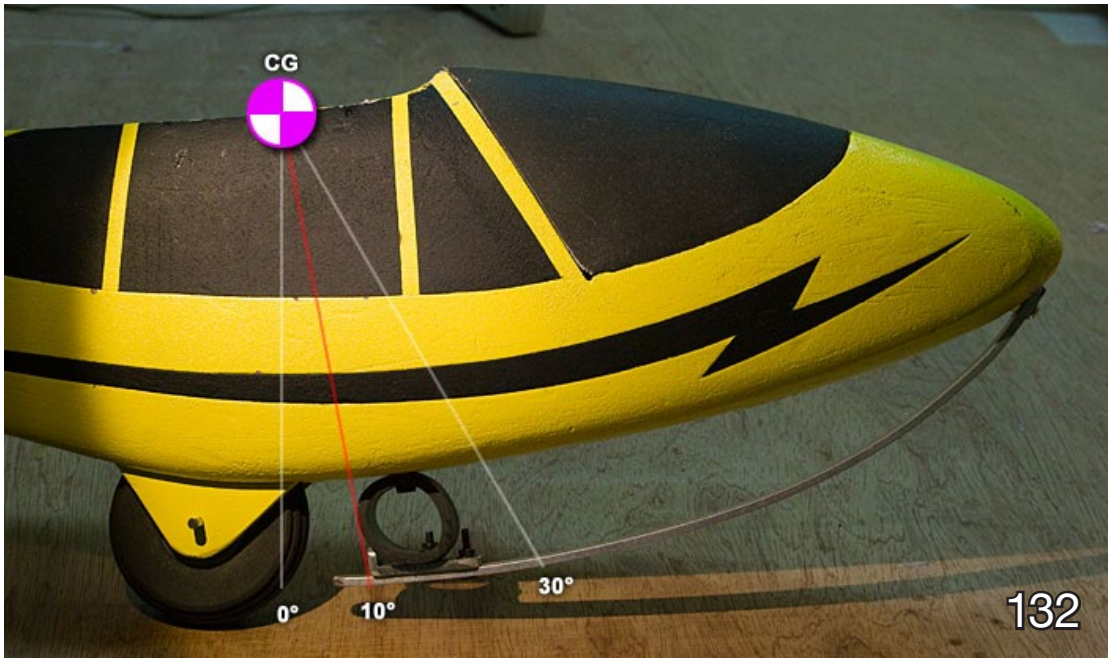
While this may come across as a poor excuse for blatantly bad design, my main drive behind this build was to learn about working with foam. This project has in that sense been a success. I'm now confident enough to proceed with some more serious designs. That said I'm not done with this Cub though, at least not yet. I'm pretty sure I can get her flying.

After Further Analysis...

Well I goofed up. I've no clue why I chose to just eye-ball the location for the high-start hook, especially as I'm well aware of the 30° ahead of the CG rule for tow-hooks.

(132) Look how far back I had my tow-hook positioned!..

(133) Its no wonder she behaved like she did, I had the tow-hook WAY TOO FAR BACK...



Aerotowing

So lets simplify things. I lobbed off the nose-skid and “tundra sized” wheel and now we have a nice smooth fuselage to work with.

(134) The wing struts are history, too...

(135) After re-balancing here’s how she sits...

Unfortunately, due to the Guppy shaped fuselage the tail is still up in the air and it looks like she’ll probably rock forward on her nose again during aerotow. Still, though, I think it’s an improvement.

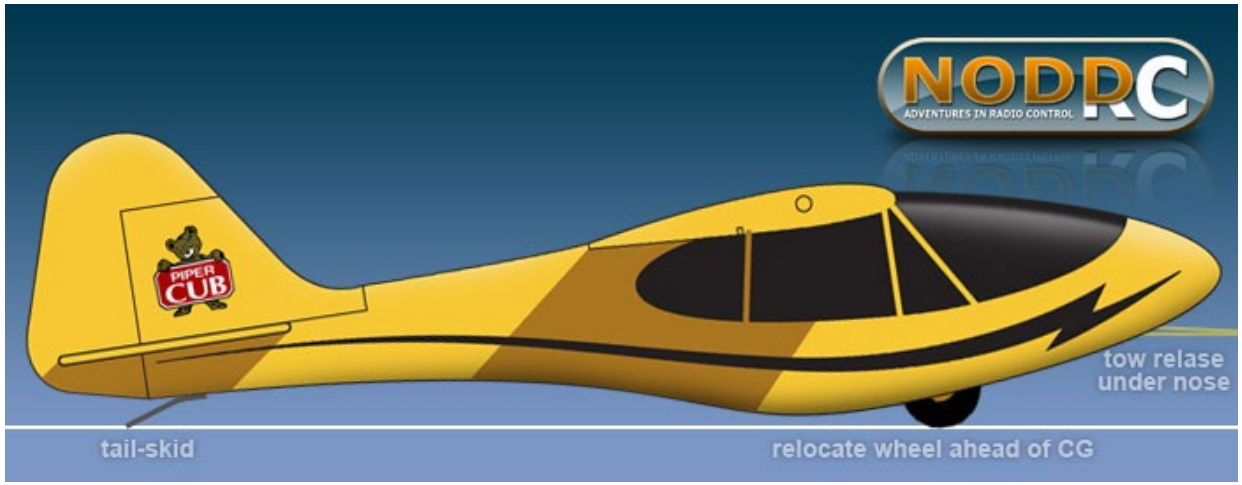
(136) At the very least she looks cleaner...

I’m going to concentrate on aerotowing for now. I’ll worry about adding a new high-start hook later on.

<u>Cub Sailplane, Part 2</u>

YouTube Video, click to watch... <http://youtu.be/tMqszLGZ4-4>

We’ll give the dolly idea a try for sure. Either that or we drag her kicking-n-screaming into the air with Len’s monster tow-plane.



Yeah, I bailed on the tow once I saw Roger's plane hanging on its prop groaning away, looked like a stall was immanent. The "brick" on the other hand was still firmly planted on the ground. Check out Roger's plane once I do release, she shoots up like a rocket singing "I'm free, I'm free!"

WE NEED MORE POWER, SCOTTY!

The guppy shape of the fuselage is a problem. She's rocking forward while under tow. The wing is at a negative AOA, which may be okay once she gets moving enough for the elevator to kick in.

When we towed her, I noticed the Fun-Cub was getting airborne first. I've seen this happen before and I assume ordinarily its not ideal but that maybe exactly what's needed here. Once the tow-plane is up she'll be pulling up on the Cub's nose. That should in theory help get her un-glued from the ground. That's assuming the tow-plane doesn't stall out first. I'm hoping the dolly will fix all this, though. It should keep her at a nice neutral AOA and also reduce the rolling friction. I hate to rely on a dolly, though.

(137) If I was to build a new fuselage (which I may consider, but we're not at that point yet) here's what I'd do different...

A more forward position for the wheel should keep her from nosing over and help reduce friction. It looks like we'd also need a small tail-skid to keep the AOA from getting too extreme.

Additionally, placing the tow-release up under the nose would reduce the tendency for her to rock forward. I have the release setup this way on one of my other aerotow gliders and it works well. Anyway that'd require major surgery, probably a whole new fuselage. I'm not

giving up on the current setup just yet.

A guy over at RC Groups said they've been hand launching their gliders while aerotowing. My flying buddy Bernd suggested we try that but everyone at the field shot down the idea.

Not just one flight but, multiple successful flights!

(138) Of course we may have set aerotowing back centuries!

Piper Cub Sailplane Part 3

YouTube Video, click to watch... <http://youtu.be/Tk5eE0ONl2Q>

Yeah, no doubt I put poor Conio and Roger through their paces and then some these last couple of weeks. Couldn't have done it without my trusty tow-pilots in tow (pun intended). Thanks, guys, and thanks also to everyone here for their support.

I'd be grounded without rcaerotowing.com and the great folks on it.

Flight Report

Well the video <http://youtu.be/Tk5eE0ONl2Q> pretty much tells the story, but here's a few thoughts...

The ground handling isn't good. The guppy-shaped fuselage with a big bulge right at the CG makes her rock back-n-forth causing a lot of friction. Although the shape looks good it does cause issues for sure. A wheel placed at the leading edge of the wing would have helped.

I may fashion a custom dolly for her.

Tow speed

With the moderate wing-loading I expected her to fly pretty fast and she does get up and go when she wants to. I was afraid she might tend to overtake the tow plane like many slick modern scale sailplanes will do. The flaps were effective air-brakes though, pretty easy to control the speed on tow.

Handling

She flies like she's on rails,. This is one of the most stable sailplanes I've flown. That's surprising considering the absurdly dinky fuselage and short-coupled tail. I expected her to be really pitch sensitive but she's not at all.

