Beechcraft Starship Build Description

25 August 2024

I was contacted by a flying club friend who has asked me if I would be interested in building him a new kit he was looking to purchase. Even though this is not a scratch build, I was very interested in this kit because I feel I can use the AMTN wing and fuselage design to aid me in coming up with plans for a JetZero Blended Wing Body RC model.

Well, the kit and retracts arrived, and were brought to me on 5 April 2024. So, this model is now my build project. A Callie-Graphics package has been ordered and will arrive well before we will need it. Below is an image of the balsa and plywood RC model in discussion. A unique aircraft indeed. You can see more images and information @: https://www.amtn.nl/starship-s/. There also is a multi-part video Build Log that Saul at Plane Fun R/C Channel has put a great deal of work and excellent information into, and you can view @: https://www.rcgroups.com/forums/showthread.php?4148453-AMTN-Burt-Rutan-Beechcraft-Starship/ .

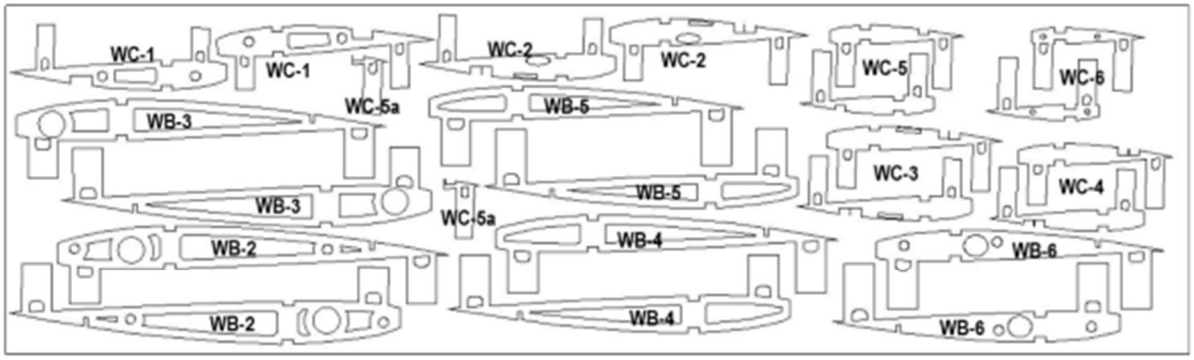
Image Source: AMTN Starship Webpage @: https://www.amtn.nl/starship-s/.

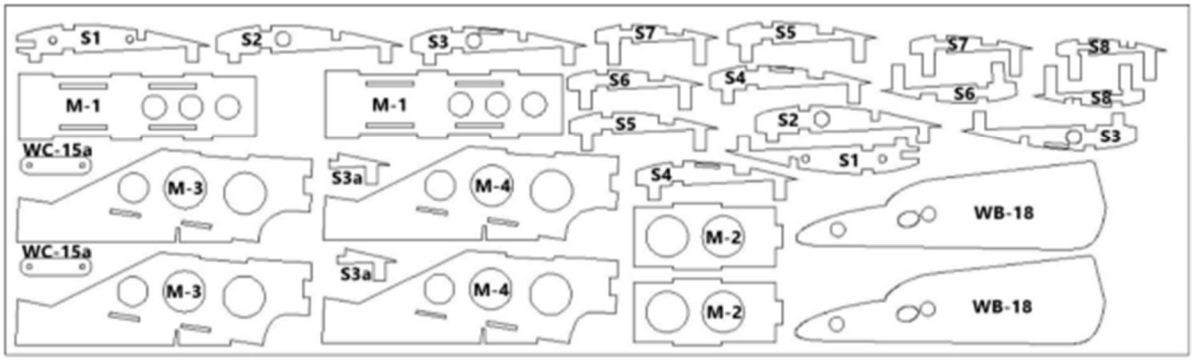
The first thing we did was unpack everything and check out all the various light plywood and balsa sheets, and there are a LOT of them as you can see in the image below. I then took the AWESOME instruction manual AMTN provided and labeled all the individual pieces to ensure I would know which were which once they are removed from the large sheets.

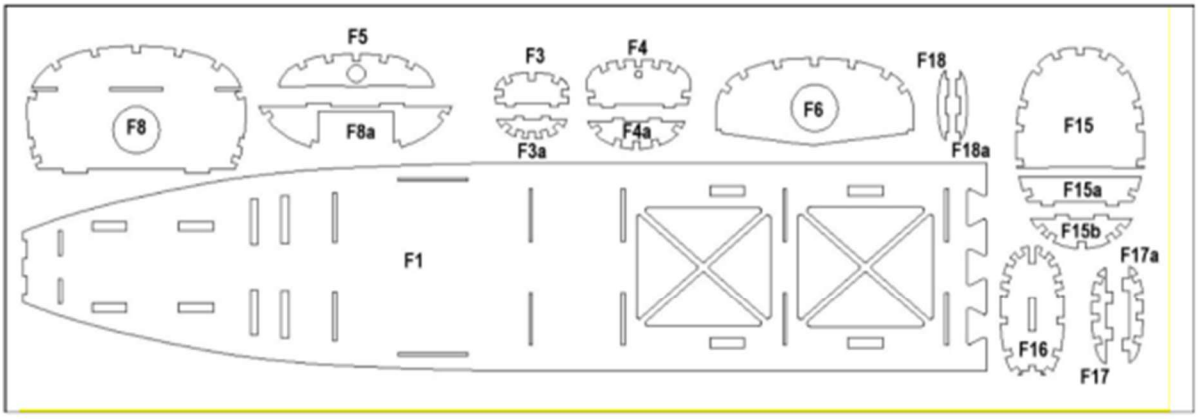
Builders Note – The 8mm balsa spar that runs along the tops of formers F9 through F16 labeled F20 on page 6 of the manual ***is mis-labeled***. This spar needs to be labeled F21 as it is referenced on pages 9, 35, 39, and 40 in the manual.

A couple of the instruction manual sheets can be seen below, or you can download the entire instruction manual @: https://balsaandglass.com/Balsa_Builds.html.


INSTRUCTION MANUAL
BEECHCRAFT STARSHIP







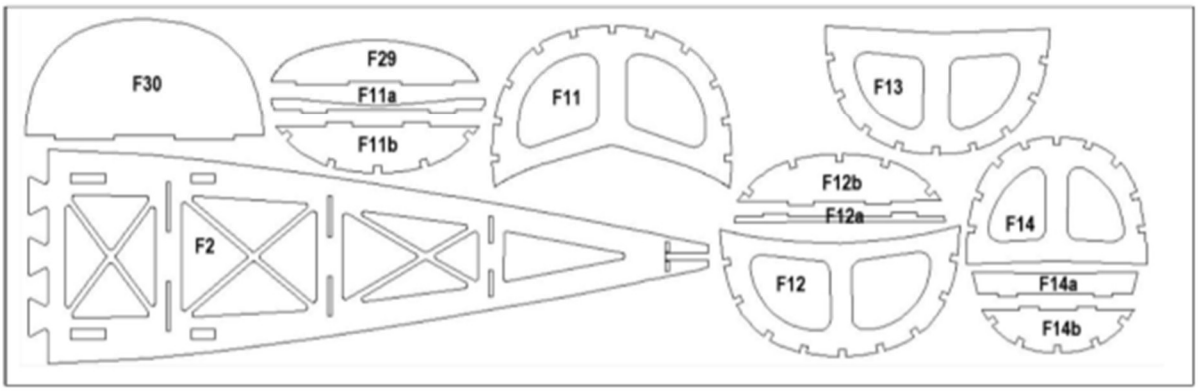
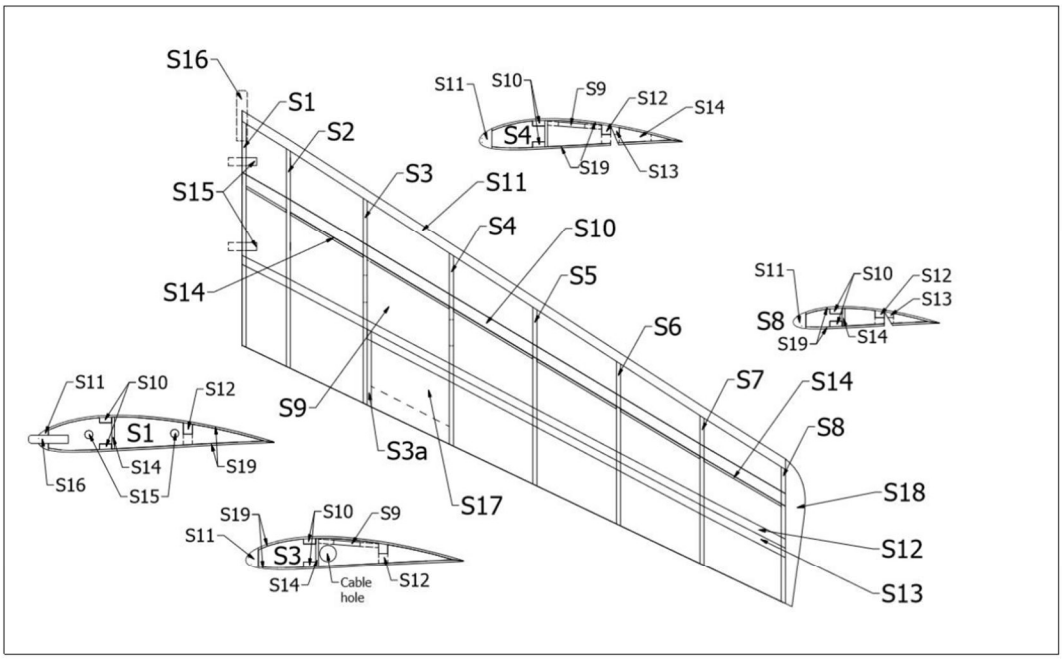


Image Source: A .png extraction from AMTN Instruction Manual.

My next task was to remove all the parts needed to assemble the front wing (or canards) from the Lite ply sheets, sanding the outside edges and interlocking cutouts to help make that assembly go smoothly.

FRONT WING



In general:
The front wing will be built by using template "S". In this template there have been made cut-outs for placement of the ribs, there for the correct angle of attack of the front wing can be guaranteed. Because the front wing has to be built in an angle of attack it is important to prepare the leading edge, main ribs and back list in an angle. They must be reworked slightly.

To correctly assure everything is nicely glued together and filled in the gaps it is advised to work with a good quality PU-glue.

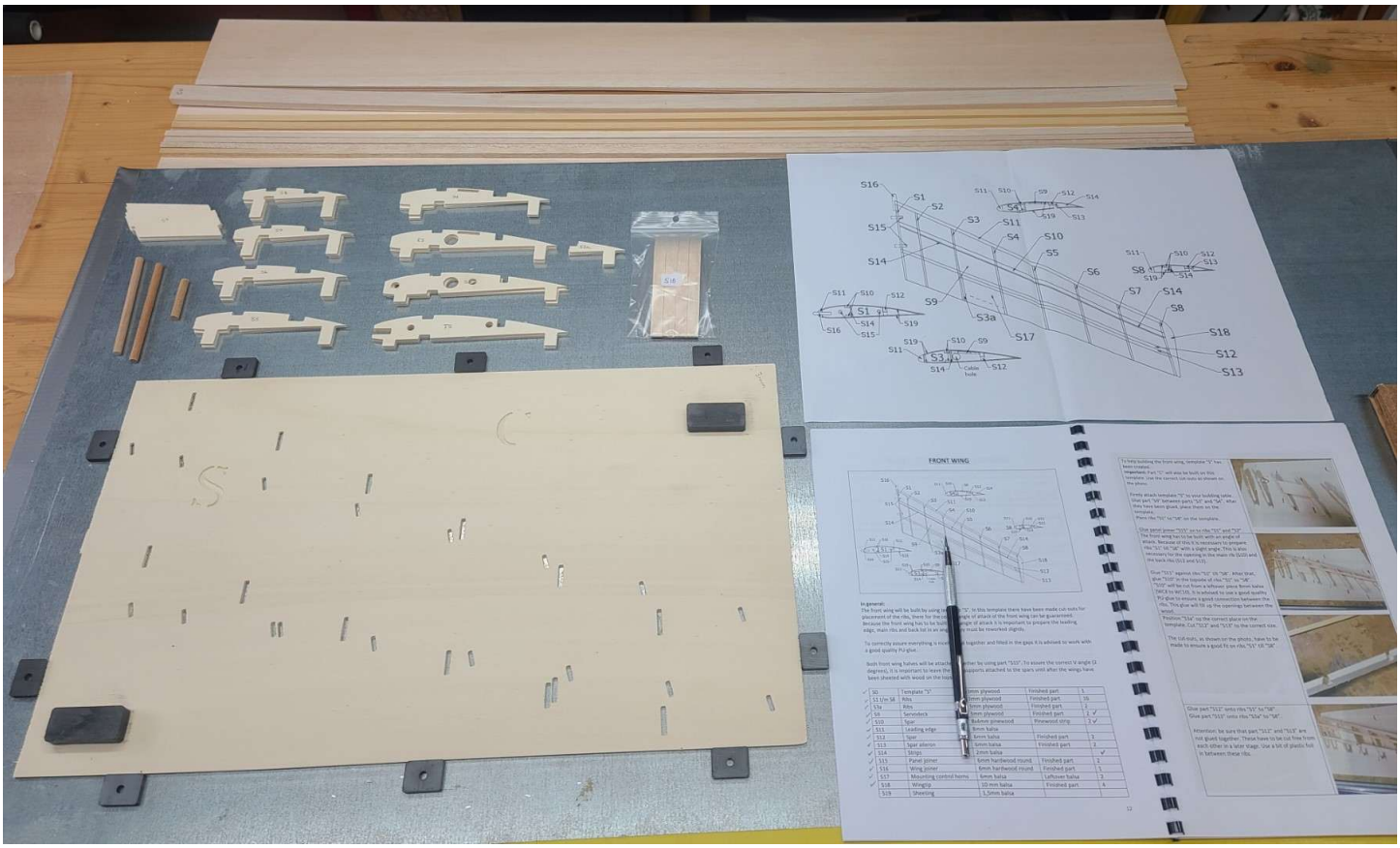
Both front wing halves will be attached together by using part "S15". To assure the correct V-angle (2 degrees), it is important to leave the build supports attached to the spars until after the wings have been sheeted with wood on the topside.

S0	Template "S"	3mm plywood	Finished part	1
S1 t/m S8	Ribs	3mm plywood	Finished part	16
S3a	Ribs	3mm plywood	Finished part	2
S9	Servodeck	3mm plywood	Finished part	2
S10	Spar	8x4mm pinewood	Pinewood strip	2
S11	Leading edge	8mm balsa		
S12	Spar	6mm balsa	Finished part	2
S13	Spar aileron	6mm balsa	Finished part	2
S14	Strips	2mm balsa		
S15	Panel joiner	6mm hardwood round	Finished part	2
S16	Wing joiner	6mm hardwood round	Finished part	1
S17	Mounting control horns	6mm balsa	Leftover balsa	2
S18	Wingtip	10 mm balsa	Finished part	4
S19	Sheeting	1,5mm balsa		

Image Source: A .png extraction from AMTN Instruction Manual.

