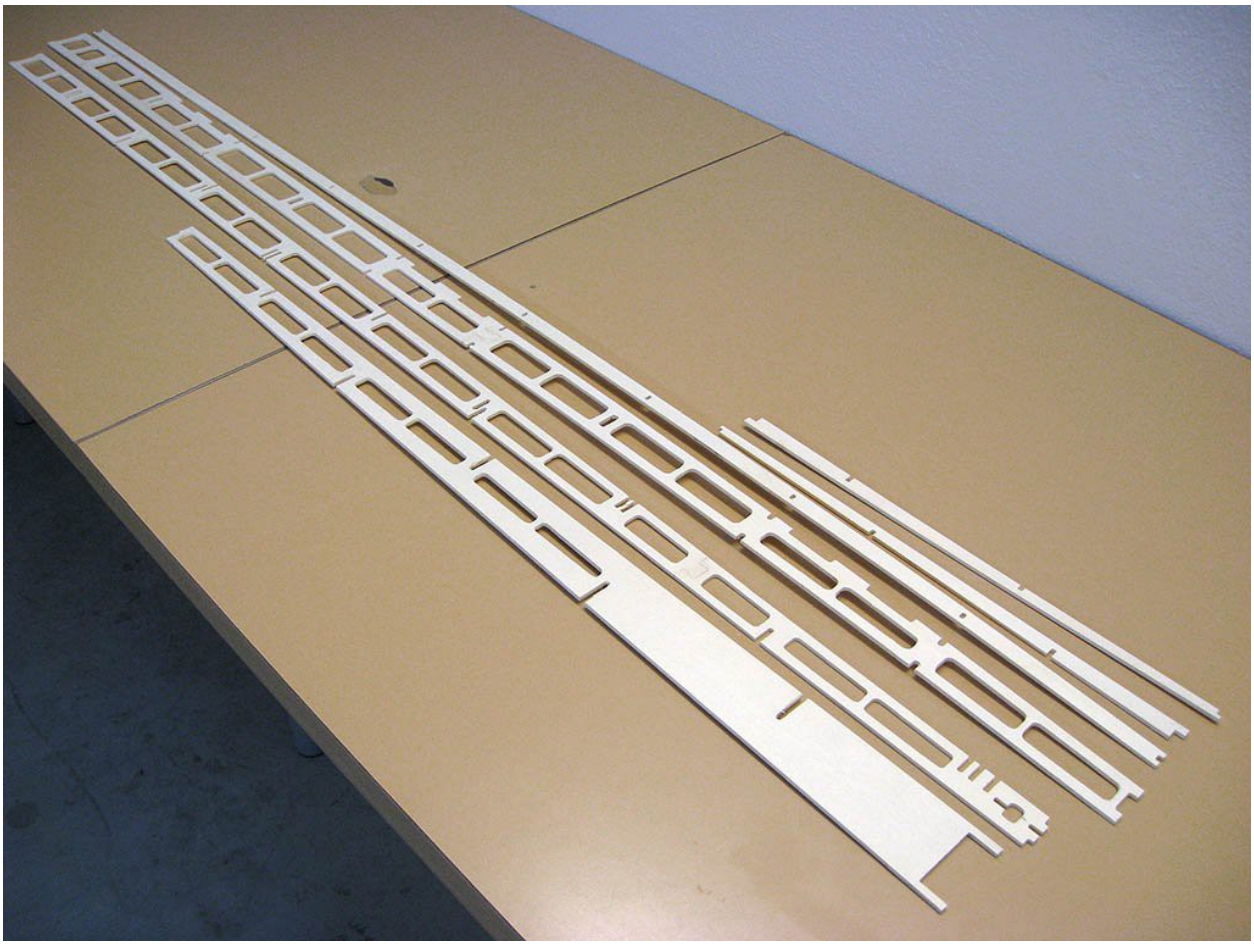
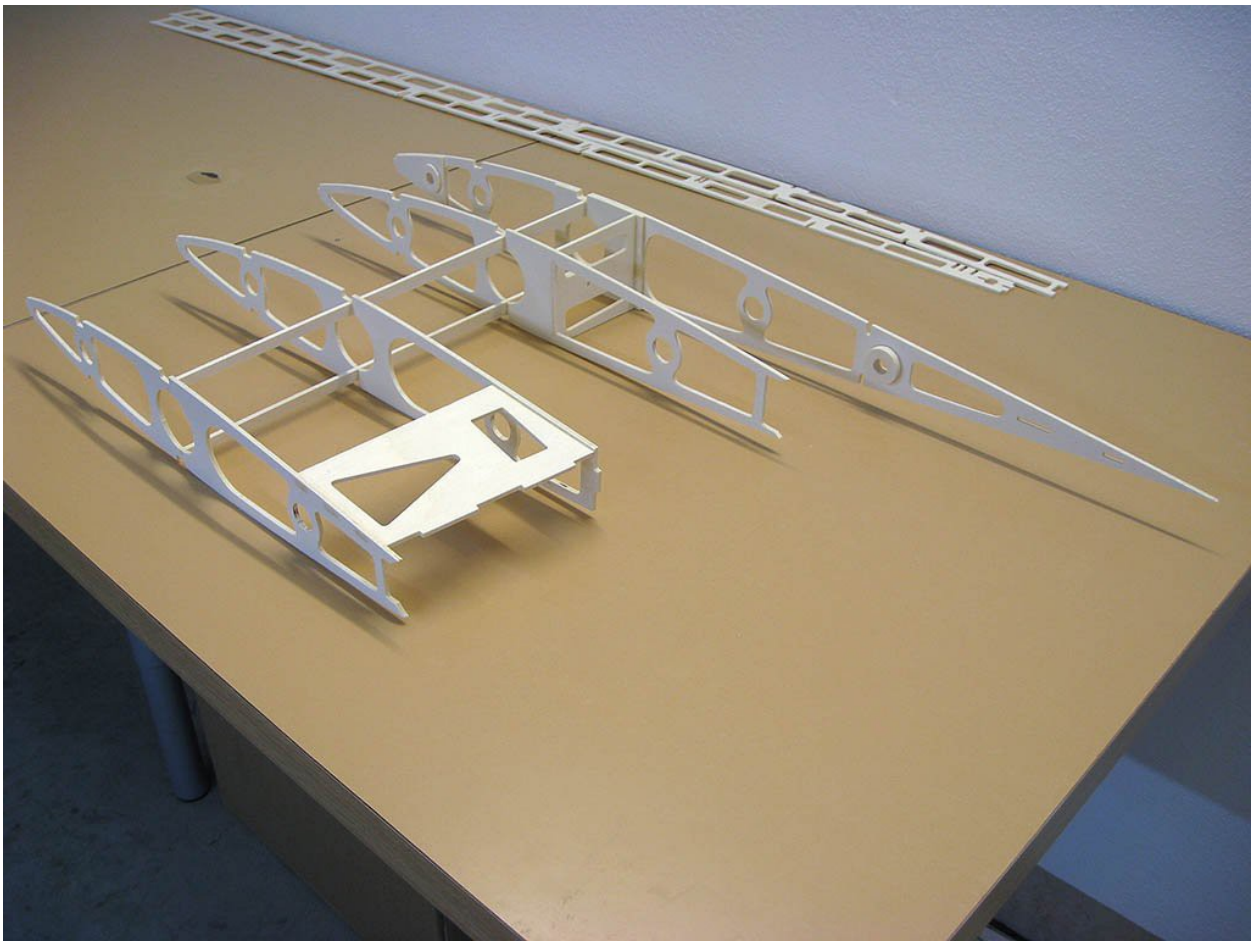
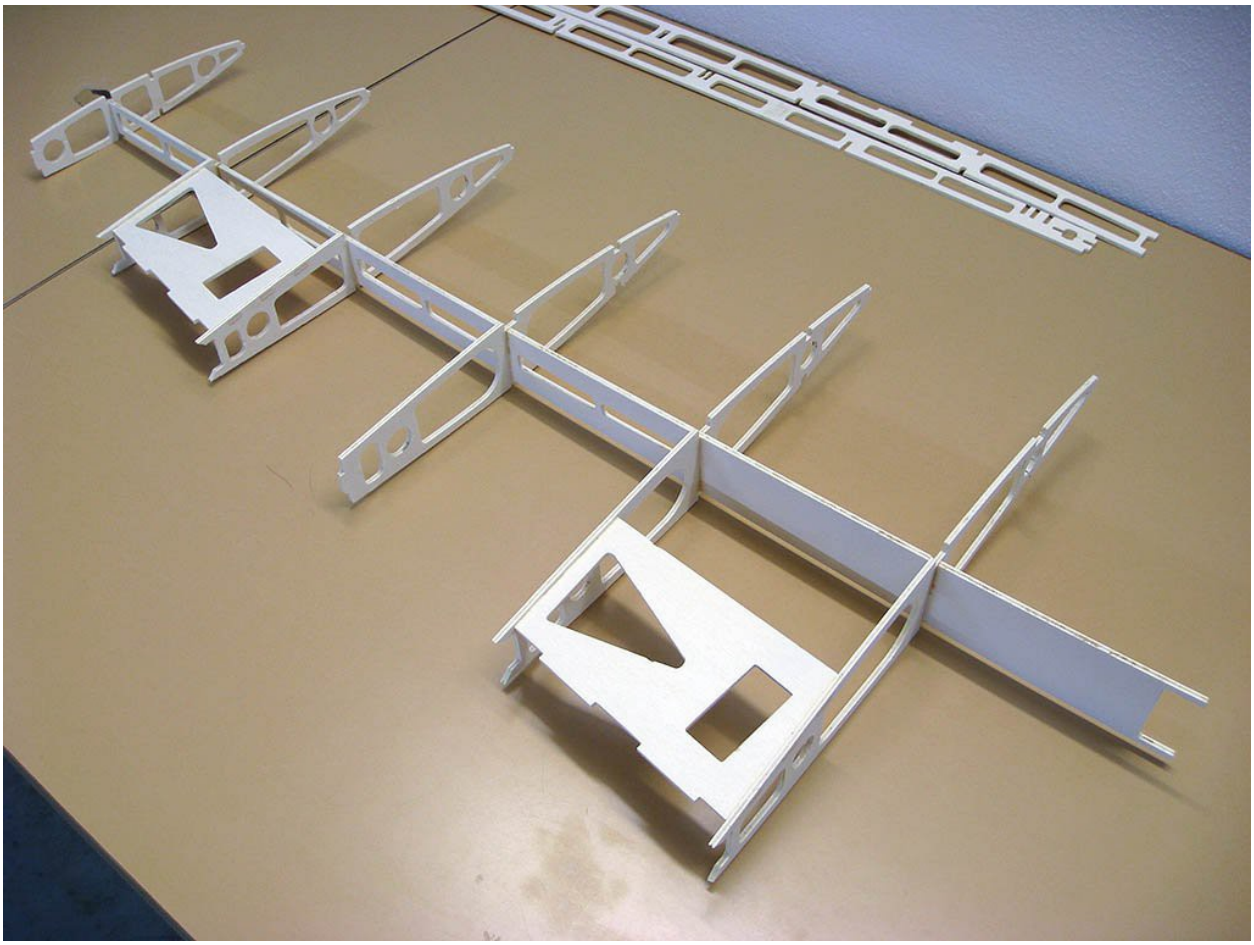
Wings



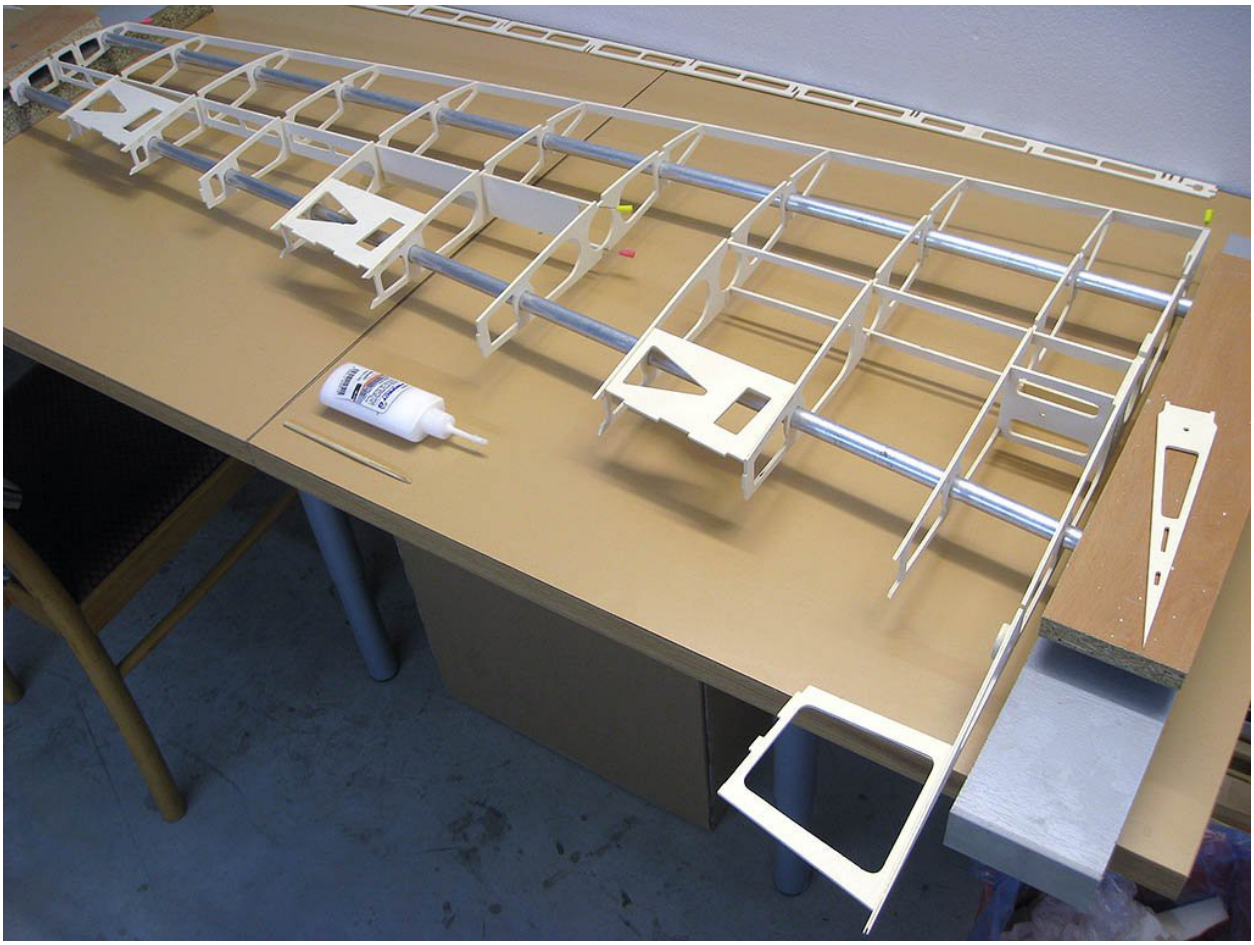
What is especially new is that the front and rear wing webs and wing webs are glued from two cut-outs. I glued along a straight cut sheet, just like the fuselage sides. It is glued with the PerfectG dispersion. The only web that does not have to be glued before gluing the wing is the main and its auxiliary parts in the place of the pipe, which in version 2 holds one more rib. The wing web is for counterweight and SFG version. In version 2, a 1.5 inch carbon wing clutch is used, which accommodates all ribs and portions of the main web, the original clutch diameter being 40 mm.



