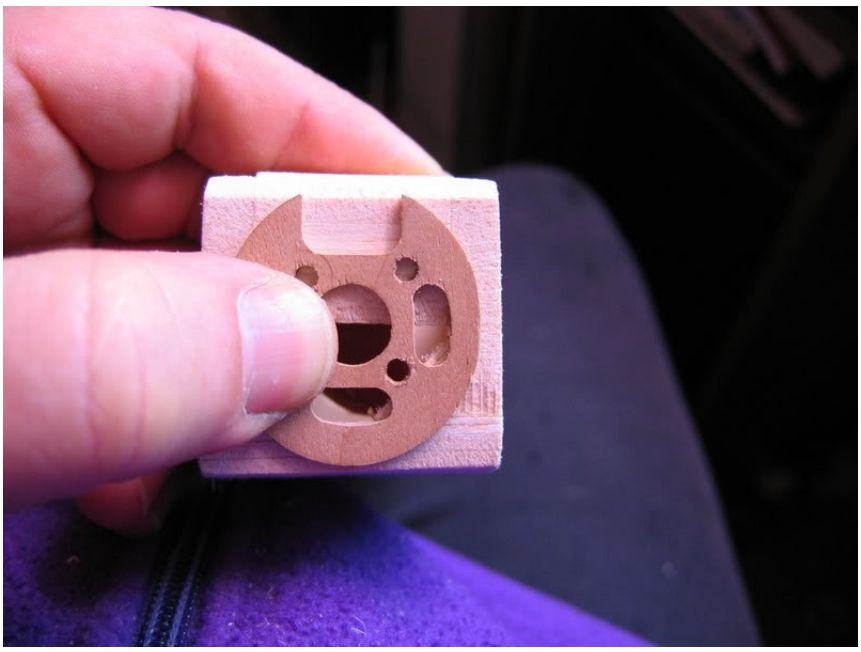
How to Assemble a Guppy

Report: fuselage

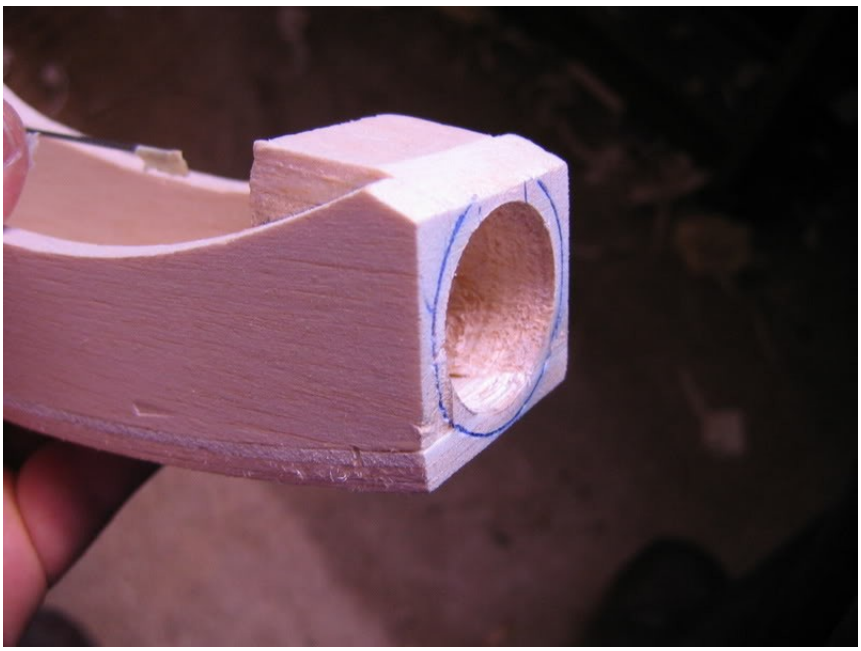
Today I glued togethet tail boom with front part of the fusselage. I use PU based expandable glue, so if any gap between the parts, glue will fill that. Iwrap joint with tape until glue dry. Before glueing the vertical tail fin must be checked if is vertical and ar proper angle to the wing saddle.

Next I use motor mount to mark roughly where it will sit at front of the fuselage.

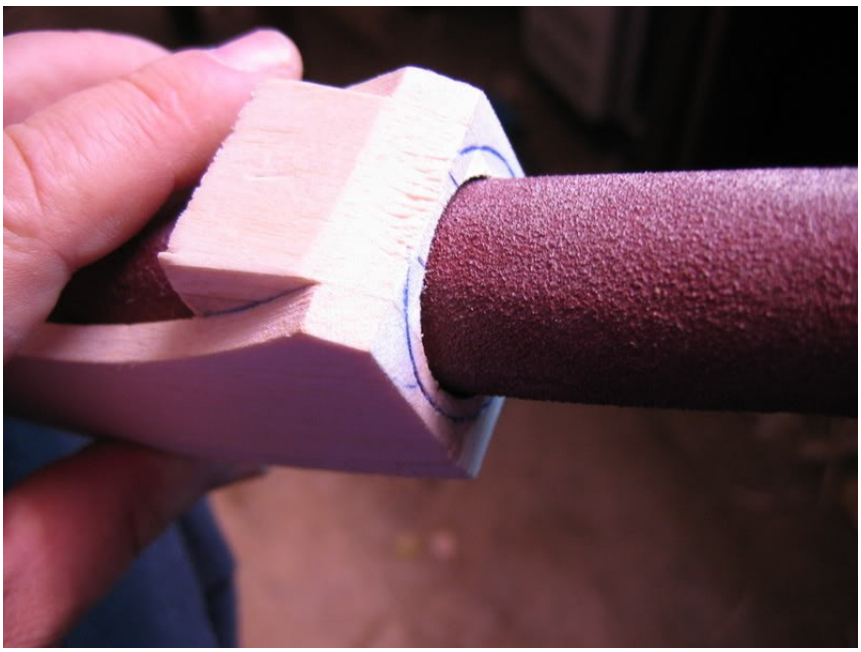


Now I "drill" a 27,5mm diameter hole in the nose perpendicular to the front surface.

I use a can from a broken Speed 400 motor. Just hold in hand and "drill" trough balsa. very carefully, but the result is satisfactory in no time.



I use some rolled sandpaper to further clean the hole. Next I paint with clear dope all interier of the fuselage including the motor compartment. I hope, that will give dome toughtnes to the inside surface of the cockpit.

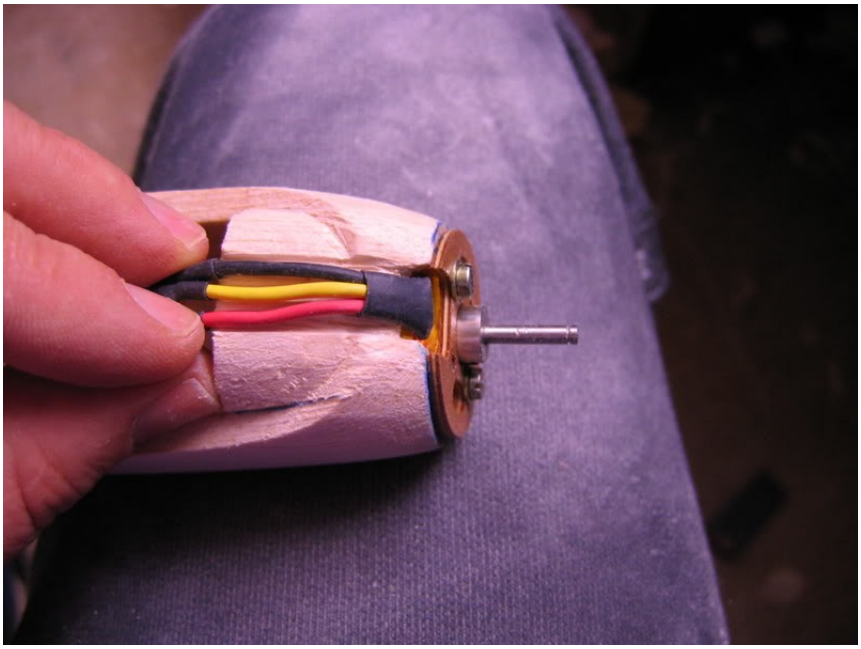


I roughly carved a upper nose section, and install a protection rib between battery and motor compartment.

I check if motor installation is not obstructed with that rib.

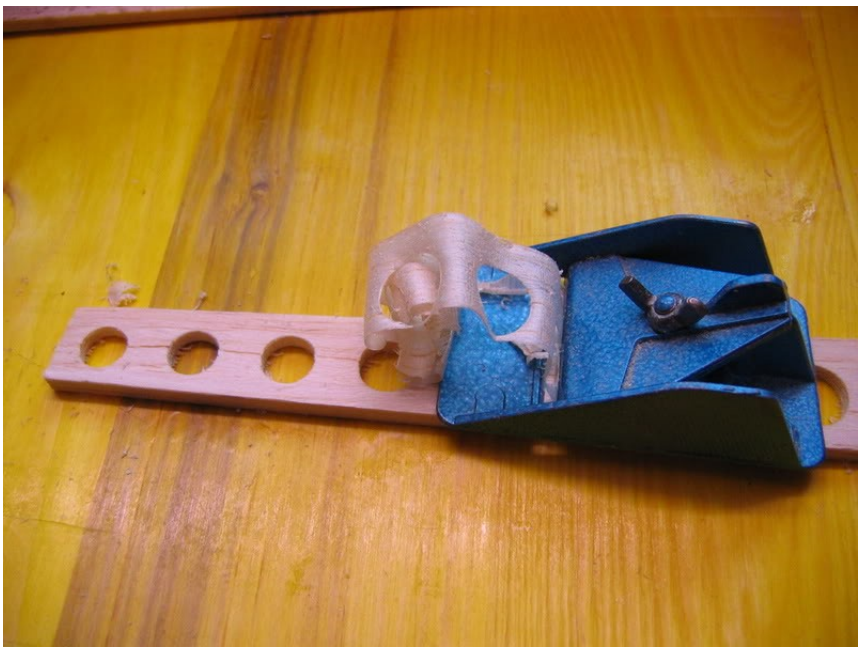
I use a plane and roughly bevel bottom edges of the fuselage. Then I make a radius. I use rough sandpaper and finish with very fine one.

I carve upper side of motor compartment and make three grooves for the motor electric wires. Some further sanding will be done later.



I glue a scrap balsa piece to the root of the vertical fin to form a radius. Some further sanding must be done on that detail.

I allso work on the wing today. I glue the wingtips, and roughly shape ailerons cross section.

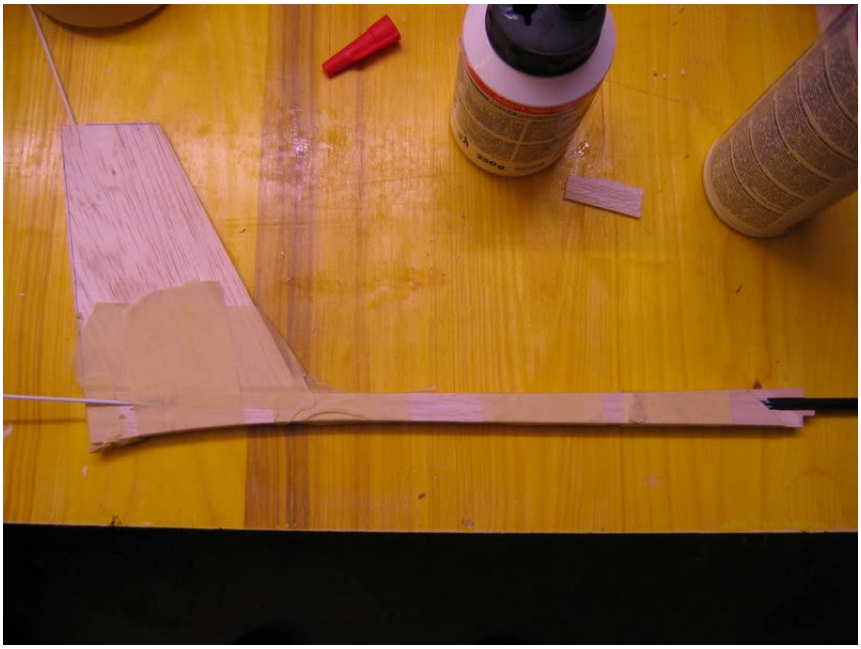


I assemble the rear part of the fuselage.. so called BOOM, using white glue and some poliurethane based glue that expands (Not PU fomam from can, but GLUE)

This expanding glue will fill most of the cavities between carbon tube and balsa sheeting.

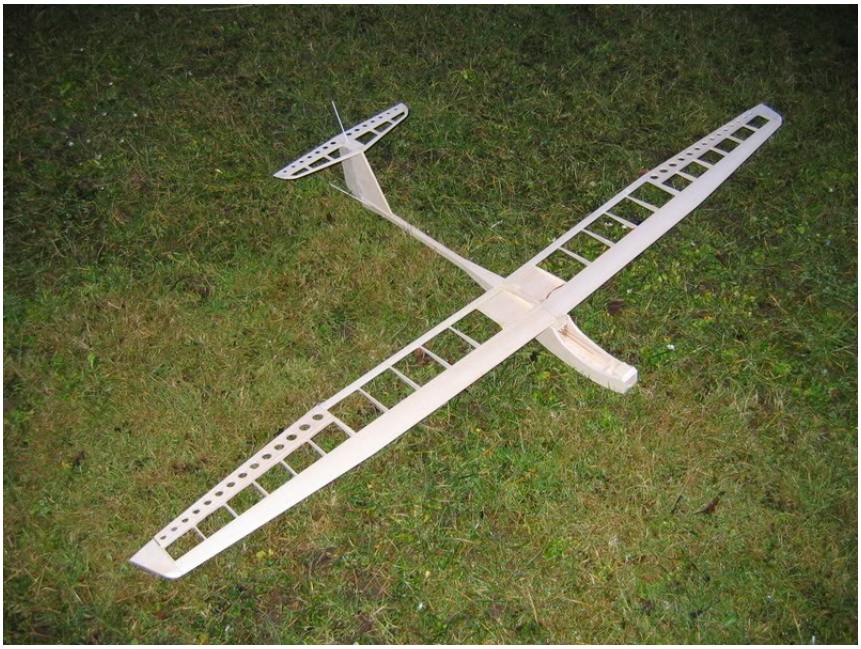
The brownish glue is PU expandable glue.

Hopefully this expandable glue make a solid "grip" between a carbon tube and a wood. Both together make strong enough tail boom, both in bending and torsion.



I wrapped the tail boom assembly with an adhesive tape and left on the flat surface until glue dry.