The 40% expo on the elevator should be helping but it seems there's sufficient horizontal stabilizer back there to make her natively stable.

Turns are nice too. I have a fair amount of aileron differential programed and also mixed in some rudder (except when the aerotow release is closed) so she stays nice and coordinated. With the flaps also

acting as ailerons the roll rate is pretty snappy for a sailplane.

Again, with the moderate wing-loading she carries a fair amount of energy which is great for aerobatics. Makes for some serious fun tossing her about the sky.

Landing

The big barn-door flaps were very effective. Although I've not tried a full flap, 45° nose down landing yet, I'm thinking she'll do that without picking up much speed.

I have 1/4" of crow programmed into the outboard ailerons to further slow things down, but mainly to keep the wing-tips flying at low speeds. After all it was a tip-stall-o-doom that destroyed the original stock fuselage and I don't want a repeat performance.

The inboard ailerons remain functional even when acting as flaps, so roll control remains crisp all the way down to stall speed. One of the easiest planes to land I've flown.

Thermalling

Before you laugh, if I can resist the urge to point the nose towards the ground and fly aerobatics, I think this daft little glider might actually thermal. Granted it'd probably need medium to strong lift, but if I keep the airspeed up, the sink-rate isn't actually all that terrible. I know from flying some of my other heavier sailplanes, a high wing-loading doesn't necessarily mean she drops like a brick. Those do have nice long, high aspect wings with fancy airfoils, though. We'll have to see.

Slope Soaring

We're talking an hour or two road trip at least if I want to hit the slopes. I think it'd be worth it though as there's little doubt where this silly Cub belongs. Fairly aerobatic, tough foam construction, big flaps for small landing areas, good wind penetration. She belongs on the slope.

Conclusion

So what I believe I have here is a "flat-land slope soarer."

She's docile enough for some lazy thermaling (assuming there's enough lift) yet aerobatic enough to tear up the sky when she wants to.

The aerotow capability means I don't have to shelf her until we hit the slope. I love the attention she gets, too — definitely something you don't see every day.

I wish she wasn't quite as beat up looking, but at least I don't have to worry about scratching the paint.

I could see myself building another one, perhaps a lot bigger, probably a lot lighter construction. I'd love to develop this concept further — built-up balsa construction, Kevlar wrapped carbon fiber main-spar, formers and stringers fuselage — but don't have the cash right now — the joys of being an out of work graphic artist. On the upside, I do have lots of time on my hands, though.

I think that'd be something fun to take to the various scale aerotow events I attend.

http://www.rcaerotowing.com

That's assuming they're okay with a "fantasy scale" glider in their midst.

A big thanks to the New Canaan Remote Control Society <http://www.ncrcs.org/> for putting up with my silliness. You guys are the best. And also for those that contributed advice/support here at RC Aerotowing <http://www.rcaerotowing.com/>.

Well, time to move on to the next project.

Stay tuned for more "adventures in radio control."

Genoma^2 sections

Marc Pujol, marc.pujol1@free.fr

Marc's articles detailing the design and construction of his Genoma^2 (*RCSD* October 2012 and November 2012) have proven to be very popular. Coordinates for the four airfoils used remain available on the *RCSD* web site at <http://www.rcsoaringdigest.com/Airfoils/Genoma2/Genoma2_Airfoil_Series.zip>, but we thought it might be helpful to publish those coordinates in text format for copying from the PDF, provide links for the DAT files once again, and present plots of the sections for those interested in more conveniently seeing what these profiles look like.

F5J 1 <http://www.rcsoaringdigest.com/Airfoils/Genoma2/GENOMAF5J1.dat>

JPP E8C2.7 2012 VH emplanture

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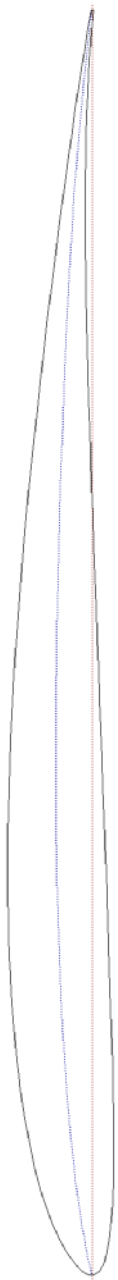

F5J 1: thickness = 7.82%, camber = 2.87%

F5J 2 <http://www.rcsoaringdigest.com/Airfoils/Genoma2/GENOMAF5J2.dat>
JPP E7C2.7 2012 S2

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0.49938	0.05664	0.02668	0.02454	0.11913	-0.01628	0.82133	0.00648
0.47731	0.05797	0.02222	0.02229	0.13032	-0.01616	0.83846	0.00653
0.45569	0.05916	0.01820	0.02005	0.14218	-0.01597	0.85521	0.00646
0.43452	0.06019	0.01462	0.01783	0.15475	-0.01573	0.87165	0.00626
0.41381	0.06107	0.01145	0.01564	0.16805	-0.01543	0.88784	0.00592
0.39356	0.06179	0.00868	0.01348	0.18212	-0.01507	0.90385	0.00543
0.37380	0.06236	0.00632	0.01136	0.19698	-0.01465	0.91976	0.00479
0.35452	0.06278	0.00435	0.00930	0.21268	-0.01417	0.93562	0.00399
0.33574	0.06304	0.00276	0.00729	0.22924	-0.01364	0.95151	0.00302
0.31746	0.06315	0.00154	0.00535	0.24669	-0.01305	0.96749	0.00187
0.29970	0.06311	0.00068	0.00348	0.26507	-0.01241	0.98363	0.00053
0.28246	0.06291	0.00017	0.00170	0.28441	-0.01171	1.00000	-0.00100
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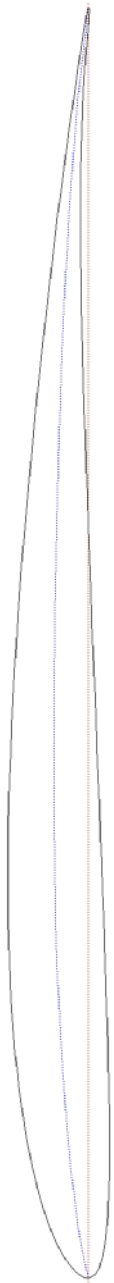

F5J 2: thickness = 7.5%, camber = 2.72%


Geronimo 2

F5J 3

<http://www.rcsoaringdigest.com/Airfoils/Genoma2/GENOMAF5J3.dat>

JPP E7C2.7 2012 S3

1.00000	0.00100	0.22808	0.05951	0.00028	-0.00164	0.32585	-0.01015
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0.96563	0.00589	0.19763	0.05801	0.00211	-0.00463	0.37085	-0.00841
0.94669	0.00849	0.18349	0.05705	0.00365	-0.00597	0.39434	-0.00750
0.92669	0.01116	0.17003	0.05597	0.00562	-0.00722	0.41834	-0.00655
0.90574	0.01389	0.15725	0.05477	0.00803	-0.00838	0.44274	-0.00560
0.88391	0.01667	0.14513	0.05345	0.01086	-0.00945	0.46743	-0.00463
0.86131	0.01947	0.13363	0.05203	0.01413	-0.01044	0.49232	-0.00366
0.83803	0.02229	0.12275	0.05051	0.01784	-0.01133	0.51728	-0.00269
0.81415	0.02511	0.11245	0.04891	0.02199	-0.01215	0.54221	-0.00174
0.78978	0.02791	0.10273	0.04722	0.02658	-0.01289	0.56700	-0.00080
0.76499	0.03067	0.09356	0.04545	0.03163	-0.01354	0.59154	0.00011
0.73989	0.03338	0.08492	0.04362	0.03713	-0.01413	0.61573	0.00099
0.71456	0.03602	0.07679	0.04173	0.04308	-0.01464	0.63945	0.00183
0.68910	0.03858	0.06916	0.03979	0.04949	-0.01508	0.66260	0.00263
0.66360	0.04104	0.06199	0.03781	0.05636	-0.01545	0.68507	0.00337
0.63815	0.04339	0.05527	0.03579	0.06369	-0.01575	0.70675	0.00406
0.61284	0.04560	0.04899	0.03374	0.07150	-0.01600	0.72759	0.00467
0.58776	0.04767	0.04311	0.03167	0.07980	-0.01618	0.74764	0.00522
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0.53847	0.05135	0.03258	0.02749	0.09799	-0.01635	0.78565	0.00605
0.51432	0.05297	0.02791	0.02538	0.10794	-0.01635	0.80375	0.00632
0.49053	0.05443	0.02362	0.02328	0.11851	-0.01628	0.82133	0.00648
0.46714	0.05573	0.01972	0.02118	0.12973	-0.01616	0.83846	0.00653
0.44418	0.05689	0.01619	0.01910	0.14162	-0.01597	0.85521	0.00646
0.42167	0.05789	0.01302	0.01702	0.15422	-0.01573	0.87165	0.00626
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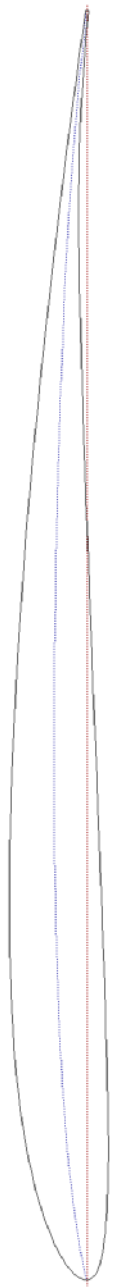