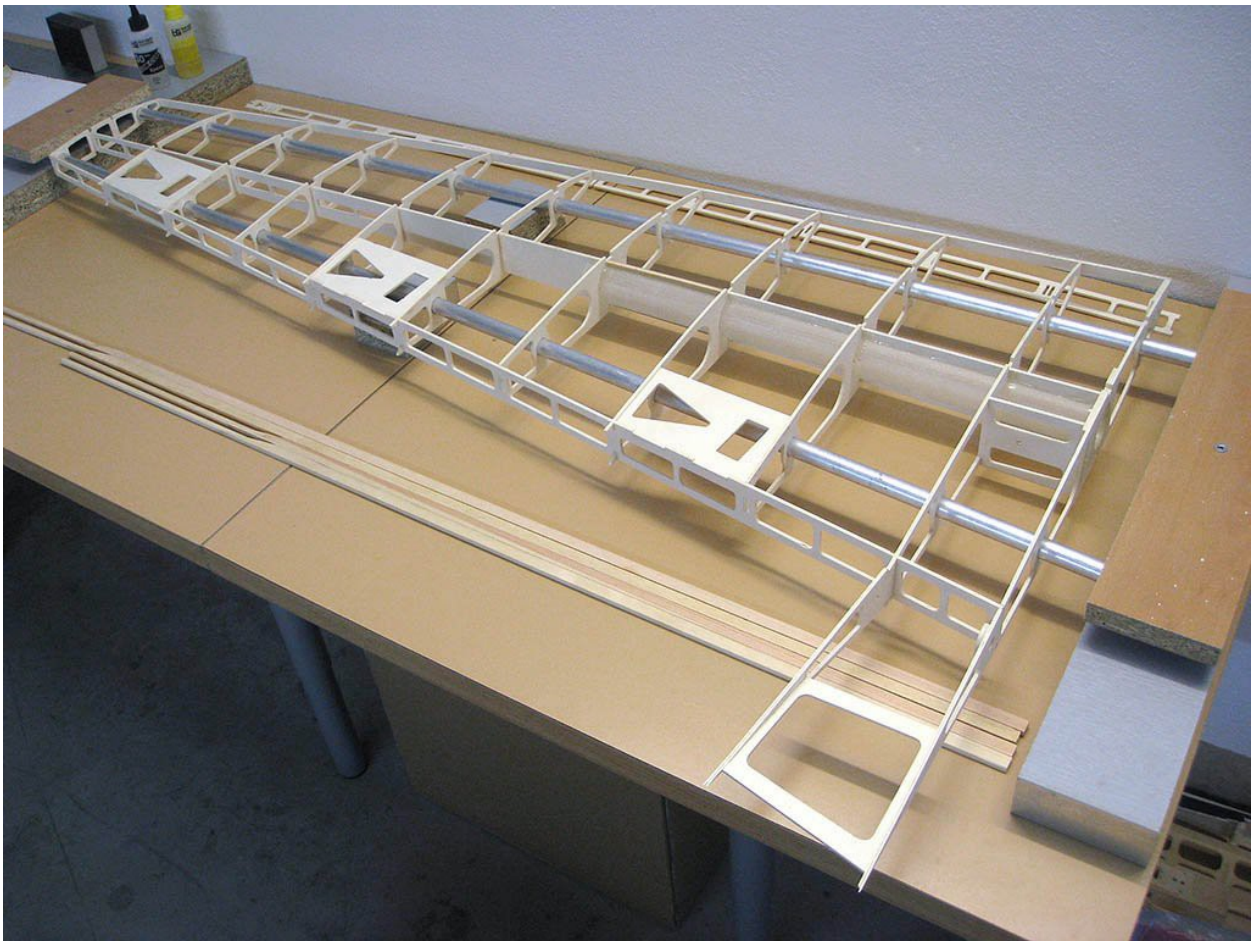
It is necessary to grind all of the wing cut-outs and "dry" if they fit together freely before they begin to stick together. Sometimes it is necessary to clean the corners of the interlocking cutouts with a small file. First, stiffeners at the root rib are stuck in front and in the middle, then the rings for sealing the safety tubes and the auxiliary web at the place of the future wing attachment (one on the front and two on the back). A second rib from the root is glued to the auxiliary web. The other two ribs are first glued through the servo plate (the plates are all the same). The two pairs of ribs are then joined by means of one auxiliary part of the main web and the other is sealed opposite. It goes well, the ribs stick perpendicular to the web.



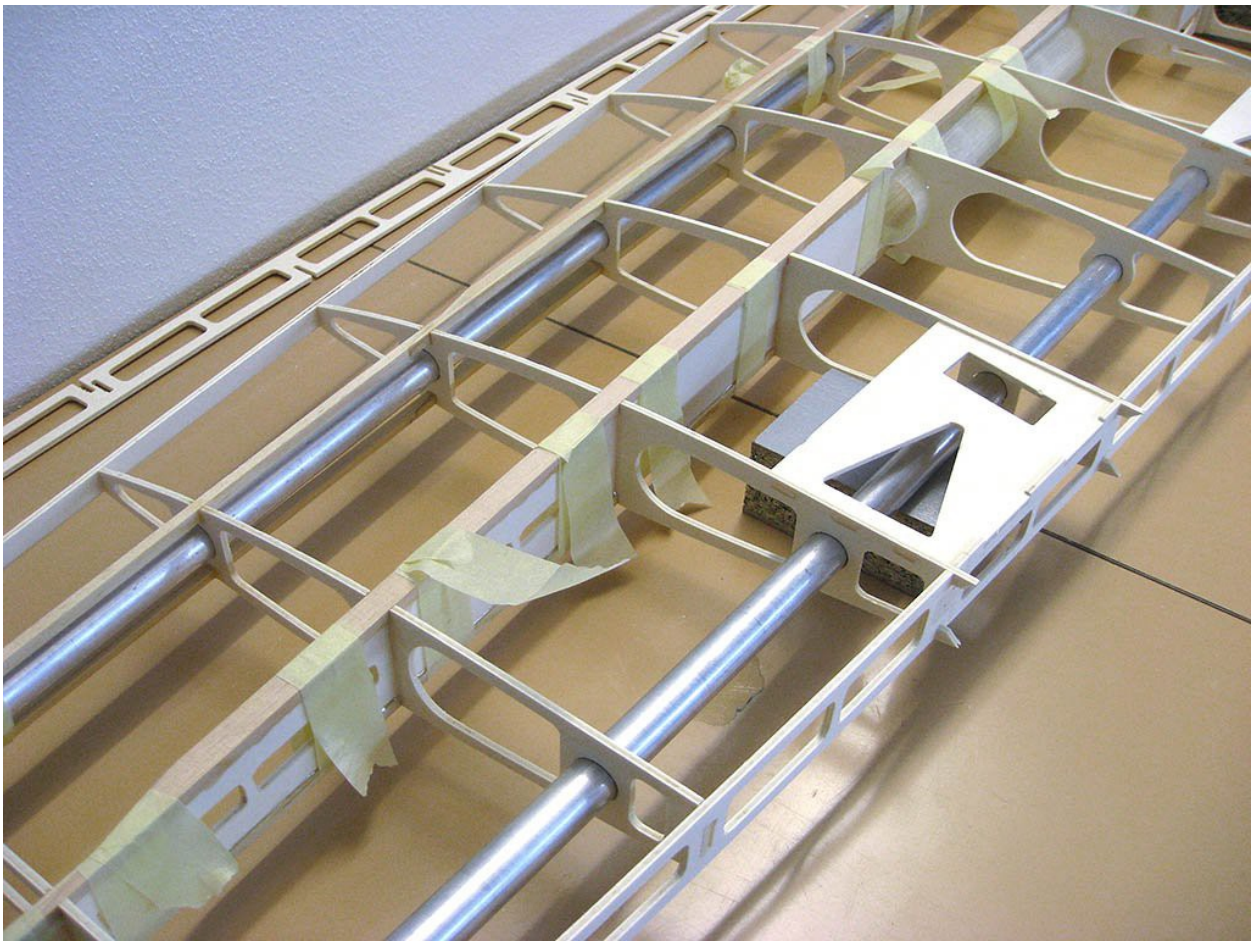
The rows are first glued ribs and before they completely dry, the servo boards are glued. Dispersion used again. Be careful to orient the ribs so that the servo plates are on the same side as the glued parts at the wing root. It is very easy to keep the ribs perpendicular to the web again.



The two glued parts of the wing are placed side by side and are connected only by the front web. Subsequently, the front guide tube is inserted and then the rear guide tube. Behind these tubes the wing is fixed in holders which assume a flat table. Then the rear web is dried to see if it can be put into place without any problem. Once the parts are fitted, the front web and the end of the main web are glued to a single rib that has no latches, so they stick to the guide tubes that help align the main web and rib. At the same time, the part on the trailing side of the root rib opposite the future aileron is also glued. The part that will hold it from the other side is glued only after the back web is glued.

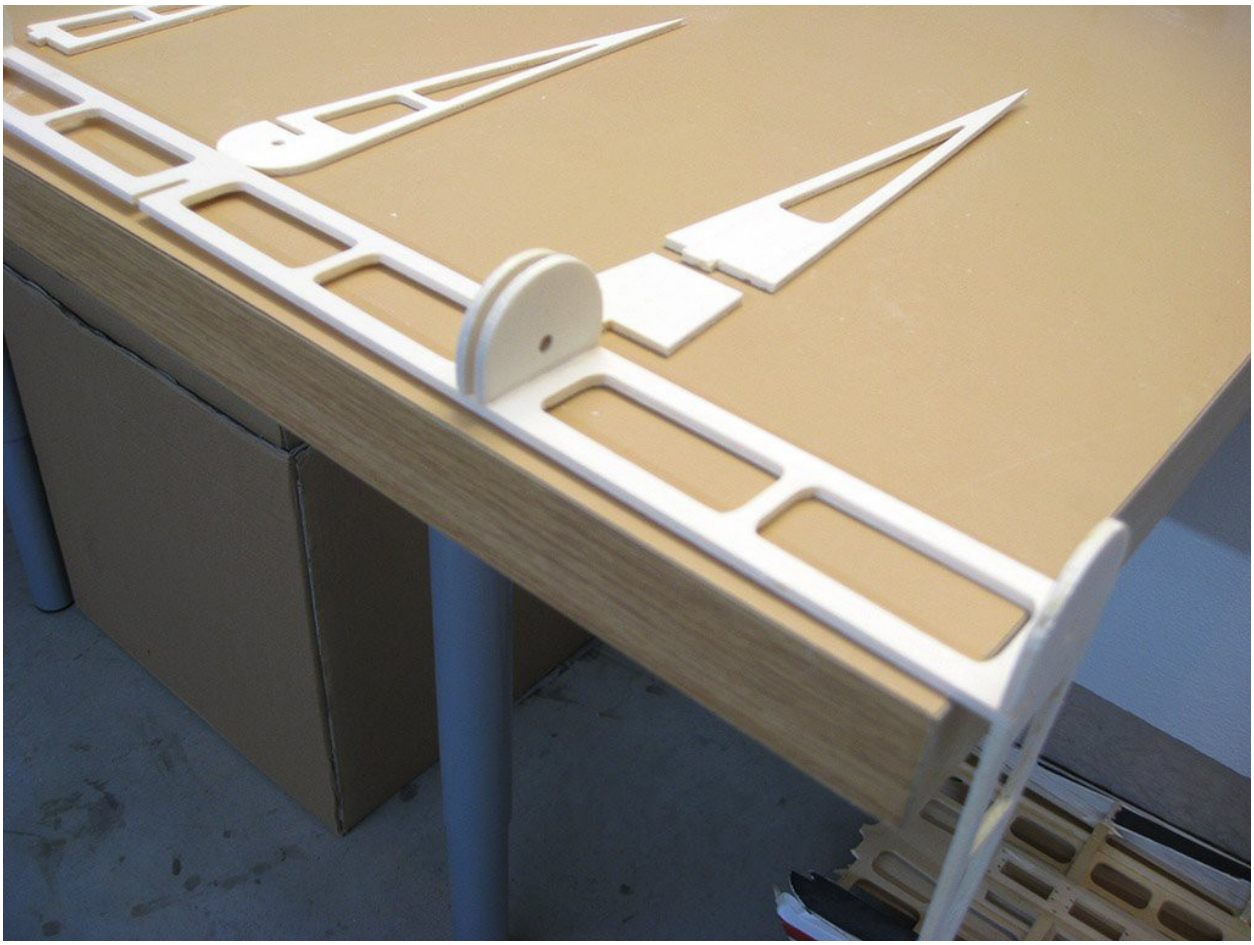


It is advisable to test the rear web again in advance so that it goes easily into the latches. Before the glue of the rear web begins to dry, the part holding the wing drain at its root will also stick on. Before gluing the pipe, it is necessary to cut the missing pieces of the web from something stronger than the hollyhock. I used the remains of the spruce molding. It is glued in advance butt before the pipe is sealed. Bonding the tube is not in 5 minutes. So it takes at least 30 min epoxy. The tube sleeve pushed into place slightly, and I apply a layer of epoxy around the ribs. Slide the case into place and slowly rotate, the epoxy spreads evenly, so it is necessary to use enough epoxide to be in sufficient quantity everywhere. Then apply the epoxy also longitudinally of the web (applied to the opposite side at the top and bottom of the web). Then again just slightly rotates the case back and forth. It is necessary to glue carefully, on this gluing it stands and falls, literally ... You can see already prepared beams for double d-box, beams are completely identical to the original version.

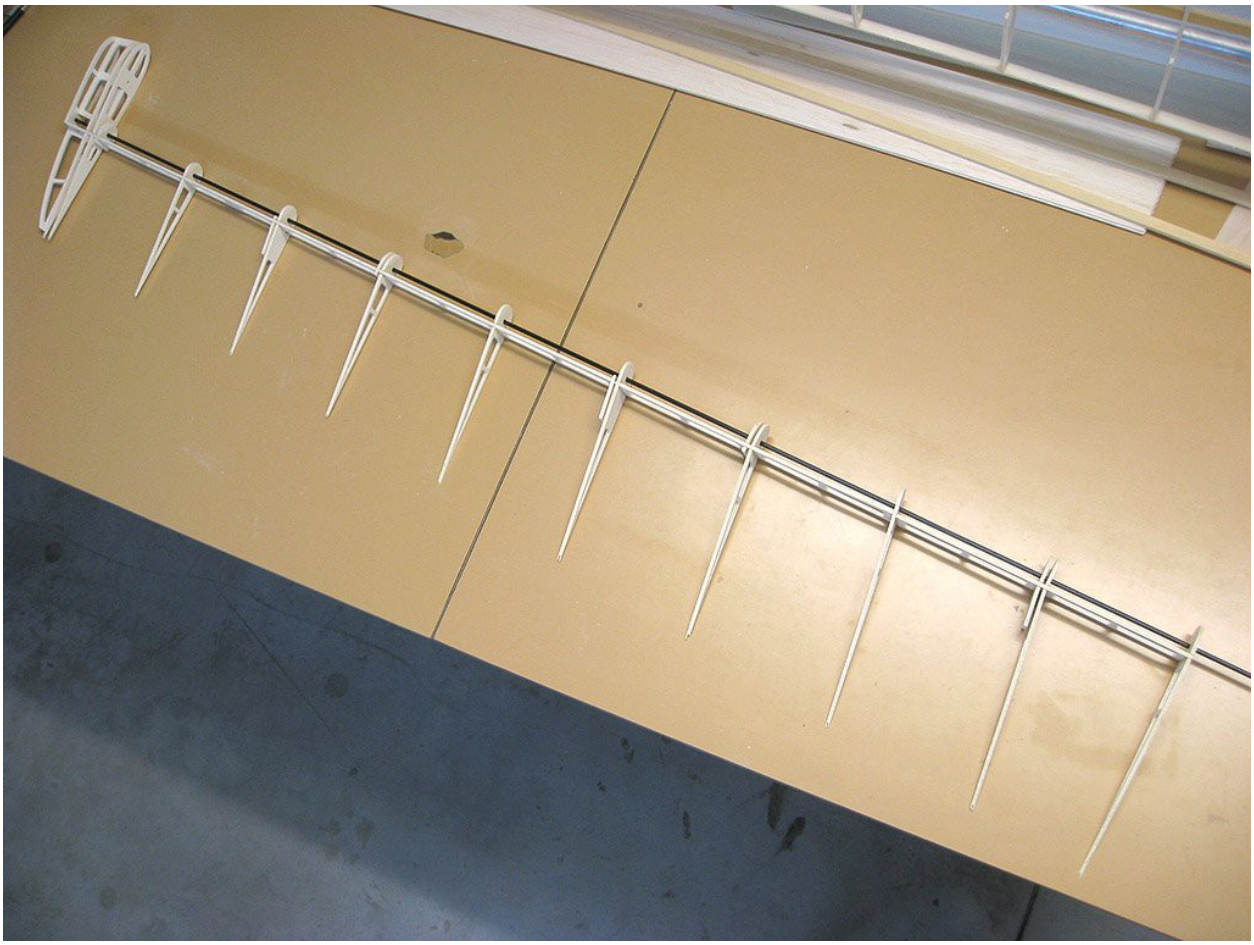


I always glued the strips to the web with Perfect G dispersion. Epoxy glues this badly, firstly badly applied and when pressed unlike the dispersion, does not hold. So it has to be retracted by tape. The strips are glued separately to the bottom and separately to the top of the wing, it is such crap, but it takes quite a long time. After checking the corners are sealed and any glue is added, it is necessary to let the wing dry in the brackets. After drying, the strength of the structure increases for the first time, so no one wants to twist it.