At this moment, model looks so, and it weights 180grams:



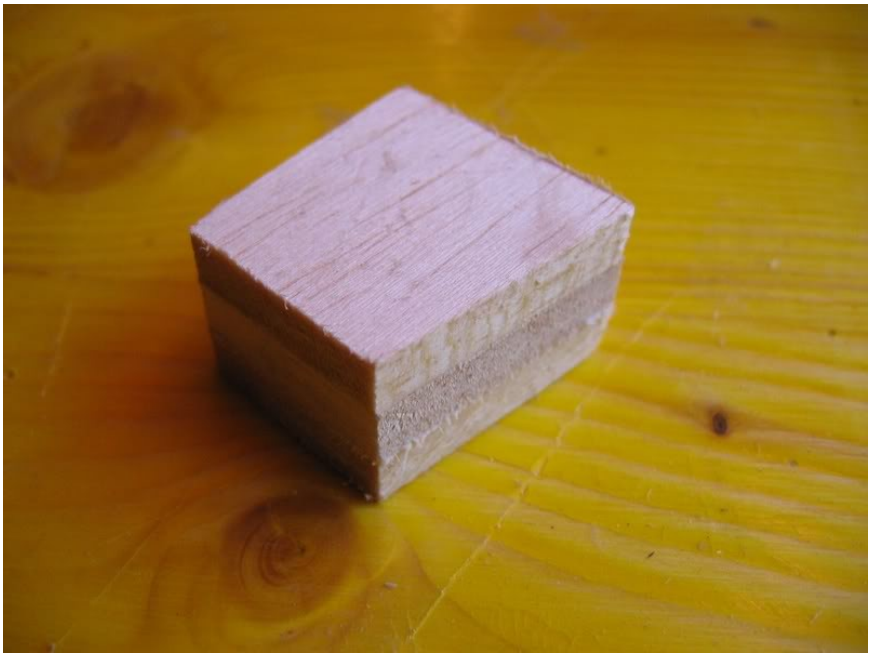
For these photos, parts are just temporarily taped together with adhesive tape.

Fuselage front and rear part are not yet glued together, and cross section is still a rectangular, not rounded.

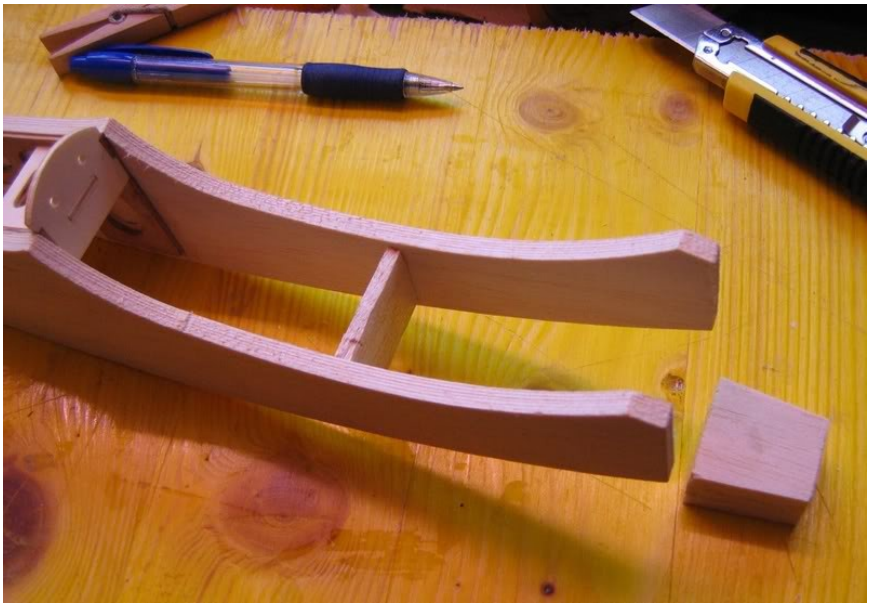
Wings missing some of the sheeting at the root and servo bays, wing tips and ailerons need to be properly sanded.

I prepare a nose block for the fuselage. It is made from 3 pieces of 6 mm thick balsa. Two parts with lengthvise grain orientation ans one with cross grain orientation.

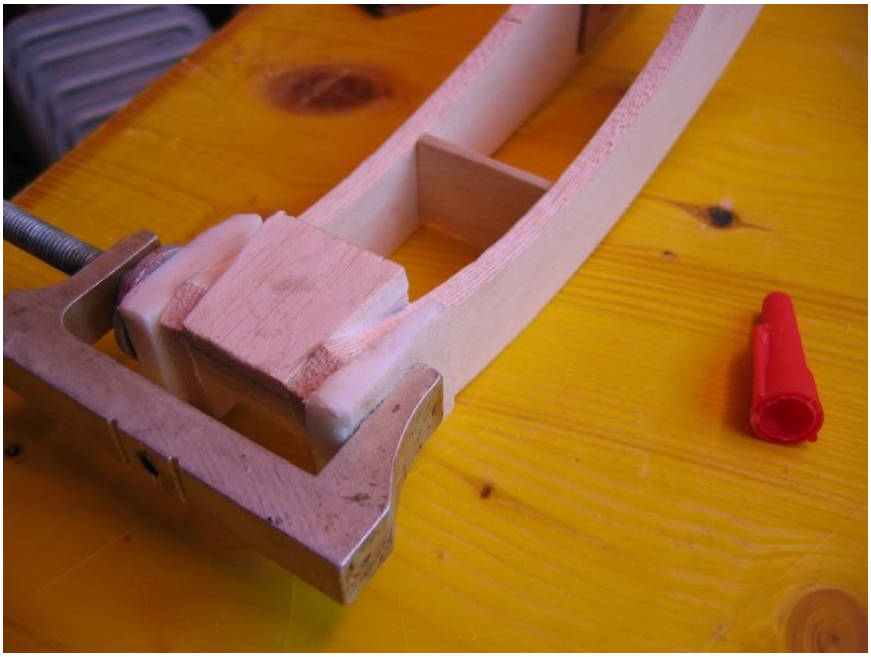
All thre parts are glued together in a block. Crossing the grain orientation prevent the splittering of the block. It became more rigid.



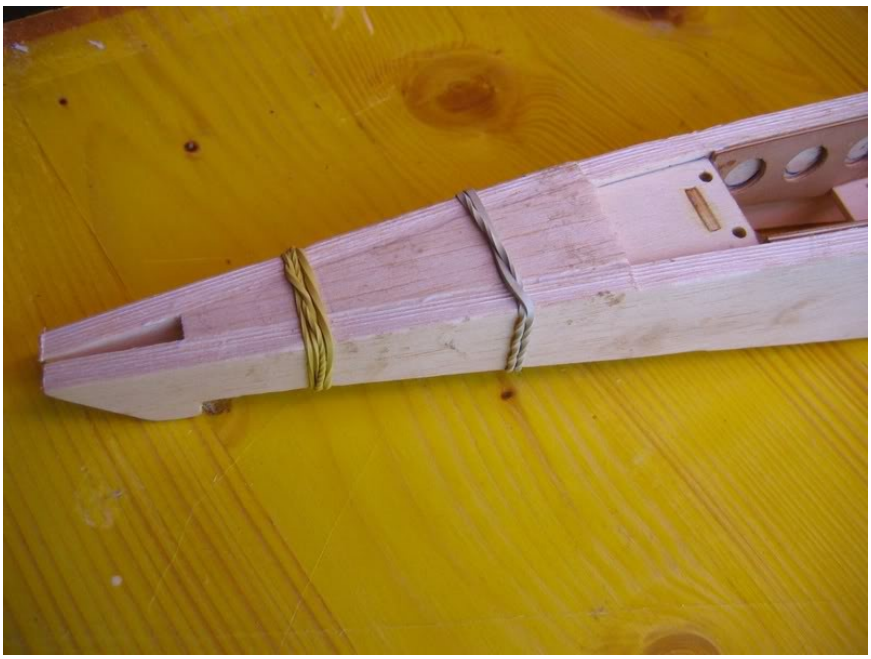
I prepare a scrap balsa piece for supporting the cockpit sidewalls area, so they stay in proper distance apart, when I clamp nose section together to glue the nose block in.



I glue the nose block between sidewalls using a C clamp and two styrofoam wedges. It is crucial here to check teh simetry. Both sodewalls should bent equally. Some moisture at the outer sidewall surfaces can help bending sidewalls.



I prepare a rear upper balsa and glue it to the rear of the front fuselage assembly. I use some rubber bands to hold all in place.



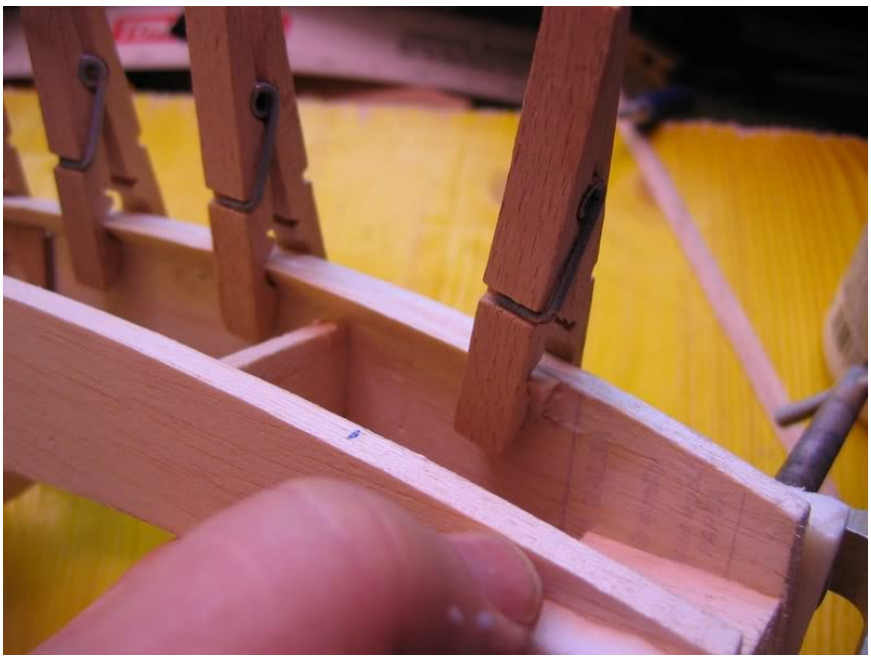
I left aside for glue to dry.

I mark a lines, where some sanding should be done later in order to accept the tail boom assembly.

The width of slot should be 6 mm.

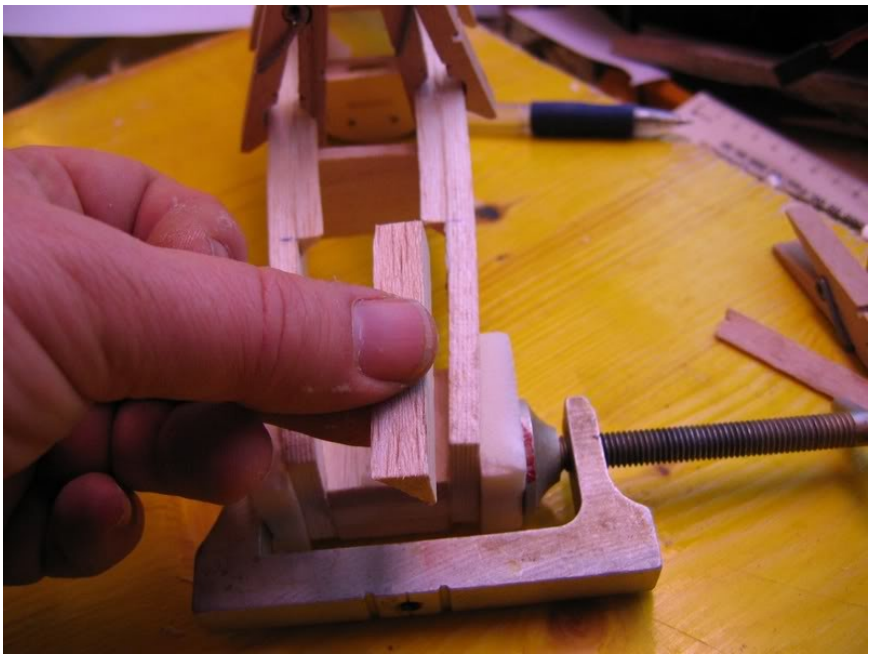
Now, we need to prepare some corner balsa triangular strips.

I cut 6 mm thick balsa at angle of 45° and glue it to inside side of fuselage walls (of course at the bottom contour) Triangular balsa ends 53 mm before very end of the fuselage nose.



I made the same allso on the oposite side.

Now I prepare slightly thicker balsa triangular blocks. They were made from a 8 mm thick balsa, and 53 mm long..



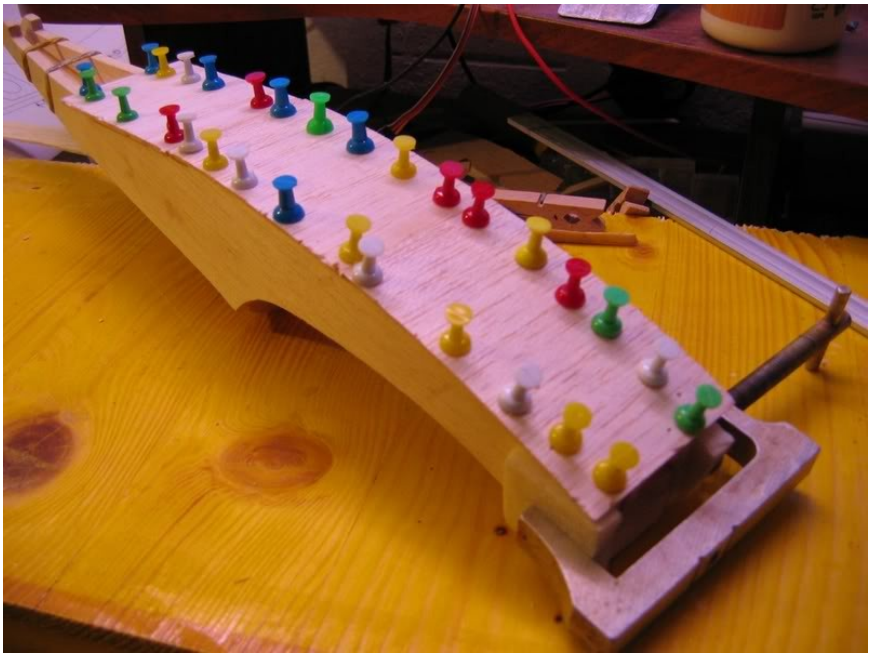
I allso glue those corner balsa on its place.

When glue was dry, I sand entire bottom side of the fuselage (sidewalls and triangular corners) flat, so the bottom balsa will have nice contact when glueing.

Then I prepare 2 mm balsa for the bottom of the fuselage.

On the older version of Guppy, the bottom was laminated in the mold made from styrofoam, but now, there is no need for such mold.

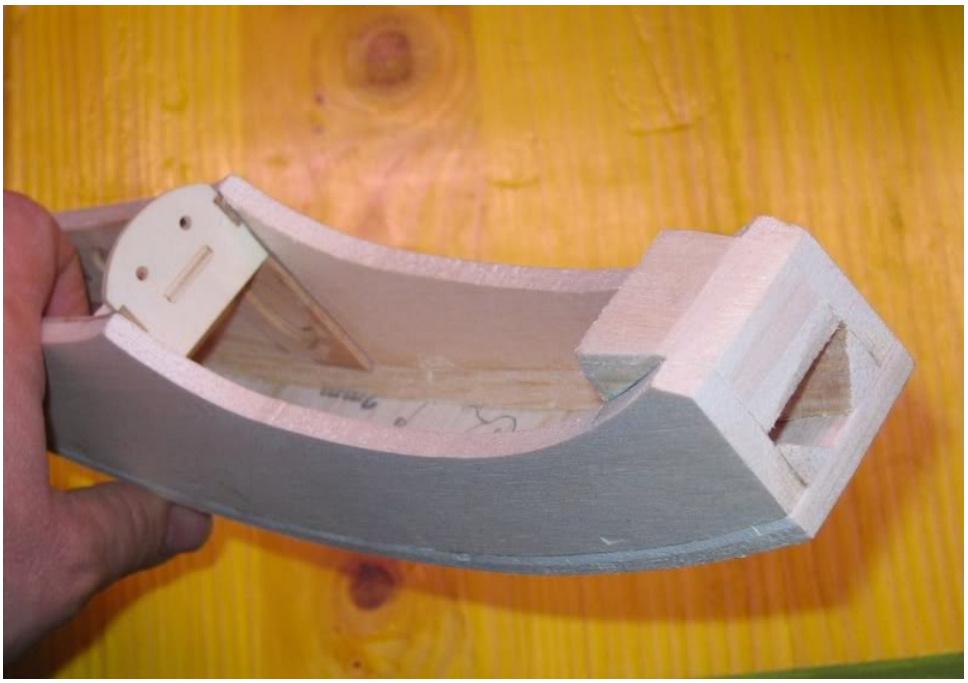
We just glue plys directly on the bottom side of the fuselage.