F5J 2: thickness = 7.32%, camber = 2.57%

F5J Saumon <http://www.rcsoaringdigest.com/Airfoils/Genoma2/GENOMAF5JSAUMON.dat>
JPP E7C2.4 2012 S4

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0.99596	0.00143	0.76992	0.02347	0.36479	0.05481	0.06152	0.03177	0.02276	-0.01290
0.99420	0.00161	0.75946	0.02443	0.35368	0.05522	0.05618	0.03035	0.02646	-0.01345
0.99212	0.00184	0.74884	0.02539	0.34267	0.05557	0.05106	0.02891	0.03046	-0.01396
0.98973	0.00209	0.73809	0.02637	0.33178	0.05585	0.04617	0.02745	0.03475	-0.01441
0.98703	0.00237	0.72719	0.02735	0.32100	0.05607	0.04152	0.02599	0.03932	-0.01480
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0.98073	0.00304	0.70502	0.02934	0.29982	0.05630	0.03295	0.02302	0.04933	-0.01544
0.97712	0.00342	0.69377	0.03035	0.28940	0.05630	0.02903	0.02152	0.05476	-0.01569
0.97322	0.00382	0.68240	0.03135	0.27911	0.05625	0.02535	0.02002	0.06046	-0.01590
0.96902	0.00426	0.67094	0.03236	0.26895	0.05615	0.02192	0.01851	0.06644	-0.01606
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0.85623	0.01541	0.46882	0.04885	0.11951	0.04352	0.00221	-0.00514	0.20695	-0.01351
0.84742	0.01624	0.45698	0.04968	0.11223	0.04233	0.00339	-0.00625	0.21722	-0.01314
0.83840	0.01710	0.44519	0.05047	0.10516	0.04111	0.00484	-0.00730	0.22768	-0.01274
0.82917	0.01797	0.43346	0.05122	0.09829	0.03985	0.00656	-0.00829	0.23832	-0.01233

0.24913 -0.01191	0.67875 0.00472	0.98000 0.00086
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0.27125 -0.01103	0.70267 0.00540	0.98663 0.00027
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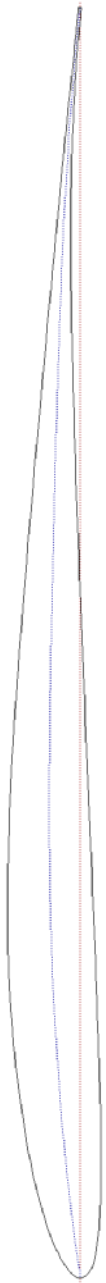
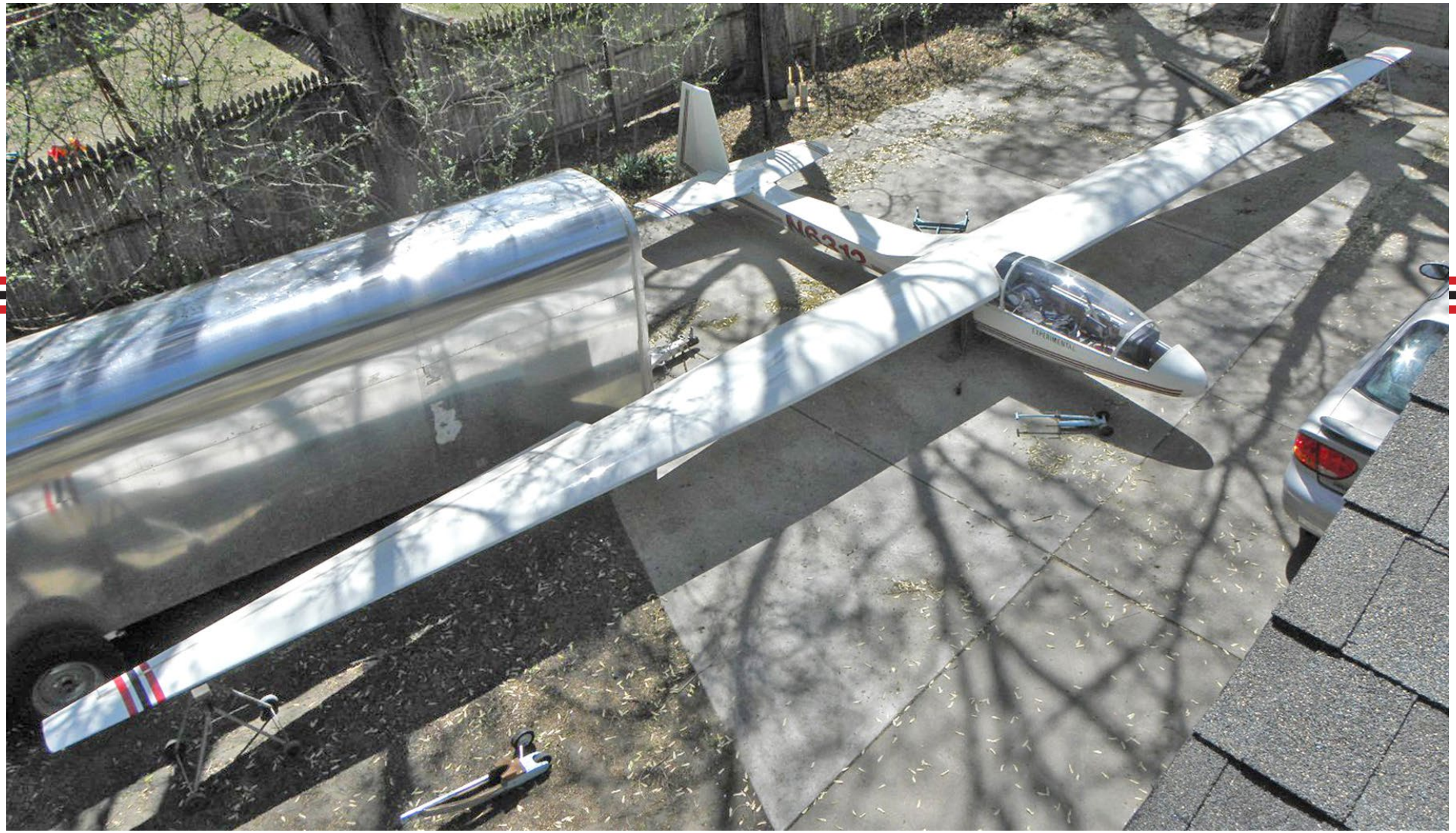


F5J 2: thickness = 7.32%, camber = 2.57%

Walk-around

Niedrauer NG-1, N6312



Text by Tony Condon
Photos by Tony Condon & Matt Gonitzke
Additional photos by Harry Clayton, Lee Cowie and Matt Michael

The NG-1 is one of the Condon family glider fleet and is an interesting collection of Briegleb BG-12 and custom made glider parts. Most people can't quite figure out what it is at first glance and the best short answer I've heard to describe it is simply "Experimental".

The glider was built by Jerome Niedrauer in California in 1971 with the goal of reducing drag and increasing the performance of a stock BG-12. Niedrauer had previously built a BG-12B. The fuselage is modified in an attempt to lower the wetted area, reducing the height of the cockpit to 34 inches from 43 inches. Because of this the cockpit is necessarily lengthened in order to accommodate a reclined seating position. This has a few interesting side effects. One is that being so reclined means that the pilot cannot reach the instrument panel in flight. Set your altimeter before getting in!

In the interest of reduced drag the fixed main wheel is recessed as far as possible into the fuselage. This creates an interesting dynamic on takeoff as the pitch change between the glider being on its skid vs. on its tail is only a few degrees. This extends the takeoff distance and with no flaps on my first takeoff I nearly took as much runway as the towplane, while bouncing between the skid and the tailwheel. Later I discovered that using the first notch of flaps on takeoff and just holding the attitude steady made the takeoff a lot more enjoyable. Getting the right pitch attitude on landing is equally tricky and I'm proud that most of my landings have touched down on the wheel first, but a few have touched skid or tailwheel first.