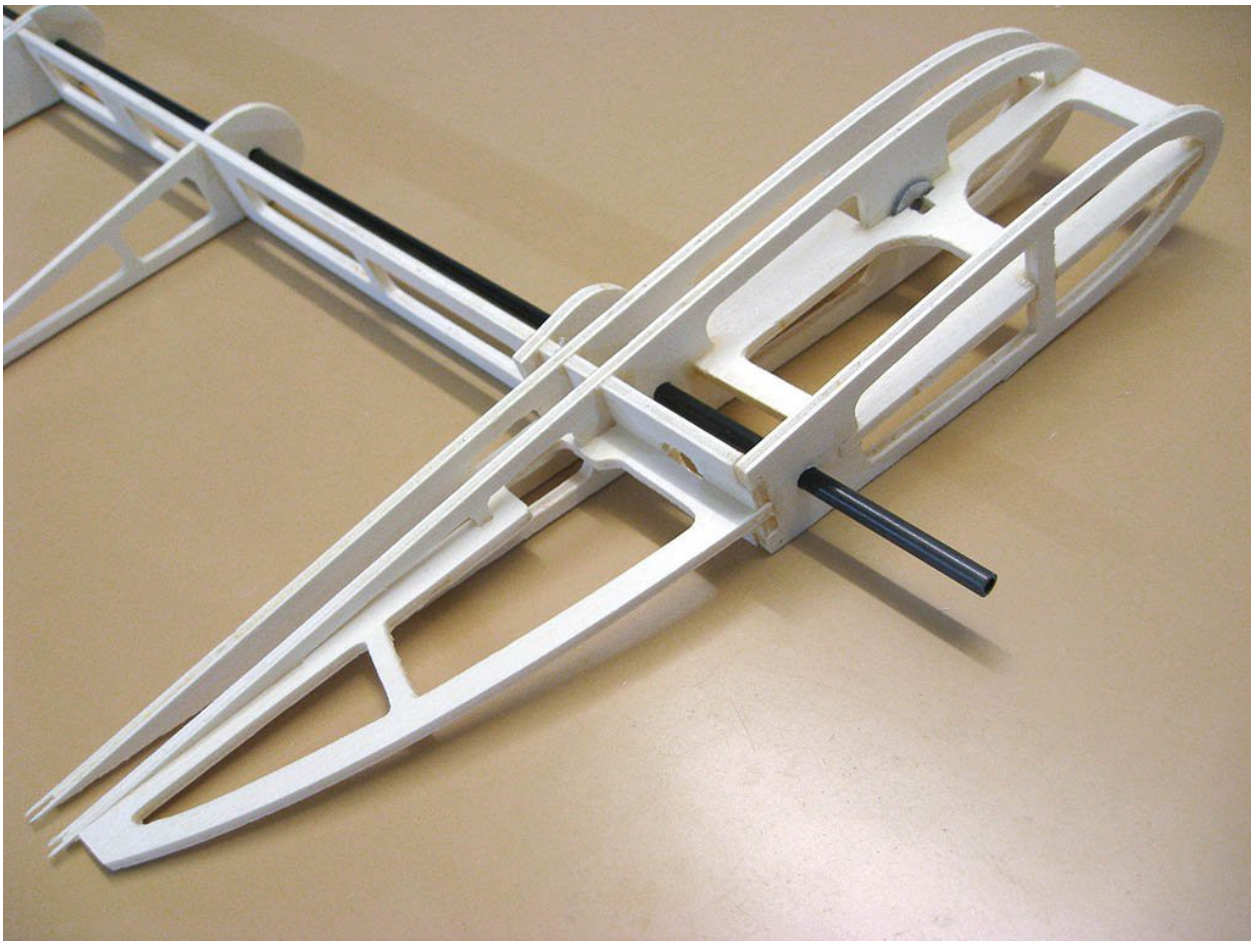
It is advisable to dry in advance and check the ribs for salvation. In particular, the portions of the ribs with the bore for the guide tube should be fitted to cover the bores. In the photo you can see the individual parts of the rib wings, how they belong together and where they belong. Some ribs are through, some are doubled due to the hinge, others are due to the lever. Some parts of the ribs are glued perpendicular to the web of wings, some are glued obliquely to follow the ribs of the wing. In the photo you can see the parts already inserted on the web, which are glued perpendicularly. The edge root rib and all parts of the double ribs are glued perpendicularly in front of the web where there is a laminate curtain in the wing.



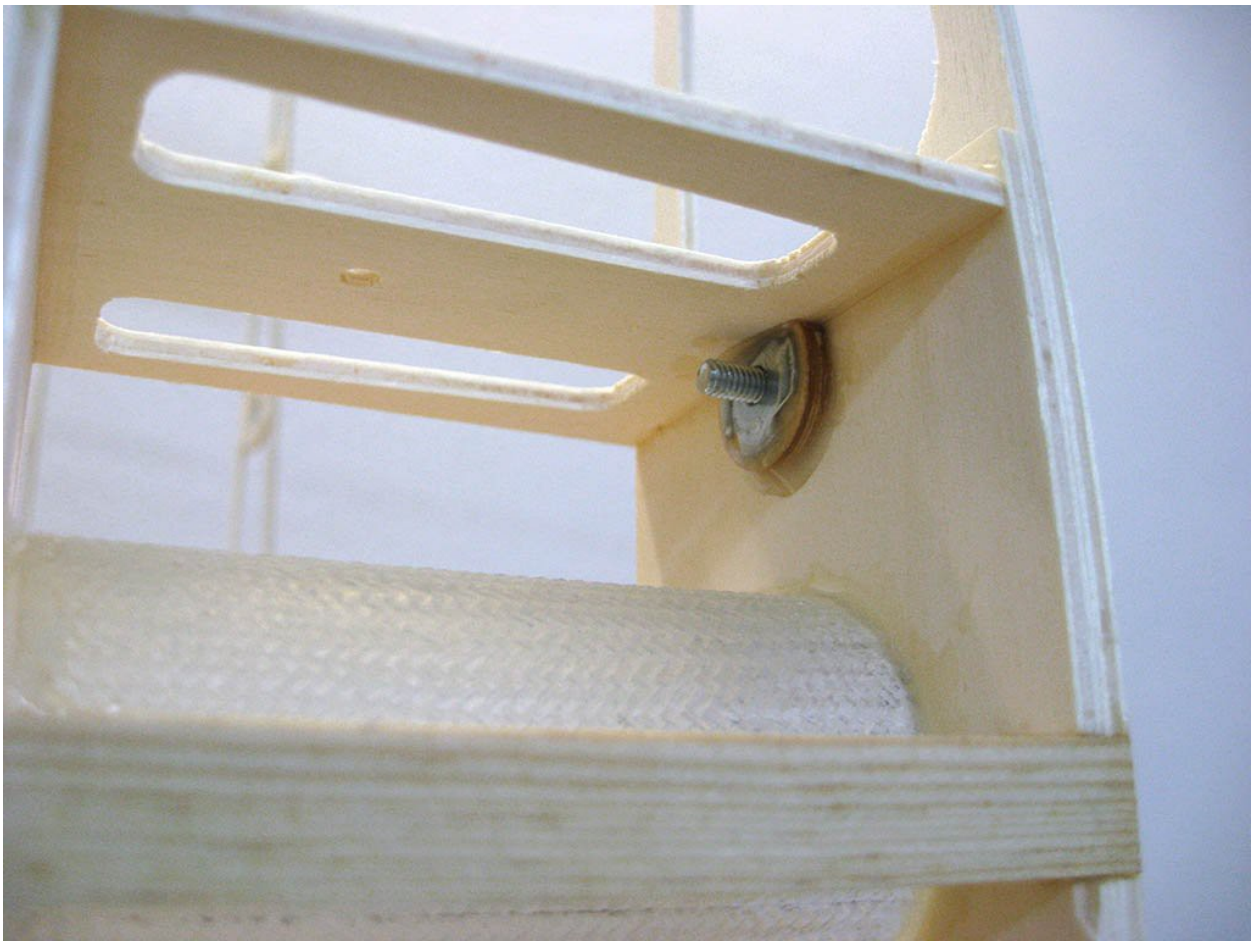
These parts must be glued really perpendicularly, otherwise the aileron will not walk freely in the curtains. It is good to try to insert a loose hinge between the two parts so check the gap, it should be slightly larger than 2 mm, which is the hinge thickness. It is good to wait for the adhesive to dry completely before continuing.



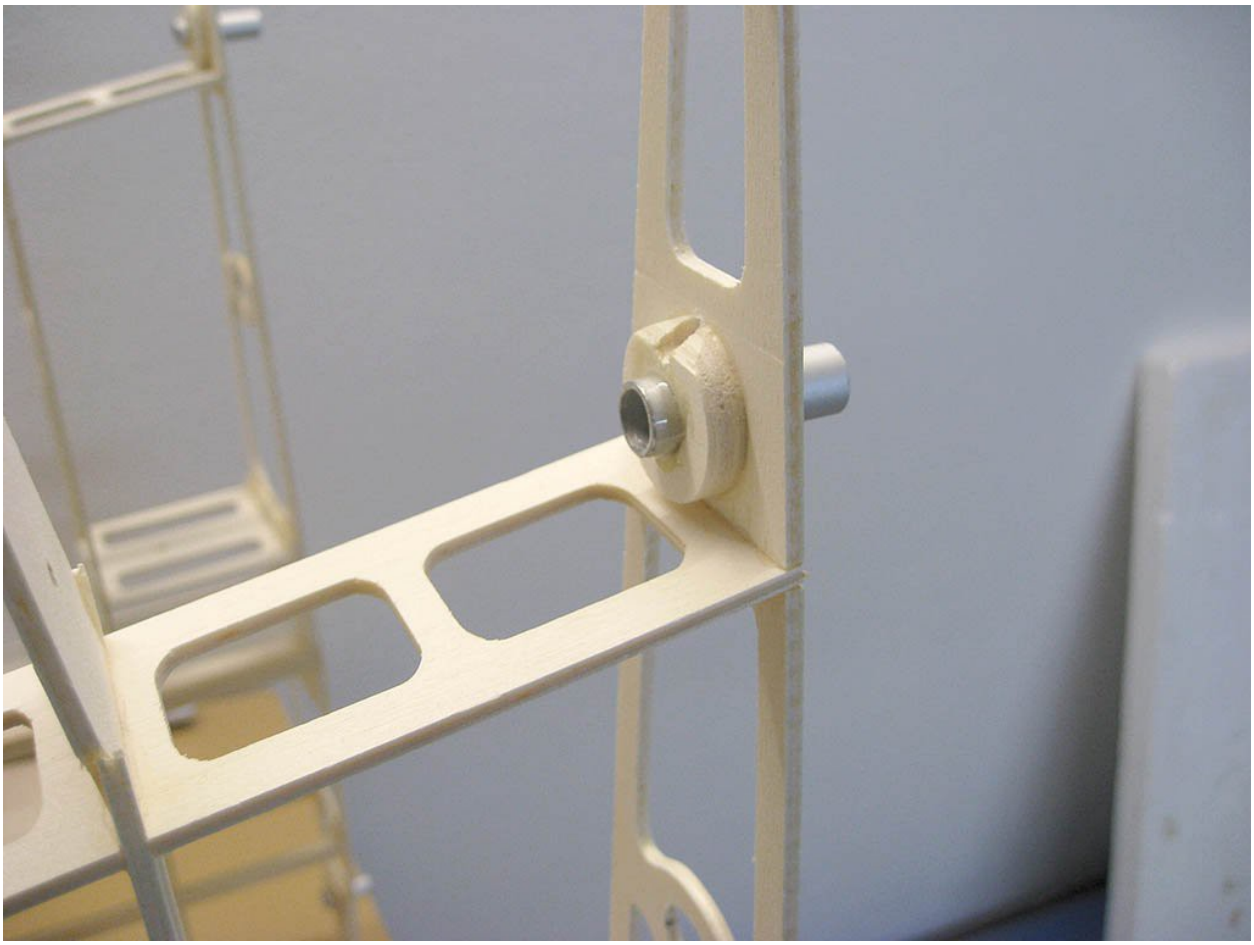
All the remaining parts of the fin ribs are glued obliquely, for this purpose it is advisable to make a template for checking the angle with the poplar plywood trim. A carbon tube with a diameter of 4x3 mm is used as a guide tube. Its length is greater than 1 m, so it is necessary to connect it from two pipes. A carbon rod with a diameter of 3 mm and a length of about 40 mm is used for the connection. The rod and the tube are slightly ground on the contact surfaces so that the tubes can be easily pushed onto the rod, but without much play. It is glued by thin CA, first the rod is inserted into one tube, it is poured, then the protruding part is rubbed and the tube is pushed fast. If the transition is not quite smooth, it is necessary to finish the transition so that the pipe is always the same diameter.



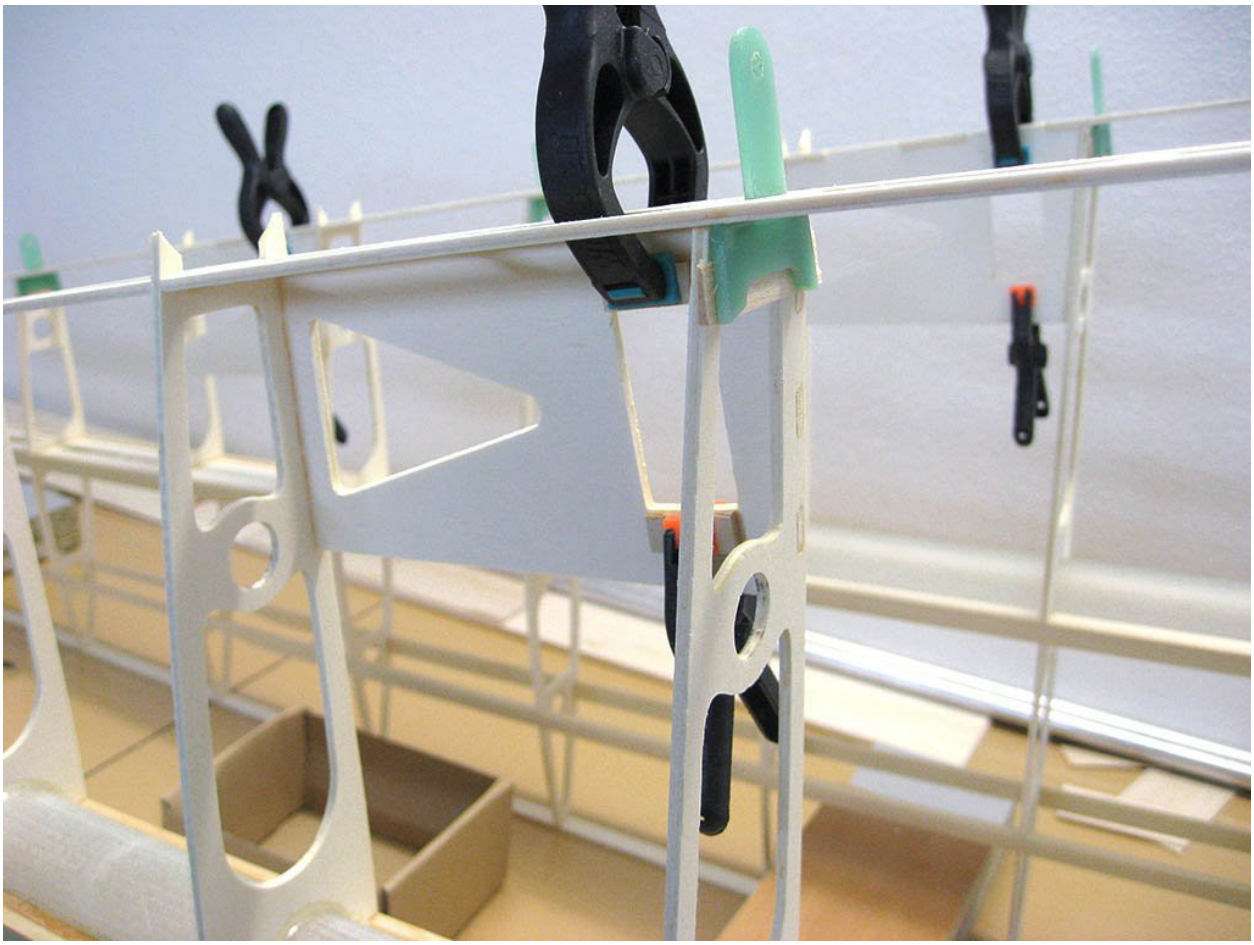
Completely new is the design of the wing end with counterweight and shaft for SFG. First, an M4 epoxy fixing nut will be sealed into the rib with a 5.5 mm hole to serve for the screw fixing the inserted SFG. The connecting plate in front of the guide tube needs to be slightly modified to have a recess for the nut and a space for the overlapping screw, which is nicely seen in the photo. Before bonding, it is advisable to dry the end arch parts into the aileron web without much resistance at the correct angle. Then the two long ribs are glued together by means of a modified plate, between which a future shaft for SFG and a width of about 6.5 - 6.8 mm has been created, into which half of the SFG will slide against each other. This bond is then glued to the web of the ailerons. To ensure the correct angle, the plate is glued behind the guide tube. Finally, the end item is sealed. Once all parts of the aileron are glued together, the holes for the guide tube are gradually and carefully sanded with a round needle file. The guide rod must go with a slight resistance, but at the same time it should not have any play, so do not grind.