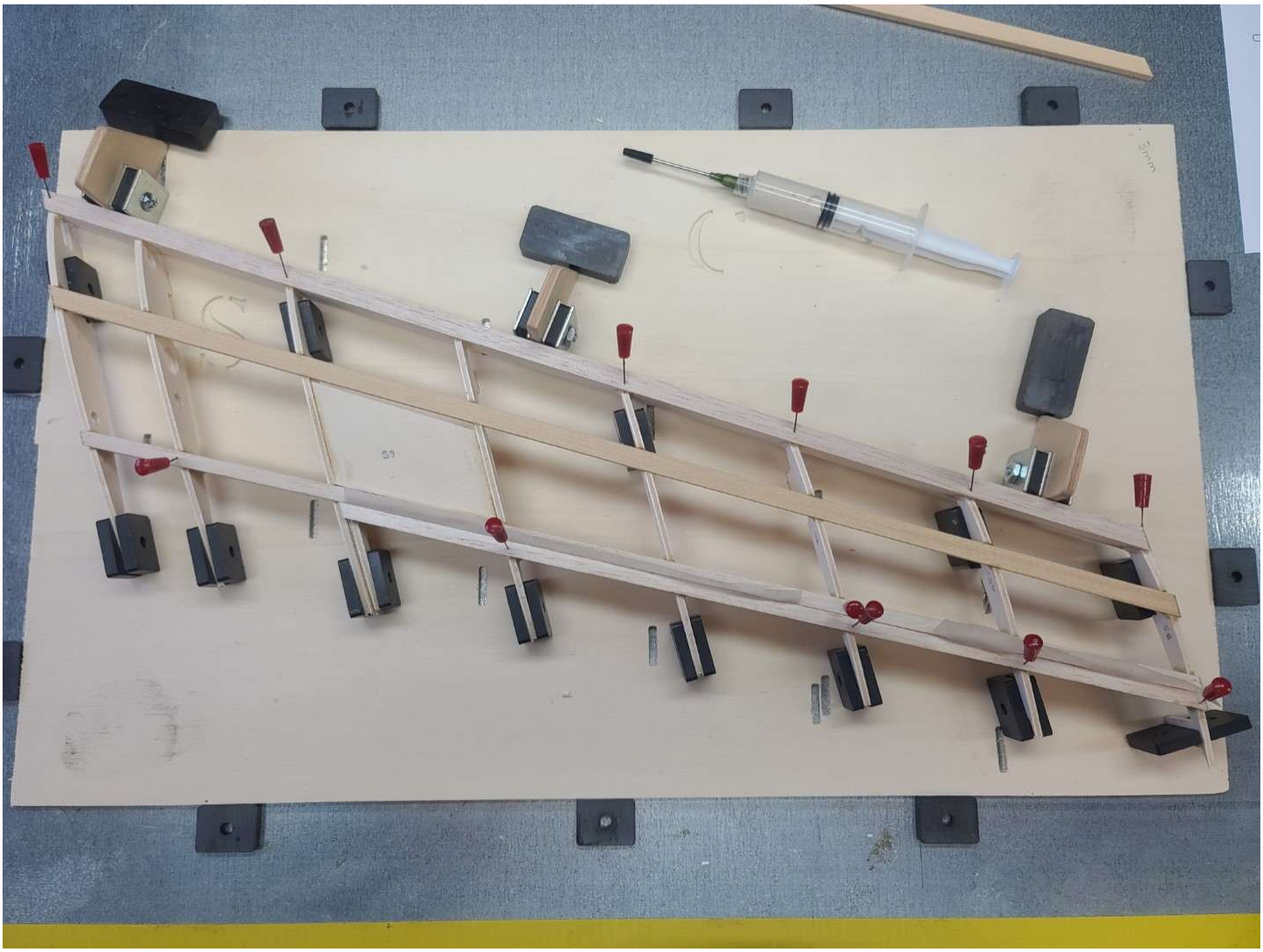
Below you can see all the AMTN parts and other materials needed to assemble the front wing (canards), including the plywood template “S”. I used a Dremel tool with a small fine saw blade to remove the various pieces from the Lite ply sheets.

Builders Notes – 1) Ribs S2 did not have holes to accept the S15 panel joiner 6mm hardwood dowels. Determine the correct location for these holes and drill them in both S2 ribs prior to starting the front wing build. 2) Use a S9 servo deck part to make a paper template (minus the two side tabs) for the elevator servo hatch covers needed later in the build.

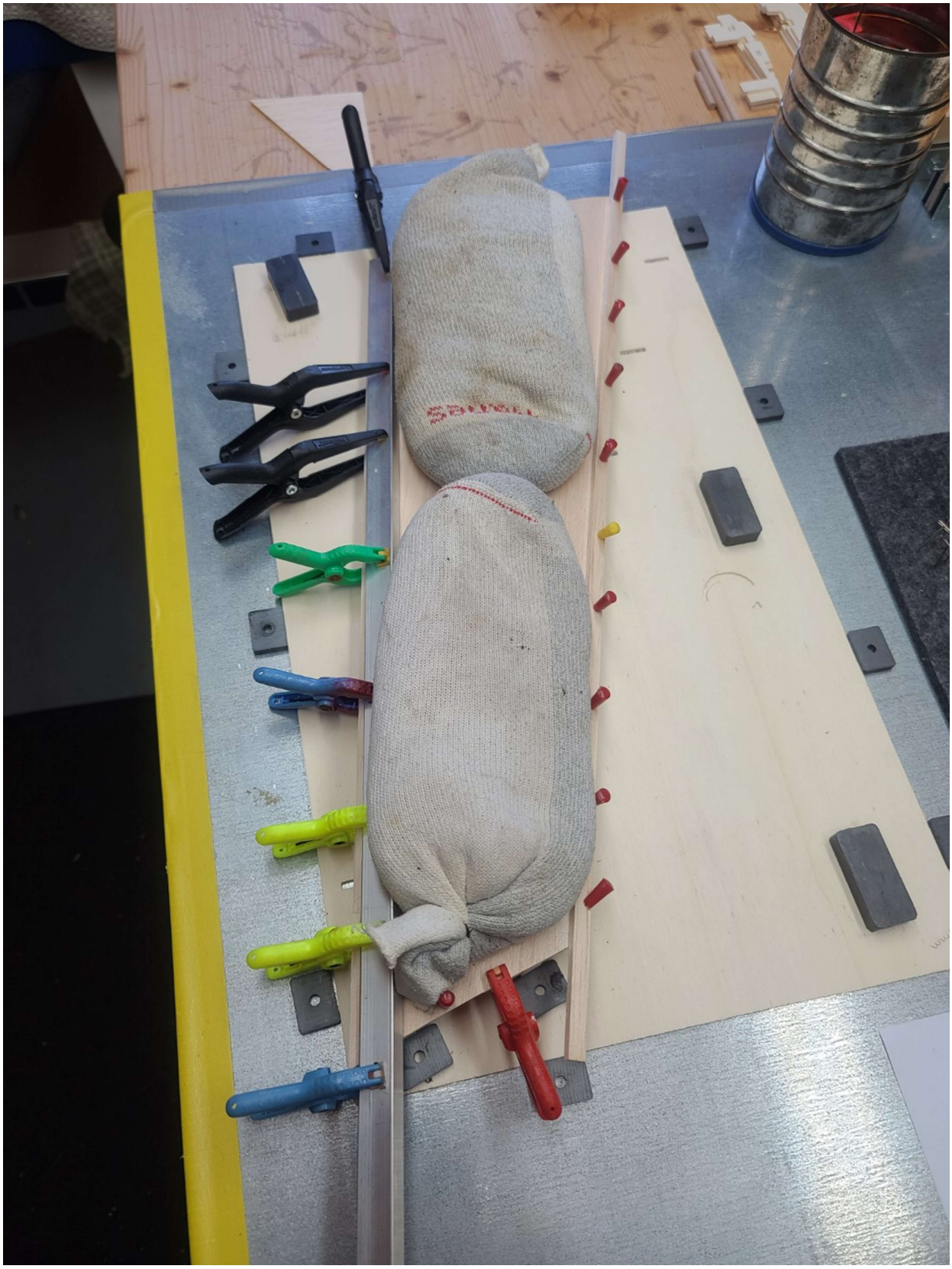


This next image shows the start of the right canard build. Magnets are used to keep all the ribs in place and perpendicular to the ply template. I use Titebond III Ultimate wood glue for all the joints, and after parts have been initially glued in place, I go back and put a small bead of glue along all joints using the syringe you can see in the image. Once the glue had dried, I removed some magnets to allow for the installation of another S10 pinewood main spar along the bottom of the eight ribs. I also glued two 1.5mm balsa sheets together (edge-to-edge) which would be used to sheet the tops of each canard.

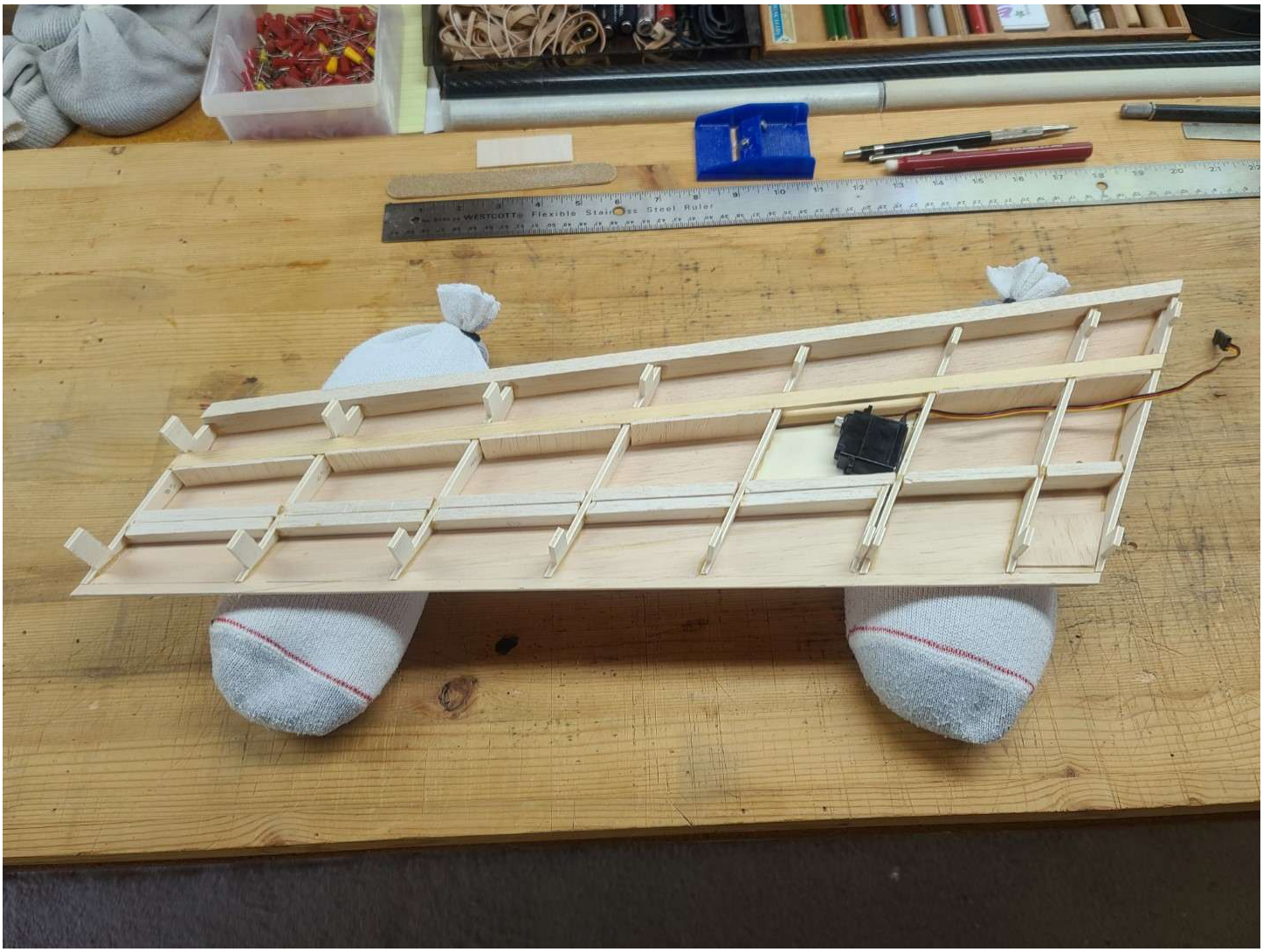
Builders Note – In order to get the top cover sheets for both canards out of these two 1.5mm balsa sheets, you need to stagger the ends of the sheets by 63.5mm, otherwise you cannot get the lengths needed to cover both canards.



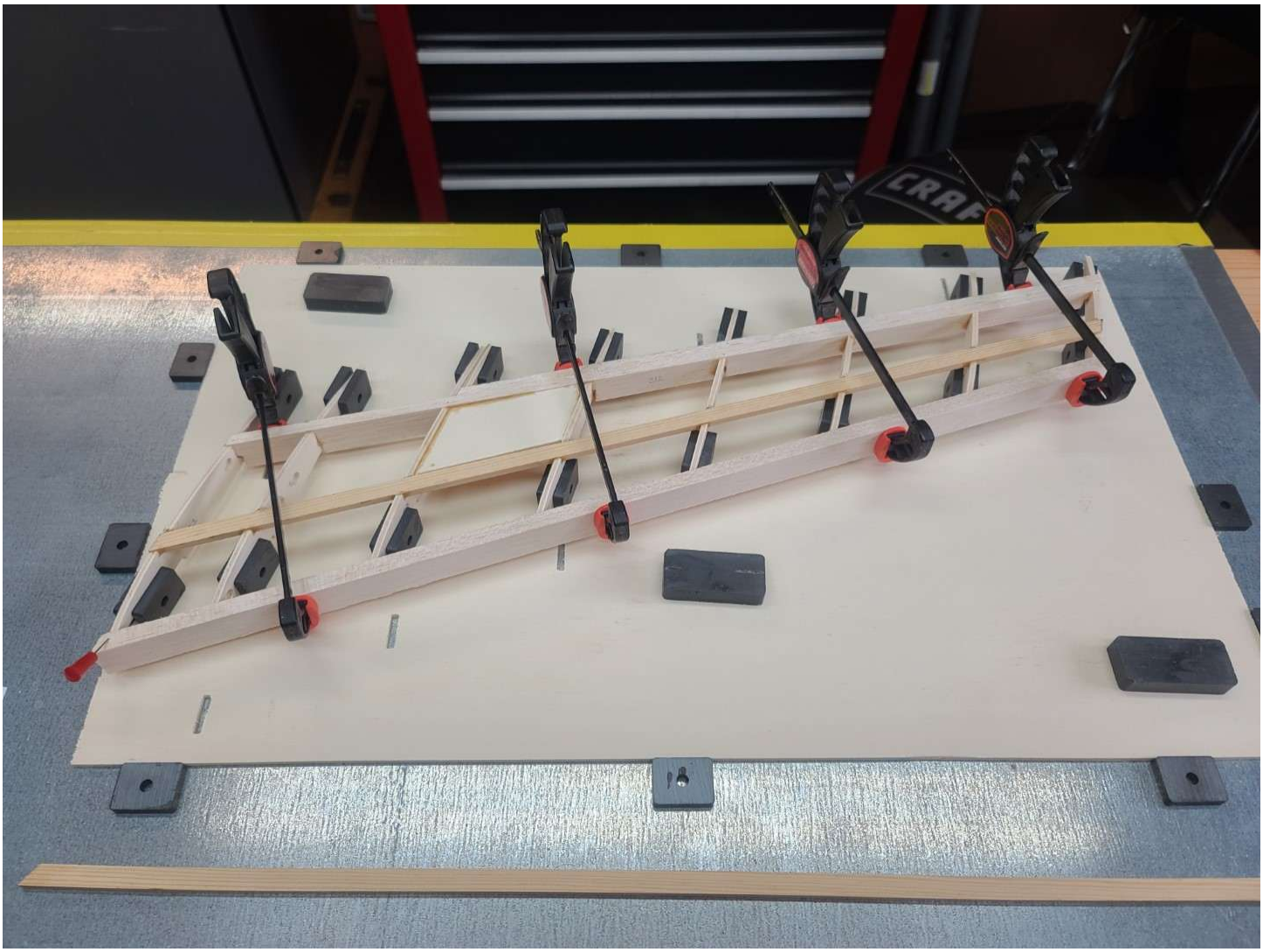
After a complete sanding of the canard to the final top airfoil profile of the ribs, the 1.5mm balsa sheeting was applied. The image below shows the gluing of this top balsa sheeting on the right canard. I use old socks filled with lead shot to apply weight evenly over the surface while the glue dries. These work great!