The glider has been extensively sealed in the interest of aerodynamics. The wing roots are closed off and the aileron connections are surrounded by fabric seals. The canopy is equally well sealed and the nose is actually quite well insulated to keep cold air from leaking onto the pilot's feet during high altitude flight. The well-sealed, large canopy is somewhat of a detriment in the hot

Kansas summers however. The flight controls are all very well sealed too with foam seals or fabric tape between the fixed and moving surfaces and then a mylar-type external seal. The flaps have a fabric tape on the lower surface.

The original radio was mounted in the right wing root since that area is much more accessible in flight. That has been removed, along with the huge steel oxygen bottle and A8 regulator system. I do use the wing roots for in flight storage of flight recorders, handheld radio, and snacks. Visibility does suffer somewhat because the seating arrangement puts the pilots head (especially tall pilots like me) right between the wings. Another result of the shorter fuselage is that the shoulder mounted wings are 9 inches closer to the ground. Wingtip clearance is pretty minimal and wing runners have to be briefed to not lift the wing to "normal" height. If they do the other wing will nearly be on the ground.

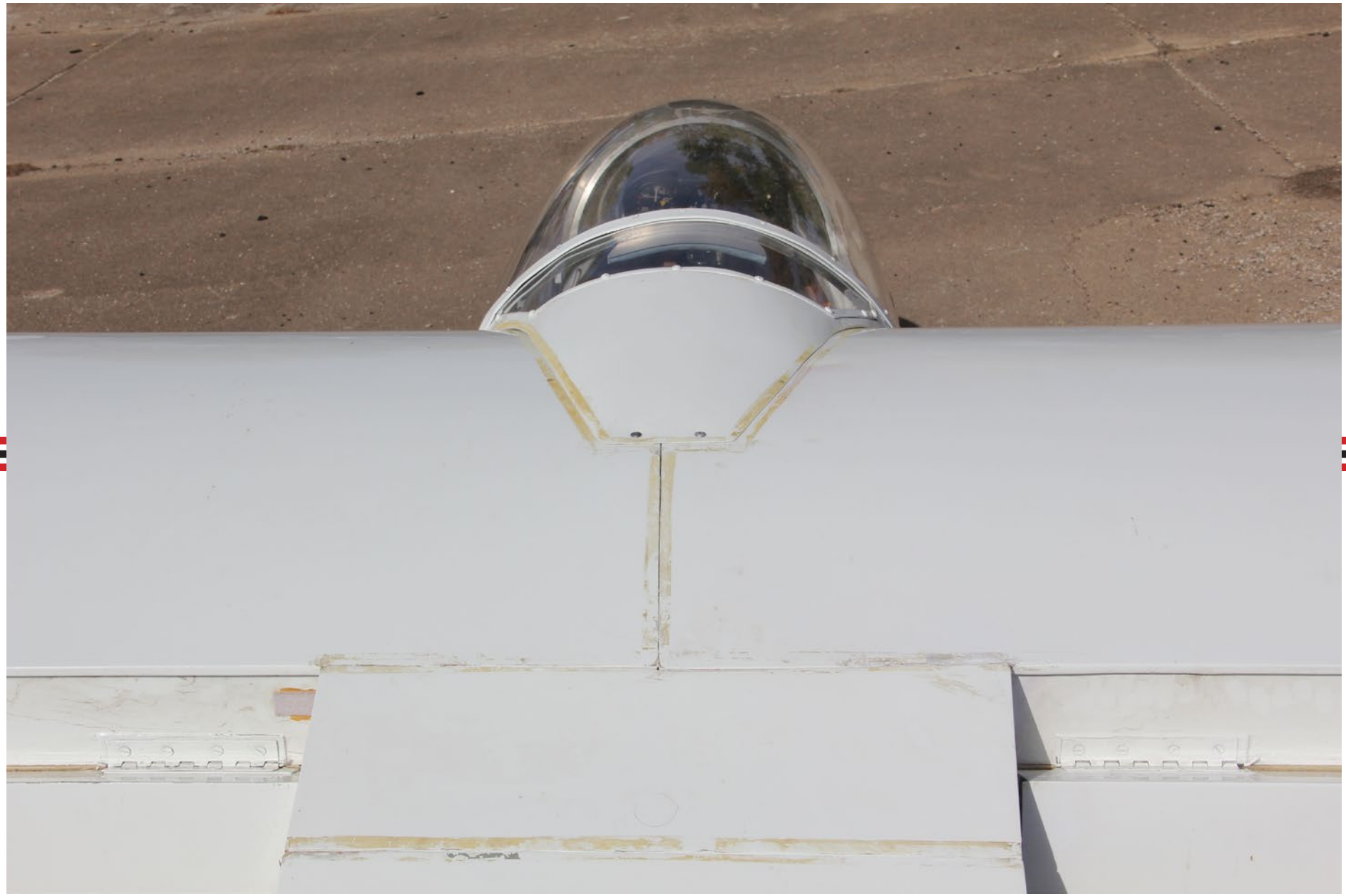
Speaking of the wing it is almost but not exactly a stock BG-12 wing. The main structure and carry-through is the same, including the 1/8" plywood skin, and the NG-1 features the larger span flaps which extend from the root of the wing to the aileron, following the taper of the wing. However, Niedrauer decided to go with a NACA 4400 series airfoil on this design. The flaps provide incredible glide path control. I don't think I've ever flown an airbraked glider that can approach as steep as the NG-1. As you can see from the pictures, the flaps add a LOT of frontal area. A full flap approach is not only impressive but a lot of FUN. As far as Leah and I can tell, the wings are just as heavy as you would expect from any other BG-12.

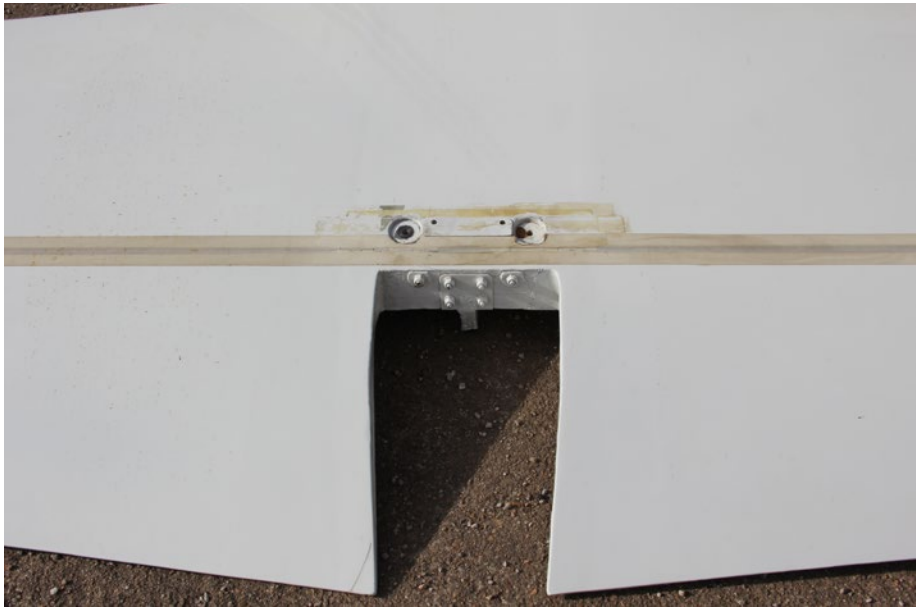
A few modifications have been made since the glider was built. Most noticeable among them as that the previous owner, Stan McGrew, changed the orientation of the stick to a side-stick. Originally the stick was vertical like you would expect in most planes but for Stan this resulted in an uncomfortable arm position and also affected forward visibility in flight. He cut the end of the stick off and welded it back on to the side in a comfortable position for him, so his arm lay nicely on his right leg. It works pretty well for me too. Stan also added a wheel brake to the glider, which previously relied on its skid for stopping power. He added a Matco disk brake, actuated by a T handle on the left side of the cockpit, below the tow release (red