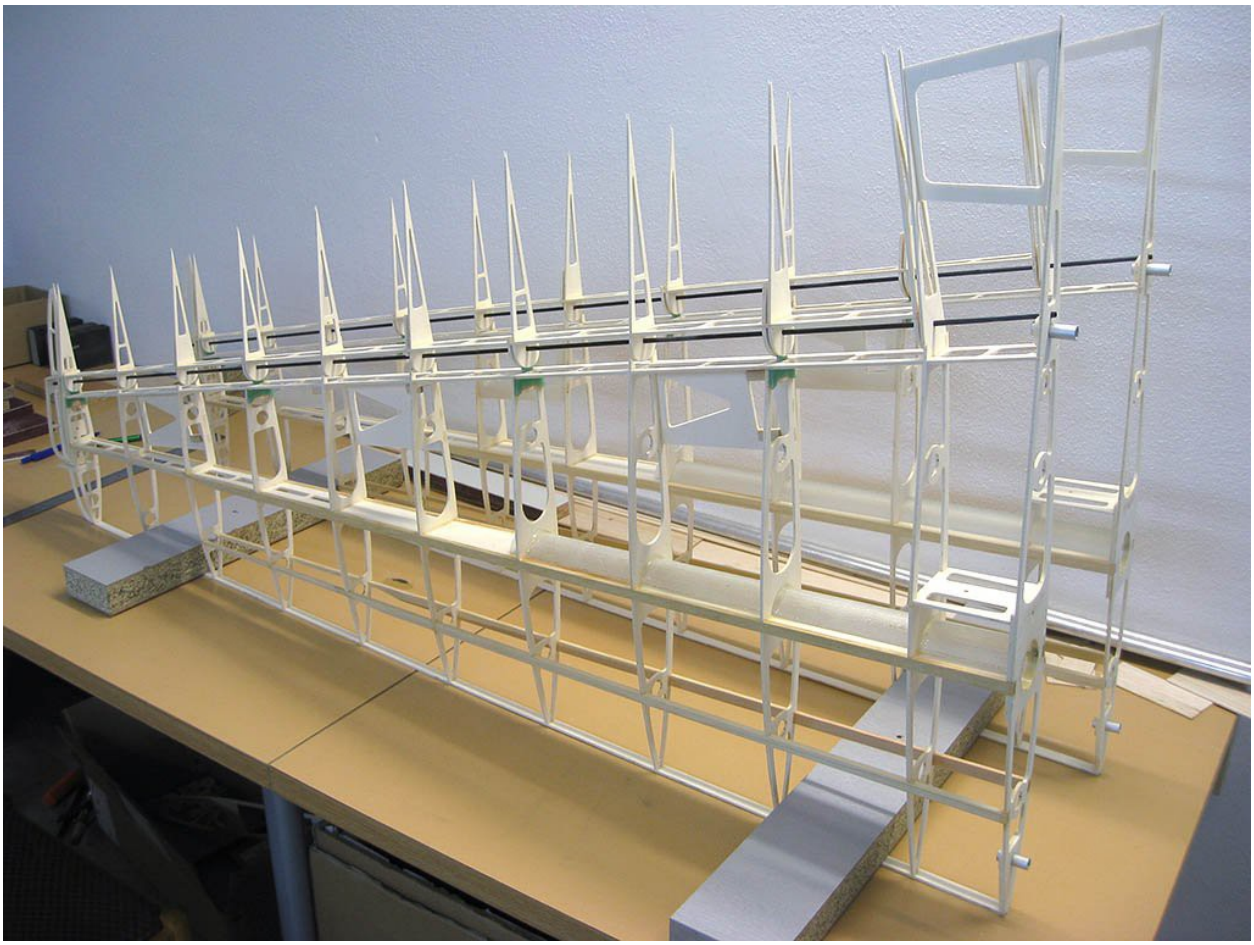
The wing can be fixed to the fuselage in various ways. I use wing pulling together. For this purpose, through the birch plywood insert is embedded nut M4 into the root rib of the wing, the whole is glued for 30 minutes with epoxy. When the wing is finished, a steel hook for a rubber band, spring or belt is then screwed from the other side. If someone wants to screw the wings to the fuselage, the procedure is basically the same, but it is good to use for one wing two locking nuts, which are away from the tube housing.



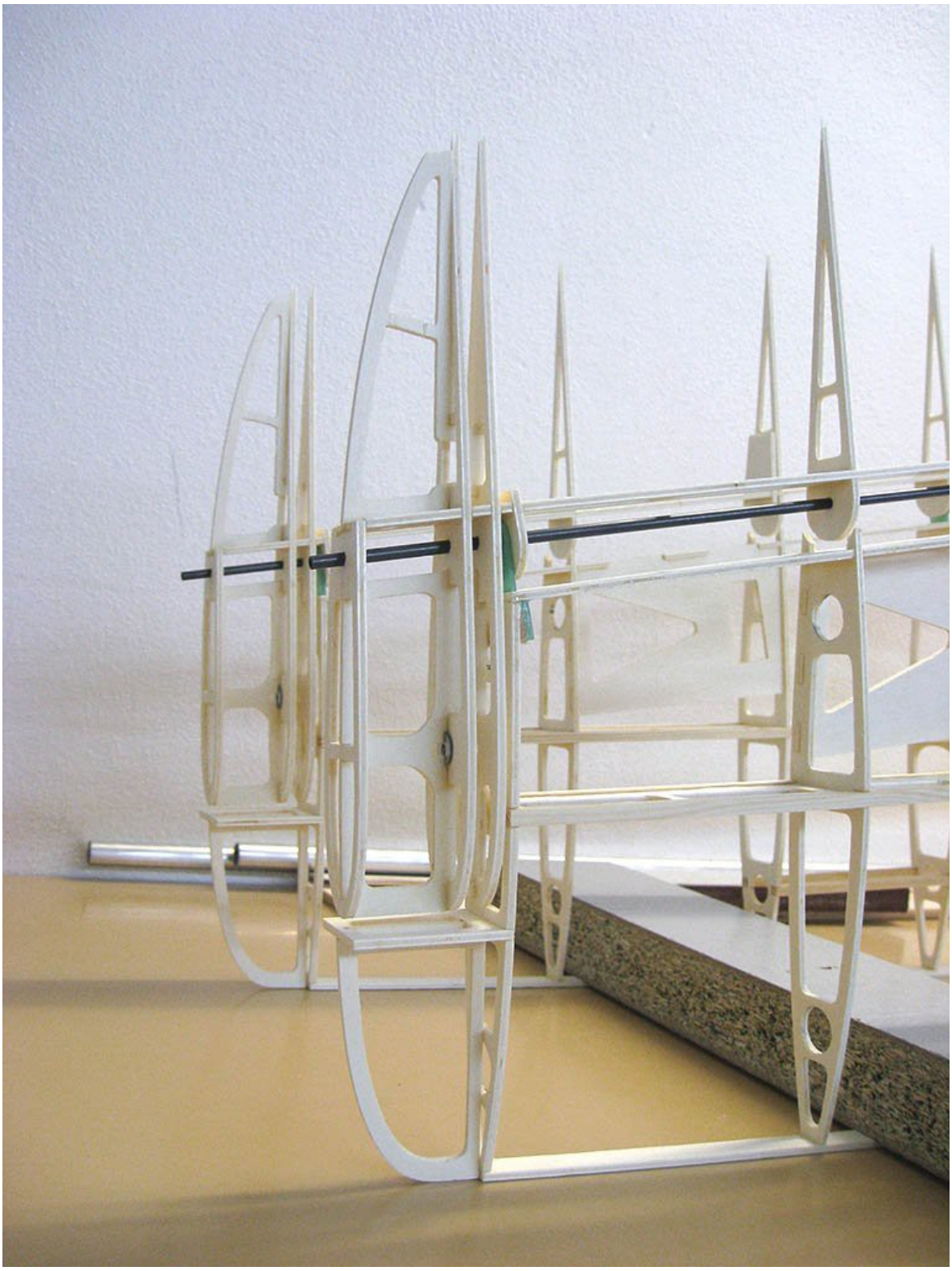
They are cut from an aluminum tube with a diameter of 10 mm. On the one hand, they ensure the exact position of the wing in the fuselage and secure against turning when the wing is pulled to the other wing at only one point. The front tubes are shorter, only copy the height of the reinforcement in the fuselage, the rear tubes overhang the reinforcement in the fuselage by about 6 mm, at this point there will be safety catches against pulling out the wing in case of failure of the main withdrawal. Above the rear tube, the photo shows the opening for the aileron guide tube



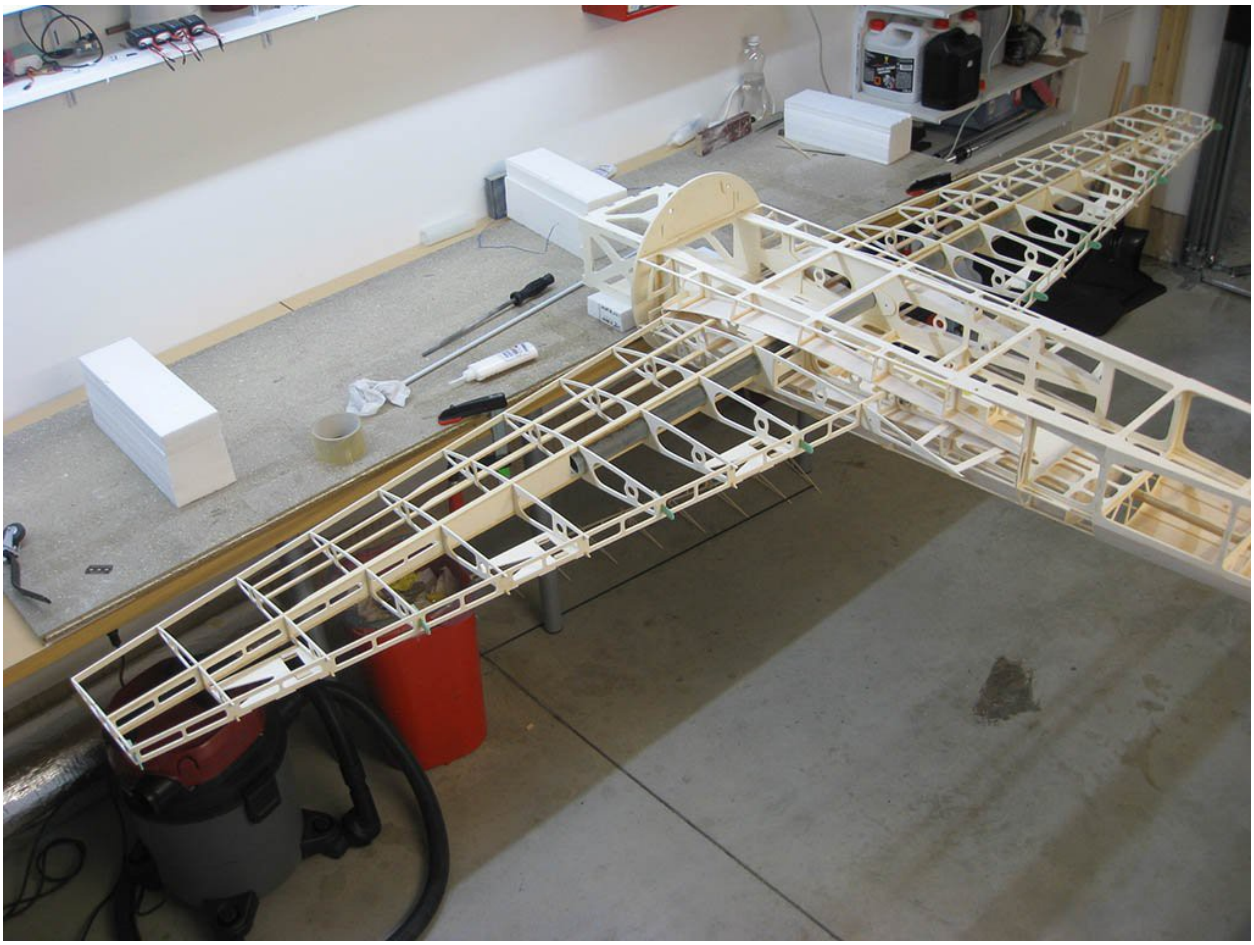
In version 2, the hinges are at 90 degrees to the web and always from the rib side towards the wing root. Thus, the hinge does not rest on the rib, there is an oblique gap. First check that the curtains pass through the aileron guide tube, then insert the curtains into place. It is necessary to make sure that the hinges are supported on the web, if not, it is usually necessary to grind the adhesive from the structure of the previous gluing. After sliding the hinges, which are not yet glued, the wing is slipped onto them and the aileron guide tube is pulled through. The aileron ensures the correct position of all hinges, which must fit into the slots, or touch semi-rib at the last hinge at the end of the wing. Once everything is established, the curtains drip from the front of the web with thin CA to fix them in the correct position. After drying, the guide tube is pulled out and the aileron is removed, the hinges should already hold relatively well. Subsequently, the harder 2 mm balsa is cut and polished to fill the oblique gap. The epoxy is put into the gap first and then the plywood is inserted and the epoxy is added. You can do it differently. Simultaneously, 3 mm birch plywood is glued in place of servos screws, only in poplar trees would not hold much.



One motivational photo, the wings are ready to be coated, the basic construction is finished. The wing is in place. Maximum satisfaction, the aileron already walks freely, has no play and a deviation of +/- 60 degrees is smooth. The original version was a considerable problem, slits and curtains had to be grinded and there was a clearance, which with the operation even increased ...

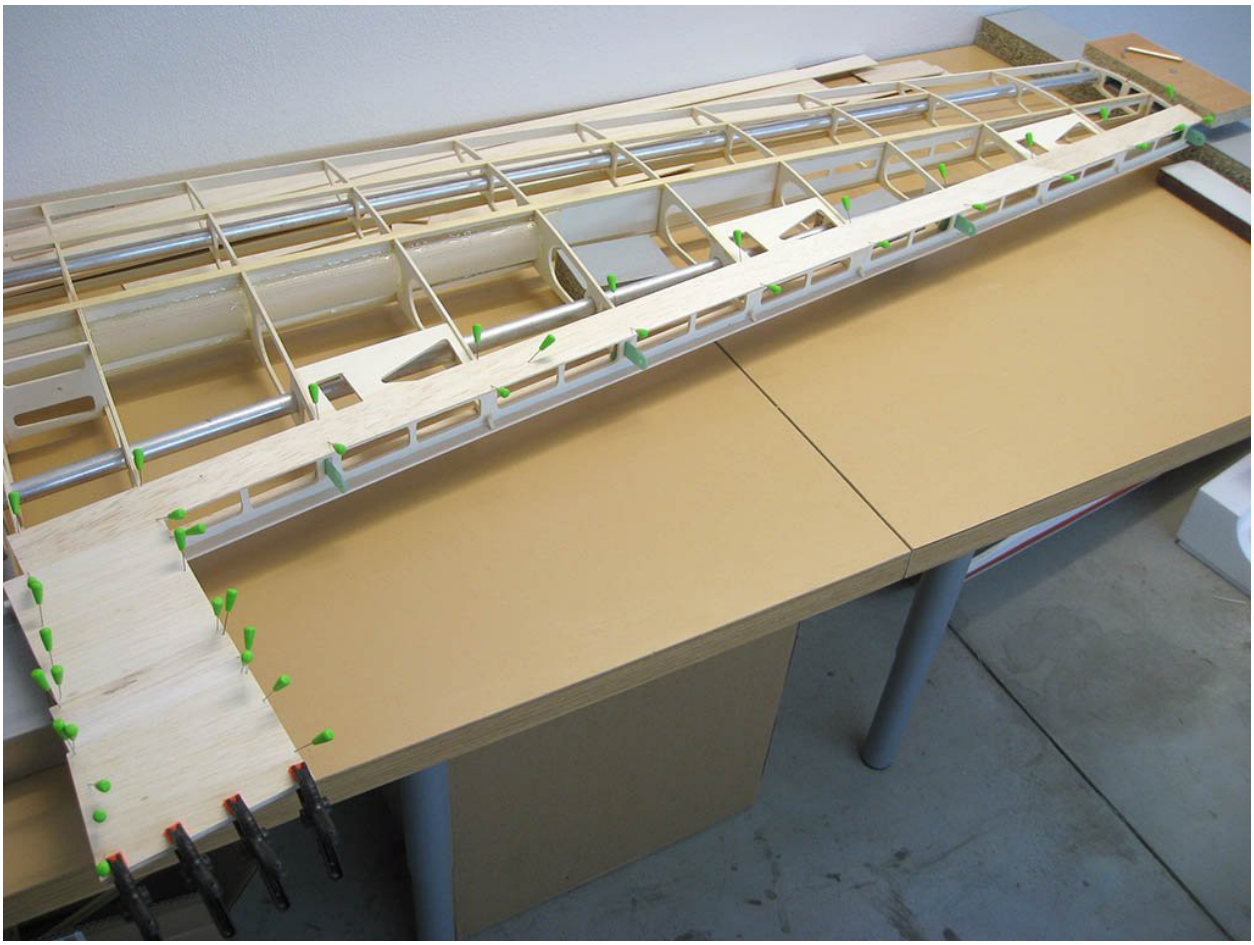


New wing arch design complete. On this construction, balsa will be glued to the side and the final shape of the arch will be shaped. The front part of the arch is not yet glued, the cover must be glued on the tubes, the tube must go into the ribs with the necessary overlap