The first layer of balsa is glued with grains going from one to another side. That will reinforce the bottom against splittering.

Now prepare two balsa plates for another two layers. As seen from photo below, grains on those two goes lenghtvise.

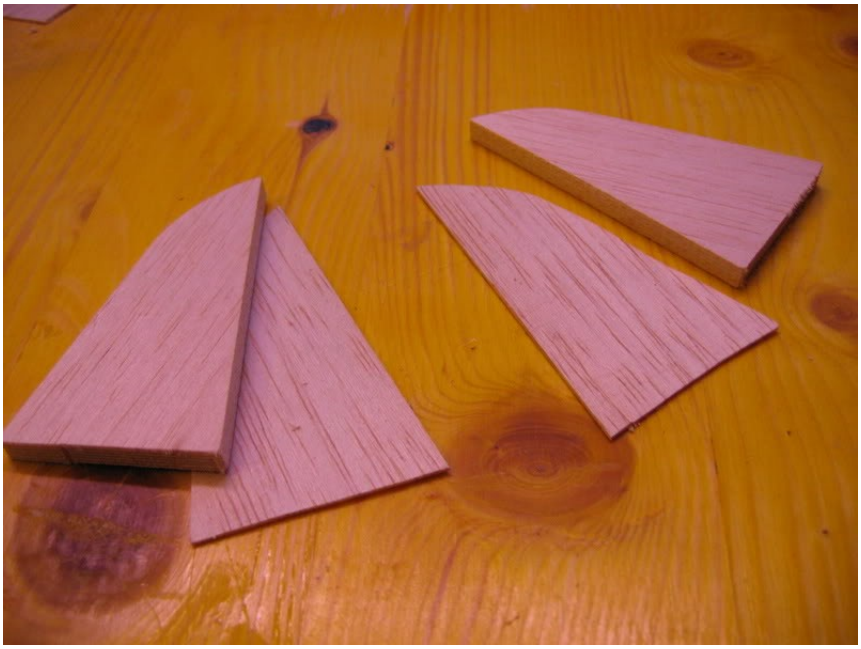
Glue those two layers over the first one and weighten tight untill glue dry. You can allso use an adhesive tape, to temporarily pres laminations together until glue dry.



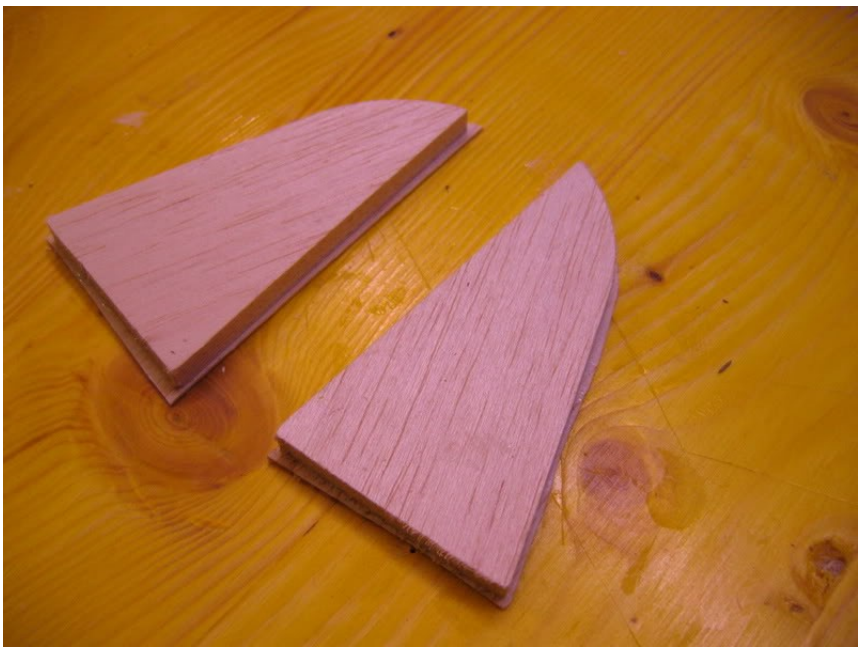
Now it is time to roughly sand all edges as fuselage bottom planks are made slightli oversized.

Sanded fuselage. Note the first layer of balsa with cross orientation of grains.

Wing tips are made from 6 mm solid balsa, that is reinforced with 1 mm thick balsa at the bottom, so the tip will be less prone to splittering.



Wing tips parts prepared for the glueing.



Parts glued. Note the 1 mm balsa is larger than 6mm. It will be trimmed off when sanding the tip shape (airfoiled shape)

Some work on the tail

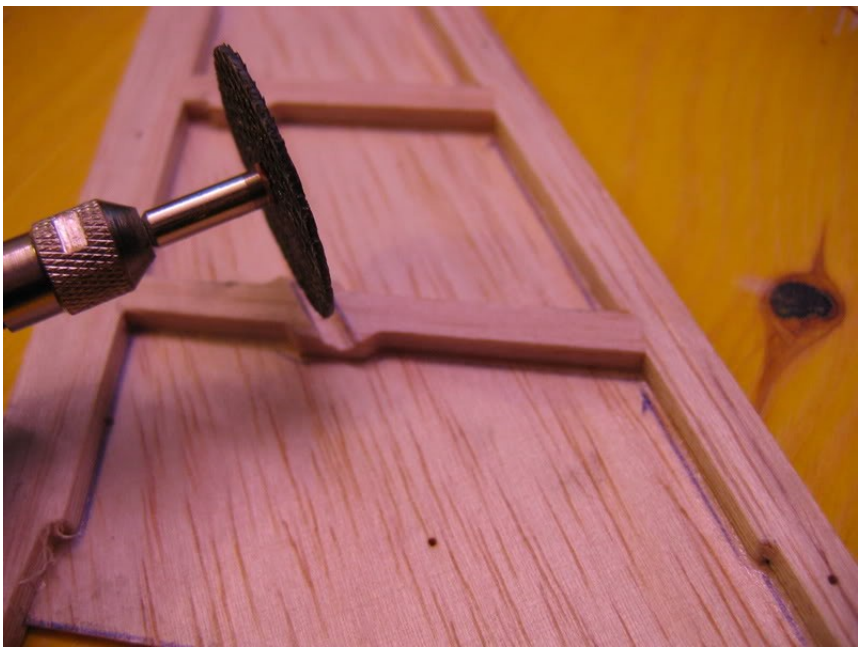
Today I didnt do much..only some minor work on the vertical fin and tail boom.

I cut slots on the carbon tube for exits of elevator and rudder bowdens.

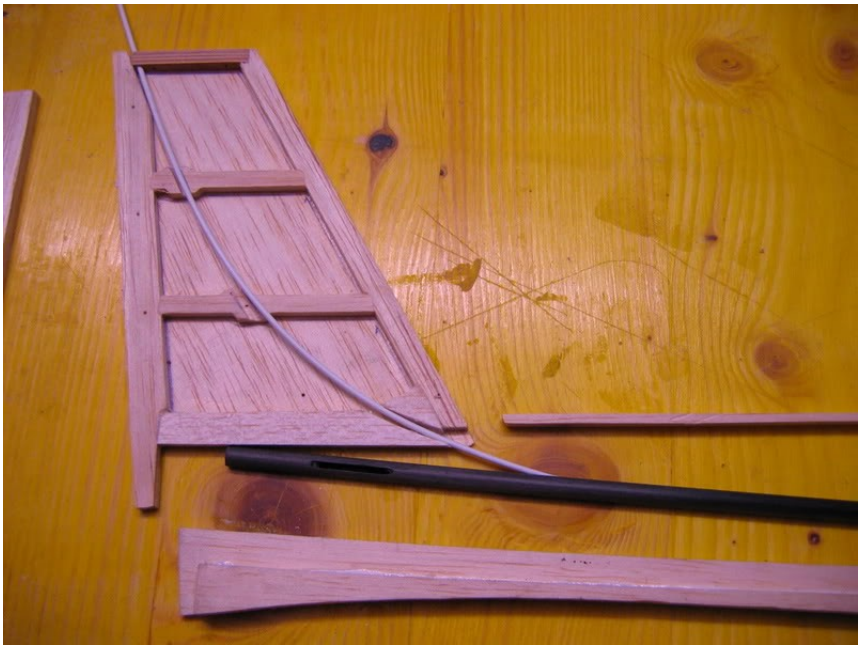
I use disc cutter and make slits 2mm wide and ~25mm long.

To mark where slots must be done, I wrap tube with an adhesive tape. It is easy to mark slots with pen on the tape. Tape also prevent tube to split accidently. After the slots are made, tape must be removed.

I made a grooves into the fin ribs to accept the elevator bowden.

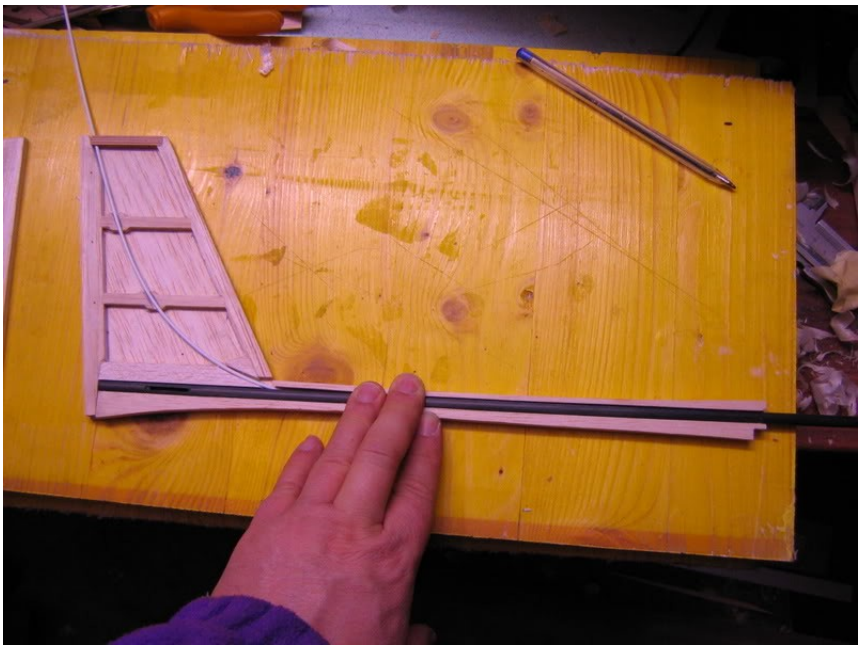


I prepare parts to test fit them, befor actual glueing.



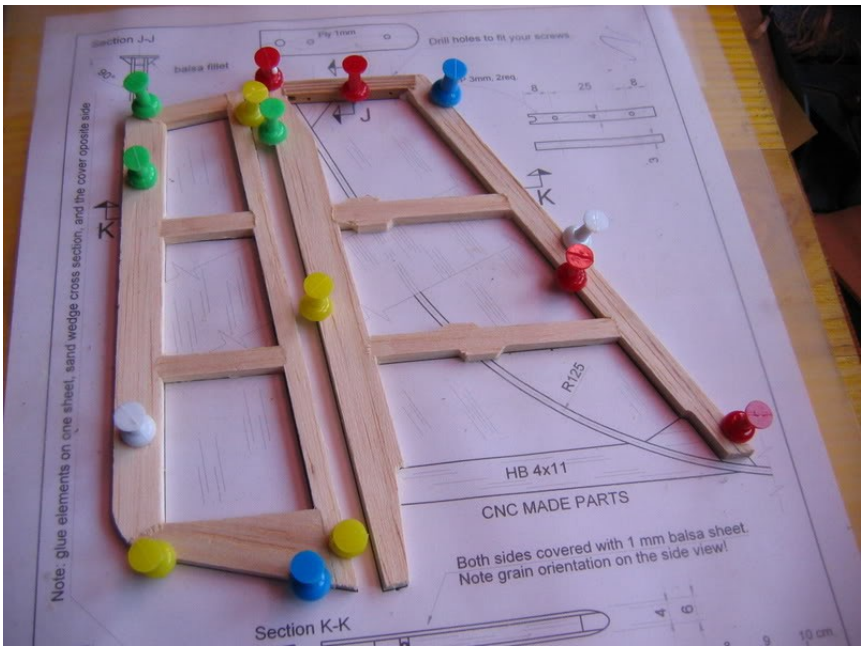
And that is how they must go together. Note the nice curvature of the elevator pushrod.

NOTE: all work with elevator pushrod must be made while a pudhrod steel wire (0,6mm dia) is ALWAYS inside a plastic bowden.



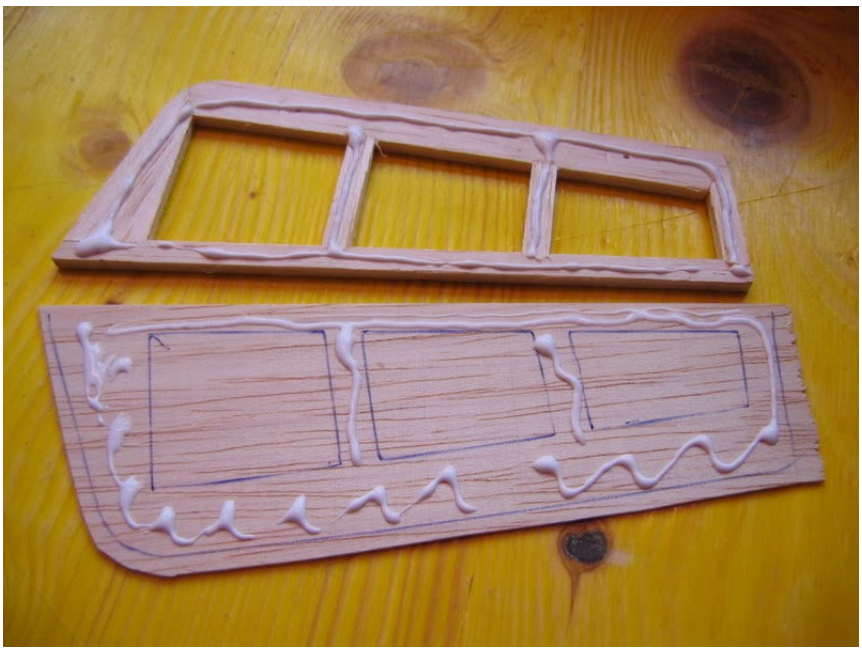
I start with rigt wing, but while glue was hardening, I throw myself onto the tail feathers.

Here you can see the basic structure of the vertical tail. I glue parts over the plans. Off course, plans are covered with transparent plastic foil.