handle) and air vent control (yellow knob). When the glider is empty there is very little weight on the tail, so almost all of the pilot weight is on the skid. Between lots of weight on the skid and the wheel brake it can stop very quickly with effort. The towhook on the NG-1 is unlike any I have ever seen. It has on over-center mechanism inside the glider and can only be locked from the outside. Another thing on which to brief the launch crew.The flying qualities of the glider are generally good, with no bad manners discovered so far. It is somewhat neutrally stable. The wing has no noticeable dihedral and it seems that it is happy to fly along in any attitude until input is made to change it. This characteristic makes for very enjoyable thermalling, as you just put it in the turn you want, return the controls to neutral, and watch the glider climb. It seems like it is on rails and with one notch of flaps, it climbs pretty well. The finish on the glider is in pretty good shape and a common question is if the glider is fiberglass, quite a compliment. In the 1990's it was refinished by an owner in Minnesota. The wood was covered with a lightweight fiberglass layer and then painted with DuPont Imron. There are a few places where the finish is starting to crack after 20 years of service, but in general it is in great shape. The great finish did come at a price though, it increased the empty weight by over 20 lbs.In the performance department it seems that the modifications definitely helped. I have not been able to do any real glide testing but a few late afternoon glides in smooth air have shown that the max L/D seems to be in low to mid 30's. Paul Bikle measured a BG-12 at 31:1 in the "Polars of Eight" testing. Niedrauer claimed 35:1 at 55 mph based on comparison testing. I had 3 cross country flights in the NG-1 in 2011. Distances flown were 190, 216, and 210 miles. The 190 mile flight was an FAI triangle for Diamond Goal and a few Kansas State Records. The 216 mile flight was for our Kowbell Klassic which was reported in the Spring 2012 Bungee Cord and won me the KSA Wooden Wings trophy for 2011. In 2012 my glider priorities were a bit different and I didn't get the NG-1 out on as many good soaring days. However on the one good day that we did fly I flew over 100 miles in just over 2 hours. The glider definitely has legs though; Niedrauer earned all of his Diamonds in the glider, climbing to 30,000 feet in the Sierra Wave.


N6312

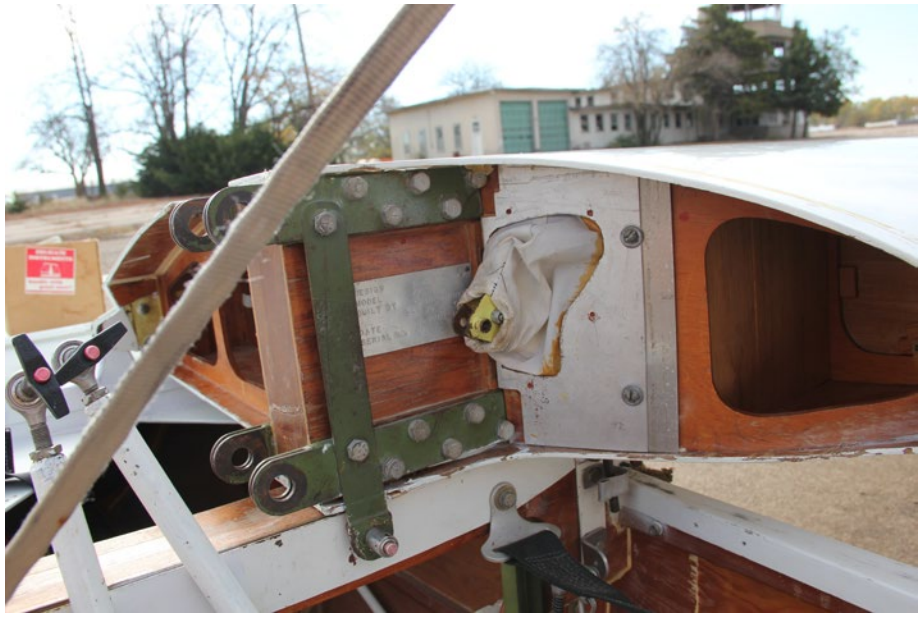

N6312






EXPERIMENTAL


N6312




DESIGN
MODEL
BUILT BY
DATE
SERIAL NO.


Harry Clayton


Lee Cowie

Vintage Sailplane Association

A Division of the Soaring Society of America

Promoting the acquisition, restoration and flying of vintage and classic sailplanes and gliders and preserving their history since 1974.

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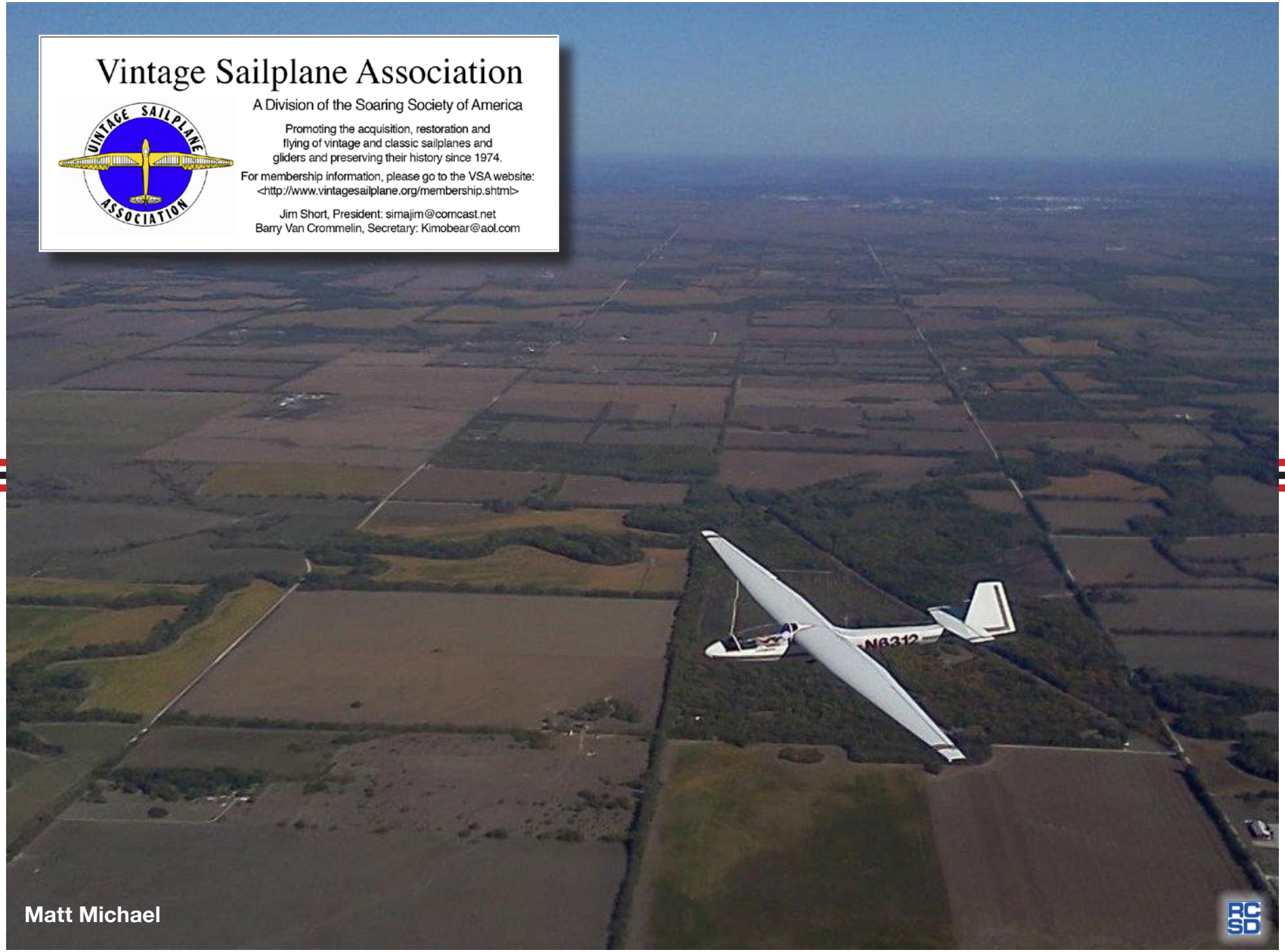
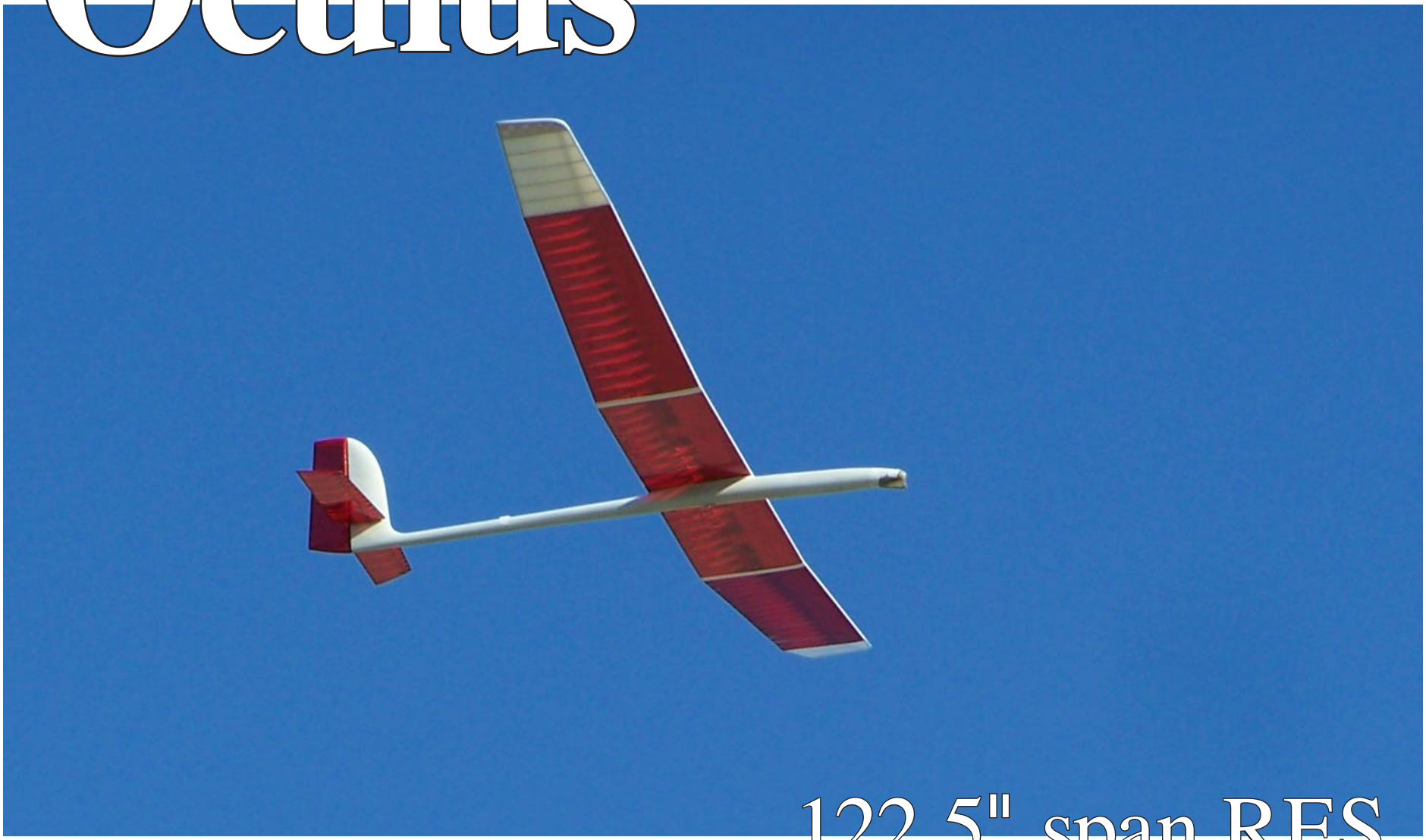