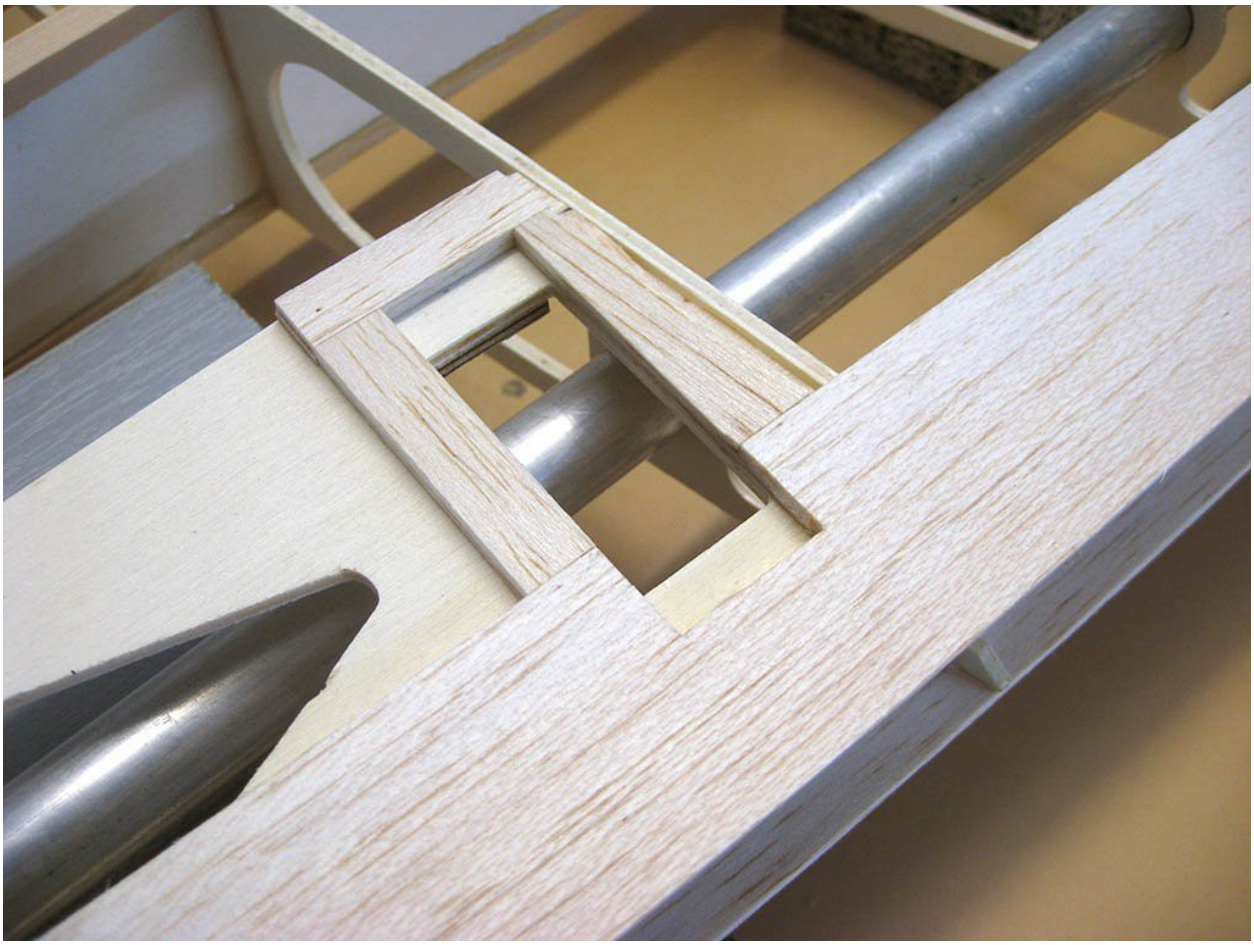


Before coating the balsa wings it is necessary to fit the wings with the fuselage so that the pipe stops in the wing are correctly adjusted. The fuselage length is inserted into the fuselage and wings are slipped on the tube, the tube is centered. The pipe must pass through all the ribs and at the same time it must not move in the sleeve, its length must be accurate. The tube length will not change in this case, only the stops on the sleeve will be marked. I use a self-adhesive rubber 2 mm thick between the wings and the fuselage to damp the vibration of the wing, I need to move the thickness of the damping stops towards the wing root.

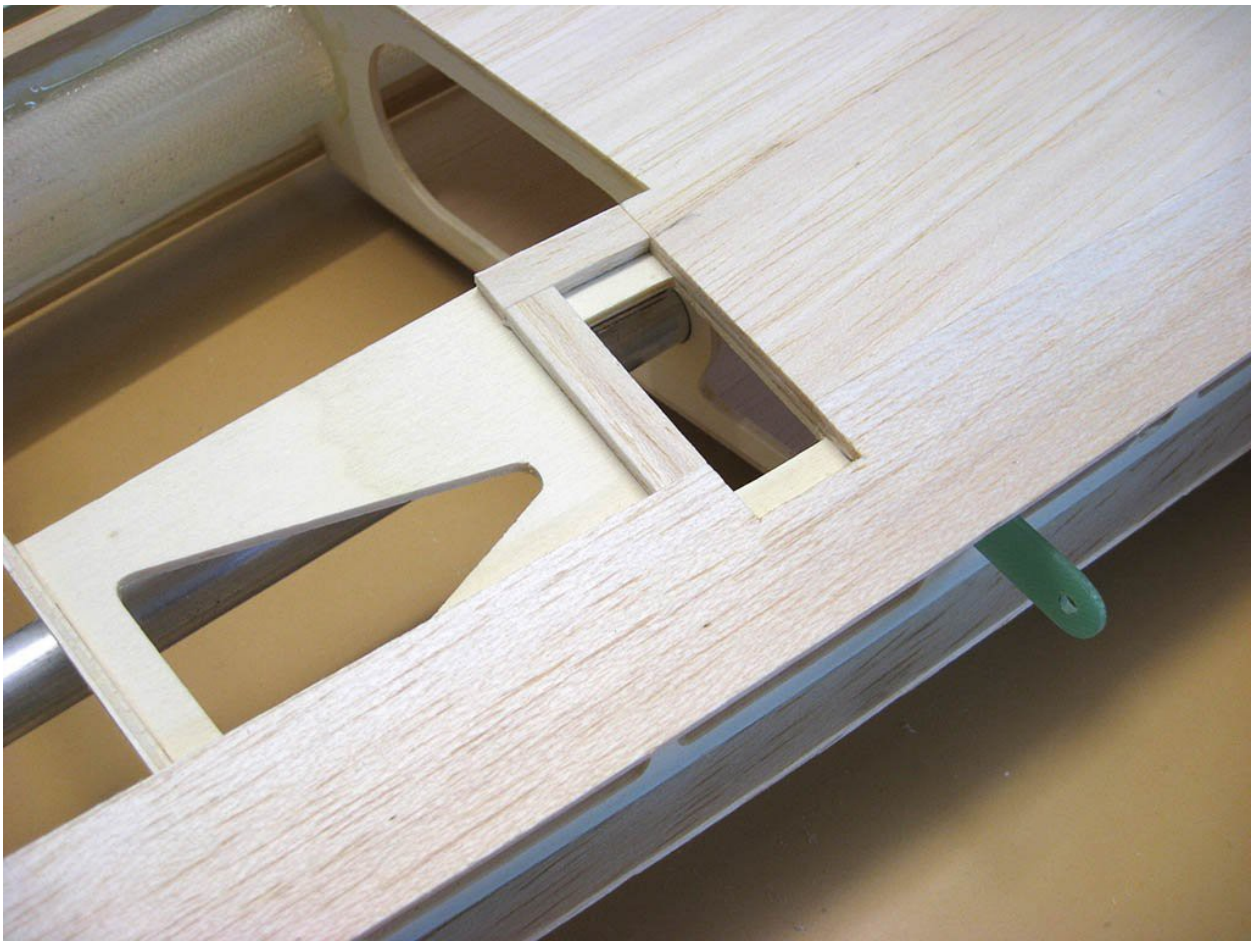
For the prototype, I managed to get a carbon tube that is slightly shorter than the original plan. I shortened the case with a one-sided plate of metal saws according to the mark I made when splicing with the fuselage. One piece of poplar plywood partially closes the sleeve, it must not close completely, it would then be very difficult to insert the pipe due to compressed air. The other two pieces of hollyhock close the opening in the web after the sleeve is shortened. It is glued with epoxy.



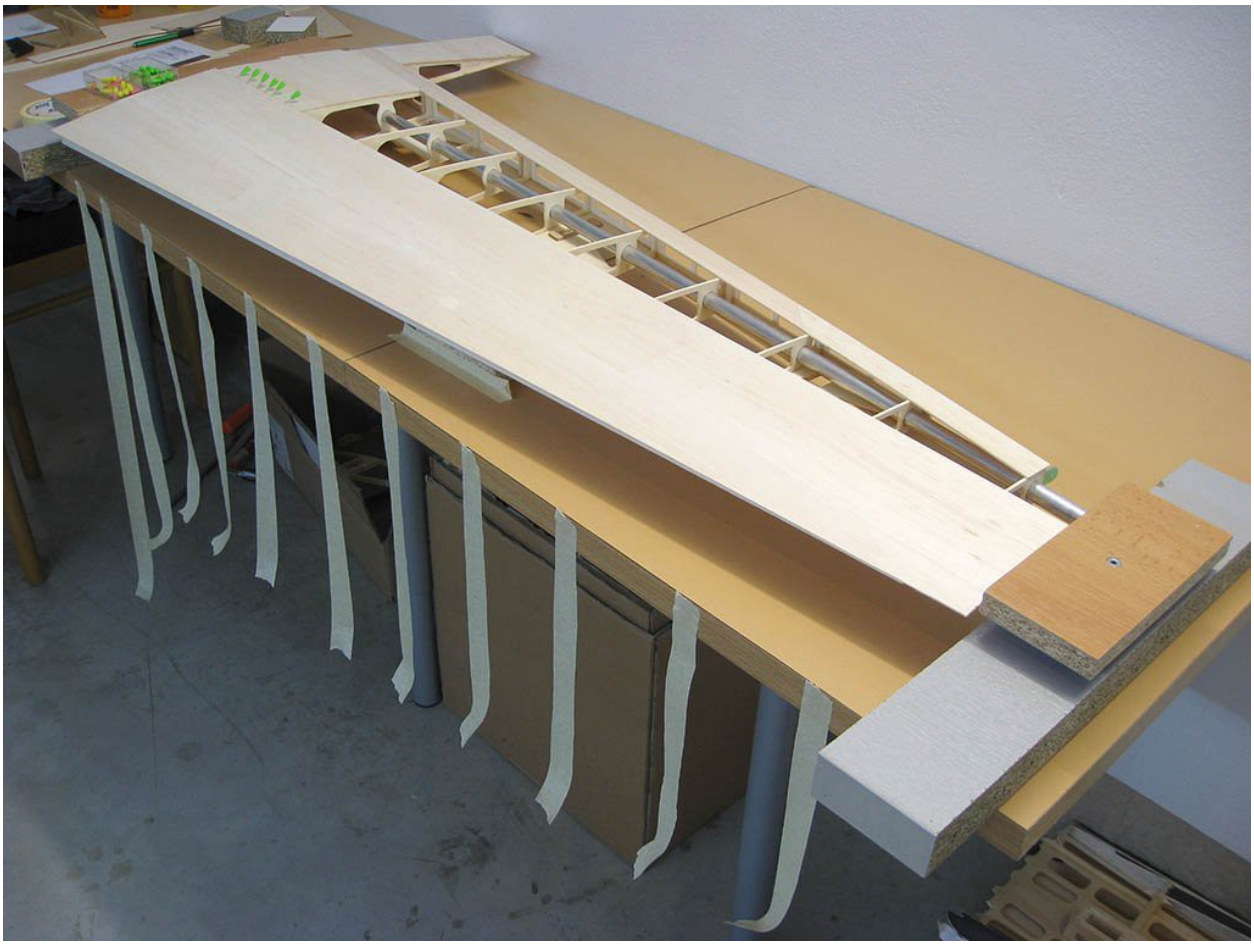
The design of the wing is put on the tubes to ensure that everything is straight. The web cover has a width of 33 mm, so one balsa board is made into three parts of the web cover. The cover has to be extended to cover the entire length of the leaf. They are glued by dispersion and set so that they end on the ribs with extension of the overlap behind the web. Immediately thereafter, the coating at the root of the wing can be stuck. The cover can be pre-glued by the middle CA over the tape as it is normally done, it is not even necessary here, it can be glued immediately to pieces on the structure, the dispersion is applied to the inner edge only . Then the cover would be badly ground.



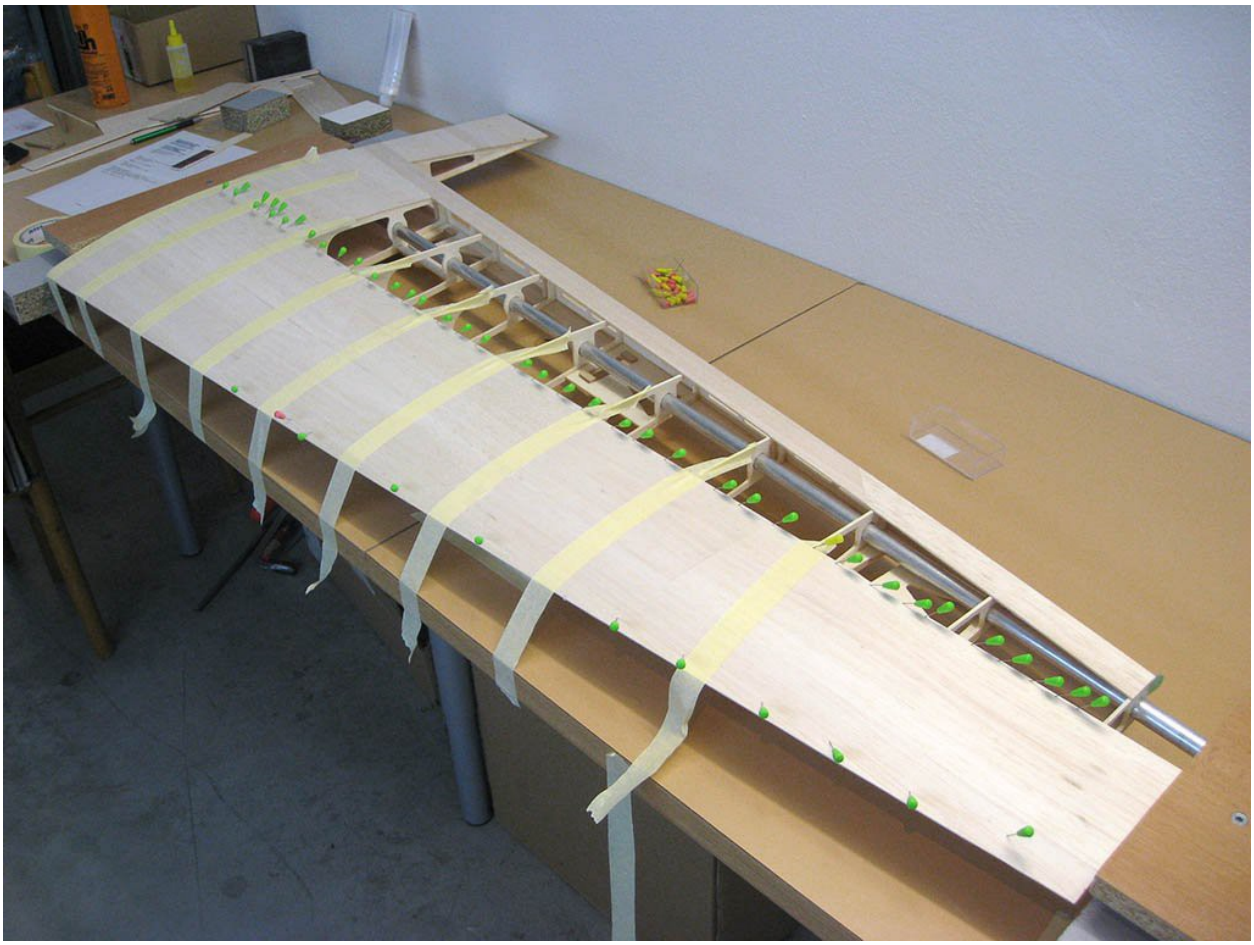
Around the servo it is necessary to vynyvelovat edge for ironing the cover and at the same time the servo more embedded in the wing. First, 10 mm thick balsa strips of 1.5 and 2 mm thickness are cut into a balsoire. First, the servo hole is covered with 1.5 mm strips so that 7.5 mm wide screw-on surfaces are created on the shorter sides of the hole. The strip is also inserted under the web and drips with a thin CA. Subsequently, strips of a second layer of 2 mm thickness are glued. The strip next to future rib bands is triangular in plan to have direct contact with the rib bands



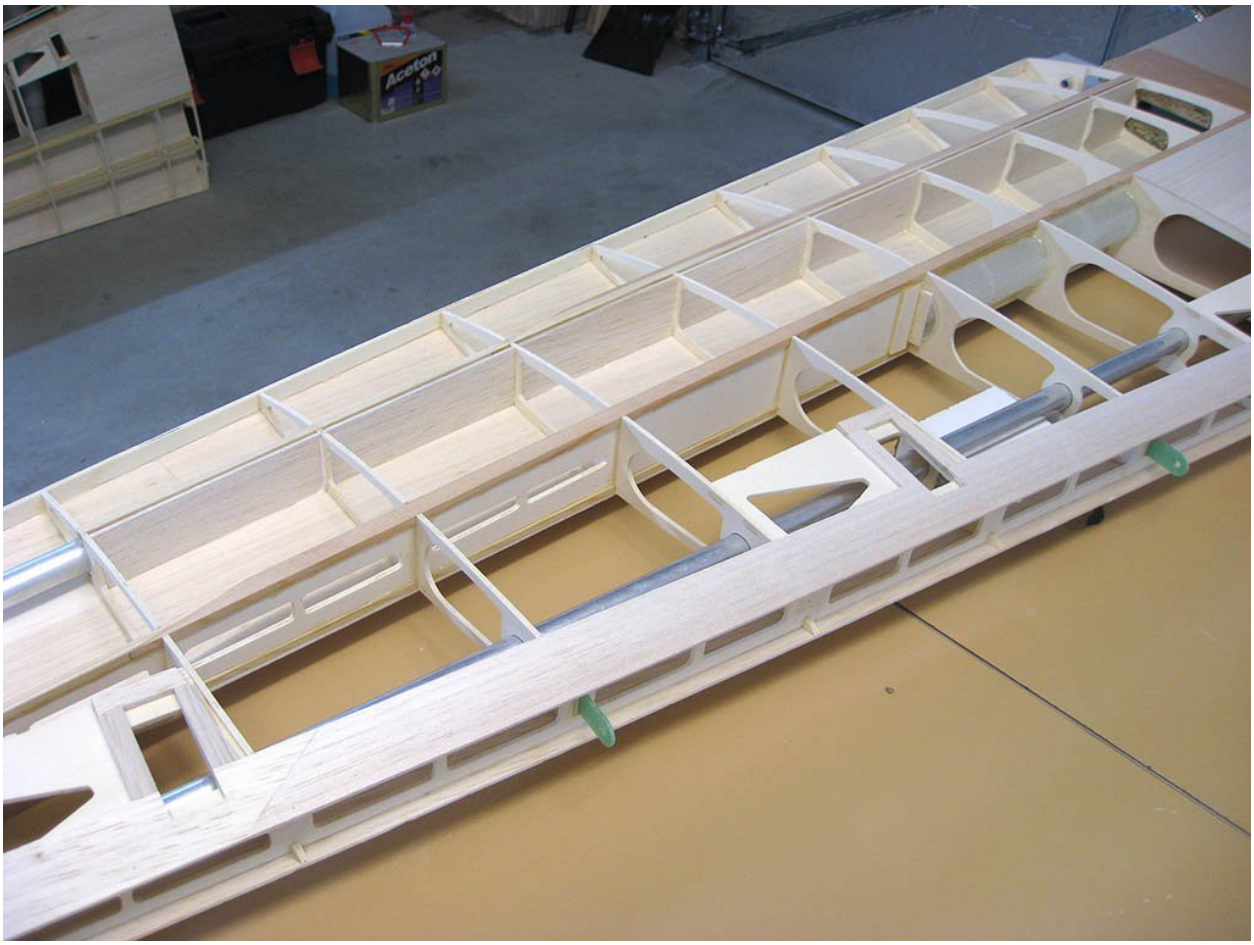
The first layer of 1.5 mm strips is made like other servos, the next layer is made directly by covering the root of the wing behind its main web.