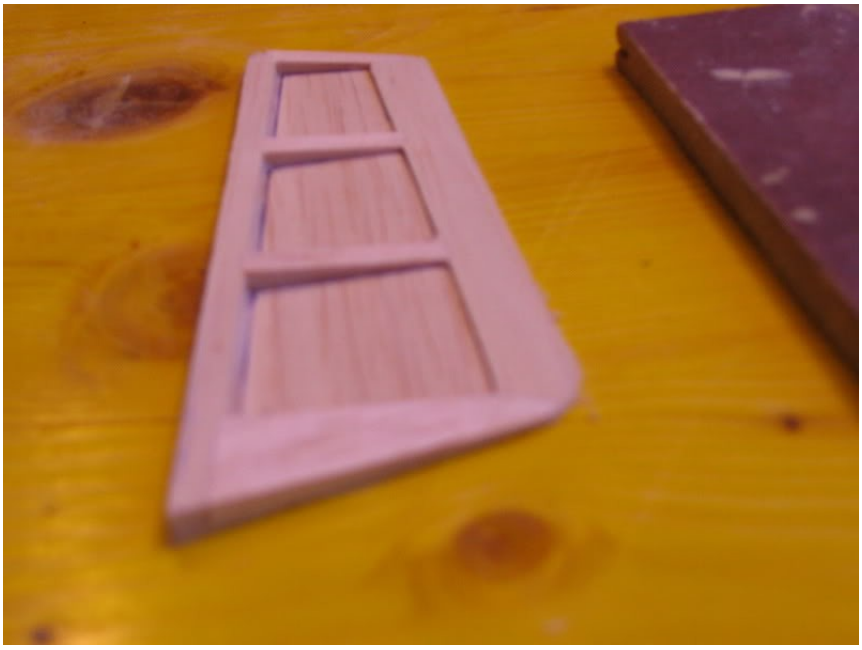
I prepare a balsa sheeting for the rudder and glue the structure on that sheet.

Of course, I spread the glue evenly over the surfaces in contact, before put both parts together.

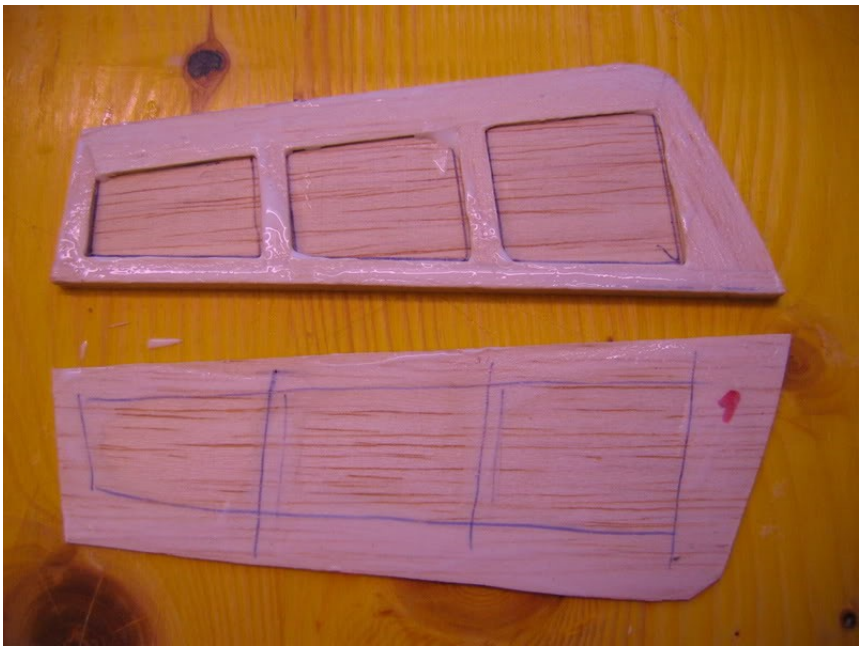


When the glue was dry, I start to shape the rudder cross section. I use a hobby plane and shave the most of the material towards TE of the rudder.

When close to the finished shape, I use a sanding block to be more precisely.

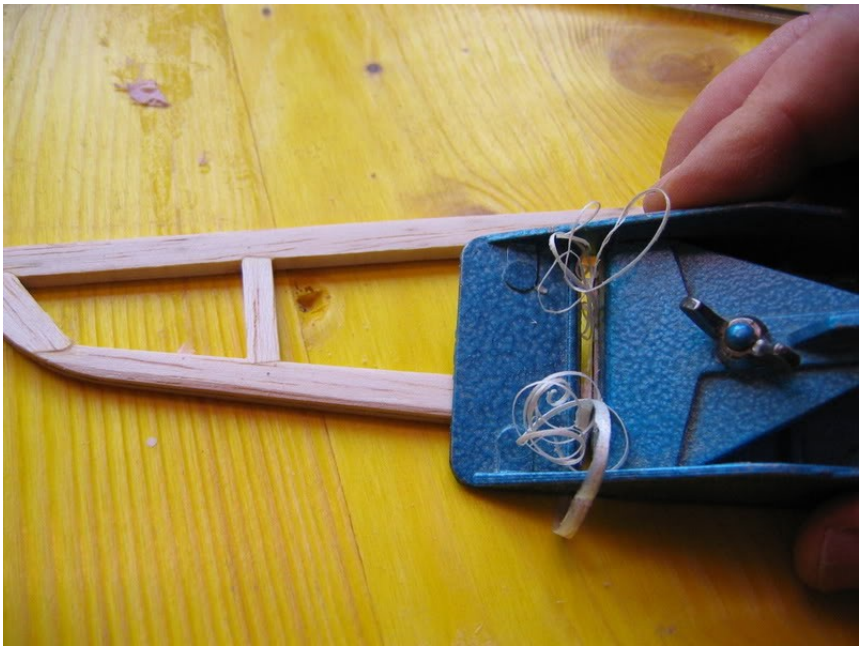


Then I prepare the oposite sheeting for the rudder and glue it on its place.



Left aside weightened with an lead battery, til glue dry. Tomorrow I will sand perimeter of the rudder to the proper contour, and bevel the front edge.

I rounded the leading edge of the horizontal stabilizer. First I use a plane, and after that I use sanding block to finish the leading edge.



Next was elevator turn. It must be of triangular cross section, but with ~1,5 mm thick trailing edge. (It could be thin also, but thick TE is more durable) Again I use a plane to do rough chawing, and later I finished the

surface with a sanding block. I help myself to control what I am doing, with some lines made with pencil.

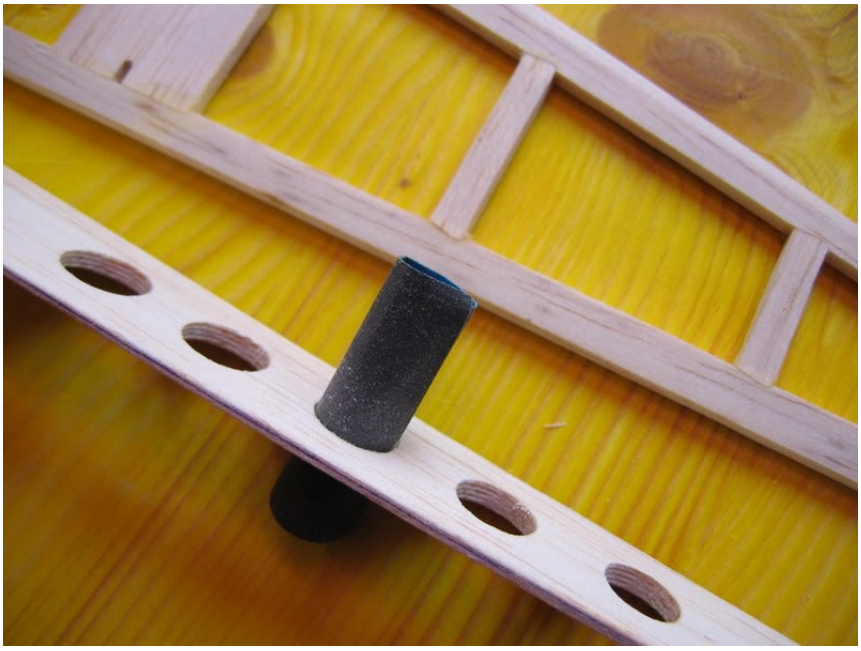
A line to determine trailing edge thicknes.

Halfway shaved... note pencil lines to observe the progress.

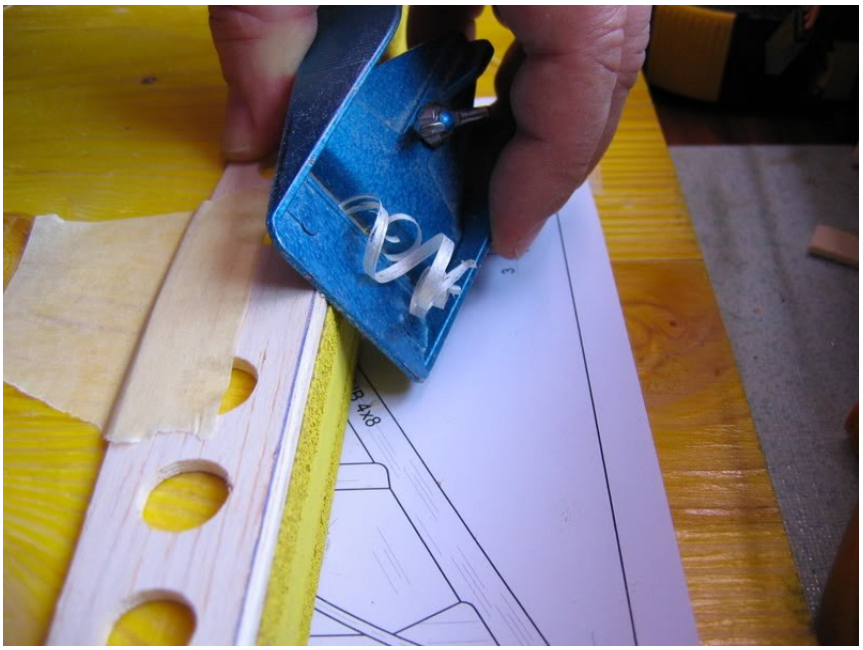
Plane is the easiest way to remove a lot of balsa.

Finishing with a sandpaper glued to a wooden plate.

I clean lightening holes with fine sandpaper rolled into a tube.

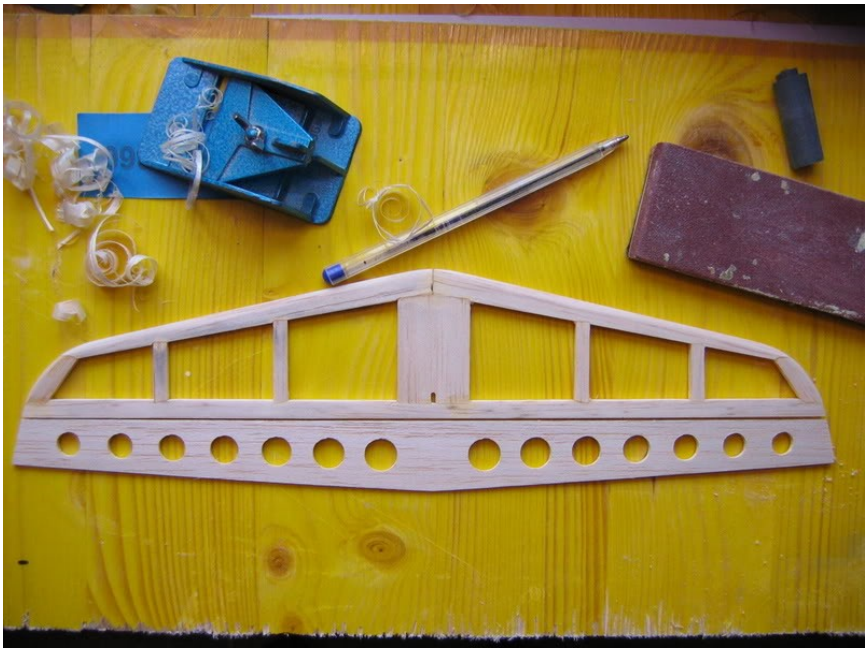


I bevel the leading edge of the elevator using a plane and a sanding block.



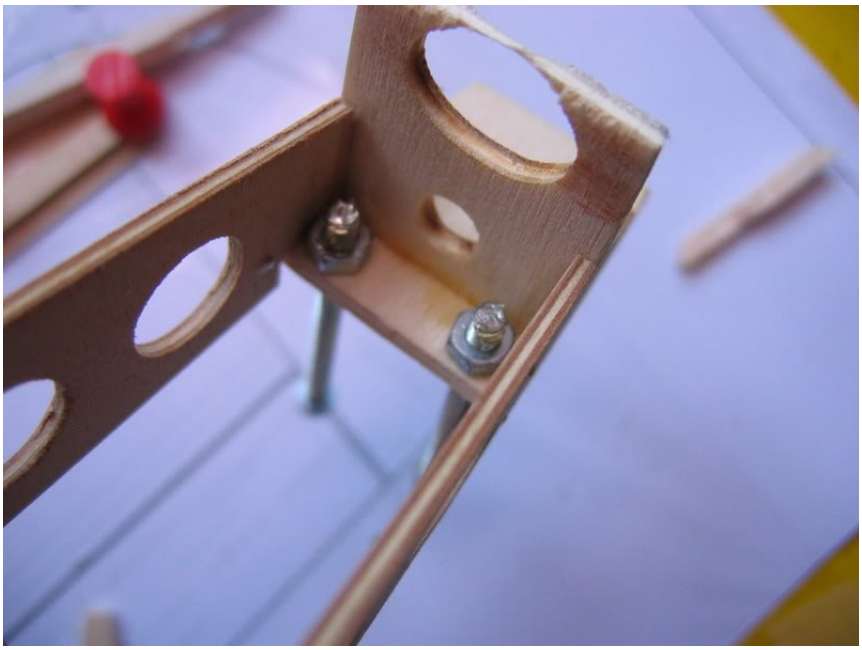
Fiished elevator cross section should look like this one.

And that was all about tail feathers for today!

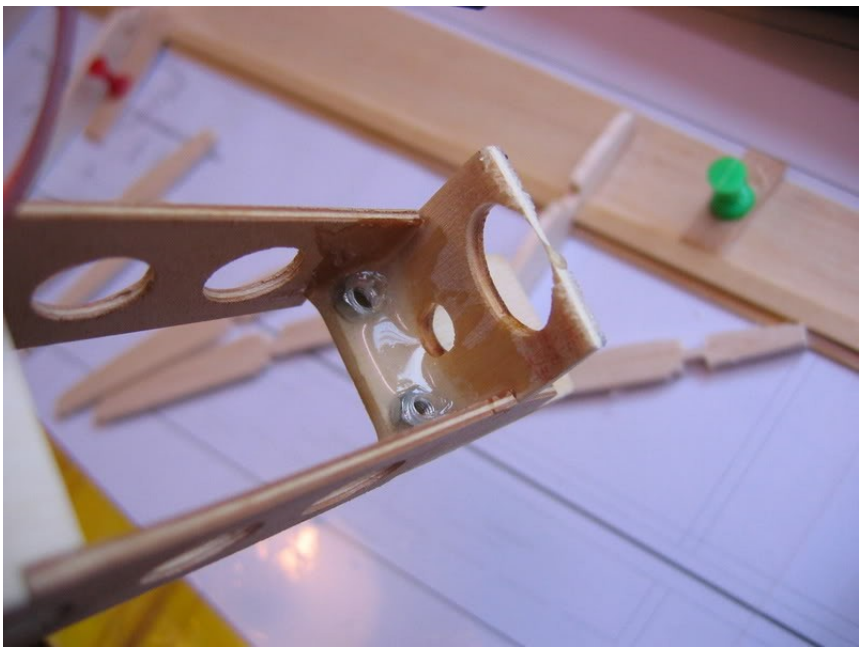


I prepare two M3 bolts and nuts for installing the nuts at rear wing attachment points. The nuts will be permanently glued with 5 min epoxy.