Matt Michael

Oculus



122.5" span RES

MM Glider Tech

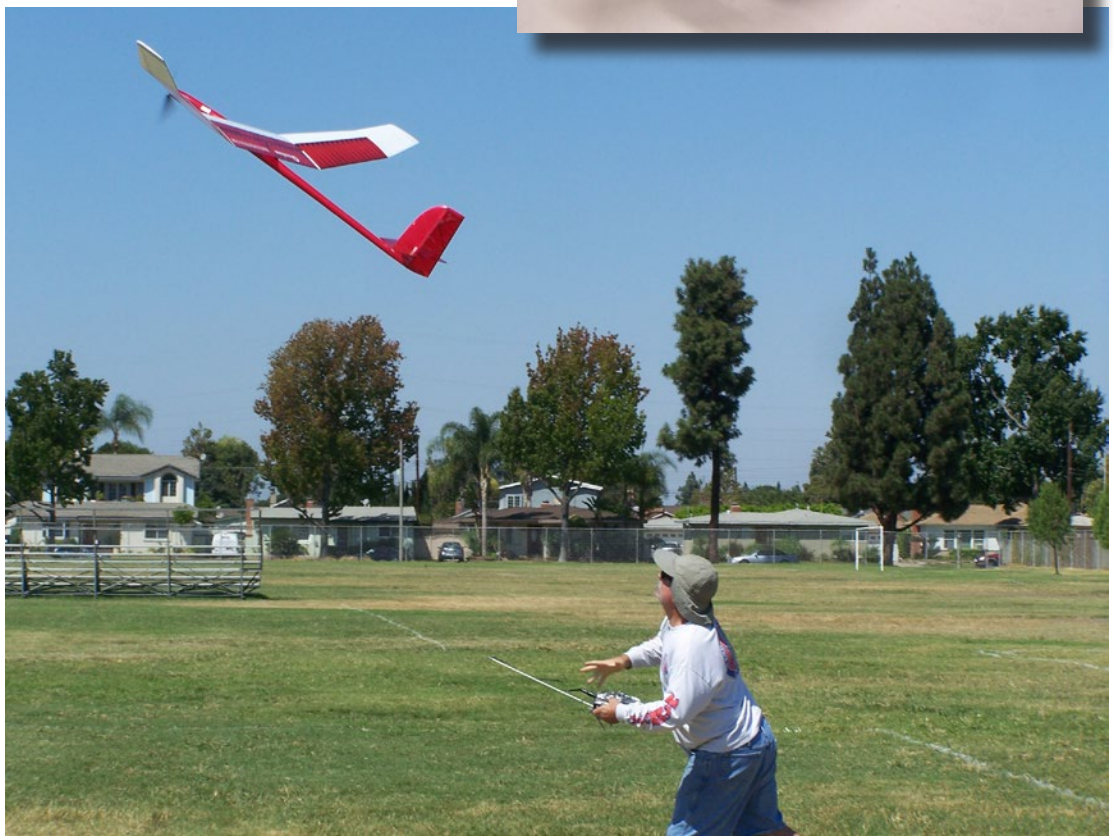
Merrill Brady, mm.glidertech@verizon.net

MM Glider Tech is proud to introduce the Oculus RES competition sailplane kit. Oculus is the result of many years of model sailplane design experience and many competition wins. Oculus gives the RES competitor a world class American sailplane with equal or better performance than exotic and costly European contest aircraft.

Oculus uses traditional balsa and plywood construction, strengthened in critical areas with carbon fiber. Veteran RES designer and contest-winning pilot Merrill Brady worked very hard during the design and development to capture the ideal balance between the sailplane having the strength to withstand competition launches, and a glider that delivers unequaled thermal indication/ response/handling.

This sailplane delivers the highest flight performance, yet still gives the RES competition pilot “instant” fingertip control that only a light balsa structure can achieve. The result is a nearly magical ability to turn and perform in light air, making usable lift out of what would otherwise only be a gust.

The magnificent Oculus kit is a joy to build, with beautiful precisely laser cut ribs, hand-selected contest quality strip and spar woods, top quality carbon structural reinforcement materials, and exquisitely drawn plans. Drag reduction and world class styling are provided by a gorgeous hand-laid epoxy fiberglass fuselage. An electric version for limited motor run type events will soon be available, as well as the original RES competition sailplane version. The MM Glider Tech Oculus is proudly designed and manufactured in the USA.



Specifications

Wing Span:	122.5 in.
Wing Area:	1285.25 sq. in.
Length:	63 in.
Airfoil:	SD3021
Typical Flying Weight:	62 - 68 oz.
Construction:	2.4 friendly composite lay-up, laser cut ribs, carbon tubular, Kevlar wrapped spar

The Oculus kit will come with:

- Painted in the mold white 2.4 friendly fuselage.
- Pre-wrapped carbon fiber tubular spars.
- Compression molded joiner rods.
- Laser cut ribs for the wing and tail.
- 0.007 carbon for the rib caps.
- CAD blueprints.
- Detailed instructions.

Oculus kit price: $425 + S&H
California residents add 9.75% sales tax

<http://www.mmglidertech.com>
<mm.glidertech@verizon.net>

Wiring RC Sailplane Wings

Pete Carr WW3O, wb3bqo@yahoo.com

Bill Kuhlman, Editor of *RCSD*, has sent me a copy of an article that appeared in *Flying Models* magazine. It was the January issue and the R/C Aerobatics column by Dave Lockhart.

The material covered the radio/servo wiring of aerobatic aircraft with special attention to expected servo loads and wire sizes. There are several tables included that deal with voltage drops and measurements for typical size 3-conductor cables as well as "universal" type connectors. There is also a discussion about using a single pair of red/black wires in each wing panel or the fuselage for battery power and connecting to that at each servo location. It's an interesting article and well worth reading.