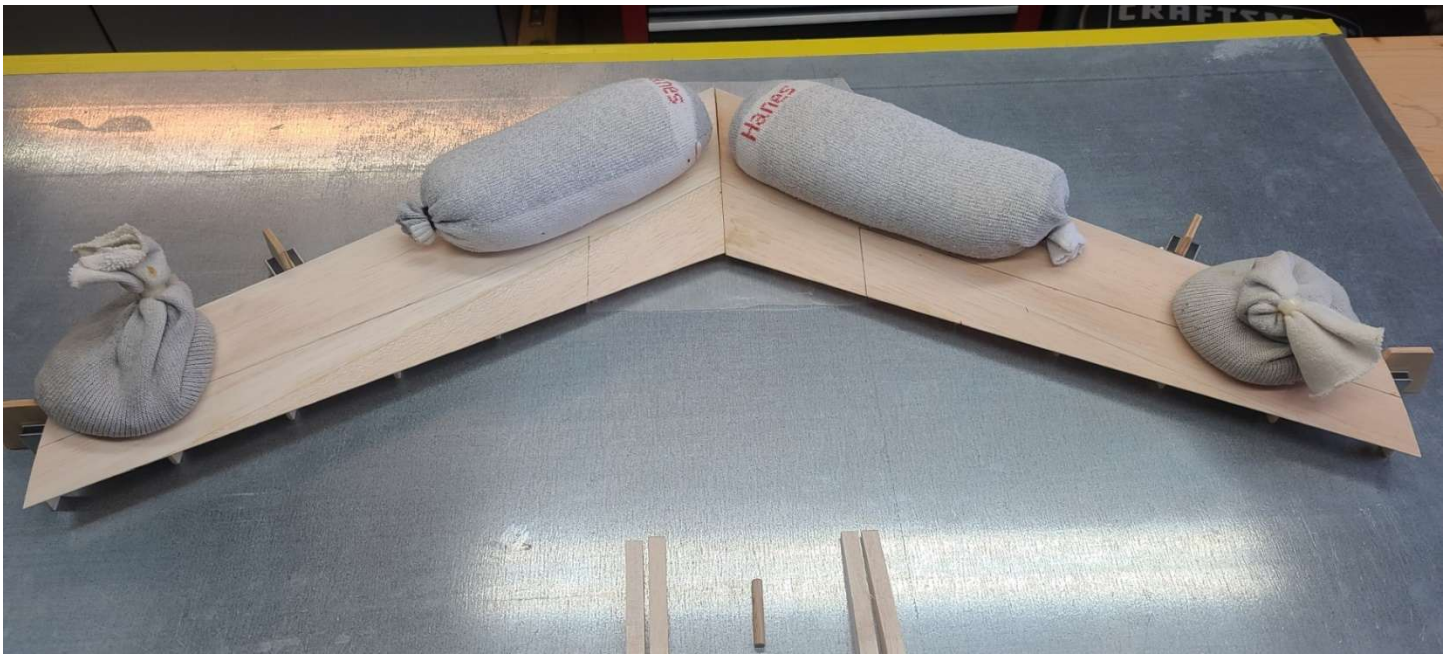
The image below is the right canard removed from the plywood build template “S”. You can see the 2mm vertical grain balsa shear webbing has been cut and installed along the aft side of the main spars. I temporarily set the elevator servo in place for a fit-check, only to find that it is too thick to allow for proper fitting of a 2mm ply hatch cover. Looks like we will need to see about getting a couple thin wing servos.



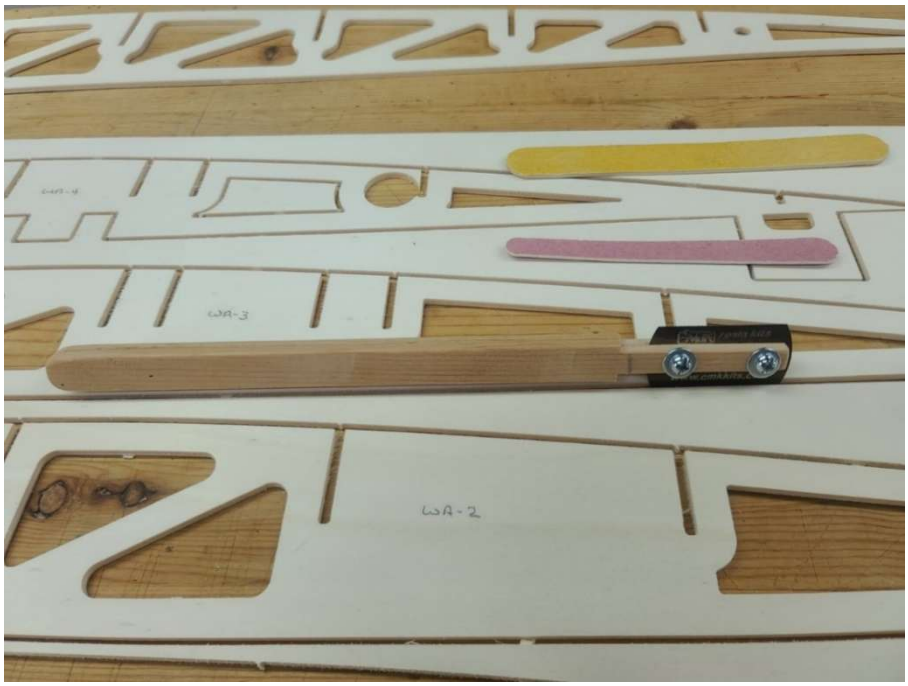
After flipping the plywood template “S” over, I started the build of the left canard. The image below shows that build in progress. Those mini bar clamps are one of the best purchases I have ever made. Over the many years, I’ve used them on all my scratch builds. I just wish Craftsman was still making them. I jointed two more 1.5mm balsa sheets and then cut out the top and bottom sheeting for the left canard.



This next image is the canard wing in what we use to call in the C-17 program “a major join”. After inserting the two S15 6mm hardwood dowls into ribs S1 and S2, the two front wing halves are joined together using 30-minute epoxy, and to ensure all the rib tabs remain in contact with the building board during the cure, I once again use my trusty sock weights.

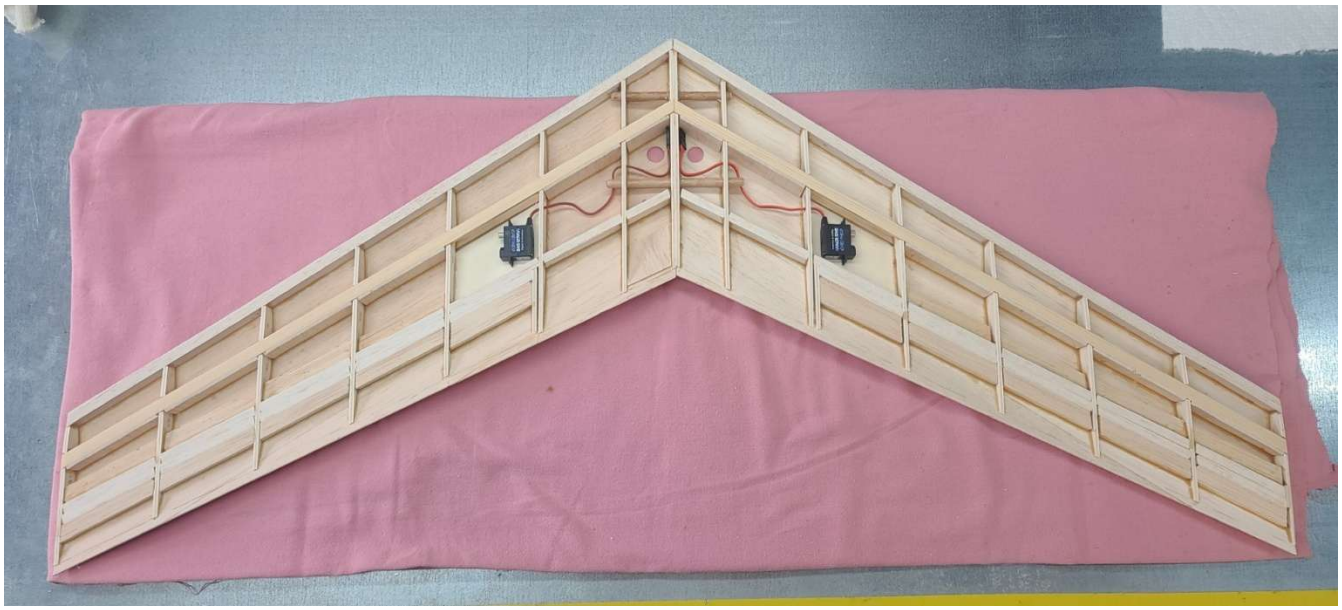


While the canards were in-join, I decided to start the prep for the build of the Main wing Part A by removing all the required pre-cut parts from the Lite plywood sheets. The image below shows a nifty little tool I made to cut the small ply tabs holding each of the parts in the sheets. This is a very sharp and very thin razor saw blade sold by Micro-Mark Tools @ https://www.micromark.com/mini-hand-tools/knives-and-cutters?page=4&mini-hand-tools%25252Fknives-and-cutters=. After each part is removed from the larger Lite ply sheet, I take the large tongue depressor sanding bar covered with 100 grit sandpaper to clean up the outside edges of each part, and the small fingernail file to clean out each of the interlocking notches.



Once the canard epoxy has completely cured, you can remove all the rib tabs; install balsa fillers between the ribs for the elevator control horn and the four hinges; cut the holes in the top sheeting to run the elevator servo leads; plane the leading edge; and then sand everything until you get a nice flat surface across the entire front wing that matches the rib profiles. You can see all this completed in the image below, along with the two elevator servos that will be mounted on the servo bay hatches. They are Blue Bird BMS-127WV+ servos from https://www.bluebirdservousa.com/product-page/bms-127wv/, and these little things give us a torque of 4.7 kg-cm / 65.3 oz-in at 7.4 volts. Next, I will run some temporary cord from the servo bays out thru the top surface holes, and then sheet the entire bottom side of the front wing using the two 1.5mm balsa sheets I cut earlier.

Builders Note – When making the top surface holes for the elevator servo leads to pass thru, cut them out so they will be aft of the fuselage former F5 that will be mounted on the top of the front wing. F5 will be placed 80mm aft of former F4 which will be placed at the nose of the front wing.

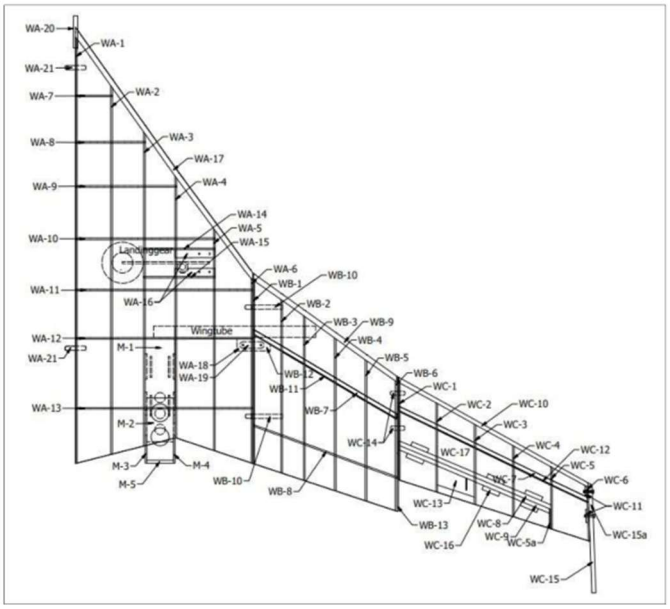


With the front wing bottom side sheeting installed, the S18 soft balsa wingtips are attached and sanded to match the S8 rib/elevator profile. The leading edge is then planed and sanded to the final shape; elevators are cut-out from the front wing and their leading edges beveled to provide clearance for deflection; elevator servo bay openings are cut-out; and the S16 nose 6mm hardwood dowel gets installed. The results of all this are shown in the image below which is the bottom side of the front wing.

This completes the front wing build for now, so let's see about building the Main wing.

The first task in the build of Main wing Part A (or inboard-wing panel) is to remove all the AMTN parts required for assembly from the Lite ply sheets, sanding the outside edges and interlocking cutouts to help make the assembly go smoothly. The bottom image shows all the parts needed for both inboard-wing panels.

MAIN WING.

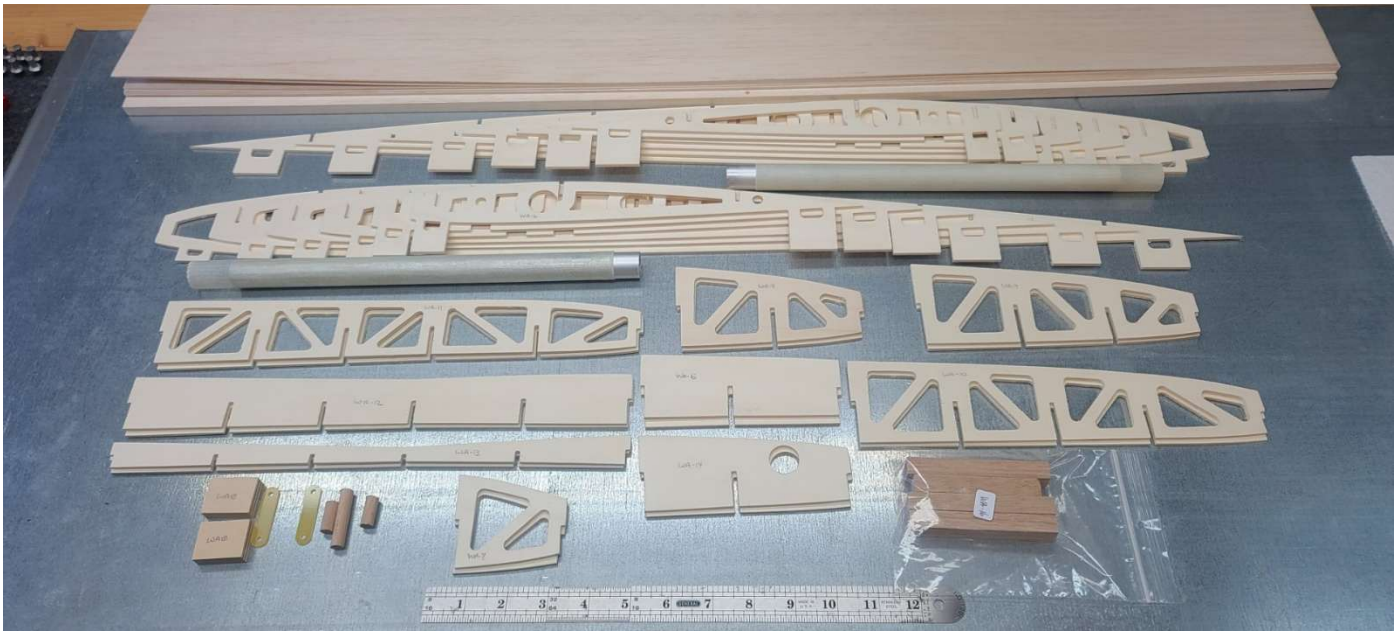


In general:
The main wing consists of 3 parts: A, B and C.
Part A will be glued in the fuselage. Part B and C will be glued together. Note that part B/C will be connected to part A with a wingtube.

To assist in the build of part B and C there is a template supplied in the kit. The ribs for part A are constructed in a way there will be no need for a template.

Part C has a negative angle of 1,5° relative to part B. Because of this negative angle the topside of the wing will be aligned with the topside of part B. This is needed to provide enough lift to the airplane during flight. If not, the airplane will not have enough lift and will dive to the ground. To increase the stability, part C has a washout of 1,5° negative to part B. It is also to be noted that the most outer rib of the wing is placed under an angle of 2° to the inside. It is also placed that the tip has a angle of 6°.

Image Source: A .png extraction from AMTN Instruction Manual.