I cover bolts thread with grease, so epoxy will not stik to them.



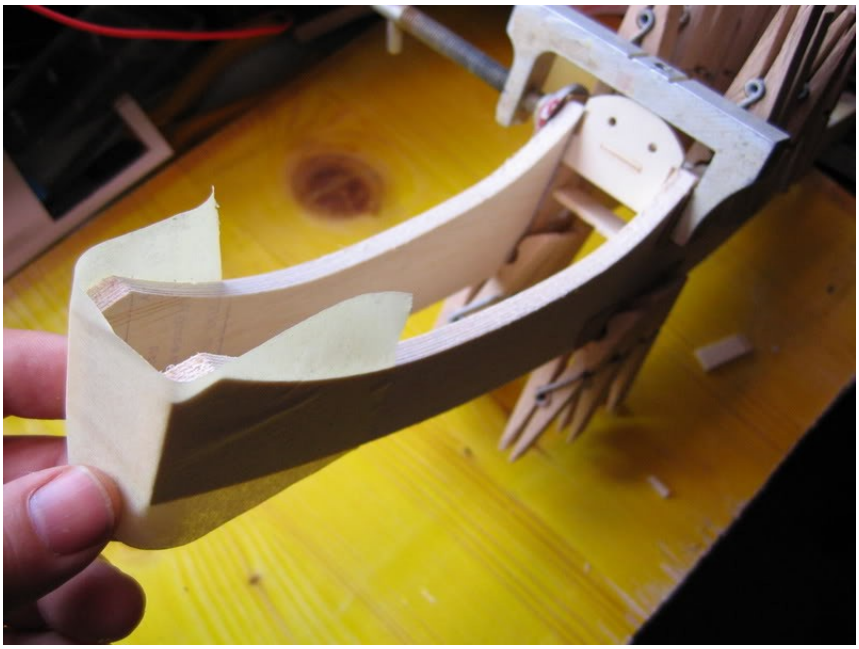
5 min epoxy.



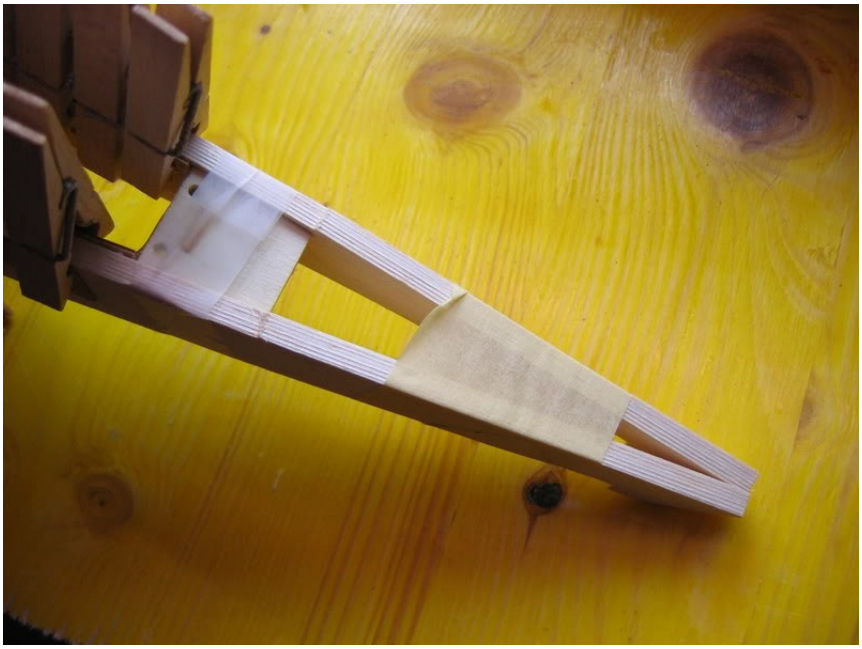
Nuts glued and bolts removed.

Next I glue central fuselage reinforcement subassembly from plywood with side fuselage walls.

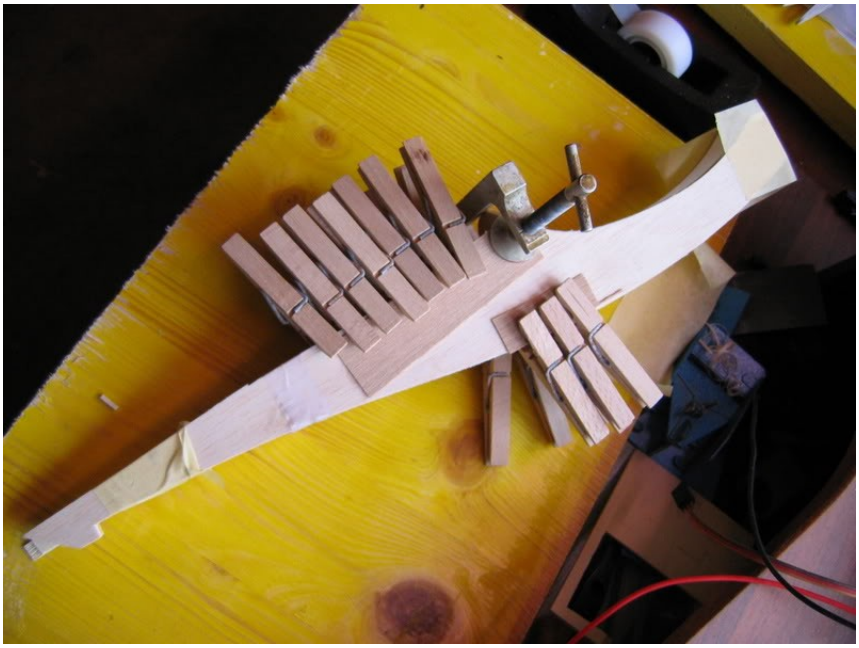
I glue together, and fix parts using adhesive tape and londry clips (I bought wooden ones really cheap)



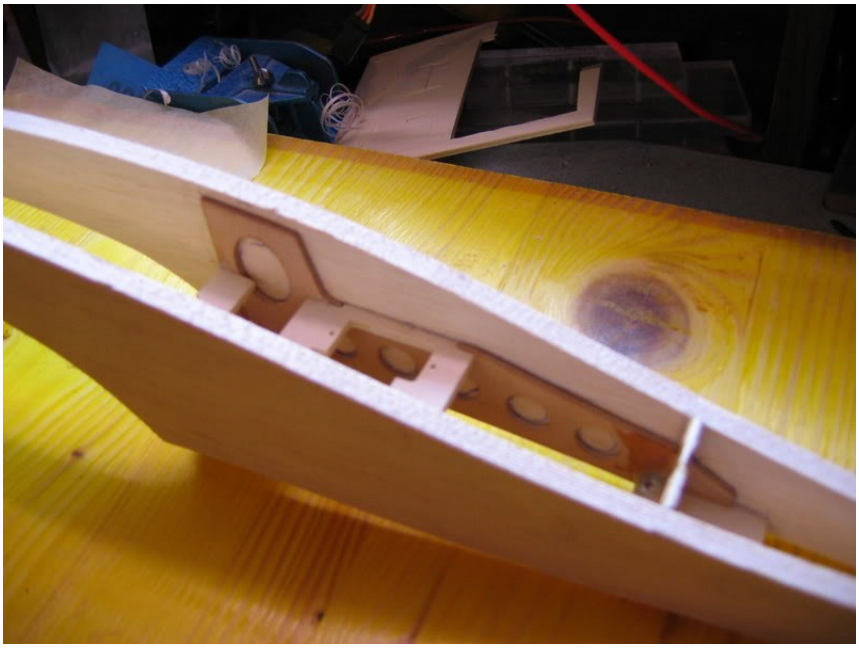
I use some adhesive tape and a C-clamp to fix parts together. This is the front part.



Adhesive tape allso at rear end of the assembly.



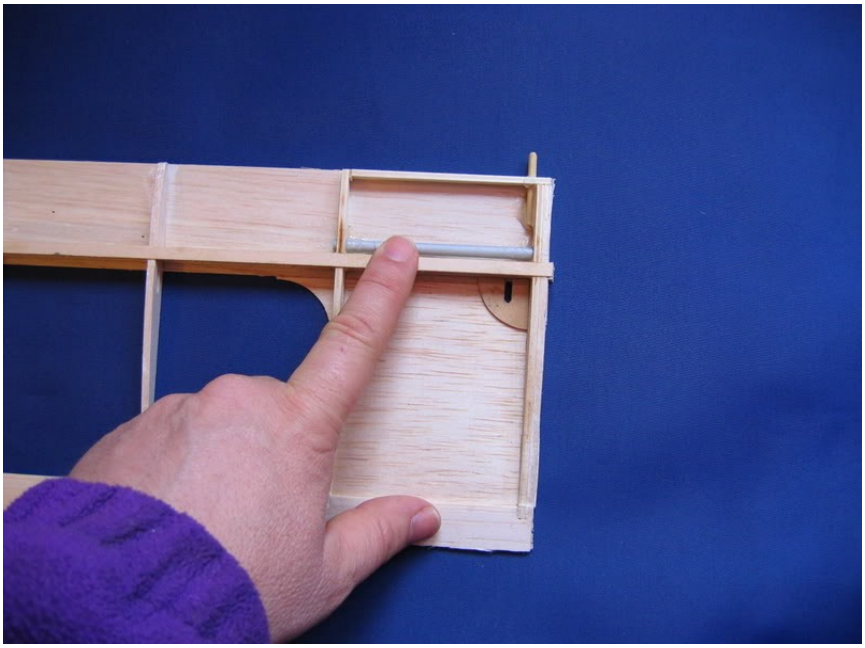
and lots of laundry clips at middle part.



Glued! View from the bottom.

Wing

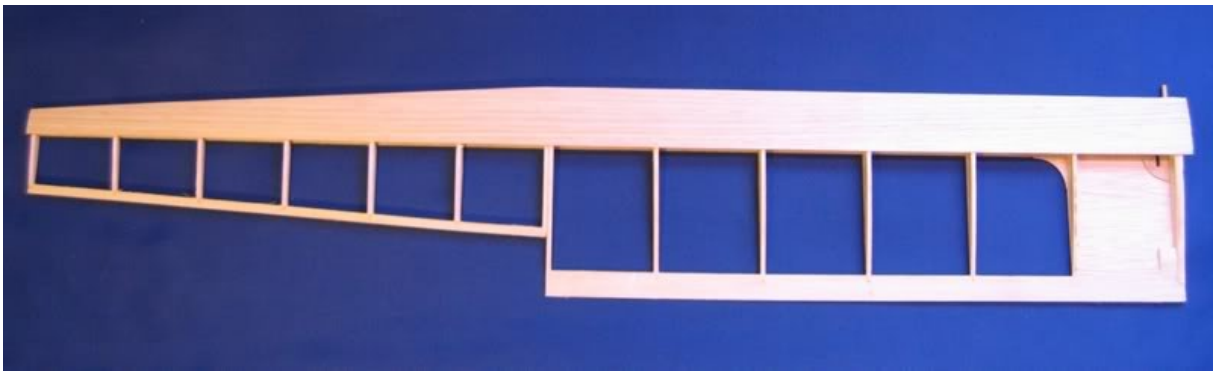
I was building a wing over the weekend.



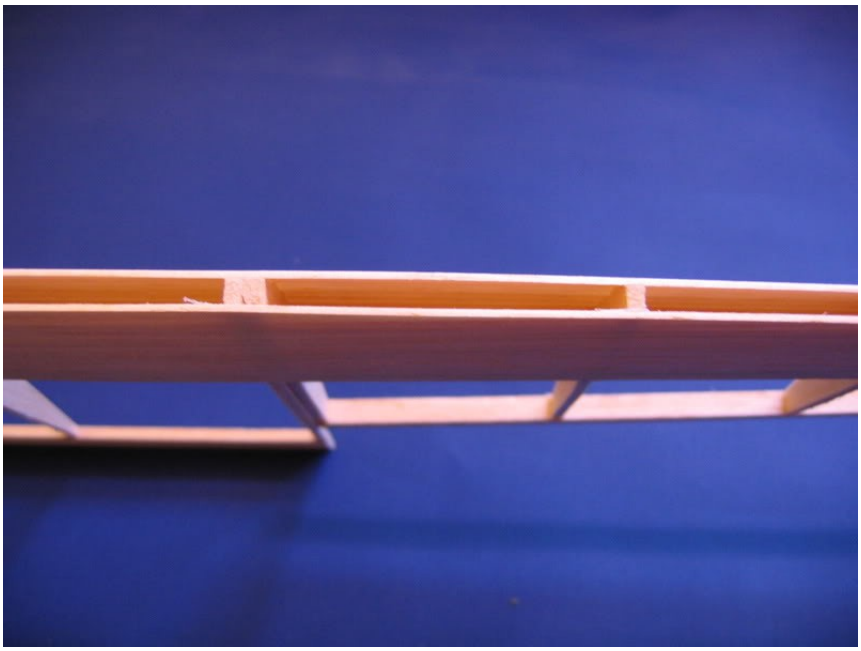
First I install an aluminum tube at root plywood ribs. This tube will accept steel round joiner. I install a round bamboo stick in front and plywood reinforcment for the servo wire exit. At bamboo stick and aluminum tube, I use large ammount of 5 min epoxy.

At the rear end of the root, I glue a piece of plywood as a "hard point" for the rear wing/fuselage attachment.

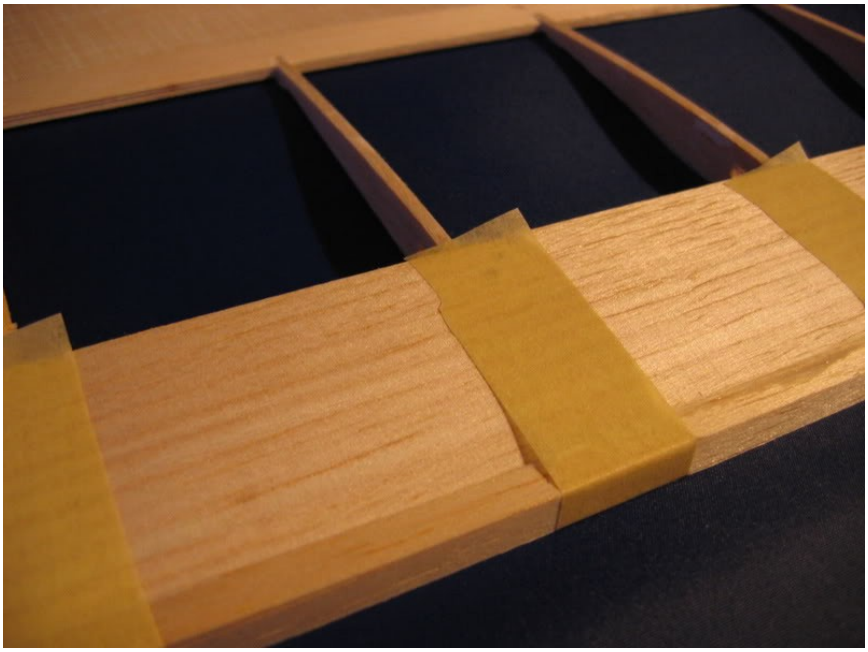
Strange funny photo? This photo show how I weighted upper D-box sheeting with old magazines. I try this method for a first time and I am pleased with result. Magazines press don very nisely a balsa sheet along the upper curvature of the ribs.