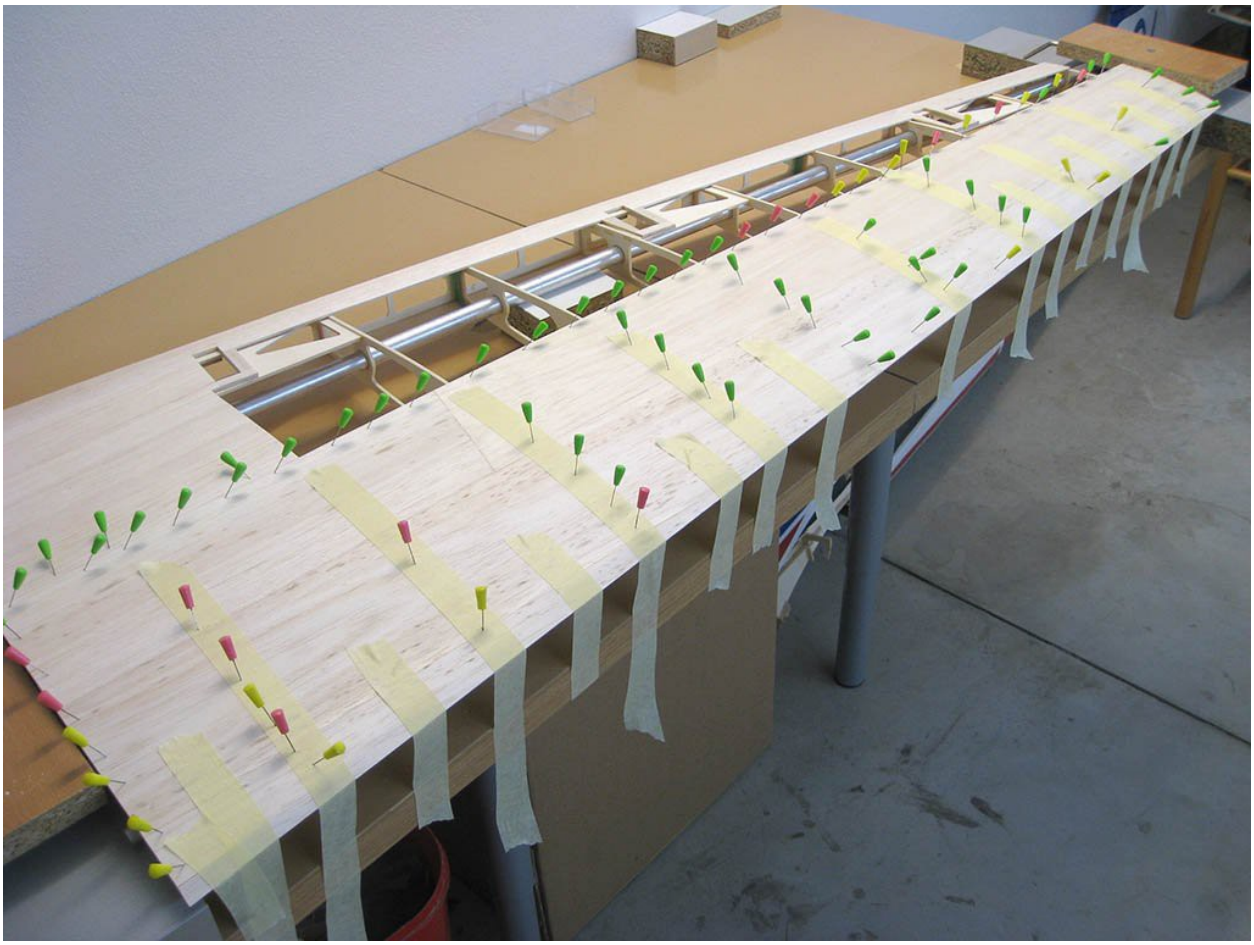
Three 2 mm balsa boards are needed to glue the cover. Preparing the cover will take some time. First, one board is extended by the other board, the whole is shortened to the required length. It is necessary to remember the arch at the end of the wing, which is not yet glued, the cover must overlap it. Subsequently, the third board is extended with the remainder of the second board and again shortened to the required length. Then the extended boards are glued together (everything is glued with medium CA using paper tape). Finally, the edge of the cover is cut obliquely along the leading edge with a margin of at least 5 mm and the oblique blank is glued back to the beginning of the cover where it will be missing. The whole covering is good at the boards glued together if there are transitions. Before bonding the cover to the structure, the cover of the central wing is lifted with pins to tie the covers together. Next, tapes are prepared to attract the coating to the structure.



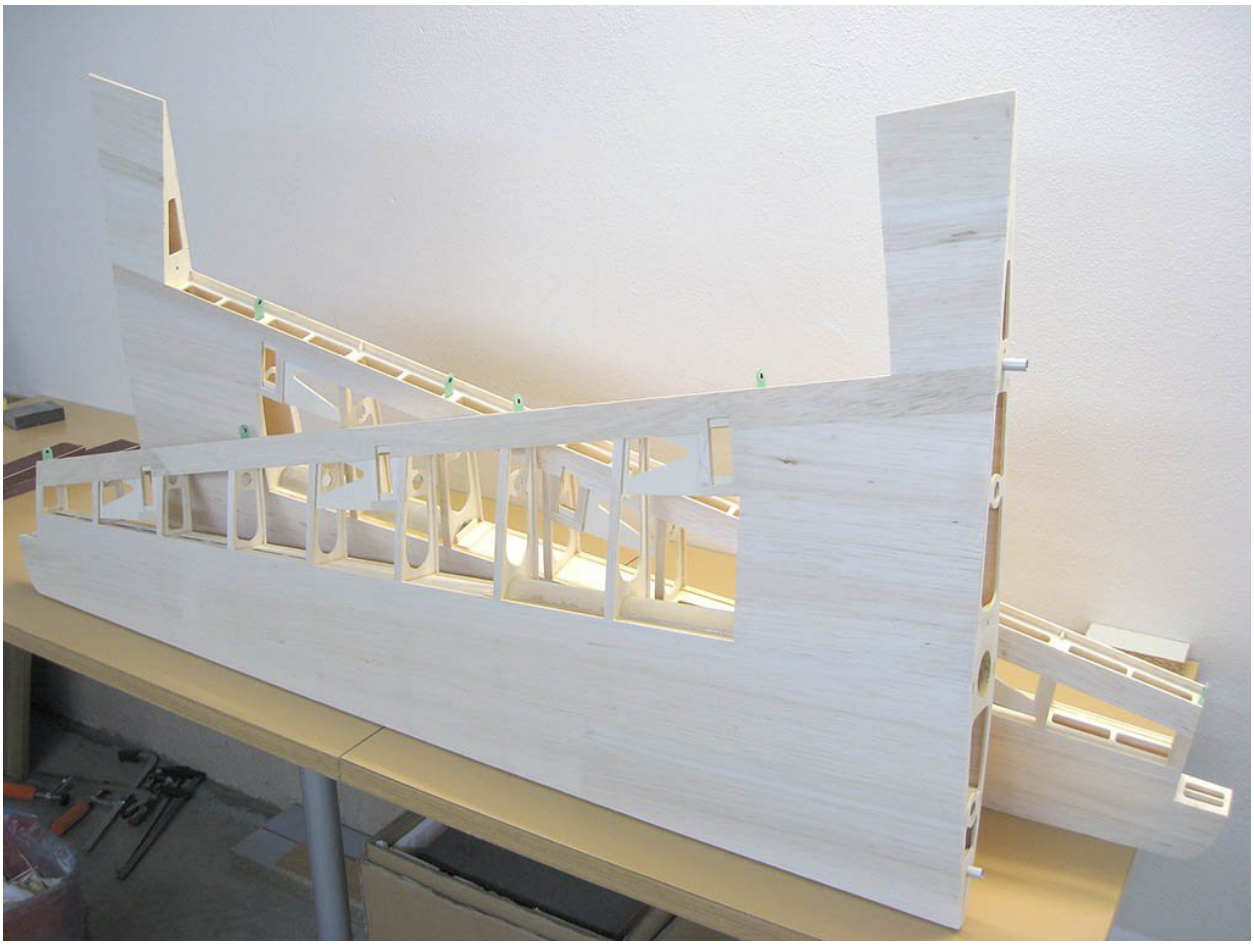
Sufficient adhesive should be applied to all parts of the structure. The cover is flush with the edge of the cover of the central part of the wing and along the entire length of the pins pin the bar on the main web wing. Then, somewhere in the third of the wing, the cover is pressed against the rib and then somewhere in the middle of the wing. Then proceed towards the wing edges. When gluing the first covering, care must be taken not to deflect the sash. It is therefore necessary to have enough pressure on the ribs, but the wing must not bend. Preferably, before bonding, it is advisable to check that the cover is resting on the ribs and that the sash does not bend, if so, it is necessary to support the sash. If necessary, the pins are attached to the front web.



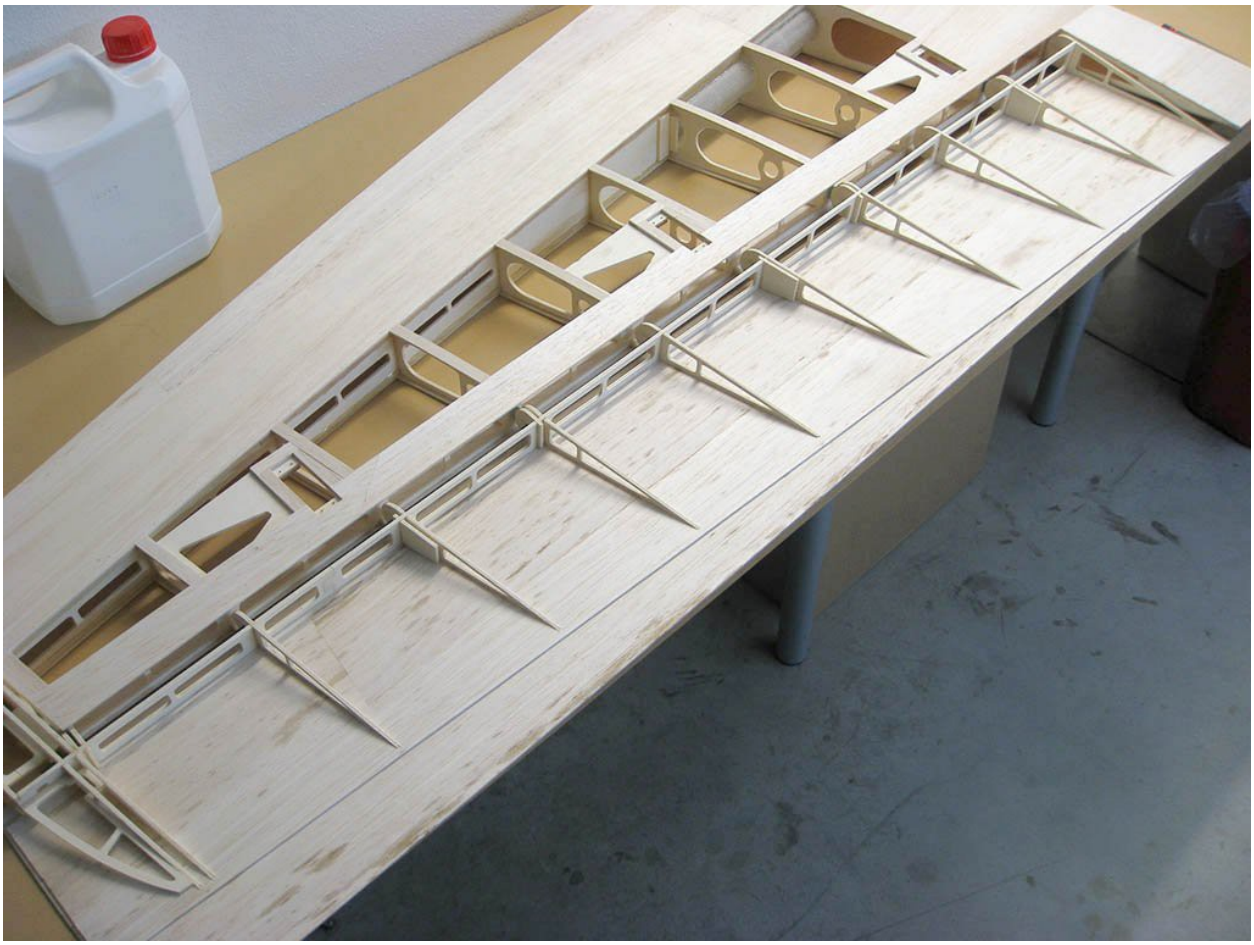
I had quite a few balsa pieces left so I could use them or throw them away. So I made an auxiliary front web and doubled the dbox. Not that it was necessary, but I just used the remains of balsa.



Before closing the cover and hence the dbox, the wing is still a bit supple. Before gluing the cover, it is last checked again that everything is straight and not twisted. The structure is set up on the table so that the leading edge is parallel to the edge of the table and the bedrock is located a little behind the leading edge in the middle, so that it cannot bend when the cover is attached. The cover is glued in exactly the same way as on the other side. First, carefully grab the pins on the main web, then from the center of the wings always first not very strongly fastened to the table tape and then the cover in all places attached to the ribs pins. Finally, the cover is bent down slightly along the length of the tape.