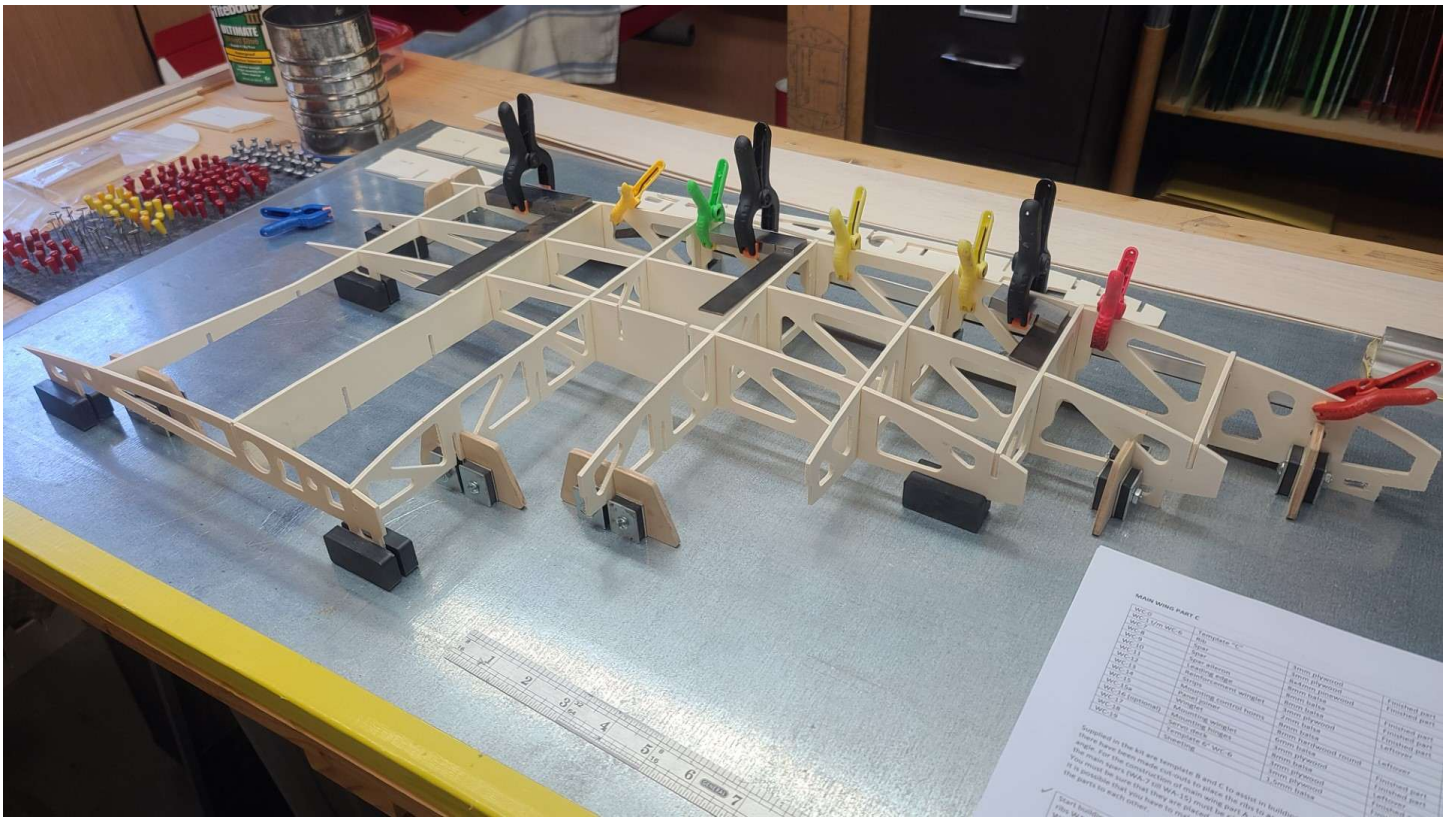


Builders Note – If you plan to install the WA-20 8mm hardwood dowel in the nose of the Main wing, now would be the time to cut 8mm notches in both WA-1 ribs for the dowel to fit into.

In this next image you can see my magnetic board jig set-up and a dry-run test fit of ribs WA-1 through WA-3, and main spars WA-7 through WA-13. Various magnetic fixtures are used to hold the ribs perpendicular to the building board, and to ensure each of the seven spars are positioned 90 degrees to rib WA-1. This AMTN kit is awesome. The Lite ply parts fit together like no other kit I have ever built. With the jig and test-fit verified, each main spar can be lifted out, one at a time, to apply the Titebond III wood glue to each joint, and then set back down into the ribs. Just as I did in the assembly of the front wing, I take my glue syringe and put a small bead of glue along all the interlocking rib/spar joints, and there are a lot of them.

Builders Note – I clamp a small aluminum "L" bar along the length of rib WA-1 to ensure it is kept straight during the panel assembly.

Once spars WA-7 through WA-13 are glued in place, this partial assembly is allowed to set overnight before I proceed any further.

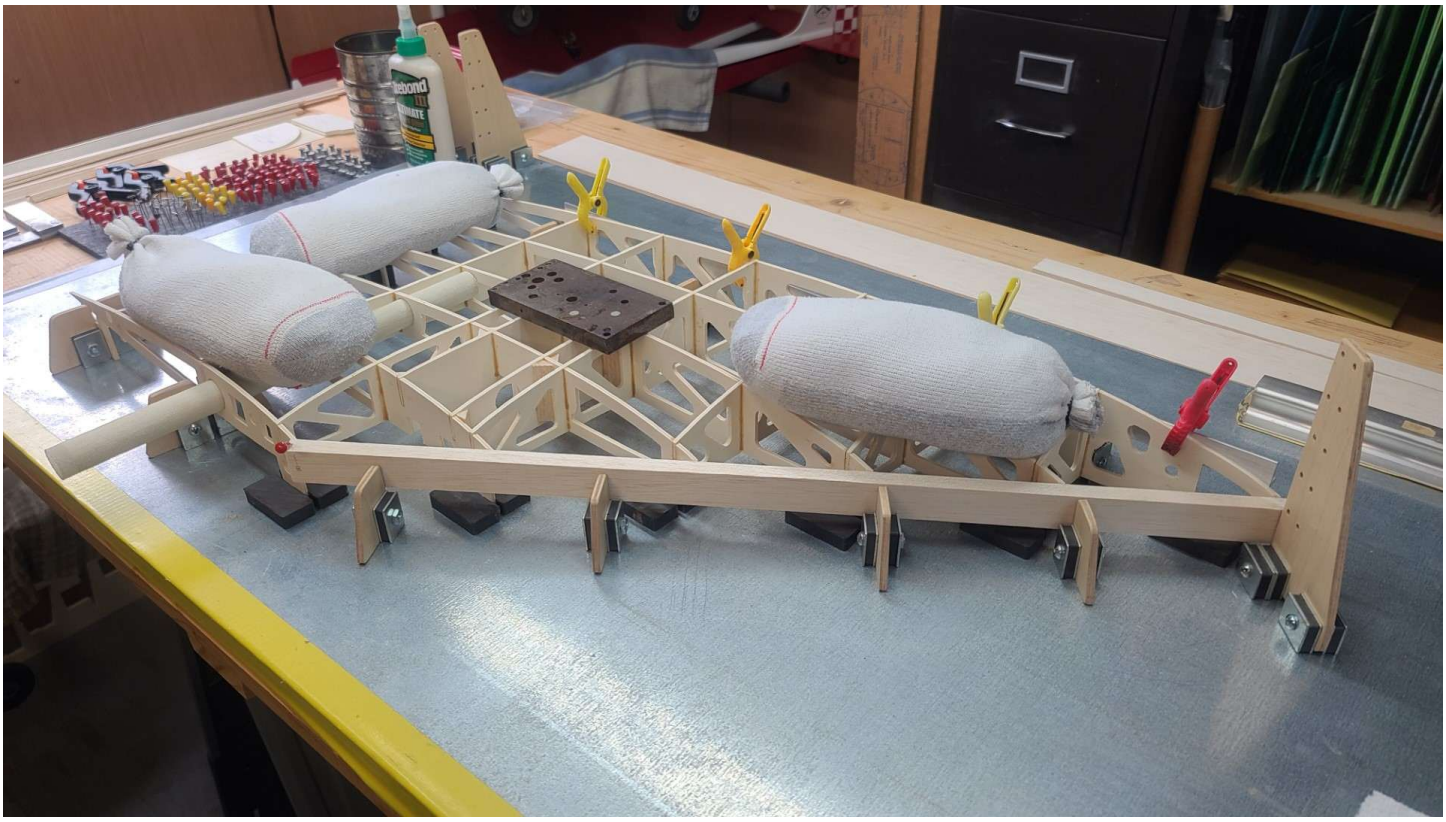


Next, this partial assembly of the right inboard-wing panel is temporally removed from the mag fixture jig and flipped over so ribs WA-4 through WA-6 can be glued into the wing spars WA-9 through WA-13. With these three outer ribs initially glued in place, flip the panel back over and reinserted it into the mag fixture jig. Place some more mag fixtures along the outer three ribs to ensure they are held in their correct positions while the glue dries. Now glue spars WA-14 and WA-15 into the interlocking slots of ribs WA-3

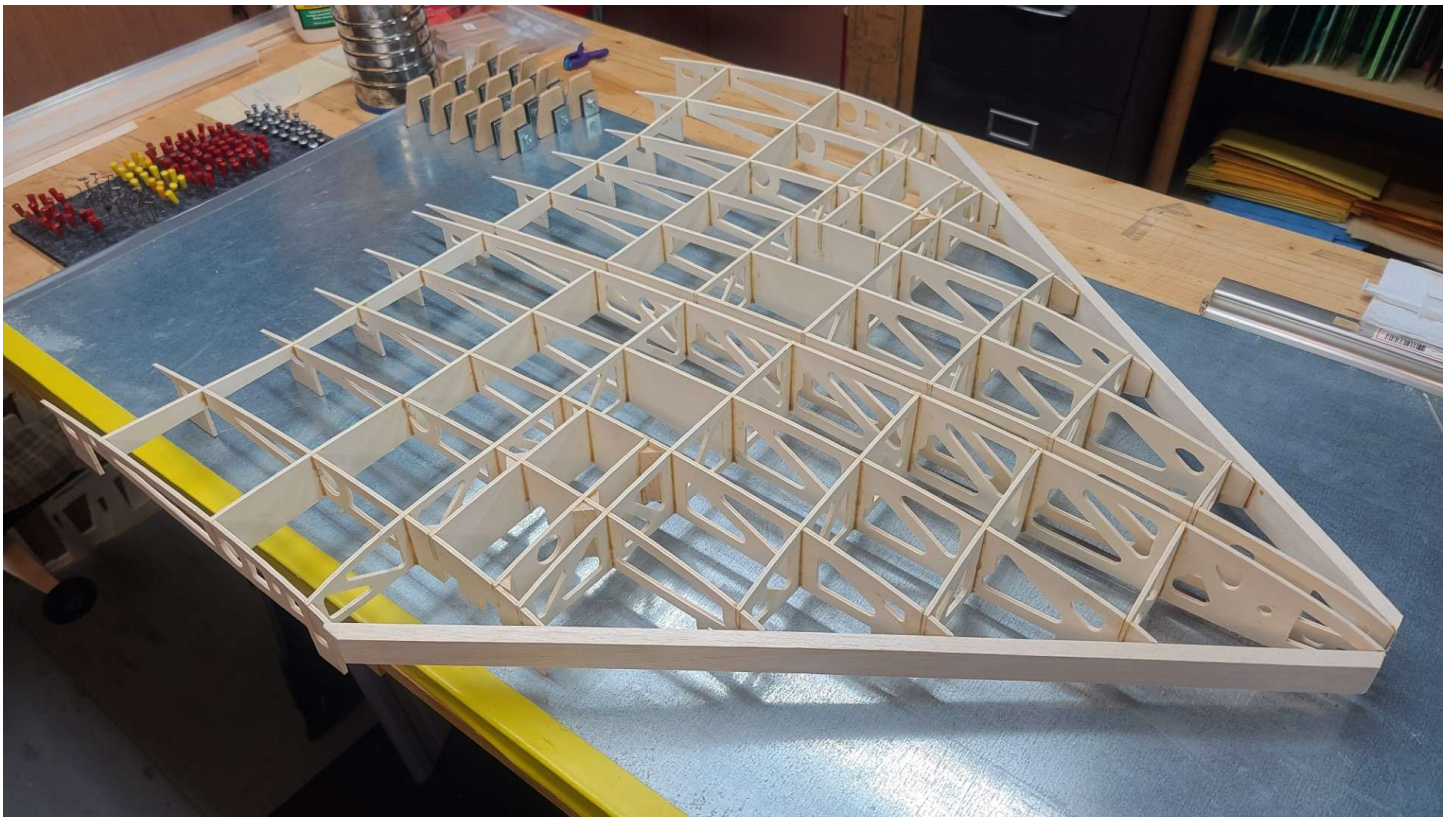
through WA-5. This forms the bay for the main landing gear (MLG) retract. Again, I used my sock weights to keep all ribs resting on their support tabs.

Builders Notes – 1) This is a good time to verify the fit of the fiberglass wing-tube sleeve through ribs WA-4 thru WA-6. 2) To help strengthen the MLG bay, I glued some 10mm balsa triangle stock in the outside corners of the rib/spar joints. 3)Finally, it is critical that ribs WA-1 and WA-6 are perpendicular to the building board surface. This is to ensure a good joint between the inboard-wing panels and the mid-wing panels, and the joint of the two inboard-wing panels.

Now I cut-out the WA-17 leading edge of this panel from a 10mm balsa sheet and glued it to ribs WA-1 through WA-6. Make sure you grind an angle to the ribs leading edge to improve the glue joint between the WA-17 leading edge and six ribs. The image below shows the right inboard-wing panel at this stage of the build.

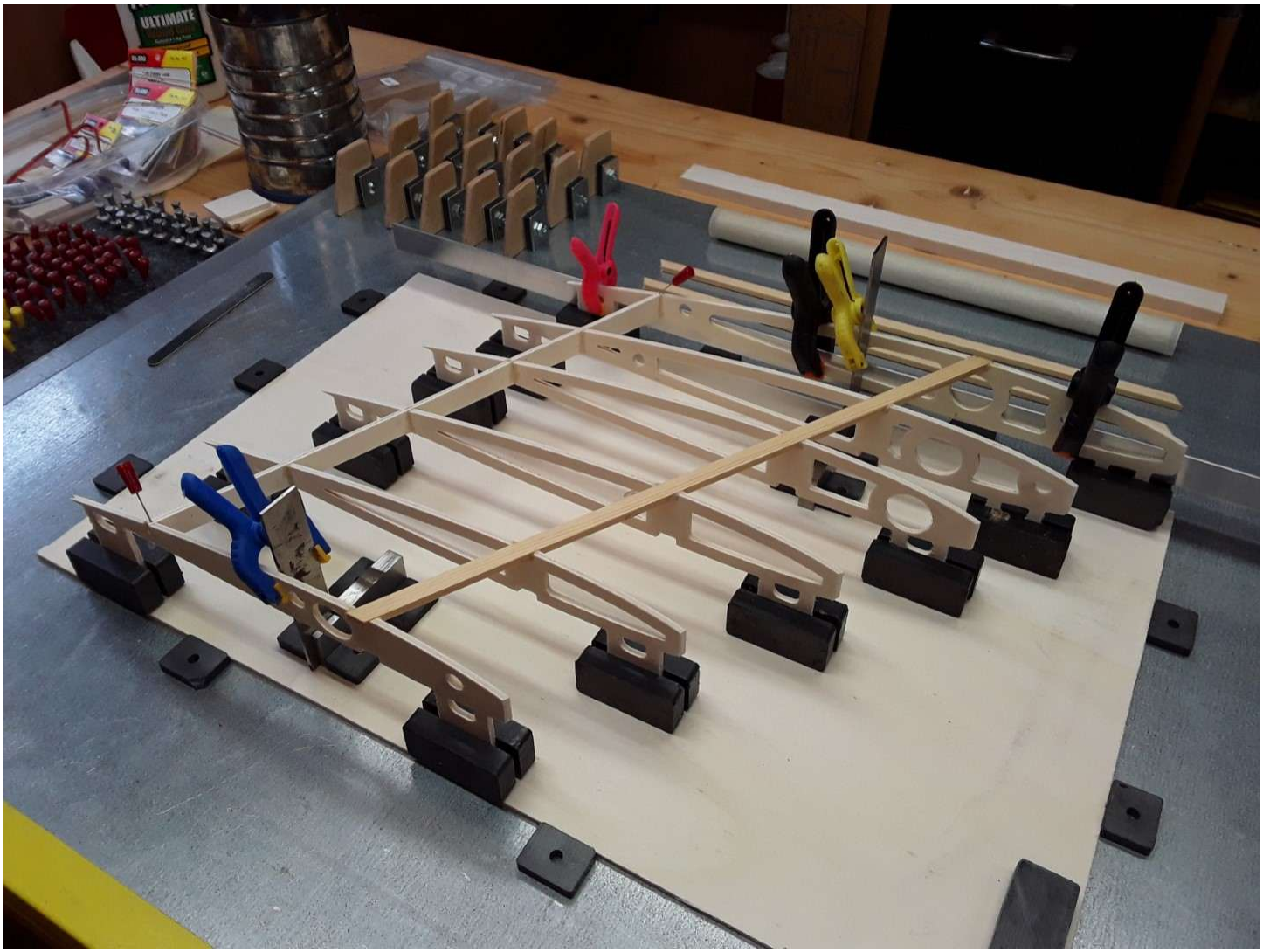


After going through all the same steps again to build the left inboard-wing panel, I pulled that panel from the mag jig and as you can see in the image below, we now have both panels needed for the Main wing inboard section. Next up is to start the build of a Main wing mid-wing panel.