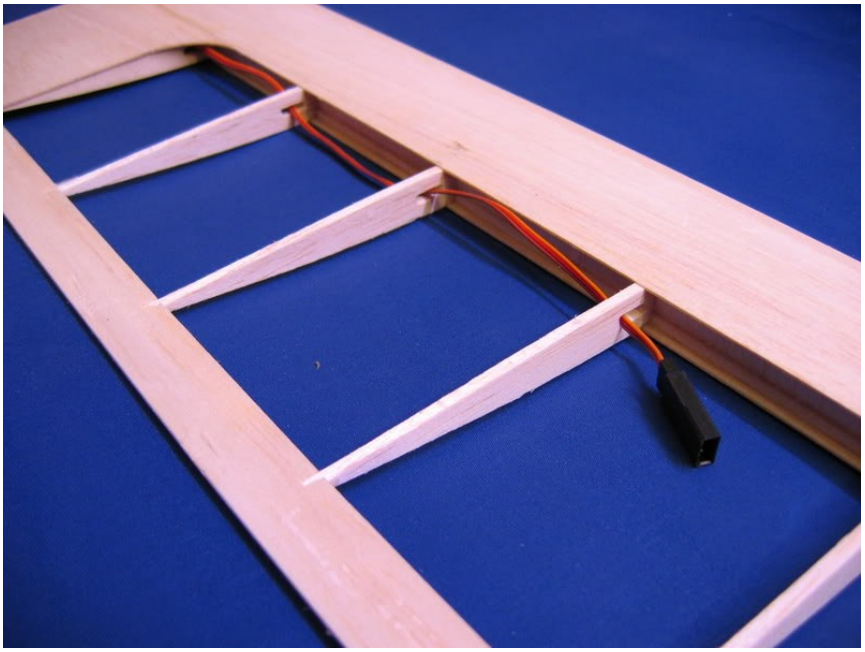
Upper wing sheeting on place.



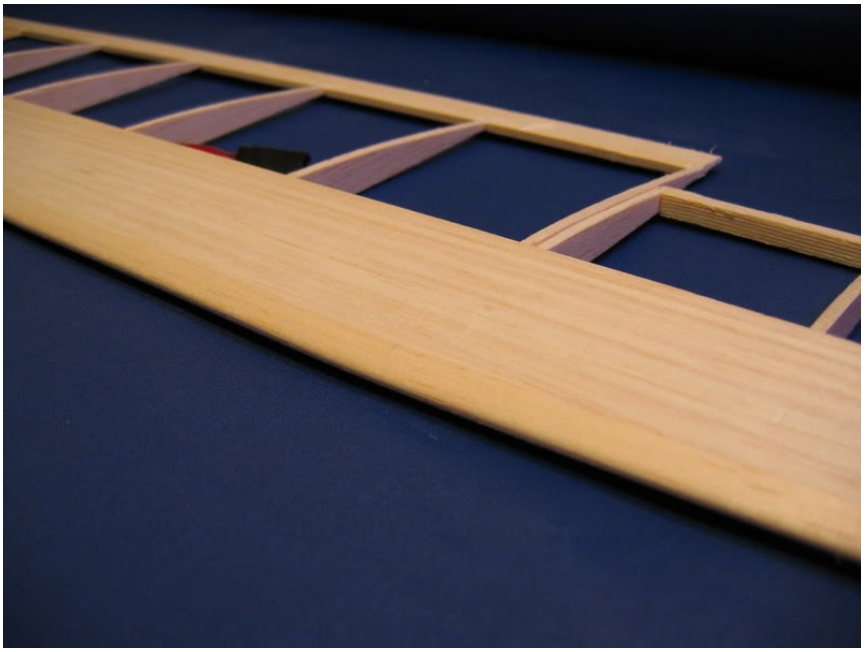
Leading edge still open. I sand sheeting flush with front edge of the ribs.



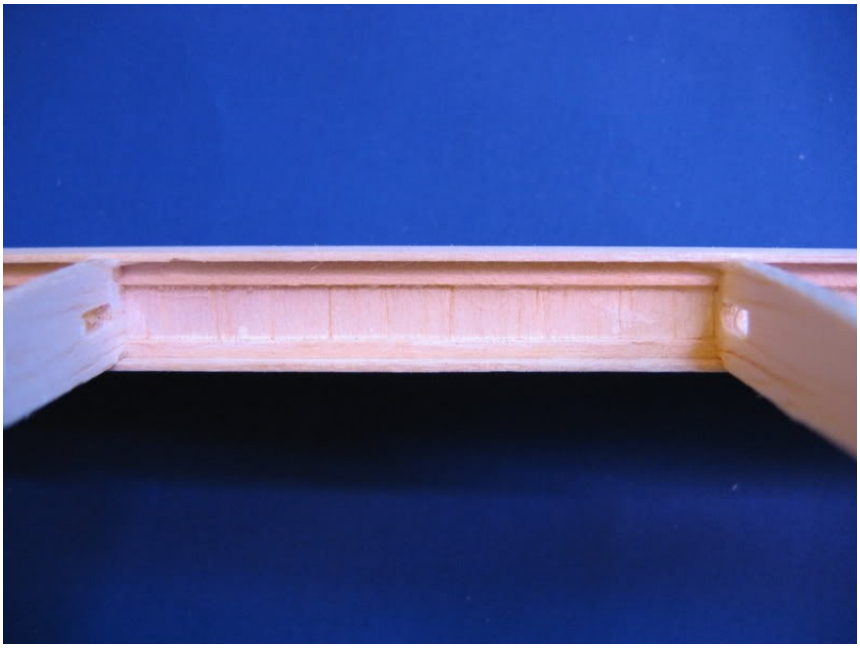
I cut a balsa strip for the leading edge and glue it to the wing. Adhesive tape helps to gold balsa on place, while glue dry.



Aileron servo extention wire installed. Seen from bellow. It should be installed before upper balsa sheeting is glued at the root of the wing.



Leading edge sanded. I help myself with a plywood template to check the curvature of the D-box and LE.

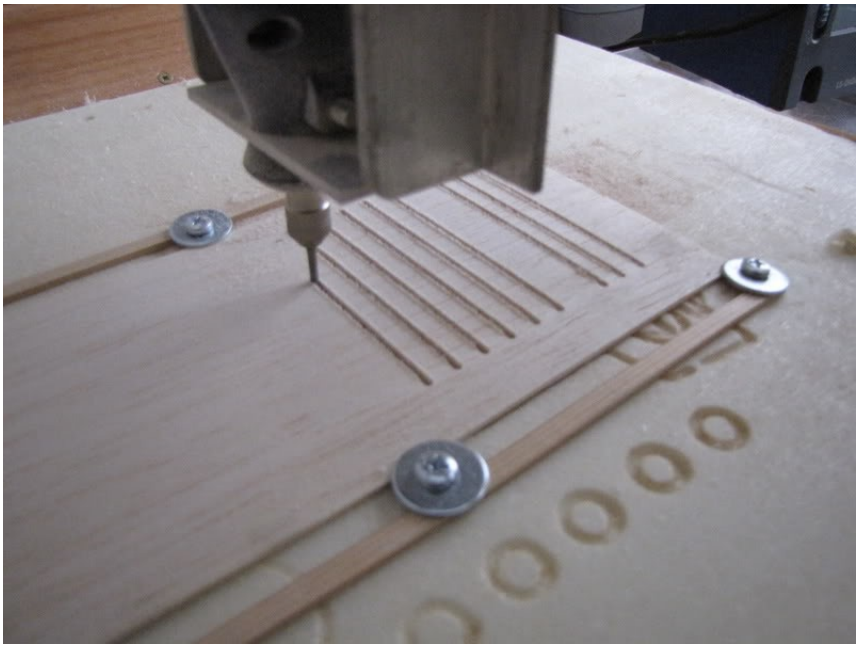


Shear web. Note the vertical grain.

Today I cut shear webs.

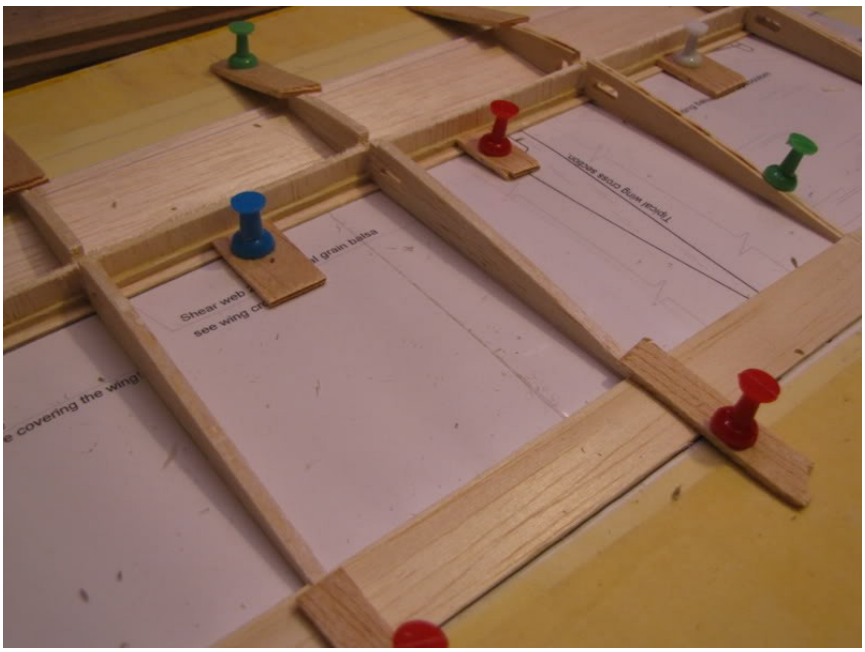
Then I glue all ribs and webs onto the lower sheeting and spar longeron. I use plane to make proper cross section of trailing edge and attach it to rear of ribs. Then I put aluminum profile over the upper spar longeron notches and shear webs and weight all with some hammers and heavy

stuff found in the woorkshop. It looks so primitive, so no photo of that building stage .



Cutting shear webs. Note the grain orientation. Grains should be vertical between spar caps, when installed to achieve highest shear strength between spar caps againts bending loads.

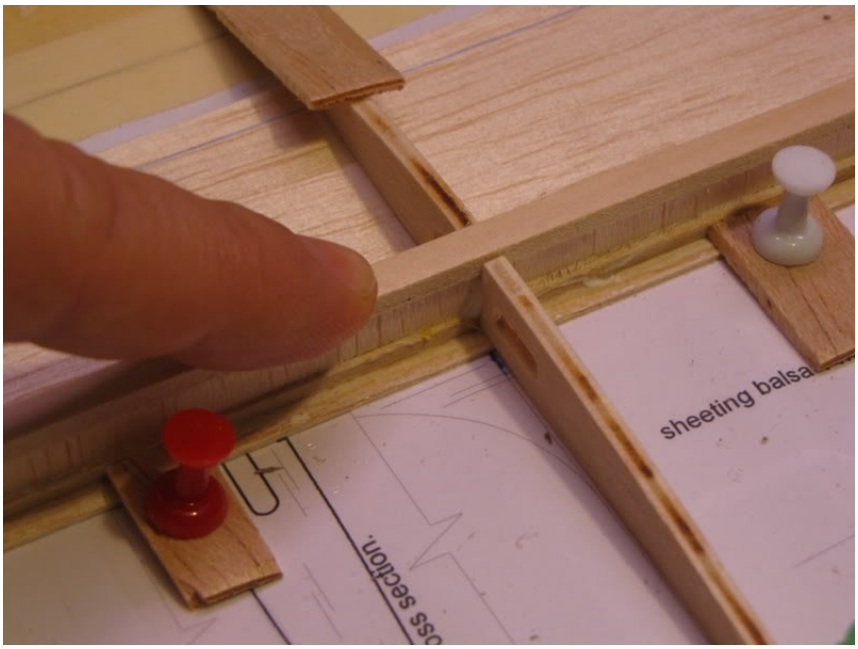
A note: as wood is stronger in tension and weaker under compression, the upper spar cap (compression under normal loads) is thicker than lower spar cap (tension in normal flight loads)



Shear webs in place.

Metal bar pressing shear webs on their places. (Heavy hammers removed on this photo)

The bottom sheeting is pressed against the ribs from bottom, by two strips of 1mm thick balsa.



Upper spar cap laying on the rins. Should be pressed down when glued to be in line with rupper contour of the rib.

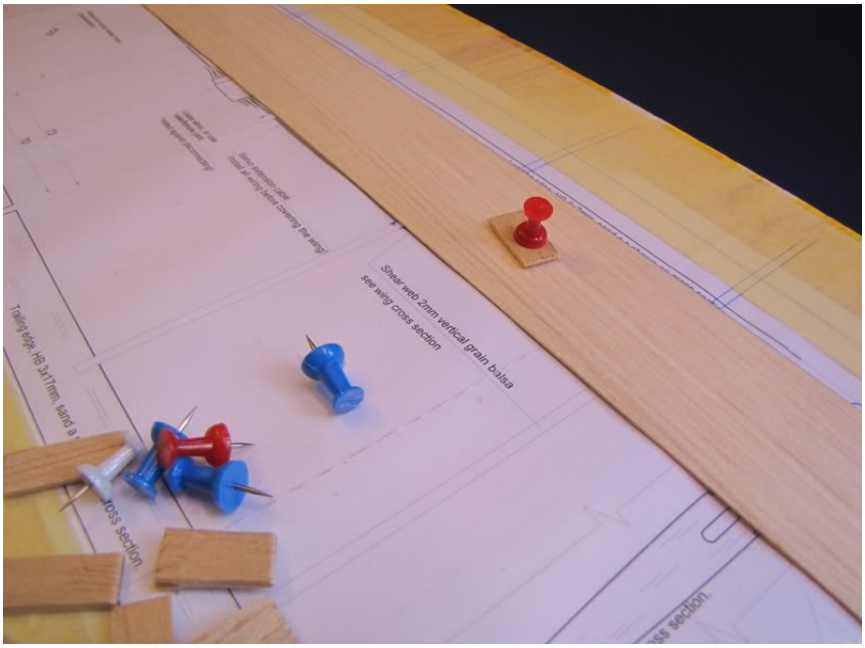
Today I start assembly of the wing for the Guppy.

I prepare a building board using two boards with hinges on the middle, so there is no problem to adjust dihedral break.

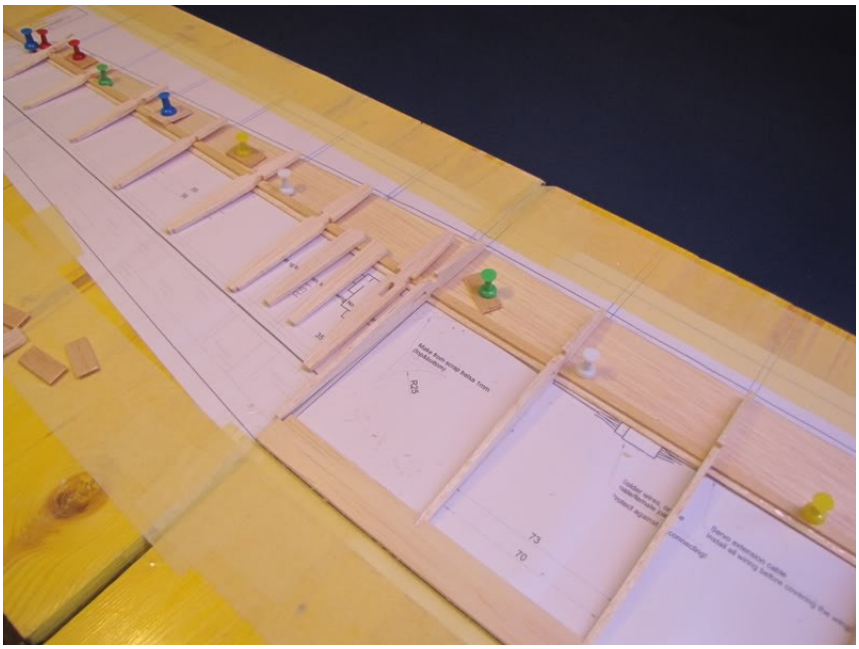
I glue the wing plan on the board and cover it with PVC sheet, so glued parts will not stick to the paper, and removing will be easy.