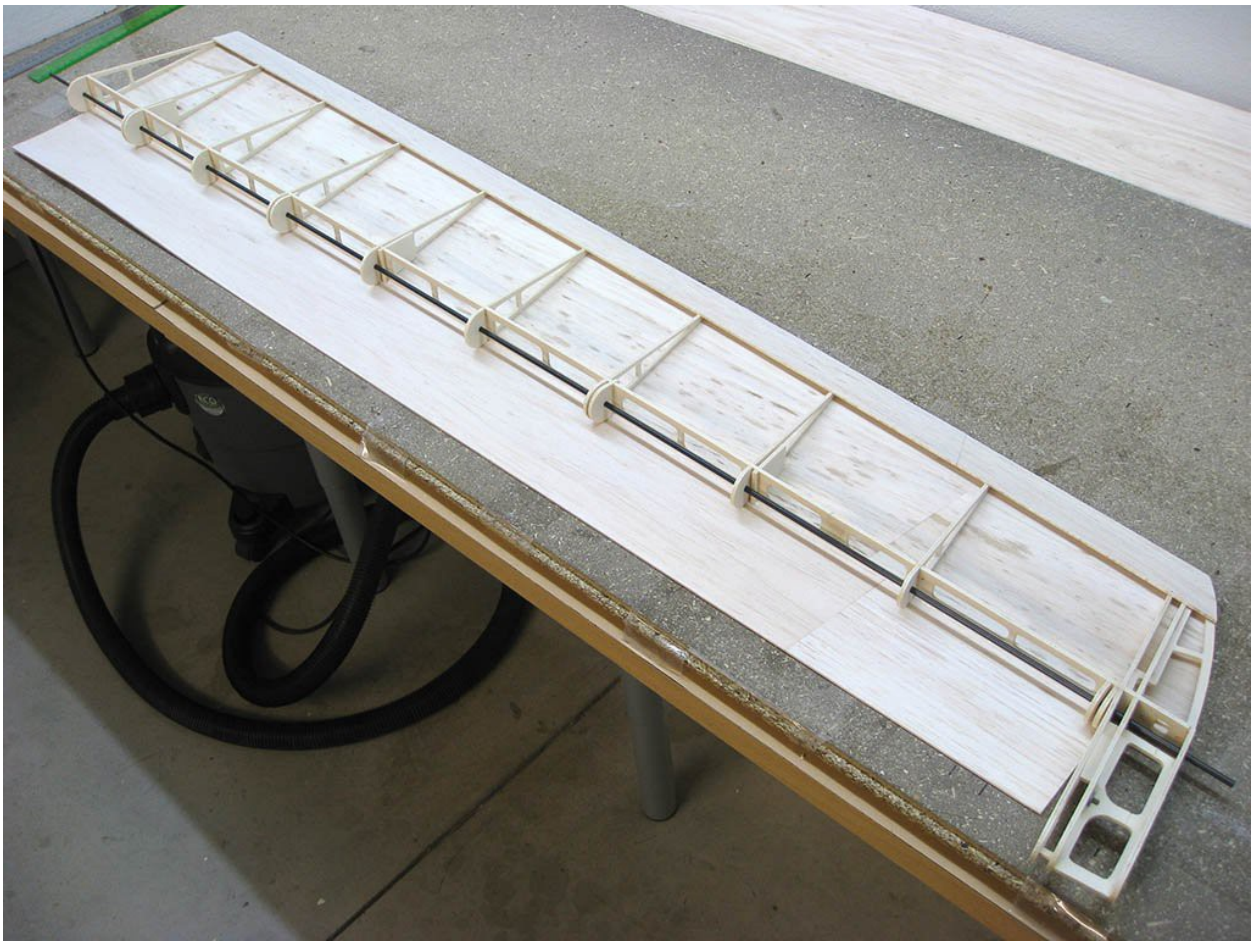
The wings are now banded and the overlapping covers have been trimmed and ground. To finish the construction of the wing, just stick the leading edges and end arches of thick balsa board.



First, the blind covering of light balsa boards is thick. 2 mm and trim front and back accurately and on the sides with a slight overlap. The leading edge is aligned to the center of the aileron web and the leading edge to the rib ends with an overlap of 5 mm. The construction of the aileron is applied glue, the web is applied only on its rear edge towards the drain, so the glue does not flow forward in front of the cover on the web. The cover is covered with other boards thickness. 2 mm below the entire surface of the cover. A wing structure attached to the wing is placed on the padding so that the hinges are in place. The wing is then loaded in the correct places so that the cover fits exactly into place, the front edge of the cover must be in the middle of the web of the aileron. Then I cover the aileron construction with a sheet of flat sheet, or even load it, so that the web and ribs lie on the cover. It looks creaked, but it's cool.

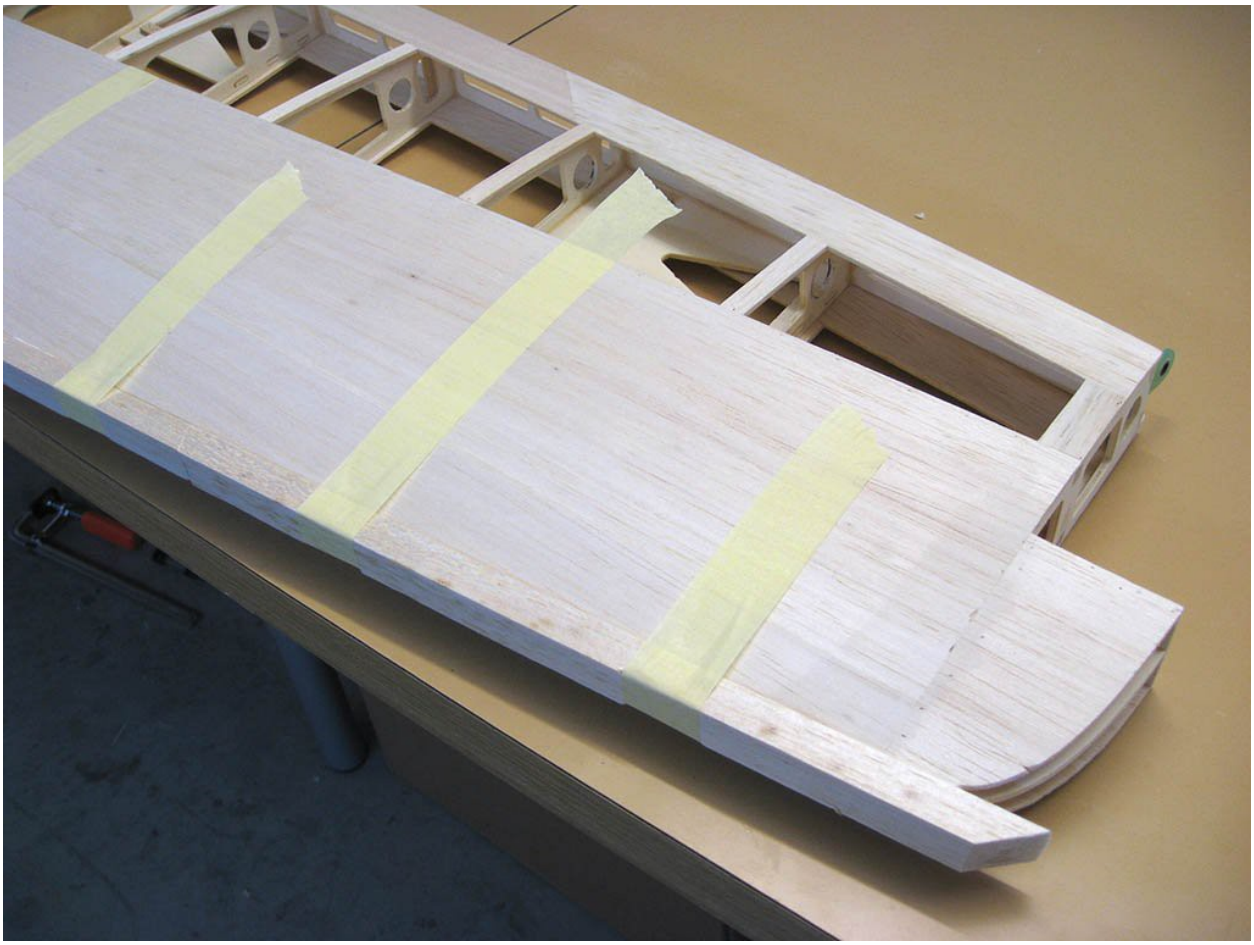
Drain board is width 33 mm from stronger balsa thickness. 2 mm, the board must be adjusted to the required length. The aileron remains on the wing and the whole is grounded so that the top cover of the aileron touches the entire surface of the table and the end of the aileron is flush with the edge of the table. The dispersion is then applied and the cutting board is first attached to the ribs on one side and the other side is pulled to the table with tape.

The aileron is trimmed together with the wing at the trailing edge and to the level of the counterweight structure. Subsequently, the wing joint cover is glued, the counterweight cover is glued and the ribs are finally banded. The wing is still missing the leading edge.



The 2 mm light balsa board is extended to the required length. On one side its width is 100 and on the other 80 mm. Subsequently, the board is saved with the already covered wing covering. The board is then attached to the cover by a tape, as if the boards simply stuck together. After opening the wings, they stick as usual with the middle CA. The butt-glued coating is allowed to dry and from both sides I recommend applying the dispersion to the points of contact with the main web of the ailerons. Then, at the point of bending, the coating is moistened from both sides. Here it is necessary to get real compliance, moisten for three times, always waiting for the water to be completely absorbed, taking it over 10 minutes. Then the cover gradually and patiently folds through the table to construct the aileron, which also takes a while. Hurrying leads to a rupture of the cover and nobody wants that.

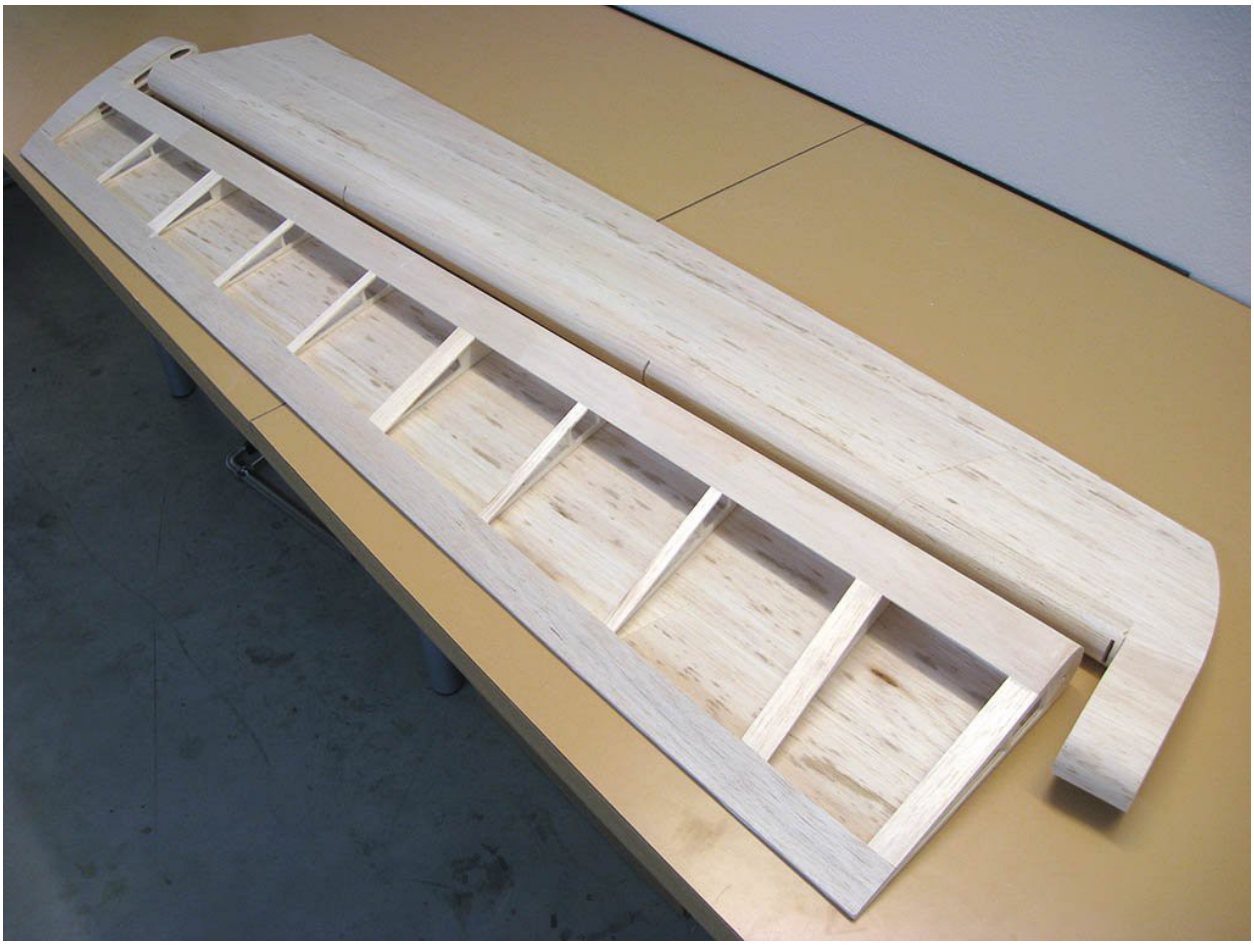
Once the cover is fully bent, it is loaded with a flat board to ensure that the cover is flush against all ribs. The bonding to the structure is carried out only after the pre-bent coating has completely dried.



There is not much to explain here, the log must be extended to the required length, it is cut from a board of 12 mm thickness, on one side it has a width of 18 and on the other 15 mm. The tape is tightened, glued with a dispersion, preferably so that the adhesive does not flow, then it is severely cut and sanded.

At the trailing edge, the aileron is glued with tape to a flat table, the aileron is loaded to fully rest on the table in all places. After applying sufficient amount of glue, the coating is gradually pinned to all ribs or even to the web.

The SFG shaft must be lined with stronger balsa on the counterweight and runner. Before that, it is a good idea to glue one SFG and lining it so that the SFG snaps into place. The SFG is threaded through a carbon tube and an M4 flat head screw from the inside of the counterweight. Only now can the counterweight be coated. In the place of the leading edge it is coated with one piece of balsa, the plate must be soaked in advance and allowed to dry on the structure before gluing.



The wings of the ailerons are belted after counterweighting. A 20 mm band is glued to the root rib and to the ribs where the levers will be. The remaining ribs are striped with 10 mm wide strips. In version 2, thanks to the counterweights, the wings are really large.

The aileron is fixed in the neutral position and the end arch blocks are glued. I glued from five pieces of board thickness. 12 mm. The photo shows the condition after trimming to the wing profile and after trimming to the final wing plan. The arc is then rounded before the arc is cut at the leading edge of the counterweight.

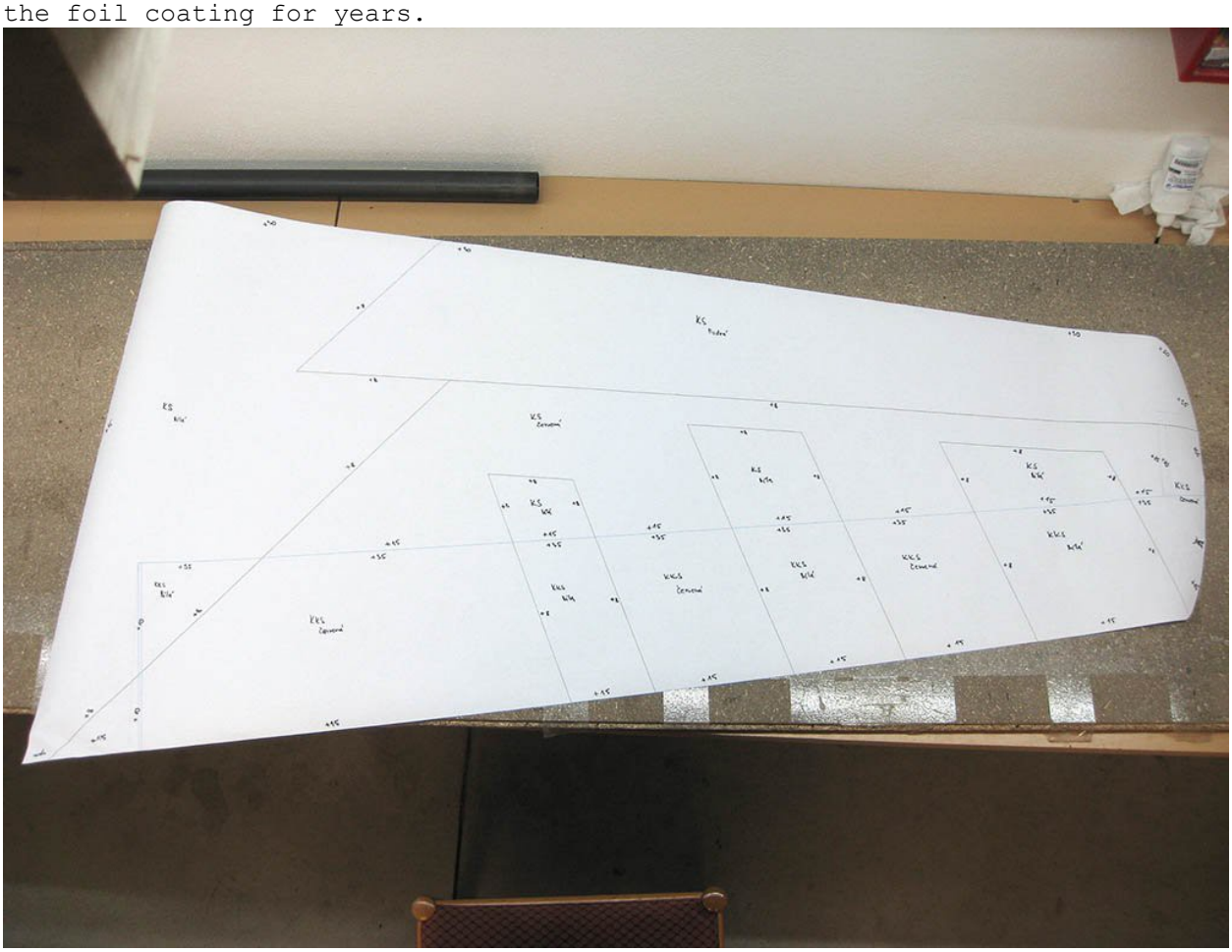
This is such a dirty and rather lengthy work, I recommend not doing without a veil. Better slow and careful than regrind. After rough cutting, the first sanding of the structure is required. First, the sash transitions are ground on the wing so that they cannot be glued from the boards and the cover has a profile shape. The lead is also ground into the profile, first to follow the dbox. Subsequently, the strapping is aligned to the dbox and to the back wing cover. The end arc is also reground in the profile. The aileron should be regrinded, which should be evenly flat on the trailing edge after this grinding and the side of the whole cover and the strapping side should be aligned. Then the sash is finally sanded on the edge of the trailing edge to the final plan, the sash must be perfectly connected to the sash. The same is done with the other wing and aileron. Once it is certain that both halves of the sash are equally ground, the rounding of the leading edge and, for the time being, the solid end arch is completed. Then the arc is cut at the level of its divide, the aileron is removed and both parts are trimmed and ground. The final grinding at this stage aligns the leading edge of the aileron, which is practically always curved at the points between the ribs to bend the balsa in wet conditions. There is quite a lot of grinding, sometimes the cement between ribs can not be avoided, the coverings should not be ground to the thickness. 1.5 mm, significantly lose their strength. Always apply, just grind as much as is absolutely necessary.