I'd done a similar article for *RCSD* about 20 years ago when PCM radios were just becoming popular. At that time the best feature of PCM was that it didn't need filters and noise traps to keep transmitter signals from being picked up by the servo wiring and jamming the receiver. Bill thought maybe it was time to redo the material in light of the advent of 2.4 GHz radios and the increasing number of servos in sailplanes.

Power (Watts) is the product of multiplying voltage by current. In the case of RC sailplanes that power source is the battery. Power is passed to the RC receiver where it is tapped to run the electronics and also to a "tie point" where it is divided at each servo connector. From there power is fed through wiring in the fuselage to a set of connectors where the sailplane wing panels plug in. Then power continues out the wing wiring to each servo. The total resistance of the wiring from the battery to each servo is the power loss which degrades the ability of the servo to do its job.

A German physicist, George Ohm, authored a book in 1827 detailing three basic formulas that came to be known as Ohm's Law. They describe the relationship of voltage, resistance and current in a conductor.

They are:

$$E = I \cdot R,$$

$$R = E / I, \text{ and}$$

$$I = E / R,$$

where E = potential difference across the conductor in Volts, I = the current in Amperes, and R = the resistance in Ohms. The formula for Power P in Watts is

$$P = E \cdot I.$$

If you use a good quality digital multimeter along with these formulas, you can determine the loss of the wiring at any part of the circuit for the radio system of your sailplane.

There are, of course, some problems with that! For example, the typical flap servo may be held at neutral while the sailplane cruises. This requires a small

amount of power from the battery. Then, because your coming down out of a thermal or the clock is running down, you need to safely get down to a lower altitude in a hurry. This means dropping the flaps to 90 degrees deflection and pointing the nose straight down. Suddenly the power needed by the flap servos goes up dramatically!

Any set of circumstances that drag the battery voltage below the threshold of the receiver operating parameters will cause a radio link failure. That's like rebooting your lap top computer. It takes time for the program to reload after power is restored. It means that a high power load on the flap servos can cause the whole system to shut down.

battery operates the servos, there is less possibility of a receiver lockout.

The *Flying Models* article indicates a loss of about 0.12V per standard servo connector with a 2A load, and a 0.04V loss at 1A. These are the 3-conductor types found on servos and battery/switch assembles.

I use two types of connectors on my larger ships. One is the Deans 4-pin connector which is red colored. The other is the Deans 3-pin connector which is black.

As the servo fights the wind stream it's components heat up and so do the "high resistance" points in the wiring back to the battery. If it takes you several minutes to get down to landing pattern altitude that can mean significant heating of the parts and an increase in the resistance as well.

The load factor, the duration factor, and the amount of wiring in each servo circuit all add variables to the Ohm's Law equations.

This set of variables has been a significant cause in the reliability problems of 2.4 GHz radio systems.

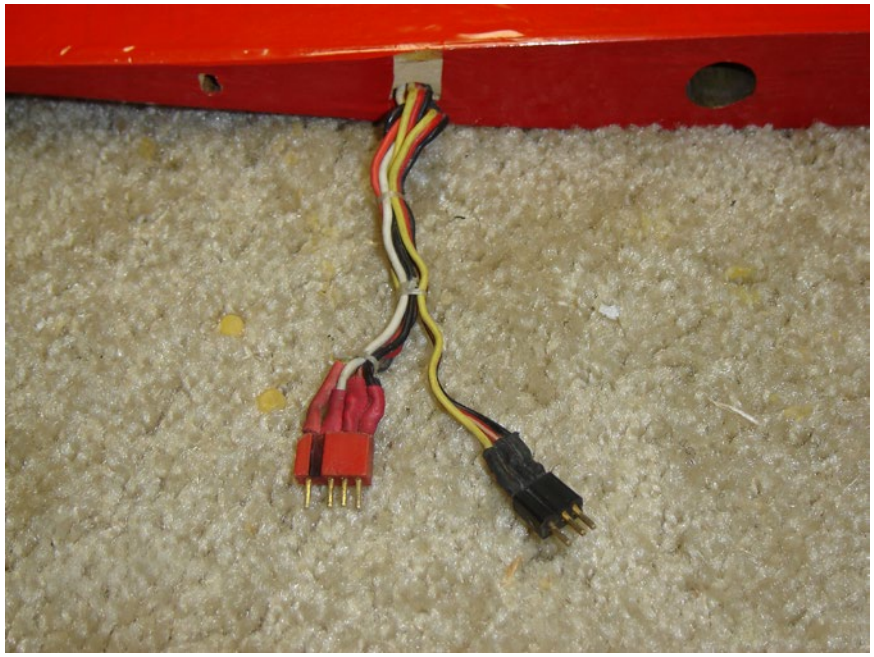
Some sailplane people have resorted to using LiPo batteries with a voltage regulator to keep the receiver voltage high enough to prevent a lockout. This has the added benefit of making the servos less prone to "sag" under heavy loads. Ohm's Laws still apply but we have raised one of the factors.

Another solution is to separate the receiver battery from the servos. Newer servos can tolerate the full voltage from a 2S LiPo where the receiver wants <5 Volts. If a voltage regulator is used with just the receiver, and the full power of the

I normally solder the cables in the wing directly to the servo leads since access to connectors is very difficult if there is trouble. I twist the bare conductors together for direct metal-to-metal contact and then add solder. The joints are then covered with good quality shrink tubing. That makes the connection the same power loss value as a continuous wire.

The *Flying Models* article also discusses the two common sizes of cables used in sailplanes. They are 22AWG and 26AWG wires. The 26AWG is considered standard size while the 22 AWG is considered "heavy duty."

This is the lower surface of the starboard wing panel of the Apache. It has inner and out flaps and also ailerons. The means that there are three servos in each panel. 3-conductor cables are spliced into the wires from each servo and insulated with shrink tubing.



Standard practice with Deans connectors is to use the male part in the wing. When not connected it has no power applied so can't short to other stuff.

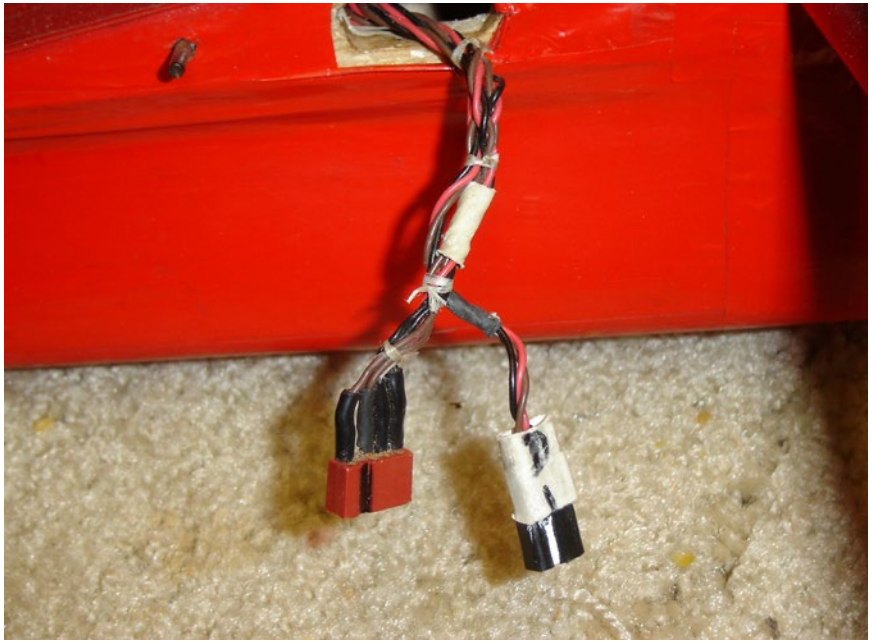
Dave Lockhart also discusses the use of a single pair of conductors for red and black power run down the length of a very large fuselage with each servo taking power from that. There is a weight savings associated with that and some sailplanes use that type of circuit. In that case the total current drawn by the servos is centered on one pair of wires. These wires and the connectors in the circuit would have to be sized to handle the worst load situation expected in flight.

Back at the dawn of radio control, radios were amplitude modulated and were prone to electrical noise interference.