Ribs for the wing. I use plastic bag to avoid loosing parts.

I draw a lower sheeting on the balsa plate, then use metal ruler and sharp knife to cut it out.

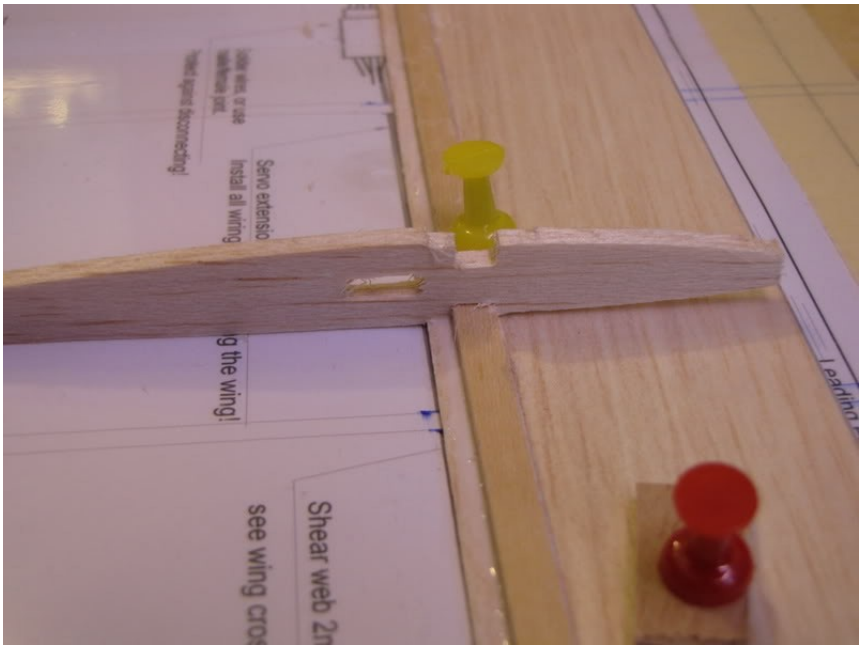


I place lower sheeting on the plans and secure it on proper location using pins and scrap balsa pieces. The rear edge of the sheeting is aligned with line on the plans.



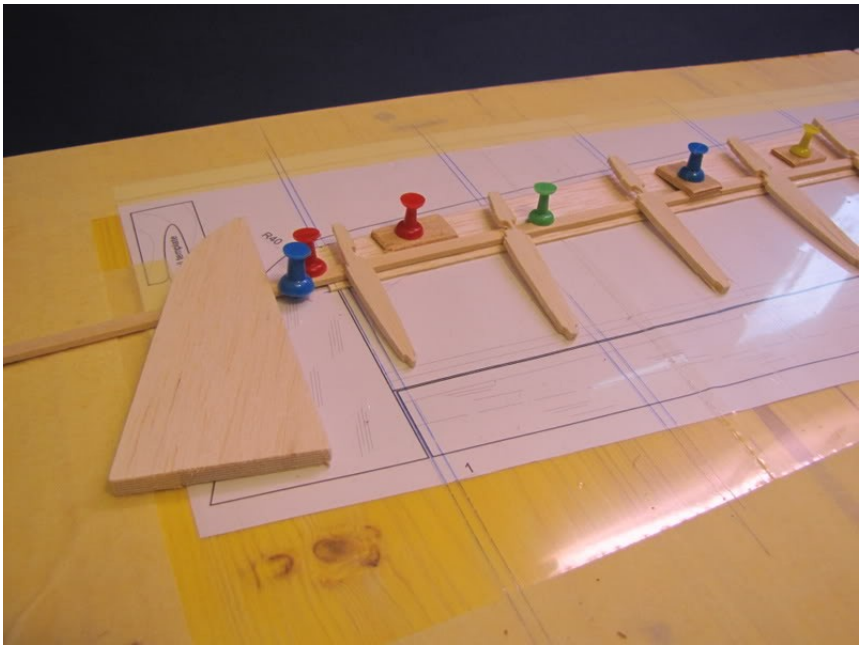
Lower spar cap glued to the lower sheeting, while ribs (not glued yet) and some pins holds all together in place, till glue dry.

It is ocasion to dry test the ribs and LE strip and to identify each wing rib proper place.

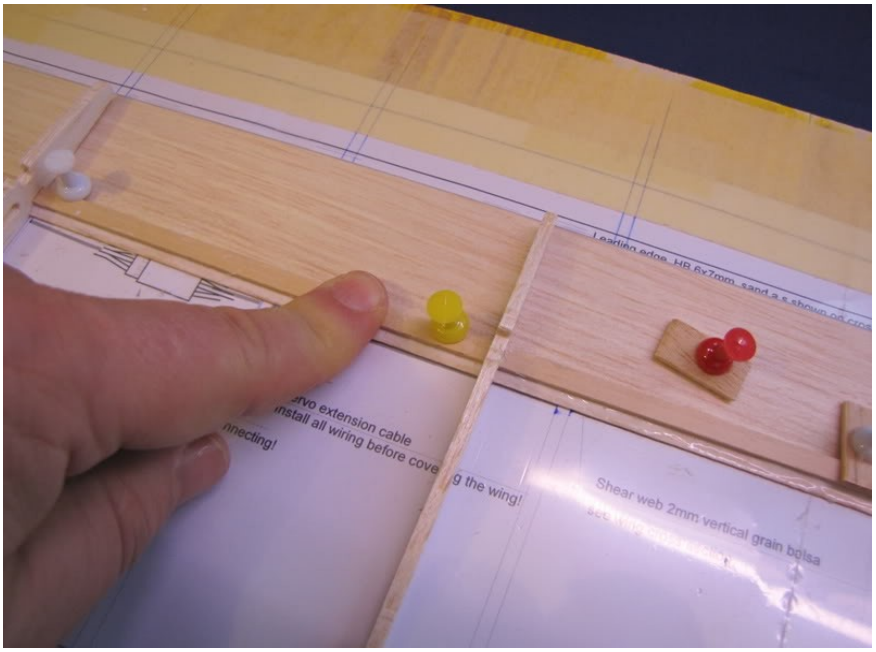


Notches in the bottom contour of the rib serve as a guide for proper location of lower spar cap while gluing it to the bottom sheeting.

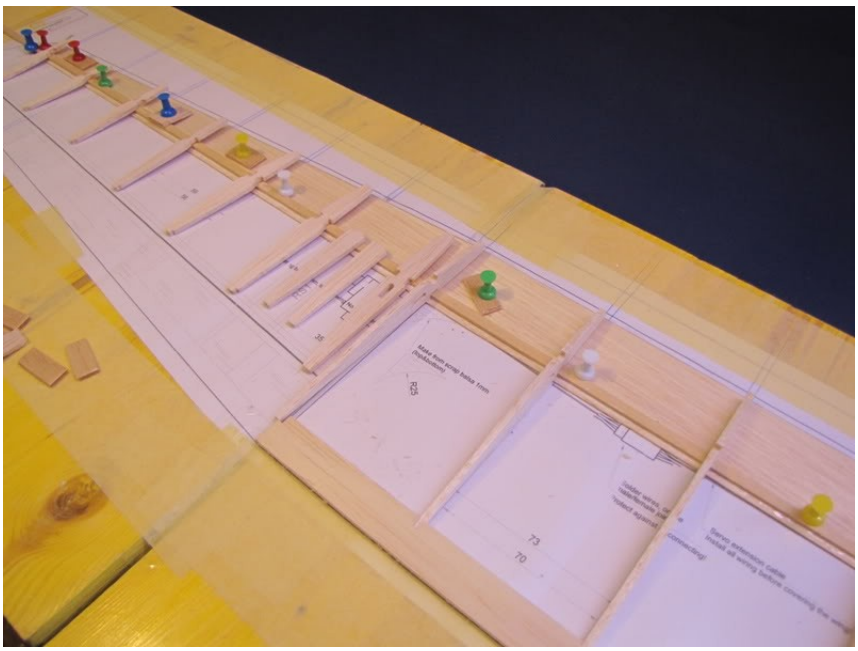
Note a gap between rib and lower sheeting from spar cap towards the LE. I will take care of that later, when start gluing ribs to their places. Now, the rib is just pressed down to position the spar.



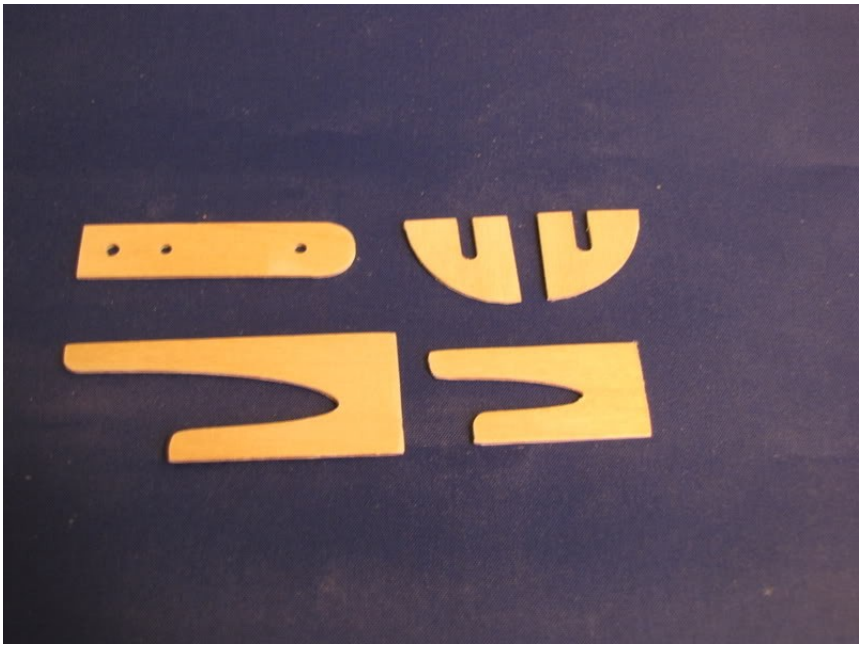
Wingtip side. Ribs prepared at their places. Note raw wingtip from solid balsa. Need some planing and sanding before gluing to the wing. (later)



Cpar cap should be firmly glued to the sheeting and true straight.



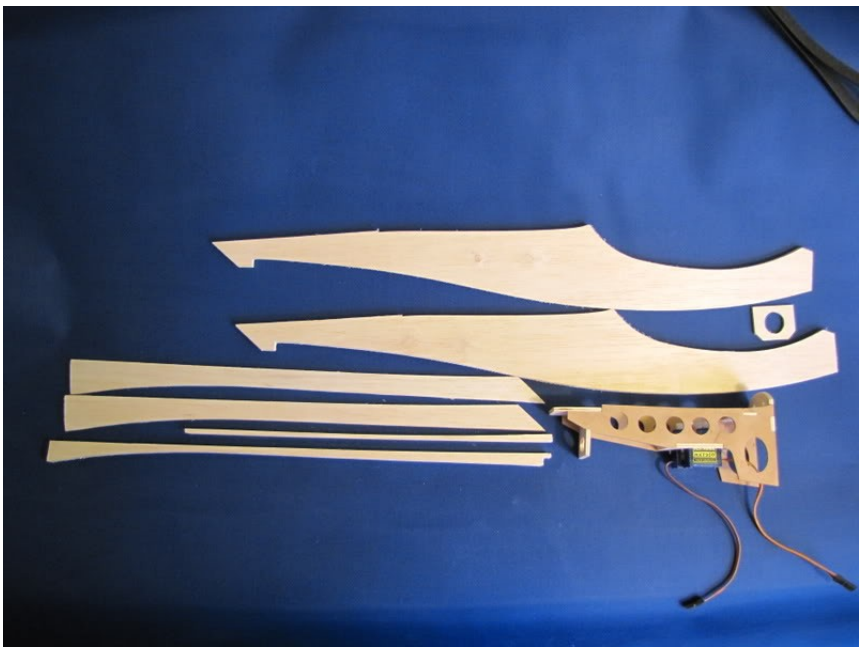
At dihedral break, the spar is just bending a bit up. Not need for split joint as angle is very small.



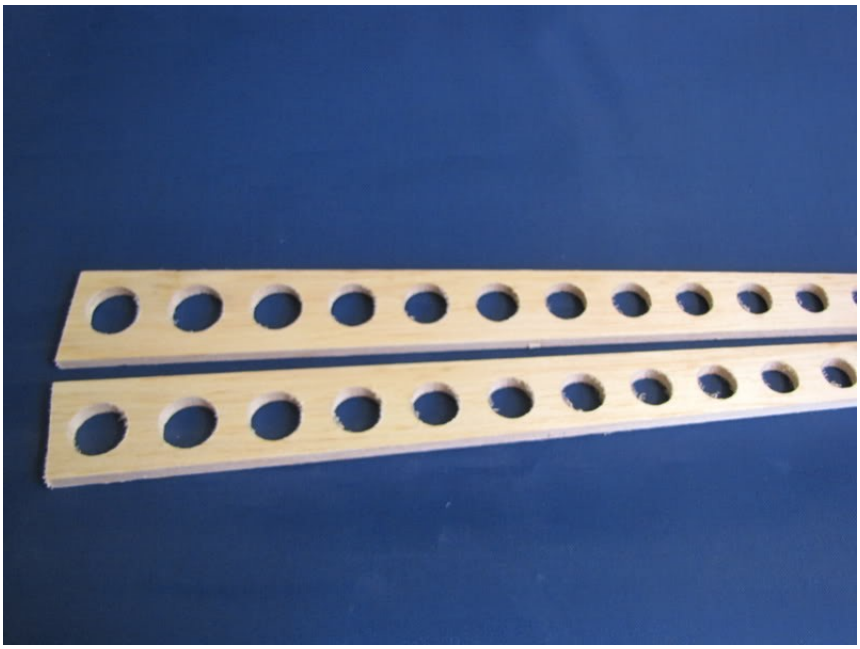
I prepare allso some plywood parts. Here you can see (two parts on the bottom) templates for the root and tip airfoil checking.

In the upper right corner are two reinforcements for the sheeting, where aileron wires will exits on the bottom skin at the root of the wing. Upper left part is a saddle for the horizontal tail.