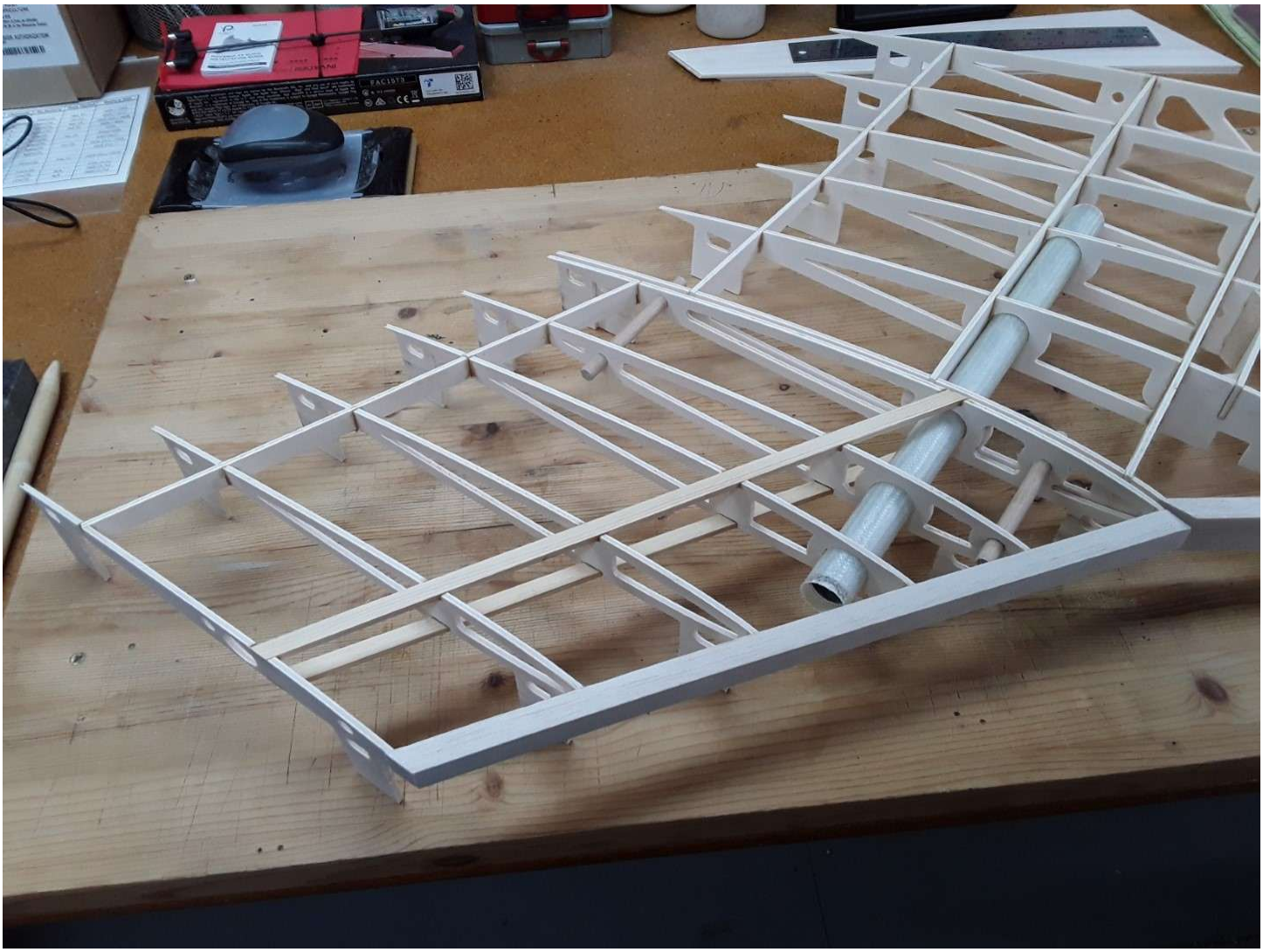


With the inboard-wing panels completed per the instruction manual, we now move on to removing all the parts from the 3mm Lite ply sheets that are needed to build the mid-wing panels. These are sanded along the outside edges, and the notches that accept the top and bottom WB-7 main spars and WB-8 aft spar are sanded to match the required angle. The leading edge of ribs WB-1 through WB-6 also require a slight angle sanding. The build of each mid-wing panel is accomplished using the supplied 3mm Lite ply template "B". The next image below is the start of the right mid-wing panel build.

Builders Note – I clamp a small aluminum "L" bar along the length of rib WB-1 to ensure it is kept straight during this panel assembly.



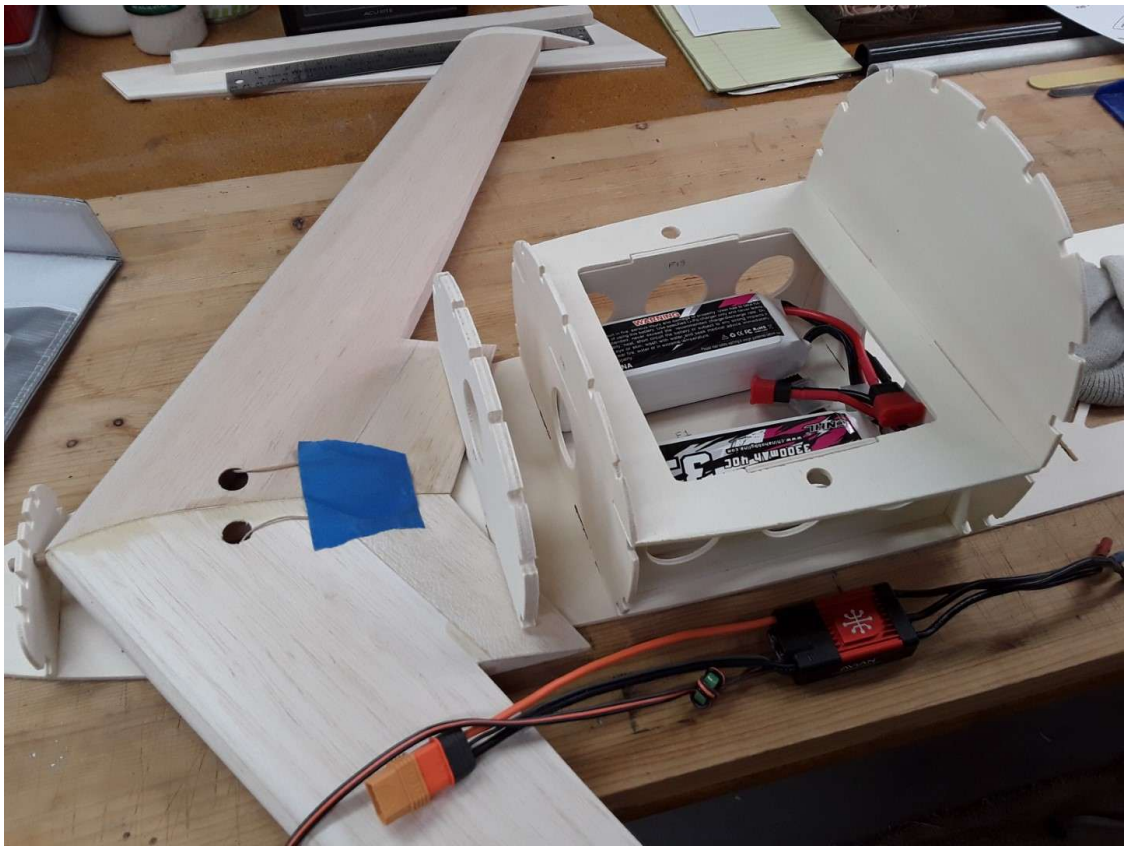
Finally, the bottom WB-7 main spar and WB-9 leading edge are glued to all the ribs and this panel is allowed to dry overnight. The image below shows test fitting of the completed right mid-wing panel to the right inboard panel before the two WB-10 8mm hardwood dowels and wing tube sleeve are mounted using epoxy.

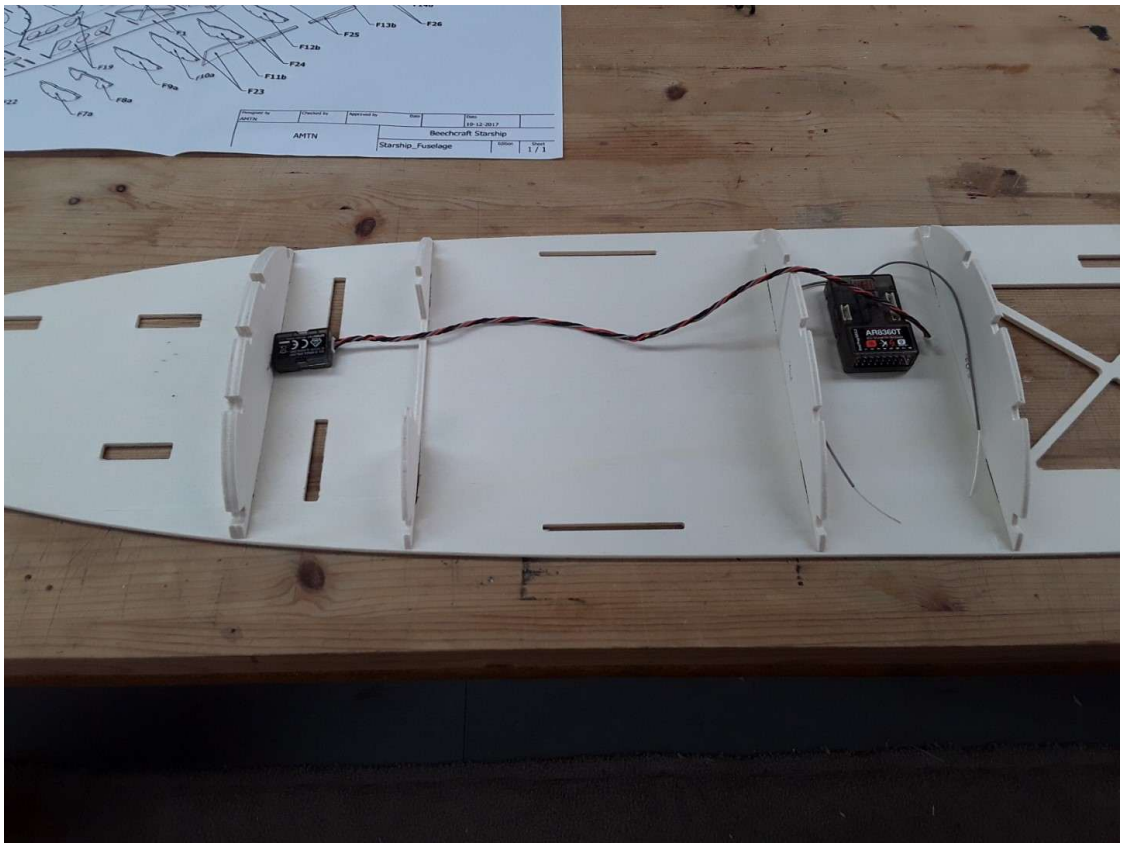


Alright, finally finished the left mid-wing panel. One item we wanted to investigate was how we could reduce or even eliminate having to add weight to the nose of the fuselage to obtain the required center of gravity (CG) location. One way to do this is to move the batteries and electronic speed controls (ESCs) from the motor mounts forward to the large bay area below the cockpit canopy between formers F8 and F9. So, I removed some of the fuselage pieces from the Lite ply sheets to try and get some idea as to how this idea would work out. The next image below shows the two 4S 3300mah battery packs we plan to use positioned in the lower bay, and one of the ESCs next to the bay. Based on a suggestion from David, putting the two batteries on their edge in the center of the bay will allow enough room for the two ESCs to be mounted along the sides (with the three large holes) of the bay. We could also put the ESCs in the upper bay under

the plastic canopy provided we painted the clear canopy and could find some way of getting cooling air into that bay. Otherwise, the ESCs will go in the motor mounts as originally designed.

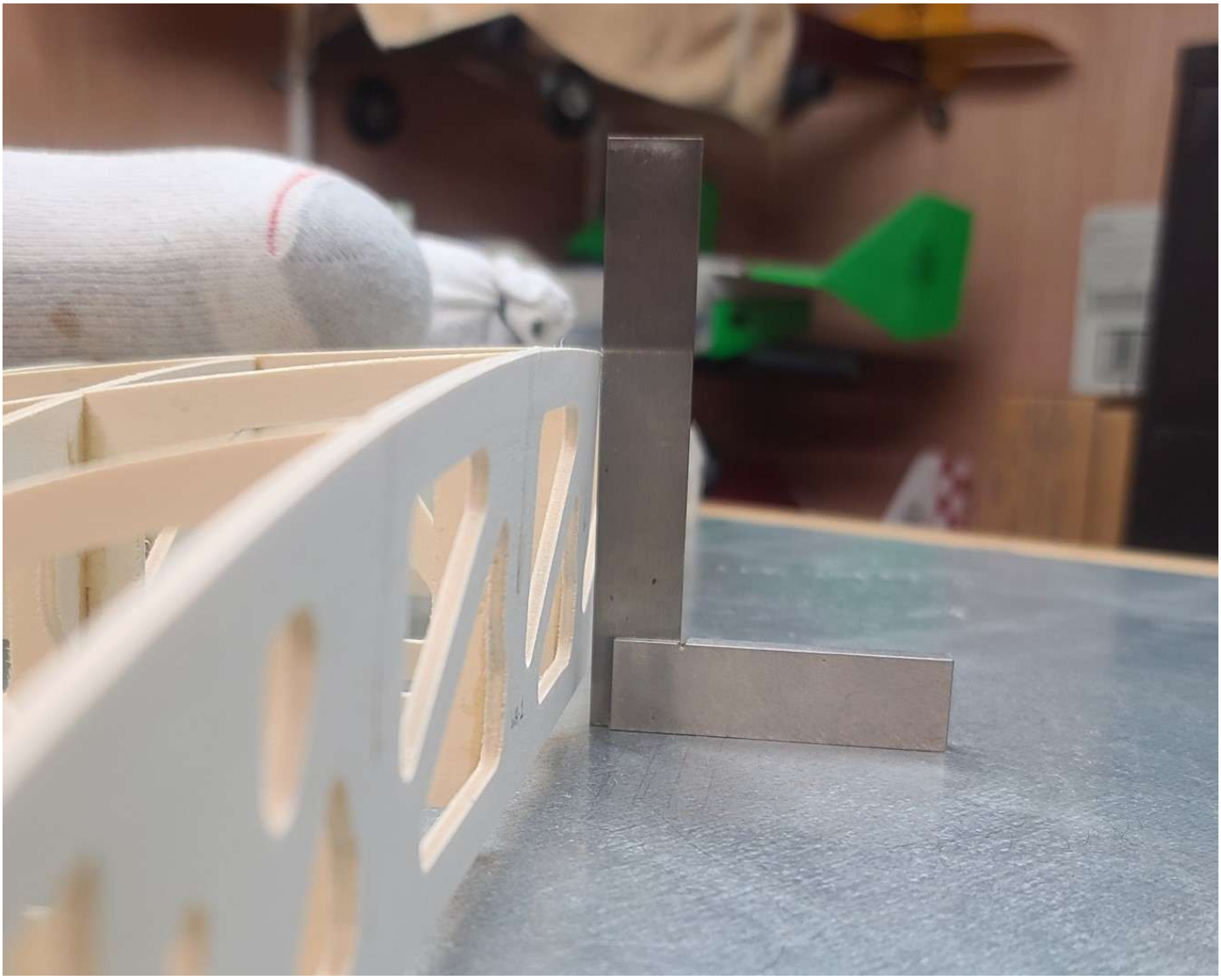
Additionally, we now must fine somewhere to mount the receiver since that was originally intended to go in the lower bay. The second image below is the bottom side of the fuselage main plate F1. The bay area between fuselage formers F9a and F10a will work to mount the receiver, and the small remote receiver unit can be placed forward of the nose landing gear (NLG) bay. I will need to put wire routing holes in F1 and F9a, plus make photocopies of F9a and F10a to use as templates to make a receiver bay access hatch. More on this modification later when building the fuselage.