After the first sanding, which usually takes about an hour, the ailerons must move. First, the apertures for the aileron hinges need to be extended and possibly extended to allow maximum aileron deflection. The aileron is put on and the gap between the aileron in its extreme position and the covering of the rear wing web is detected. If it works perfectly from the beginning, it is possible to achieve a deviation of +/- 60 degrees without a gap. I couldn't do this on either wing right now. The gap was not the same along the entire length of the ailerons, and the ends of the ribs supporting the edge interfered with the ailerons. I shortened the ribs by cutting, the web of the web was obliquely, so that on one side it dwelt and on the other it was missing. The cover is simply glued over the adhesive tape with thin CA and then the entire web cover is trimmed to evenly touch the aileron along its full length. After that, the aileron moves, so that the hinges do not drift significantly. It is done with a needle file and the aileron keeps getting in and out, it is lengthy. Again, do not regrind, otherwise excessive will will increase too much over time. If everything is as it should be, the aileron walks in its entirety with minimal resistance and holds the carbon rod in the aileron, sliding in nylon rings, thus moving the aileron. Finally, the holes in the ailerons are covered with balsa pieces to limit the actual extreme deflection, the aileron has not touched the wing at maximum deflection, I have limited to +/- 55 degrees, which is enough. I have verified from the original version, the model can be spun in the opposite direction than the propeller turns.

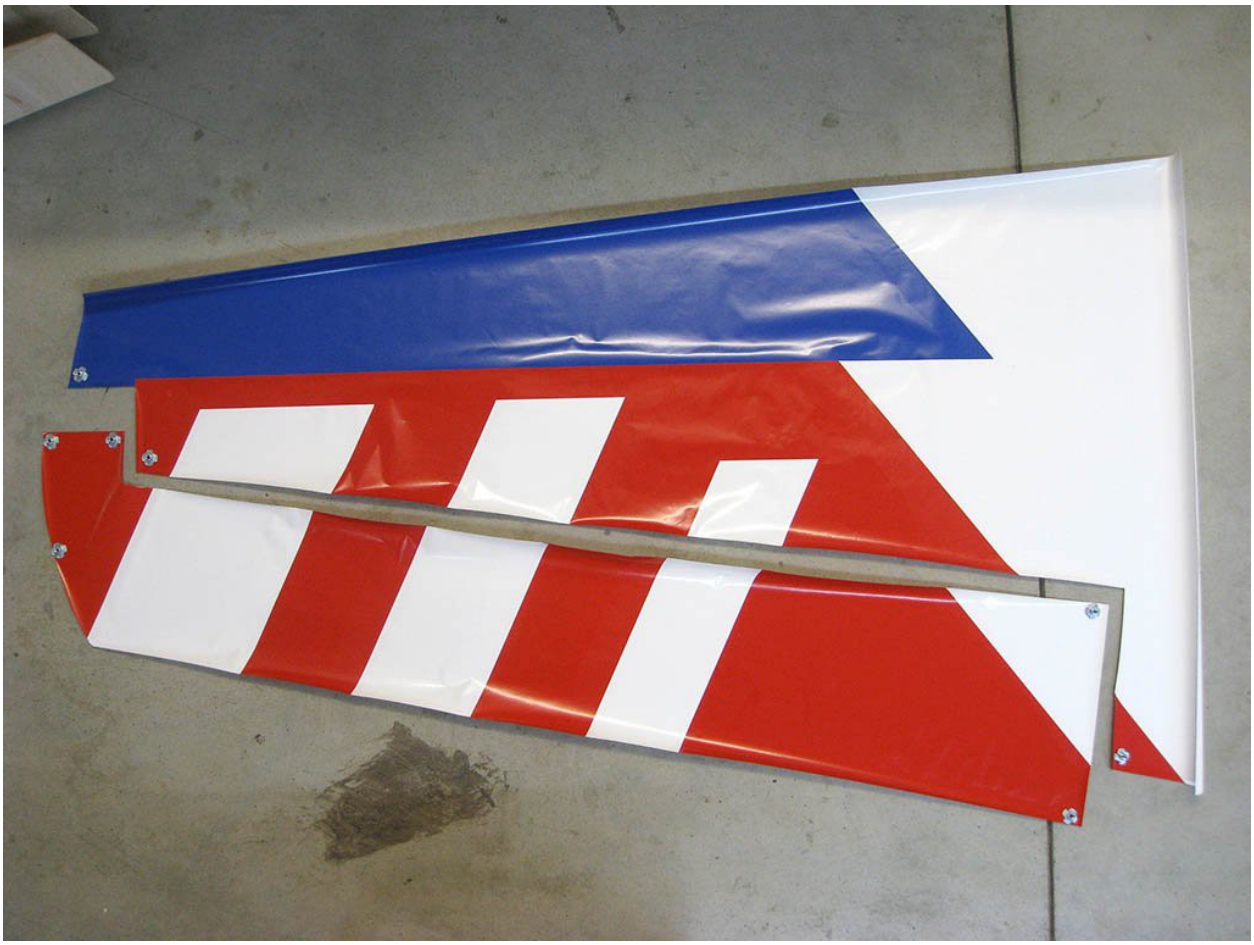
The counterweight is wider than a real aircraft to be more efficient and to help servos. Only after the flight will it be clear what the purpose of the counterweight is.

The wing with aileron should always have the same gap between each other in the ground plan, which should be about 2.5 mm in front of the coating film, if not, such gaps must be made. This is followed by the last preparation before film coating, sealing and fine sanding. In case of careful work, only small things are necessary to seal, fine sanding only removes balsa hairs and

generally smooths the construction surface so that it does not protrude into the foil coating for years.



I have a large plotter, so I made my work a little easier. The individual parts of the coating are first marked with numbers and color, everything is marked on the next paper to make clear how it belongs together. Subsequently, the print is cut into templates for each piece of coating. To the templates is added 8 mm overlap for ironing, at the edges of the entire wing are given overlaps even greater as needed ironing on the other side of the wing. Individual overlaps are always written on each edge of the template, then individual parts of the cover are cut according to the overlap templates. Irones in the order of "darkness", the darkest irones last, ie up.



Ironing has been described elsewhere. Cutting parts of the cover and ironing the covers in the photo is for more than 2 hours of time. When cutting individual parts of the cover it is necessary to be accurate, otherwise in more complicated designs they will not be reasonably ironable;

Well, it can be covered ...

You have to finish the transitions on the other side and put the stickers ...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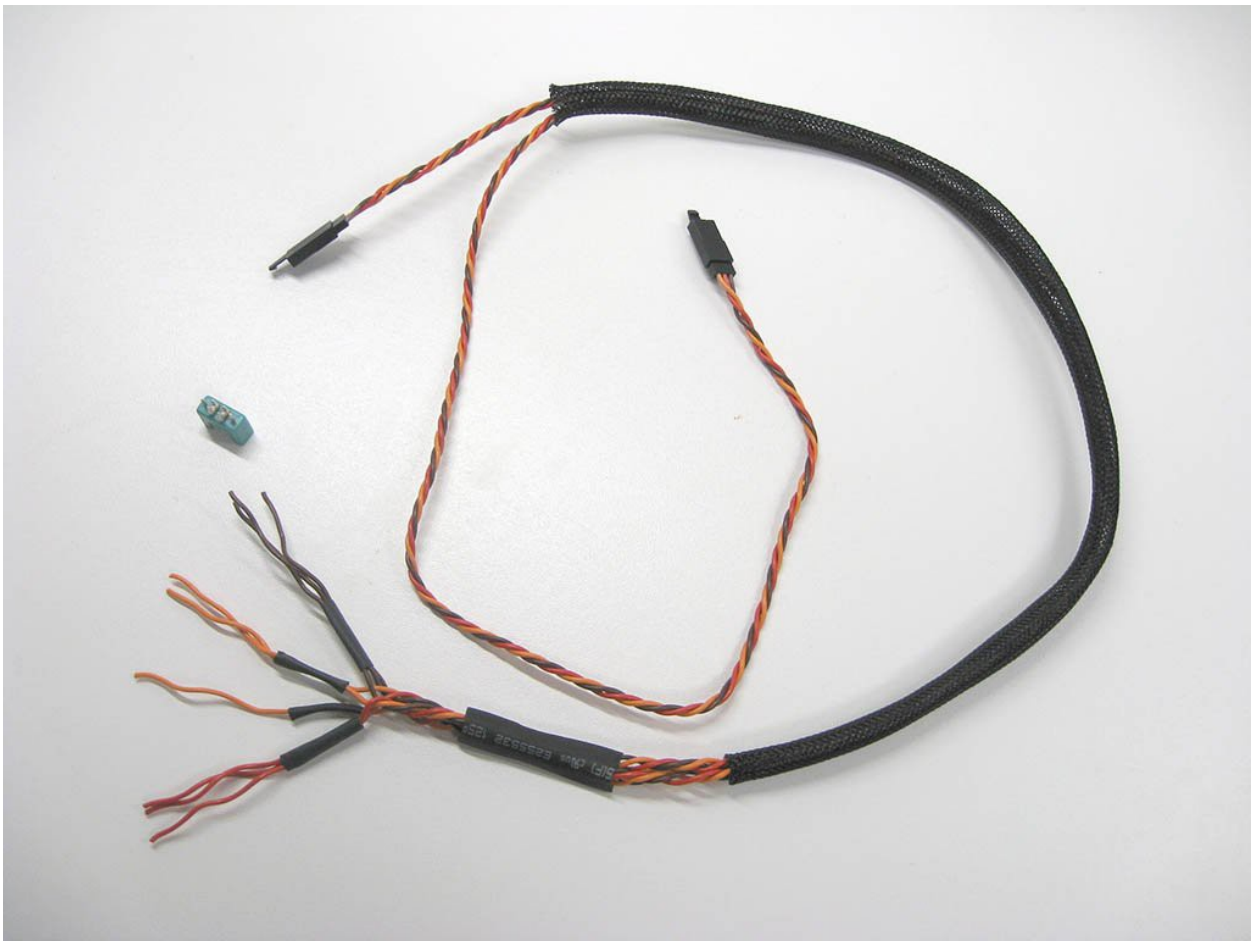
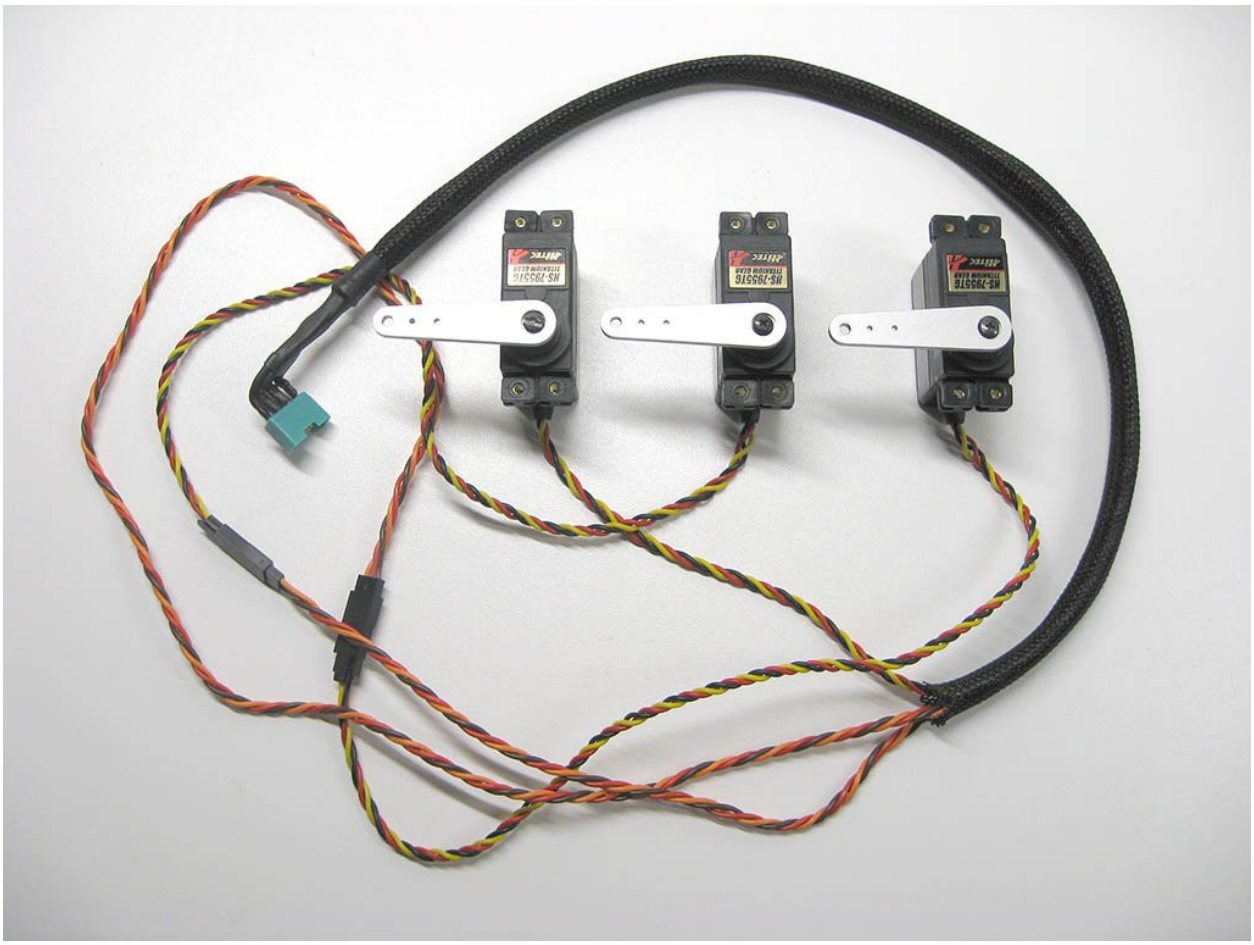


Originally, the installation was two-server, but three are required. Two servos can be optimally connected via one green Multiplex 6-pin connector. Servos have a common power supply and separate control signals up to the connector. I did not want to change the connector in my distribution board, so I used the same solution for three servos, a small problem is the permanent connection of the control signal of two servos of three. The programming of the servos must therefore be carried out temporarily via a third separate cable. After programming, the control signal is of course one for all servos. Powering three servos goes through the two pins of the connector, which allows a maximum current of 20 A, which is still enough with reserve. The unpowered connector shows that two and two pins for the + and - power supply of the servos were connected in advance, the two extreme pins being used for the control signals. The wiring is made of twisted cable with a cross-section of 0.34 mm2 with a maximum current of approx. In the photo you can see sorted cables using shrink tubing, which are soldered to one pin or a few pins of the connector. Subsequently, the cables to be soldered together are stuck together with a piece of paper tape to make it comfortable. On the other side are three servo connectors for connecting three servos, one is hidden in the sheath.



After powering, the smaller tubing shrinks first and the cables are angled as needed. The braid is then set up and shrinked together with the power and shrink cables. The result is neat and quite durable. After mounting into the structure, the servos must be programmed sequentially, first the two servos are synchronized and then the third one is added.

After mounting the servos in the wing, the servos must be programmed. The procedure is a bit complicated in order to achieve a real concurrence of all three servos and at the same time the maximum possible deflection of the ailerons. First, it is necessary to find out what is the maximum deflection of the ailerons. This is always limited by the aileron lever at the wing root. The measured value will be the maximum deflection for all servos on both sides. For each servo, it is necessary to find the correct length of the rod so that the movement of the servo lever by a certain angle from the middle neutral position causes the same angle also on the aileron, on each side equally, which is quite lengthy and demanding for accuracy. If this is not done and only the center and the edge of the servo are programmed without correcting the rod length, the servos will never really run in parallel. The lengthyness consists in finding the required drawbar length with the first approach measurement and starting to program the servo, first the center, then one and the other edge. This is repeated until the numerical magnitude of the deflection on the programmer is the same on both sides (corresponding to the servo deflections) and at the same time the same aileron deflection is achieved on both sides until the same, the rod length is changed. Any change in the length of the drawbar requires a new center and thus edge adjustment. I usually start by programming the middle servo, then the root servo and then the end servo. Once all the servos independently control the aileron the same way, I connect their control signals. The result must be non-buzzing servos in any aileron position if the wing is upright, ie if the aileron is not subjected to its own weight. For the dead zone 2 there is one wing for about an hour and a half, which is still relatively fast, for the dead zone 1 it is much harder. Finally, I glued the elastic band to the wing root, which ensures that the vibration will not slam the wing on the fuselage and also solve minor irregularities at the point of contact. I secured the braided wiring with a piece of rubber in a paper tube that leads the wiring inside the wing. The wings are not screwed to the fuselage, are using high-quality

rubber pulled to each other through the hooks. In case something happens to the rubber, there is a cotter pin in the guide tube.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Still missing some stickers at the bottom of the wing, but otherwise it is done.