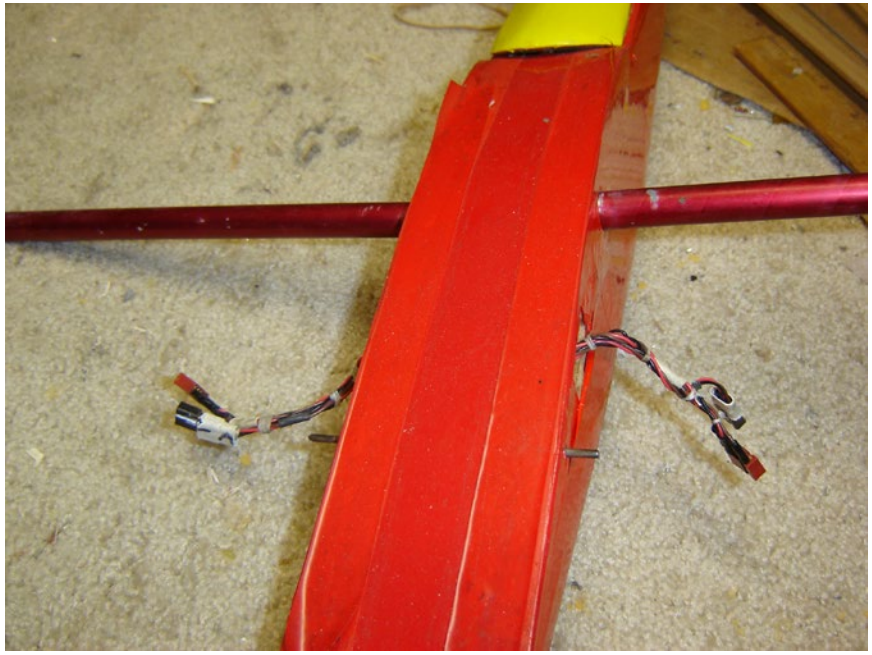
FM and now packet data signal transmission have done away with that problem. The venerable Deans connector came to be the early standard for connectors since it was very reliable and generated no noise at all.

The "Futaba" type connector was the next major change in connectors and had crimped terminals. This removed the need to solder wires and also to insulate them with shrink. This change made the junction of the wire and connector pin low power loss as well.

Unfortunately, we are still using the same connectors today that were used in much lower power applications just a few years ago.



The female Deans connectors are used in the fuselage wiring. The hole in the side is just large enough to pass the connectors. This means I have to use hemostats to feed the wiring and connectors through the holes.



The wiring in the fuselage is brought out from holes just aft of the main wing rod. Since the rudder is controlled using pull-pull cables this wiring was positioned and tied in place to avoid resting on the rudder cables.

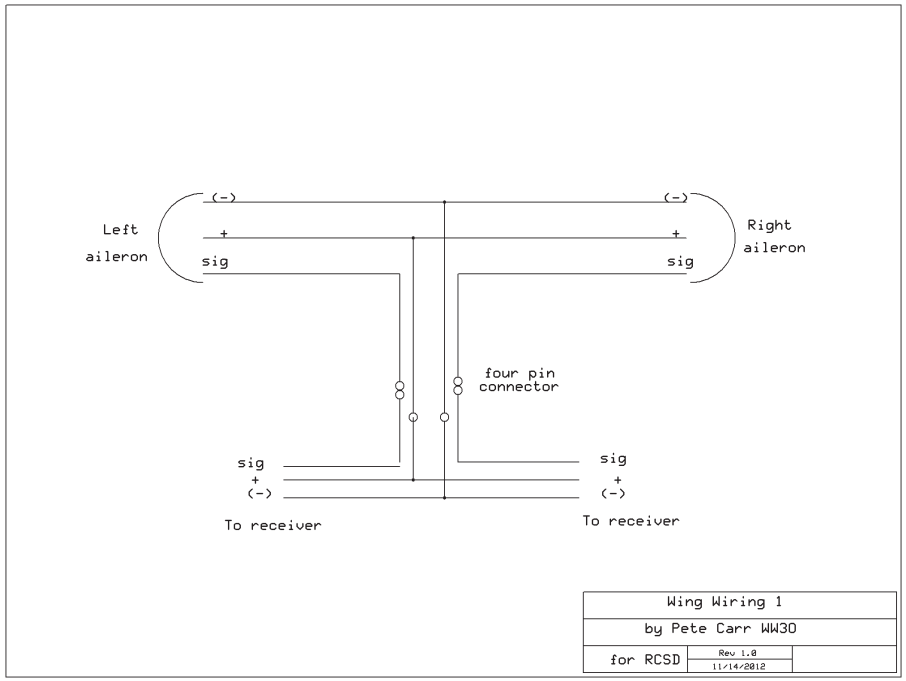
It makes no sense to use the same connector in a discus hand launched sailplane that is used in an F3J or F3B ship.

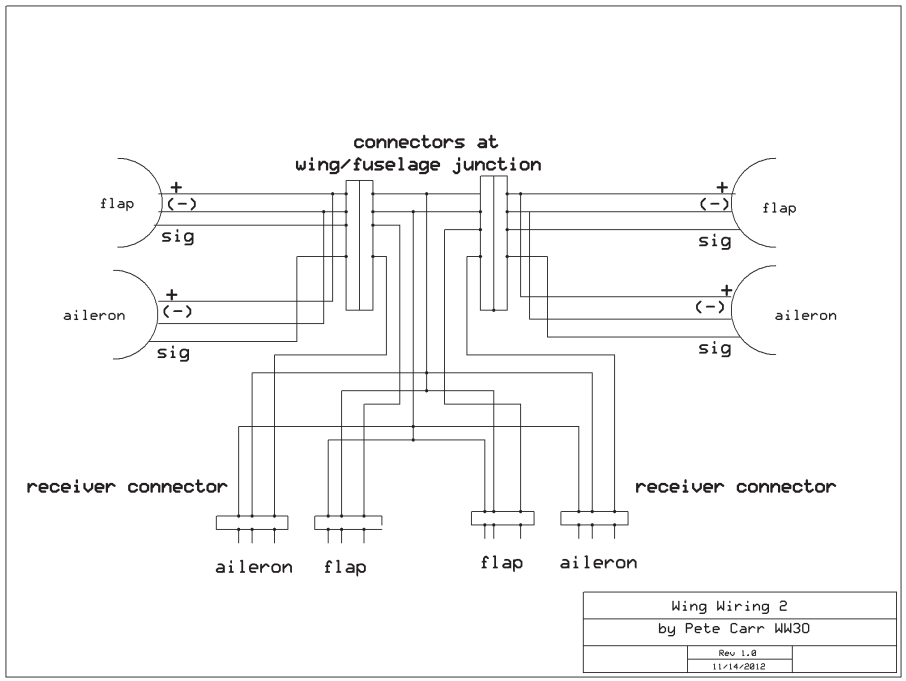
For this reason I use two types of connectors on my larger ships. One is the Deans 4-pin connector which is red colored. The other is the Deans 3-pin connector which is black. Both requires soldering of the wires to the pins and shrink tubing for insulation. Both have larger pins and sockets than the “Futaba” type so have lower power loss. They are also very repairable.

There is one aspect of these installations that is easily overlooked. Every time the aircraft is assembled or taken apart there is wear on the connectors and wiring where the wing panels join the fuselage. Of the problems I’ve had with sailplanes this location causes the most trouble.

Some people use 8-pin connectors and have a really hard time pulling them apart. That leads to pulling on the wiring instead of the connector body and that is followed by broken wires.

I prefer to use two connectors per wing panel, a Deans 3-pin and also a Deans 4-pin. That way I split the required force needed to separate the two halves of each one. The photos of the Apache wing are a good illustration of that. It also makes it somewhat easier to feed the wiring back inside the fuselage as the panel slides onto the wing rod.





Those pilots who fly 2-meter ships with a one-piece wing can use the diagram labeled Wing Wiring 1. That also works well for ships like the Olympic II that has a two piece wing joined in the center. If the Oly uses only spoilers then the second connector would not be necessary.

For ships with just a single set of flaps and ailerons the diagram labeled Wing Wiring 2 is a good example of using two connectors per panel.

Earlier I mentioned stuffing the wiring back inside the fuselage when assembling the sailplane. I use dental floss to tie these wires into a bundle. This makes it easier to fed the bundle through the hole in the fuselage side and also strengthens the wiring considerably. Nylon lacing cord, as used in telephone central office cabling, also is great but not easy to obtain. The key is to form a bundle of wires for mutual support and also to reduce flex at the back of the connector.

The power requirements and mechanical reliability of wiring of sailplane wings is a key part of the overall reliability of the aircraft. Rather than using the available parts you have on hand, take a moment to look at the circuit components from the battery to the furthest servo and decide if they are really up to the task.

Resources

Flying Models magazine, January 2012 issue, R/C Aerobatics column.

<http://www.nndb/people/649/0000873881/>. Georg Simon Ohm. Physicist who discovered the relationship of current, voltage and resistance in electronic circuits.

<http://www.arrl.org>. The Radio Amateurs Handbook, Chapter 3, Electricity, Components & Circuits. A clear description of the Ohm's Laws, the "wheel," and how they apply in circuits.