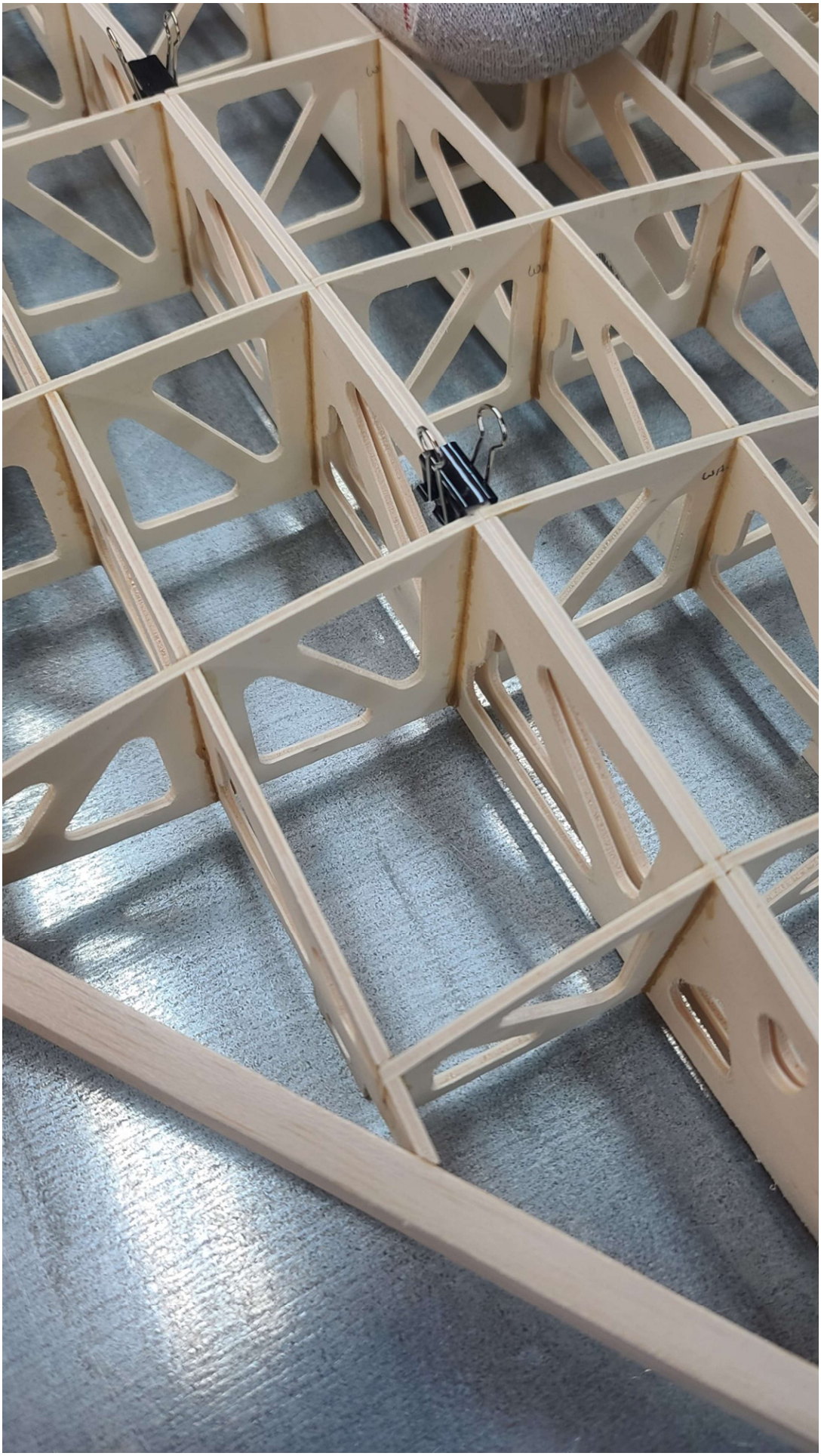




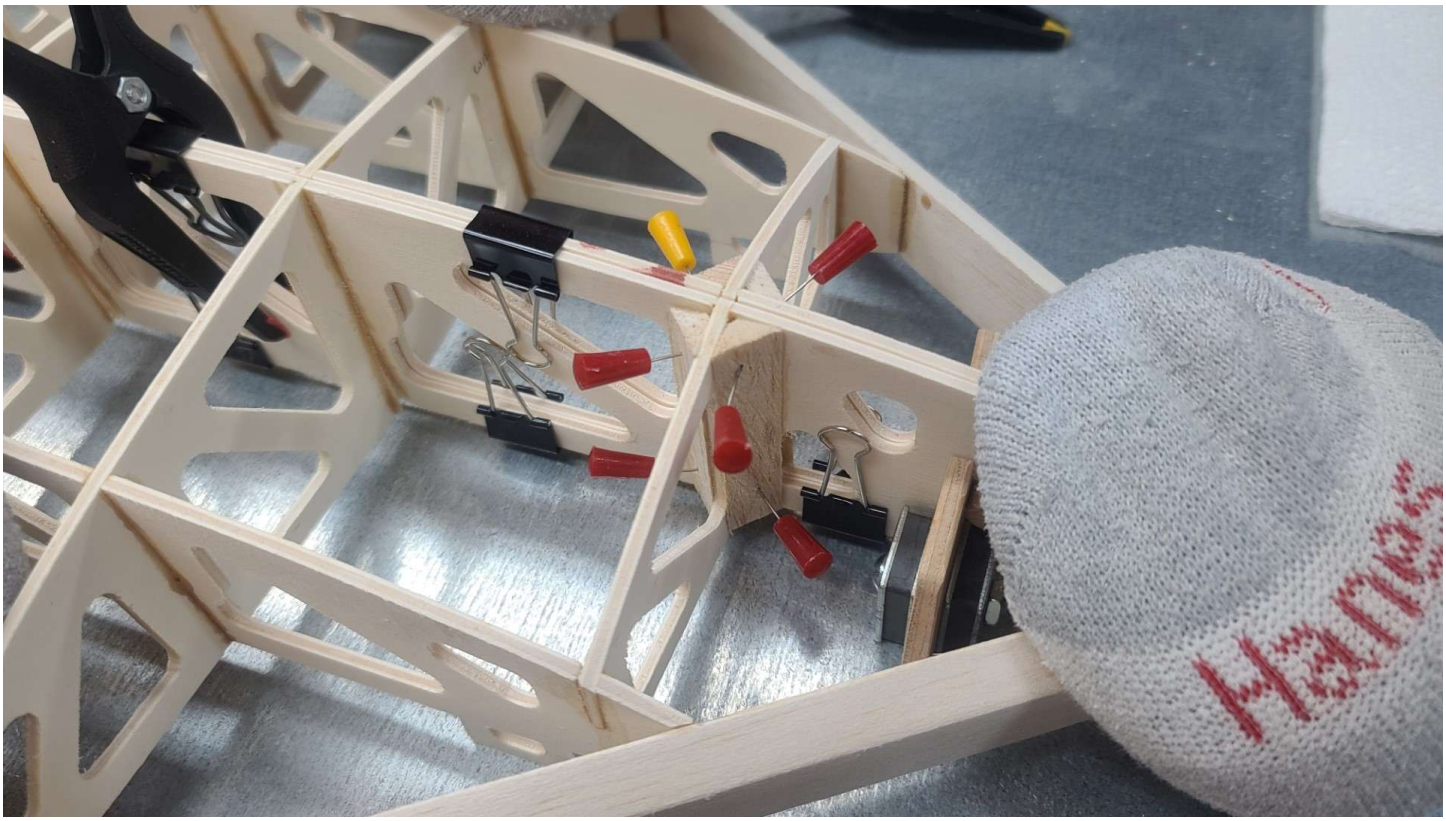
While checking the fit and alignment of the mid-wing panels to the inboard-wing panels I discovered a problem with the two WA-1 ribs. While they are nice and straight lengthwise, they turned out **NOT** to be perpendicular to the building board surface as shown in the first image below. When building the inboard-wing panels I noticed WA-1 not touching the lower spar areas, and assuming the spars were cut as to ensure a perpendicular rib, I used my mag fixtures to push the rib up next to the spars when gluing the panels together. ***This was an incorrect assumption on my part.***

When you place the two inboard-wing panels together and put weights on them to ensure all the rib tabs are flat on the building board, you get a gap between the bottom of the two WA-1 ribs as you can see in the second image below. One might think this is no big issue since when you go to join the two inboard-wing panels together, you just clamp the two WA-1 tightly together, which will work to get a tight fit, **BUT** unfortunately will also introduce a large negative dihedral in the inboard-wing panels. **NOT GOOD!**



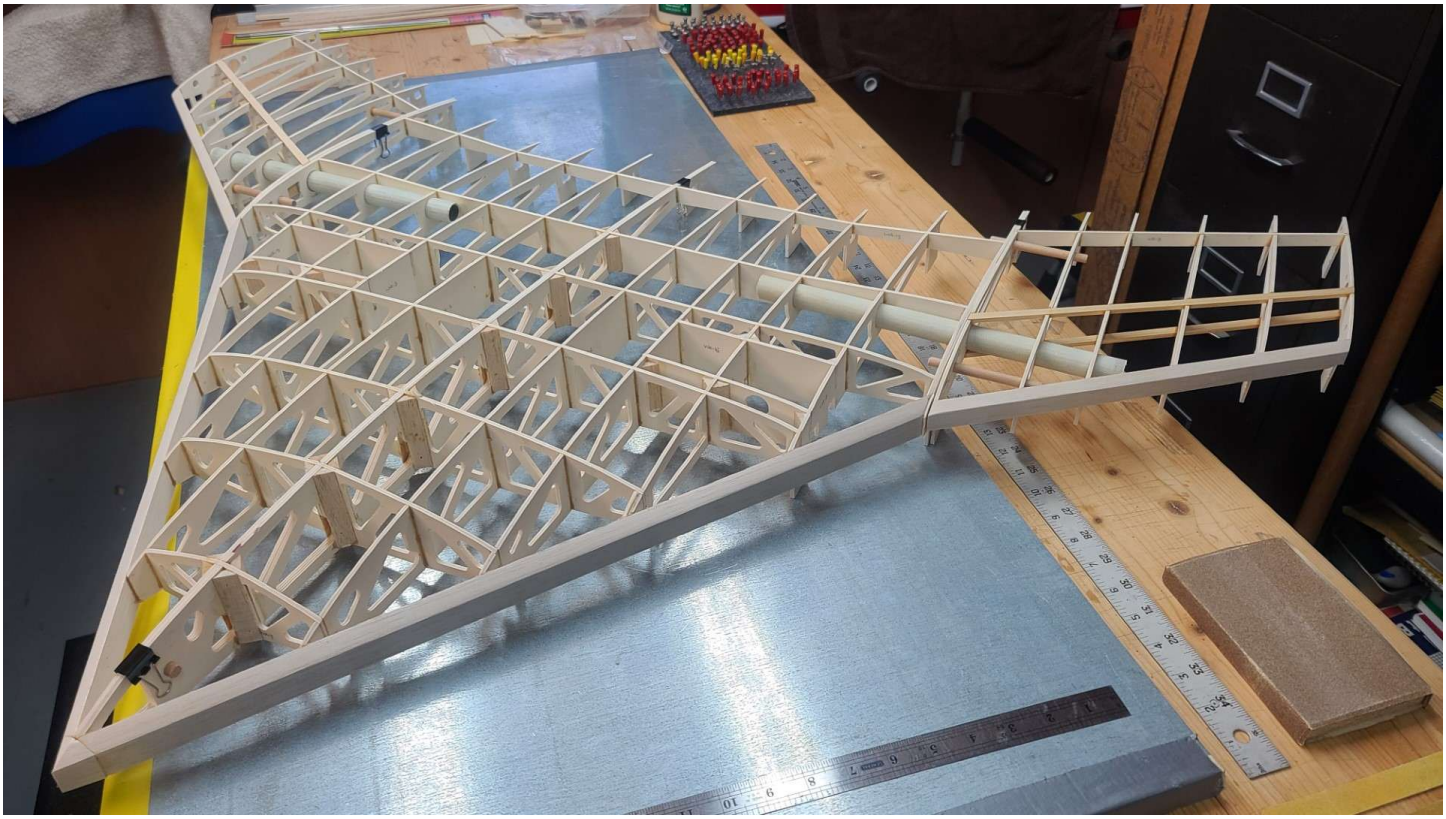


So, I needed to come up with a solution to this problem. You could put a filler between the bottom of the two WA-1 ribs during the inboard-wing panels join, which may work, but I feel it would greatly reduce the overall bounding area between the two WA-1 ribs. After doing a little more head scratching I finally decided to cut the glue joints between the WA-1 ribs and spars WA-7 through WA-12 (only the lower half of the joints), and then re-glue all those joints with the two inboard-wing panels clamped together along the top and bottom edges of the two WA-1 ribs, plus have both panels held flat on the building board using my sock weights and mag fixtures. To ensure a good joint between each spar and the WA-1 ribs, I decided to add 10mm balsa triangle material on each side of the joints. The image below shows the re-gluing in progress, and *yes that red spot is some of my DNA on the WA-1 rib*. Once all the spars are re-glued to the WA-1 ribs, this will result in a good flat fit and strong joint between the two inboard-wing panels without introducing any dihedral changes.

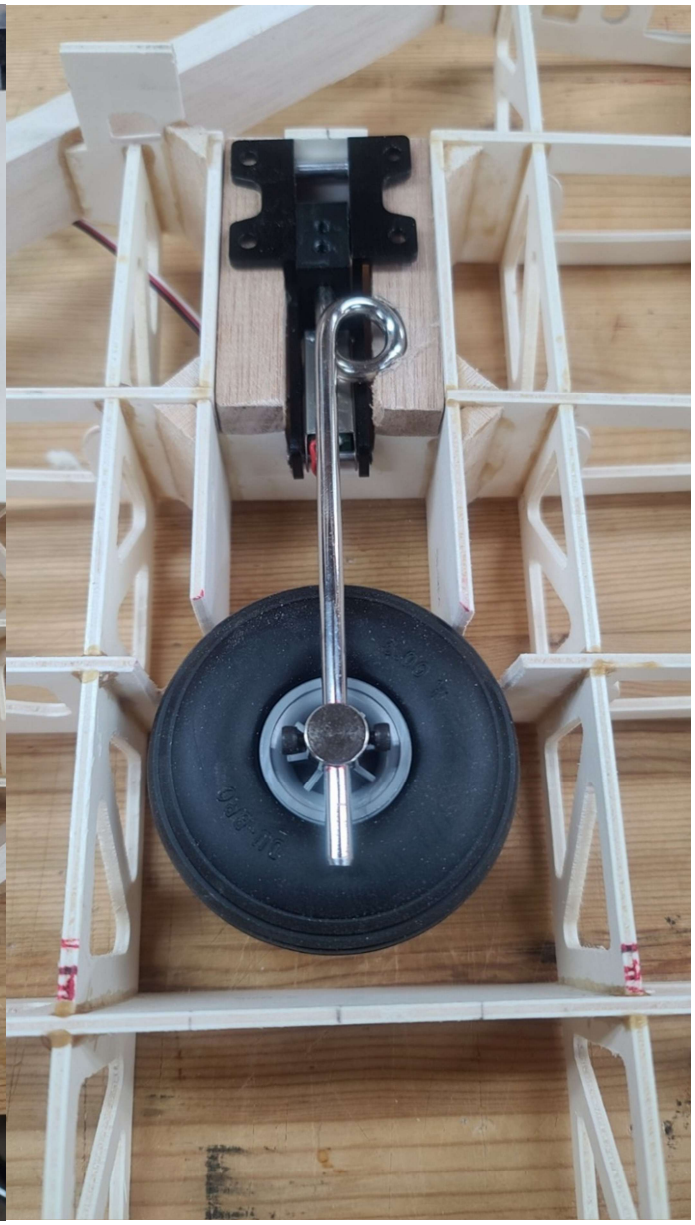


With the inboard-wing WA-1 ribs issue resolved; we can now get back to building again. As you can see in the next image below, everything now lines up very nicely with all rib tabs flat on the building board surface and this is starting to look like a pretty good size model, *and we still have the outboard-wing panels to add.* Next up is to epoxy both wing tube sleeves in place.