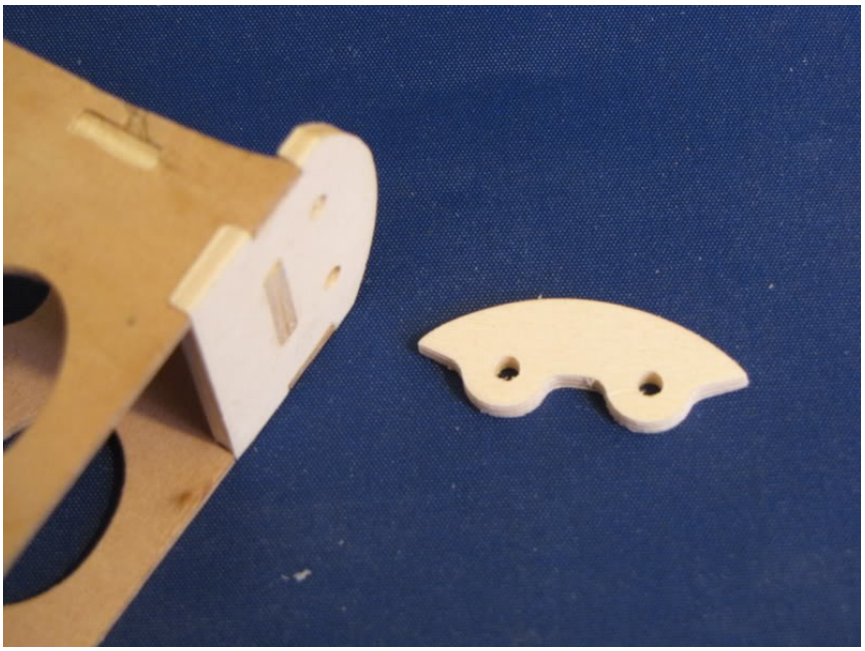
While spar cap was waiting for glue to dry, I made some shots of some other parts, that are already prepared:



Fuselage parts. Bottom sheeting, but motor mount and some minor parts are missing here.



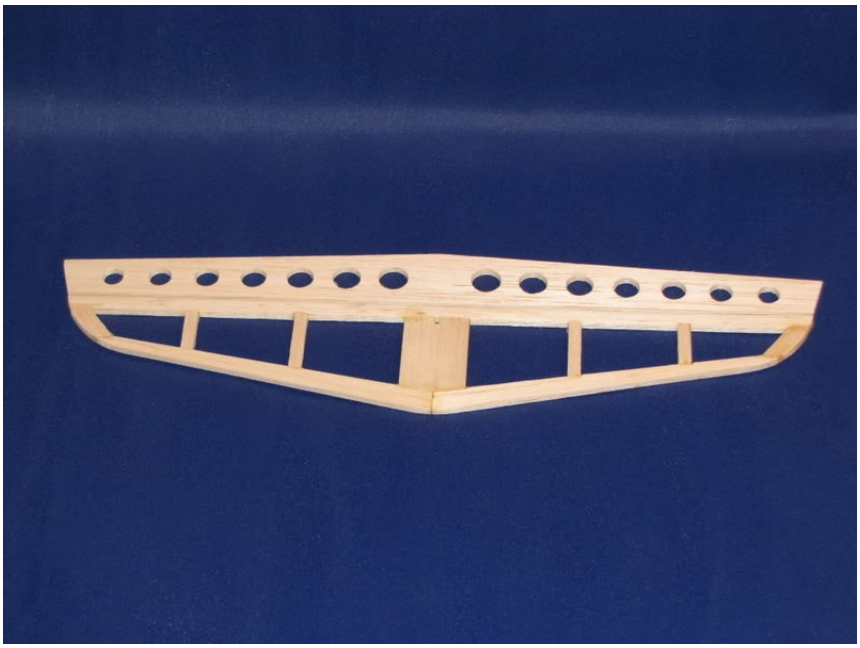
Raw ailerons. Need to be sanded down to proper cross section.

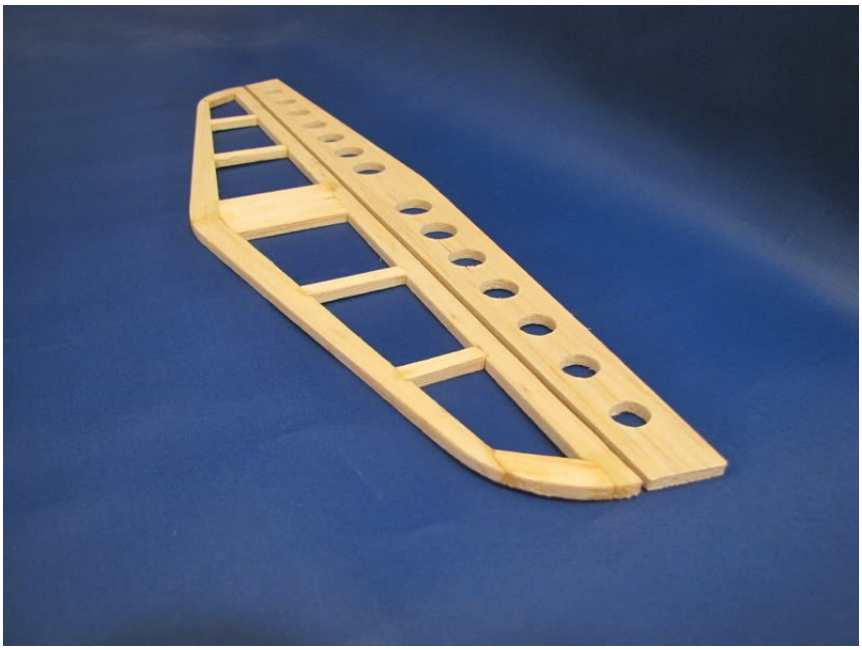


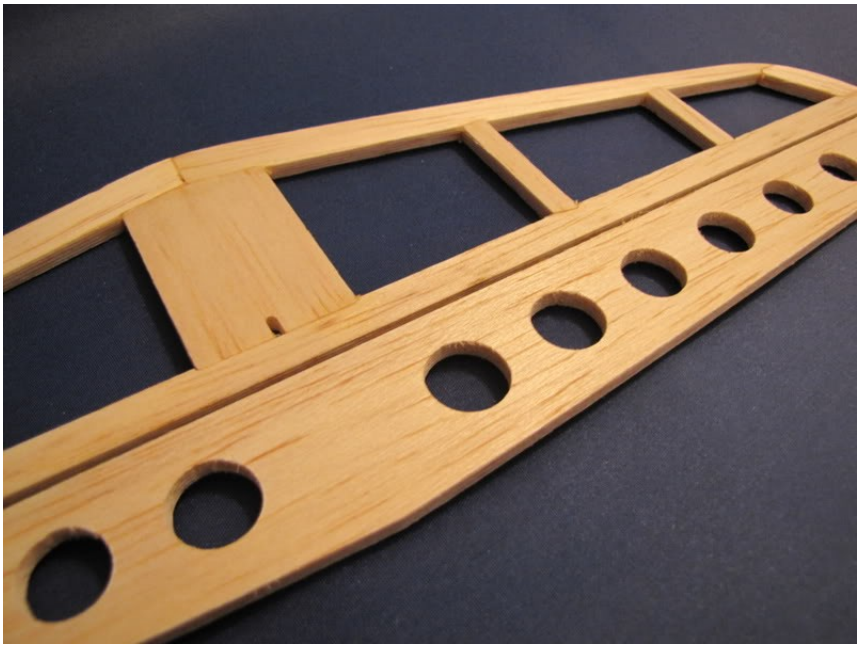
A part on the right is ment for a canopy latch system.

Horizontal tail

The horizontal tail is glued.
Now I must sand round (or better..elliptical) cross section and make elevator conical using plane and sandpaper.







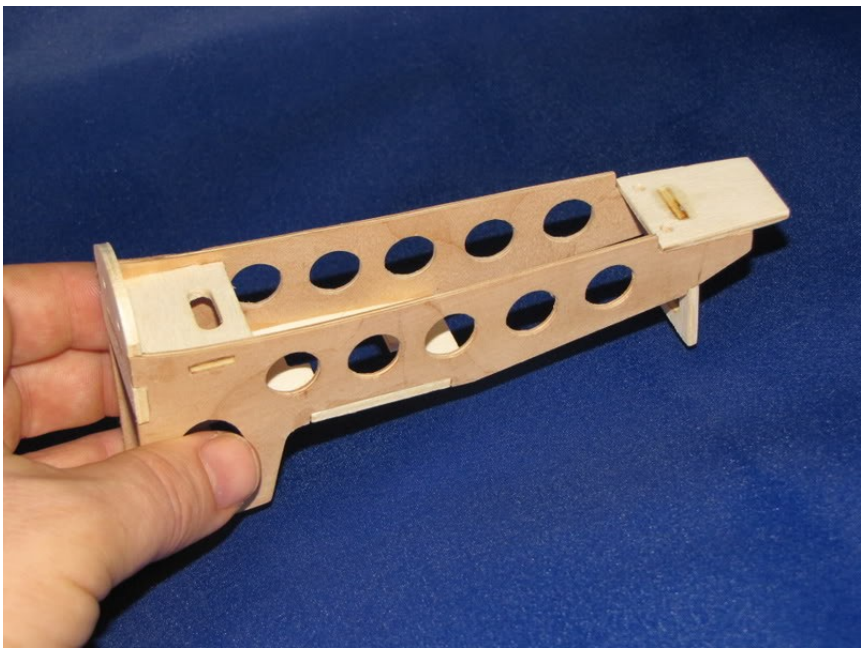
Fuselage centerpart

Today I assemble the center part of the fuselage. This is a reinforcment that came between fuselage side bellow the wing.

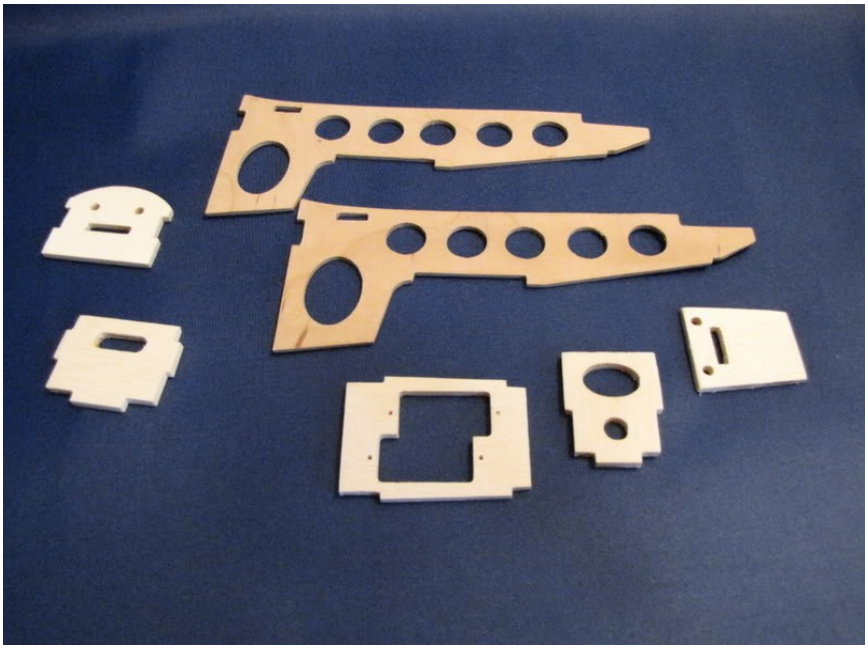
It consists from front and rear bulkheads, servo tray and side parts.

Bulkheads and servo tray are made from White Poplar 3 mm thick plywood, and sides are made out from a 2 mm thick birch plywood.

I glue this subassembly with white glue (Pattex, WOOD Super 3, water proof)



Assembled. Those lightening holes are optional and not necessarry for the scratchbuilders.



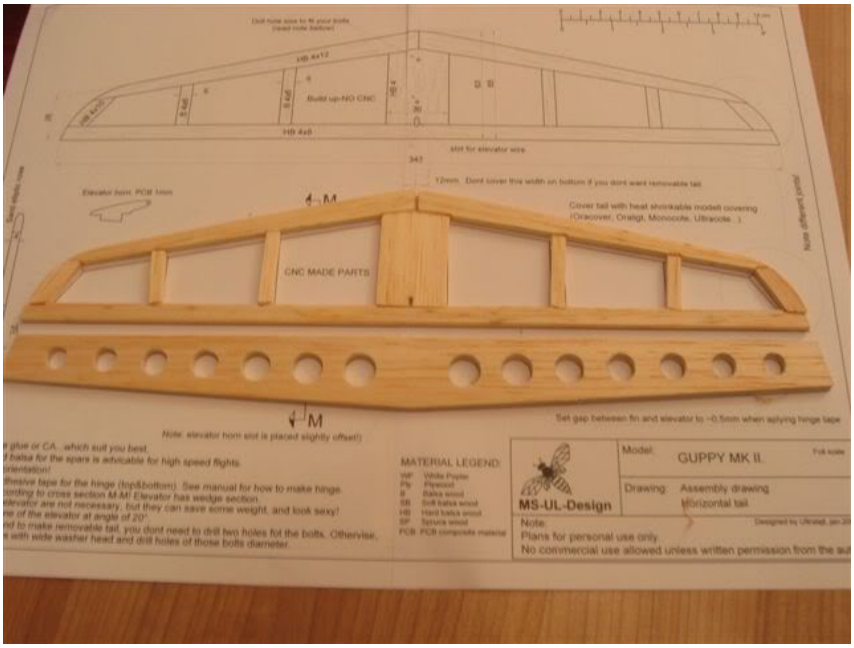
All parts before glueing together.

First parts made

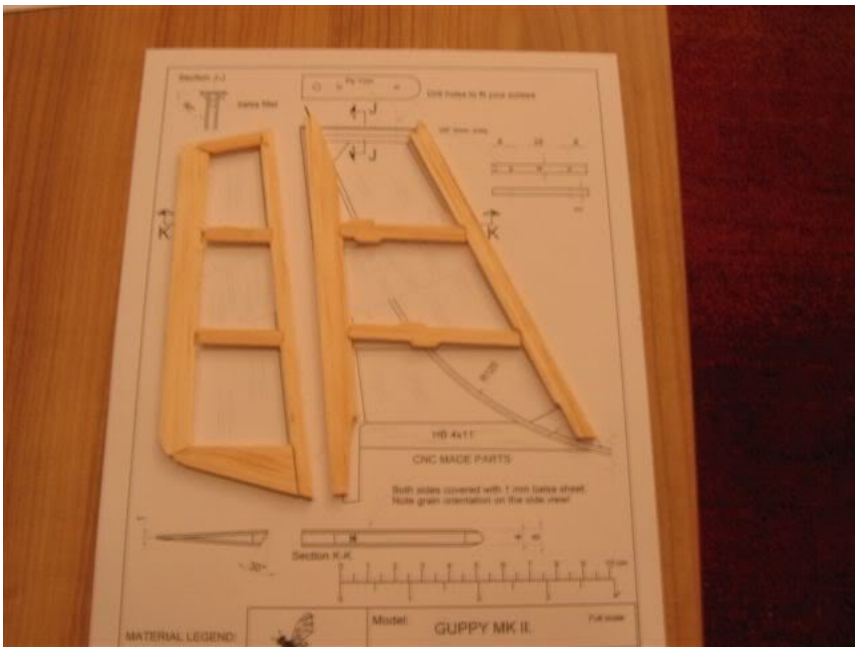
Today I made all balsa ribs for the wing, and allmost all balsa parts for the tail.

I was courious how the CNC build parts will fit together, as I create some joints that are "self aligned" and it will help to psition parts excatly where are suppose to be.:P

As my camera went crazy, the photos are bad... sorry...



Parts of the horizontal tail. Just layed on the plans. The elevator (part with lightening holes) will be sanded to tiangular cross section.



Some parts for the vertical fin and rudder.

Balsa ribs for the wing.

I am looking forward to make all CNC parts and start to assemble the sailplane, but I ned to visit a hobby shop, to buy some plywood and spruce longerons.

As far as dimensions are in concern, my CNC machine work so far inside the expected acuraccy.

The problem of some balsa grains on the parts edges are stil present, but it is easy to remove them with a stroke of sandpaper.