Builders Notes – When epoxying the wing fiberglass tubes to inboard-wing panel, have the aluminum tube inside the fiberglass tube. Initially epoxy the fiberglass tube **ONLY** to the inboard-wing panel, not to the mid-wing panel. When cured, separate mid-wing panel from the inboard-wing panel and remove the aluminum tube, then cut the fiberglass tube flush with outer rib WA-6. Put the aluminum tube back in fiberglass tube, clamp inboard-wing panel and mid-wing panels together, now epoxy the fiberglass tube to the mid-wing panel. Use micro-bubbles in the 15-minute two-part epoxy for these steps.



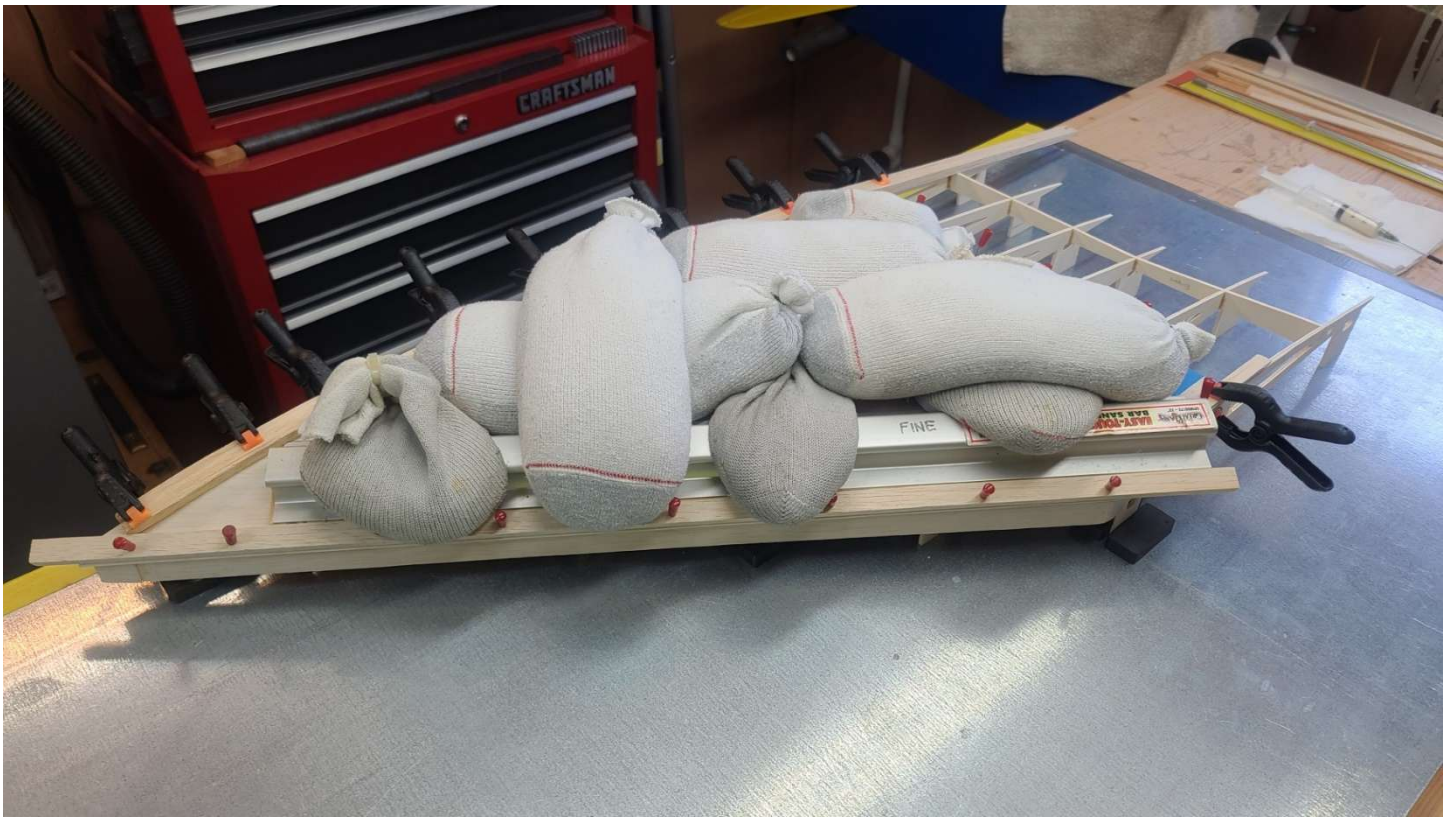
Ok, with the wing tube sleeves epoxied in place, the AMTN instruction manual says we should now sheet the top surface of the inboard-wing panels. ***Well, I want to do a couple other things first.*** After viewing Saul's build videos, I felt it would be better to work on installing the MLG retracts and the inboard to mid-wing joiners with both surfaces of the wing panels open for better access to the internal structures. First the MLG mounts and wheel wells. In the left image below you see the rear fuselage template F2 positioned over the bottom of the left inboard-wing panel, the MLG mounting blocks placed in the slots in ribs WA-4 and WA-5, and the left retract sitting on top of them. This setup allows me to see where I need to place the wheel on the retract shaft so the tire will not hit the side of the fuselage, and where I need to remove material from the ribs and spars so the retract and MLG wheel will fit down inside the inboard-wing panel. With this established I removed the mounts and retracts and then use my Dremel tool to open up the area for the wheel well. Having both the top and bottom of the wing panel open really makes this easier than how the instruction manual suggests. The right image shows the left retract sitting as it will when finally installed. Now I epoxy the retract hardwood mounts in place. I won't install the wheel well sides and floor until I can verify the final position of the MLG wheel on the retract shaft with the wing mounted to the fuselage.

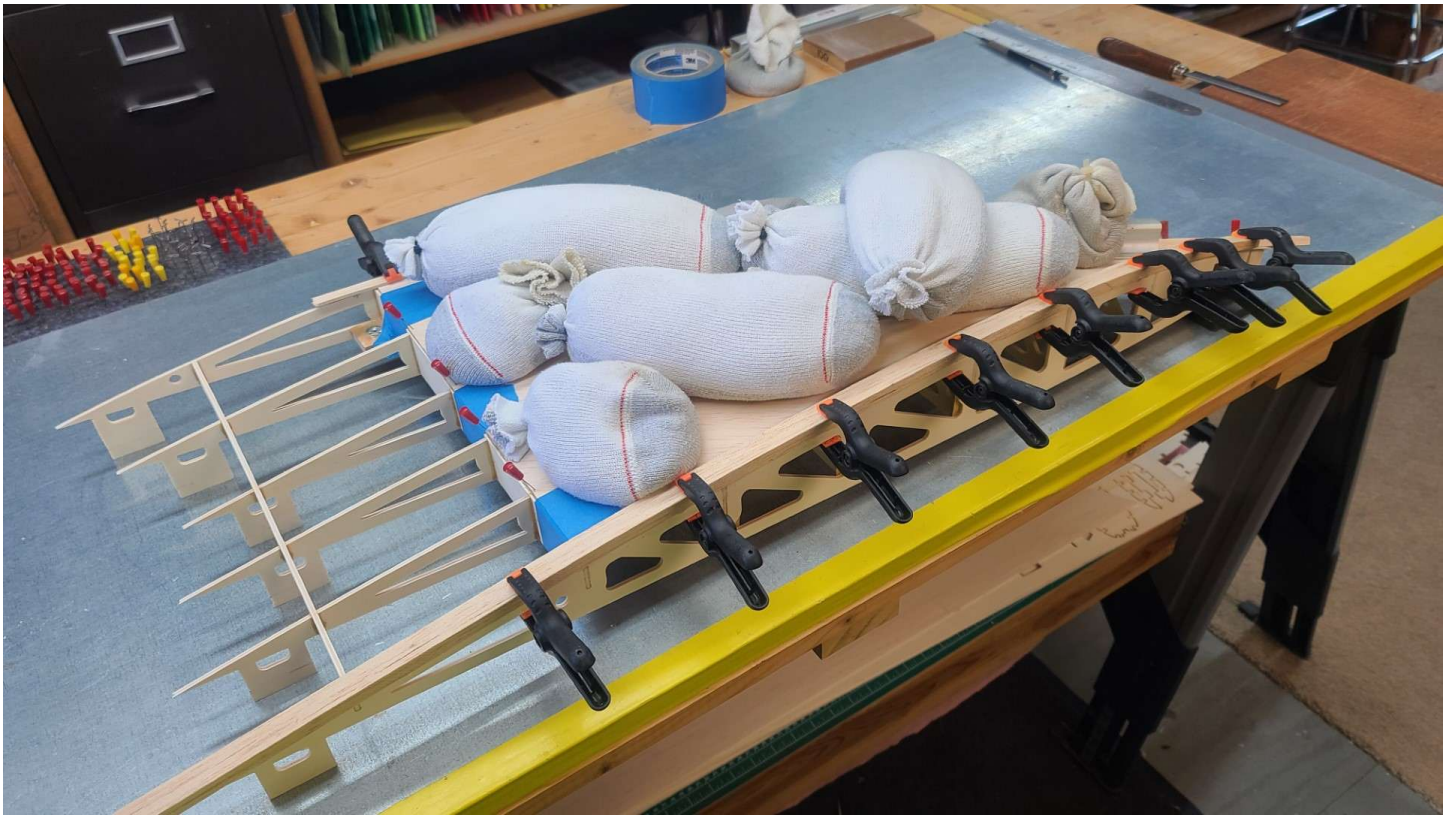


Now for the wing joiners. As per the instruction manual WA-18 and WB-12 hardwood joiner blocks get epoxied in place, and then holes drilled for the M3 mounting screws blind nuts. Having the top side of the wing panel open makes installing the blind nuts very easy and allows me to lock them in place using epoxy. You can see in the image below that I also added some 10mm triangle stock along the top side of the MLG mounting blocks and applied epoxy over the entire area to ensure a good secure mount for the retracts. With these items completed I can now return to the instruction manual and start to sheet the top surface of the inboard-wing panels.

The first step in sheeting the Main wing inboard panels is to glue together four each 1.5mm thick balsa sheets. **Builders Note** – Place the four balsa sheets together with a 135mm stagger at the ends (as seen on the right in the image below). This way you will be able to get the forward sheeting cut-outs (one for the left panel is on the left) for the tops of both inboard-wing panels from these four joined balsa sheets.

I lightly sanded the entire top surface of both inboard-wing panels to obtain a smooth transition across all the ribs/spars intersections. Next, I lined up the aft edge of the forward sheeting cut-out along the centerline of spar WA-12, then double checked the sheeting alignment along the length of the leading edge and rib WA-1. Once satisfied with the fit, I used some wide blue painters' tape to form a hinge along spar WA-12, flipped the top sheeting back, run a bead of Titebond III Ultimate glue along the tops of all the ribs, spars, and leading edge, then flipped the top sheeting back over on the forward section of the panel. You can see in the next two images how I used scrap balsa strips to hold down the sheeting along the leading edge and rib WA-1, and all my old sock lead-shot weights to ensure a good contact between the balsa sheeting and all the wing panel substructures.


CRAFTSMAN
FINE

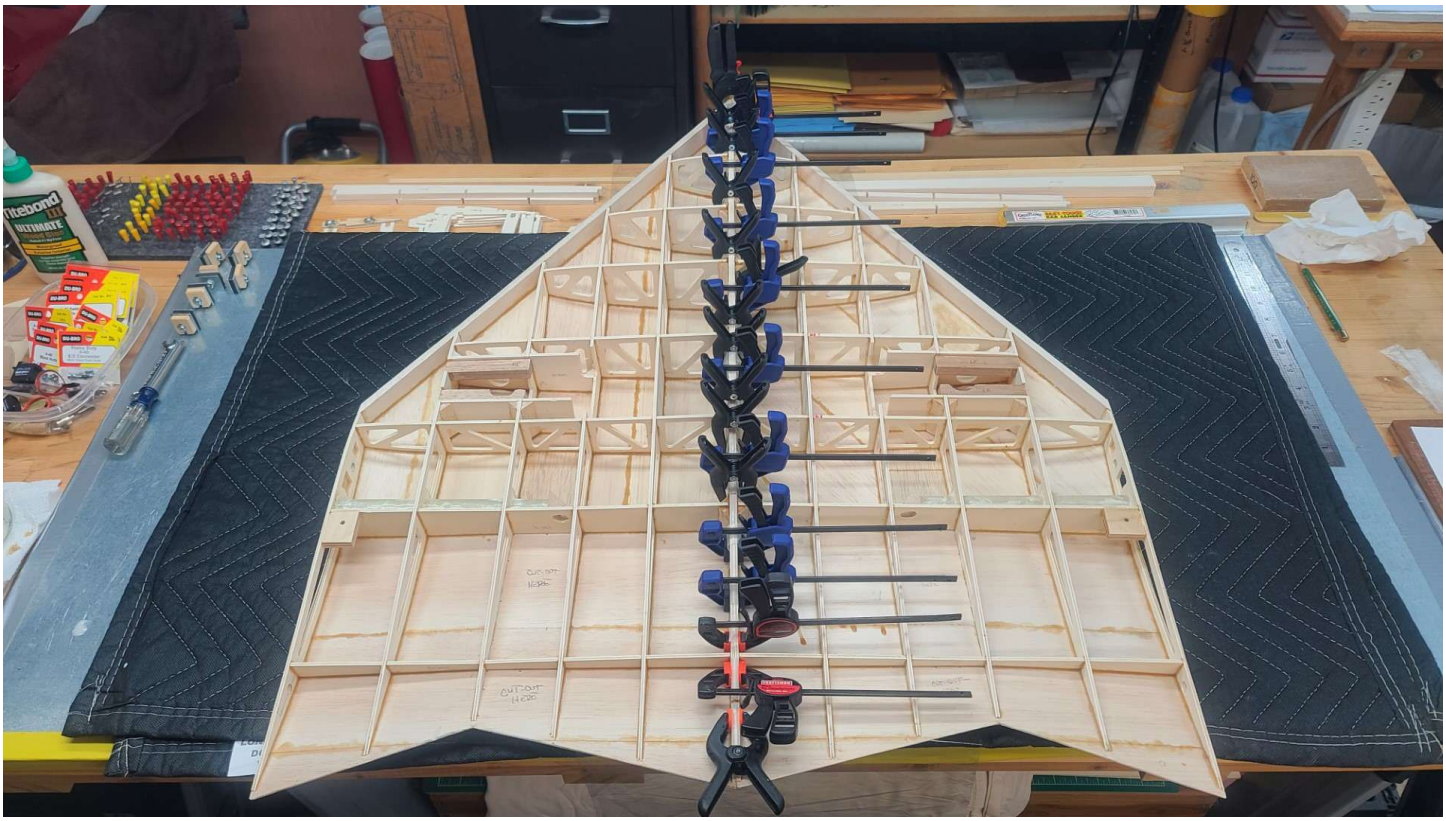


Once the sheeting on the forward portion of the panel was set, I then sheeted the aft portion of the panel using 1.5mm balsa sheets. I did this using single pieces of sheeting and some scrap pieces left over from sheeting the forward wing. **Builders Notes** – 1) As you can see in the image below, to ensure the aft tips of ribs WA-1 and WA-6 remain straight during the sheeting, I clamped them to hardwood strips running along the outside of the panel. 2) Because the center area of wing panel is lower at rib WA-4, start pinning of the top sheeting at WA-4 and work outward to each side. Again, I used the good old sock weights.

After the aft sheeting was fully set, I used my glue syringe and put a bead of glue along all joints between the underside of the top balsa sheeting and all the internal ribs/spars substructure. Next, the trailing edge of the top sheeting was trimmed to 5mm from the ends of each rib.

Builders Notes – 1) If installing LiPo batteries and ESCs in the forward portion of the fuselage as we are in this build, the holes that will need to be drilled in spar WA-12, between ribs WA-3 and WA-4, must be large enough for all three 10-gauge motor power wires going to the motor mount. 2) I used a thicker balsa sheet (2mm) to reinforce the underside of top sheeting at the motor mount location between spars WA-11 and WA-12, and ribs WA-3 and WA-4.

With both inboard-wing panels top sheeted, all the inboard-wing rib tabs were removed. I lightly sanded the entire bottom surface of both inboard-wing panels to obtain a smooth transition across all the ribs/spars intersections, and all top sheeting edges were sanded to match the side ribs and leading edge. Then I joined the two inboard-wing panels together using 30-minute epoxy mixed with some micro-bubbles. As you can see in the next image below, I used a lot of clamps in this "major join" step.

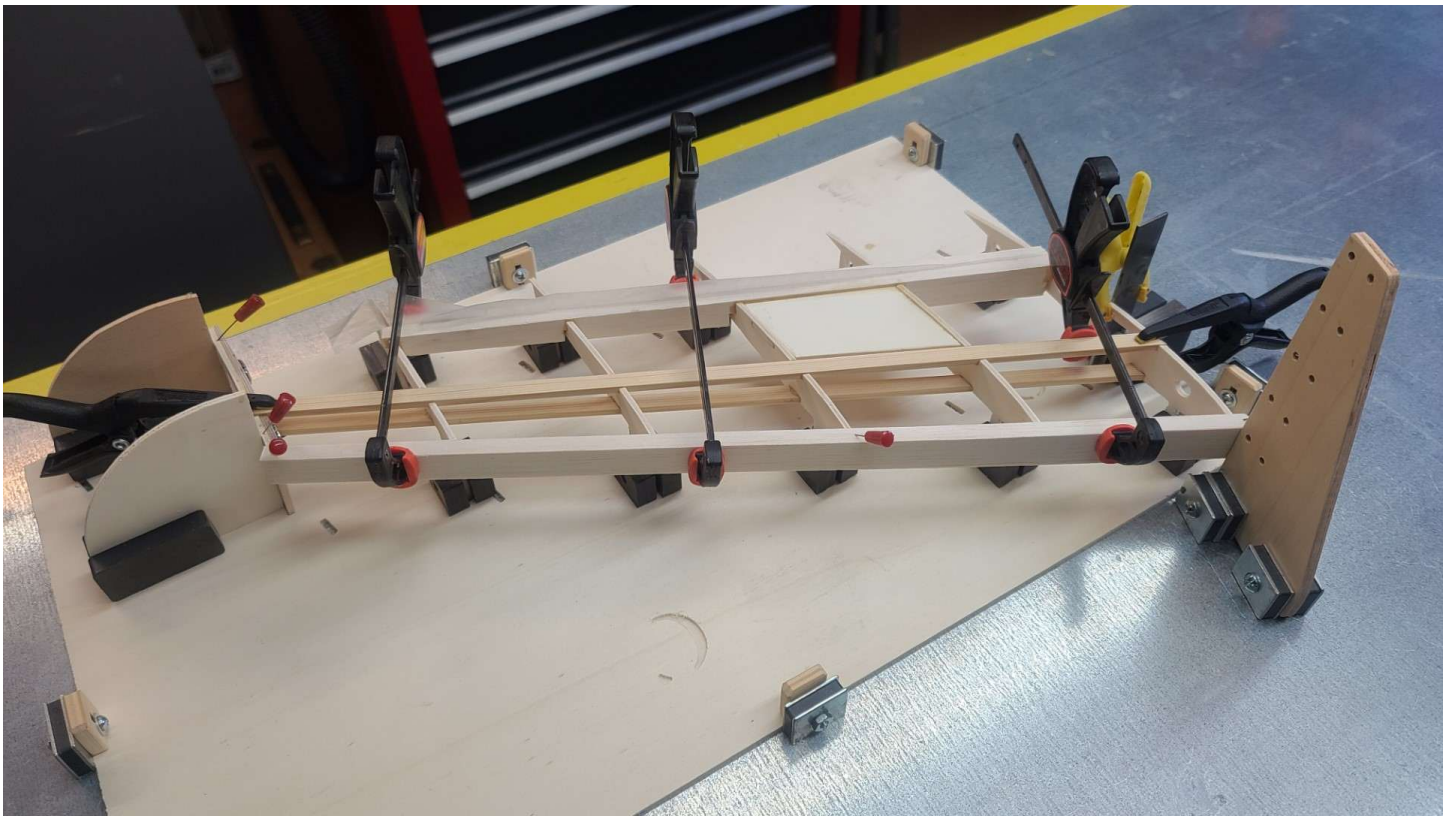


While all that epoxy cures, I start to get ready to build the outboard-wing panels. Below are all the pieces needed for both panels, including hardware and even the aileron hatch covers which I made using WC-17 as a template to trace the hatch covers out on 1.5mm birch plywood.

We are again using Blue Bird BMS-127WV+ servos from https://www.bluebirdservousa.com/product-page/bms-127wv/ for the ailerons and these little things give us a torque of 4.7 kg-cm / 65.3 oz-in at 7.4 volts.

Builders Note – Both wingtip WC-6 ribs need to be reinforced to provide the rib thickness needed to install two M3 blind nuts. I used the WC-6 rib provided and traced out two more on 2mm birch plywood. As seen below, the blind nuts are secured using 15-minute epoxy.

This next image shows the start of the right outboard-wing panel build using the AMTN supplied 3mm ply template “C”. As in the canard panel builds, small magnets are used to keep all the ribs in place and perpendicular to the ply template, plus I used a steel square to keep rib WC-1 in place . Note the two WC-18 winglet angle templates on the left holding rib WC-6 at the correct 6-degree inward angle. Again, I use Titebond III Ultimate wood glue for all the joints, and after parts have been initially glued in place, I go back and put a small bead of glue along all joints using my glue syringe. Remember to put some wax paper between the wing panel trailing edge WC-8 and the aileron leading edge WC-9 so they won’t get glued together.



David made a delivery today of his ***custom hand-made*** cables that are for the inboard-wing panels. This next image shows their routing through the various inboard-wing panel ribs and spars. The six motor power cables are 44-inches long to run from the motors to the ESCs that will be in the fuselage bay below the canopy. These will have a few twists put in them to reduce the potential for any interference with the receiver. The two MLG retract cables are 32-inches long to run from the MLG retract bays to the receiver bay which will be built between fuselage formers F9a and F10a. And the two aileron extension cables are 46-inches long to run from the outboard side of ribs WA-6 to the fuselage receiver bay. Before I put the balsa 1.5mm bottom sheeting in place, I will run a complete sub-system checkout of all these cables using the receiver and all the other components these cables connect between:

Receiver – Spektrum AR8360T, AS3X and SAFE, 8 Channel Receiver

ESCs – Spektrum - SPMXAE1060

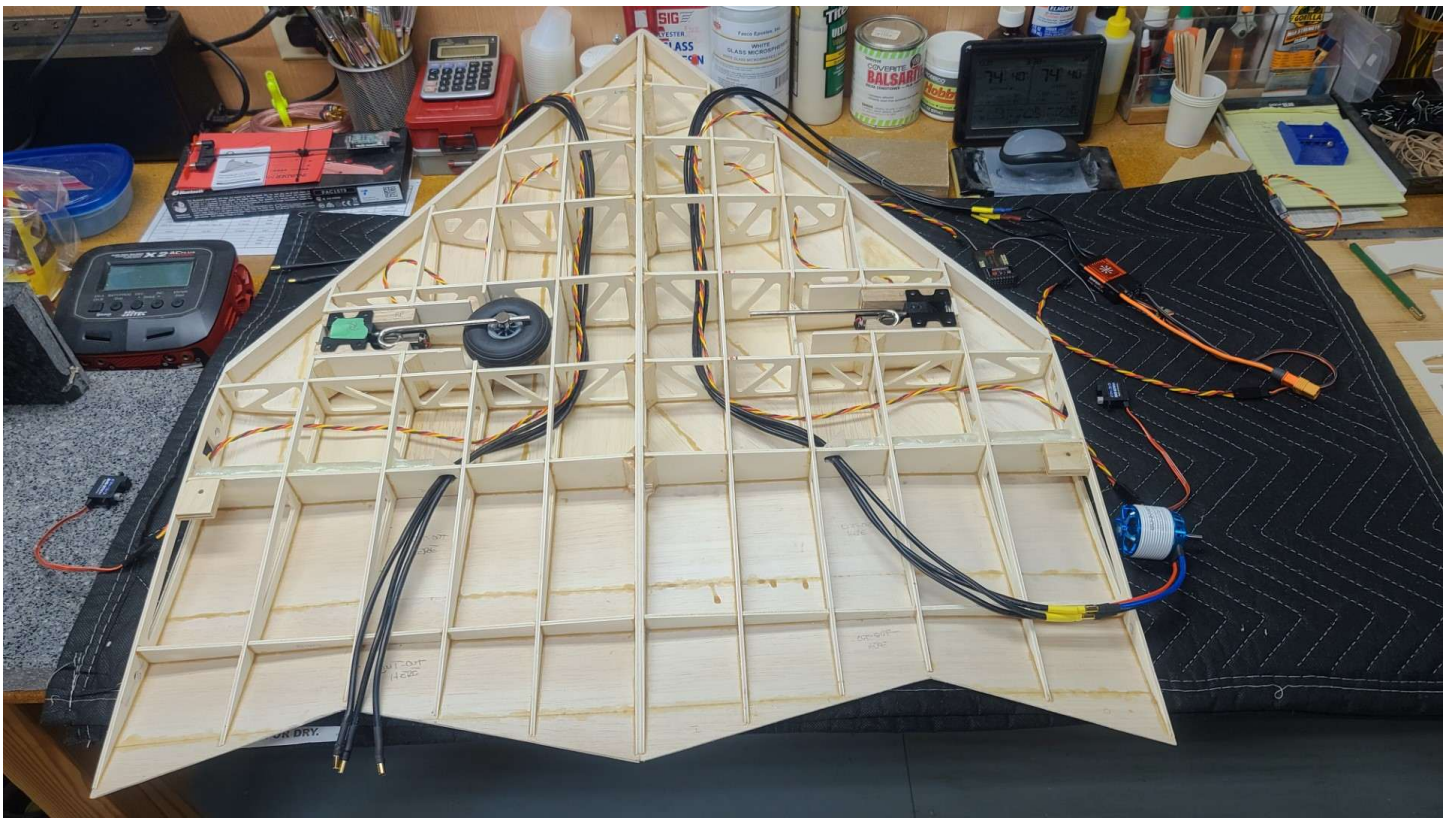
Batteries – SMC 4S 2,800 mah 45C LiPos

MLG Retracts – HIMARK Aircraft Mechanics Electric Retracts 60-120 Size

Motors – Sunnysky X3120-KV880

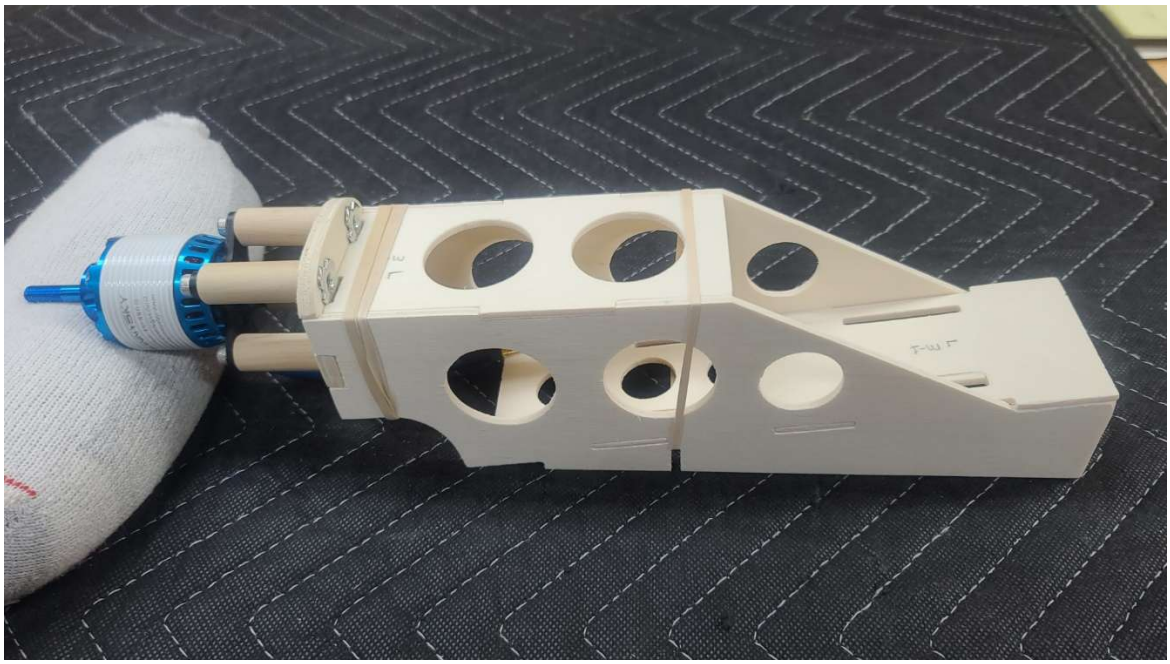
Aileron Servos – Blue Bird BMS-127WV+

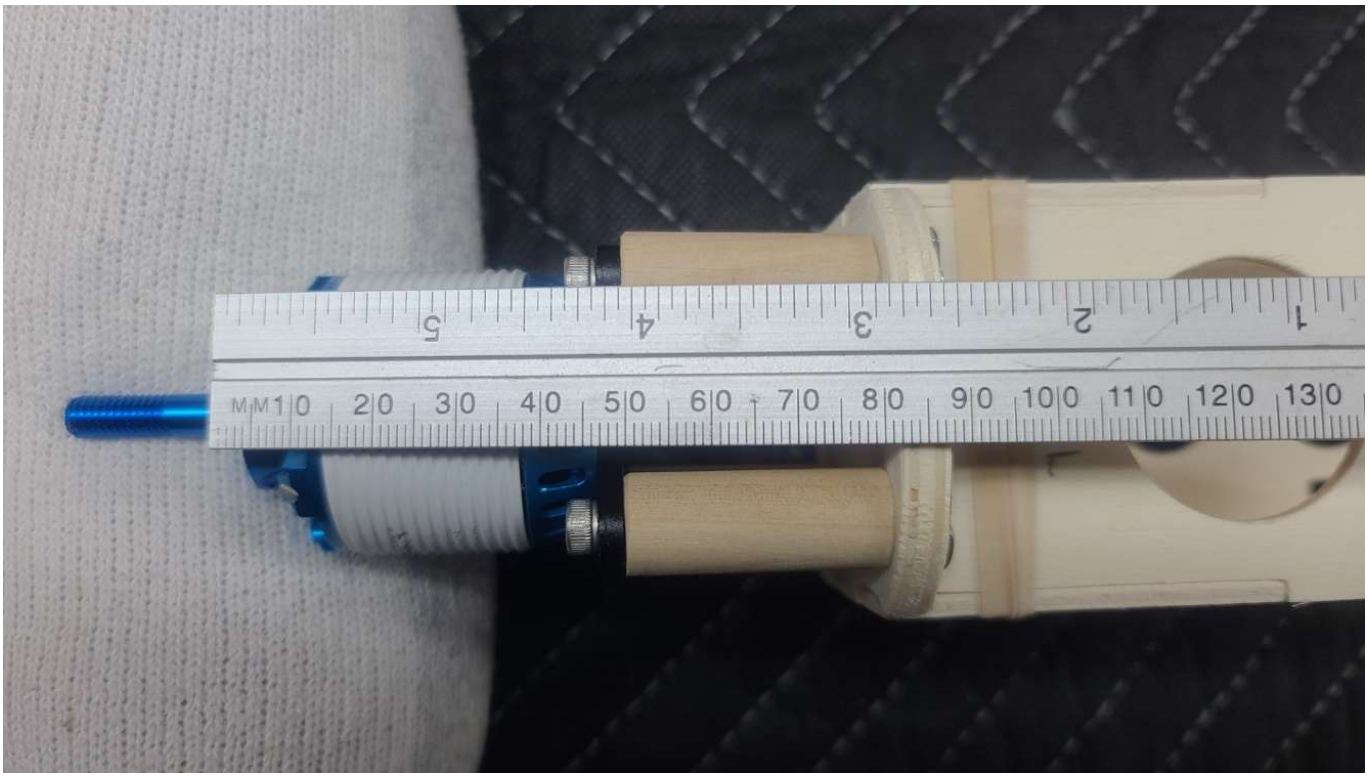
Builders Note – When making the top surface holes for the various leads to pass thru, cut them out so they will be **forward of fuselage former F11** that will be mounted on the top of the Main wing inboard panels. F11 will be placed 140mm aft of former F10 which will be placed at the nose of the Main wing. I would recommend placing the holes on each side of ribs WA-1 and forward of spars WA-7.



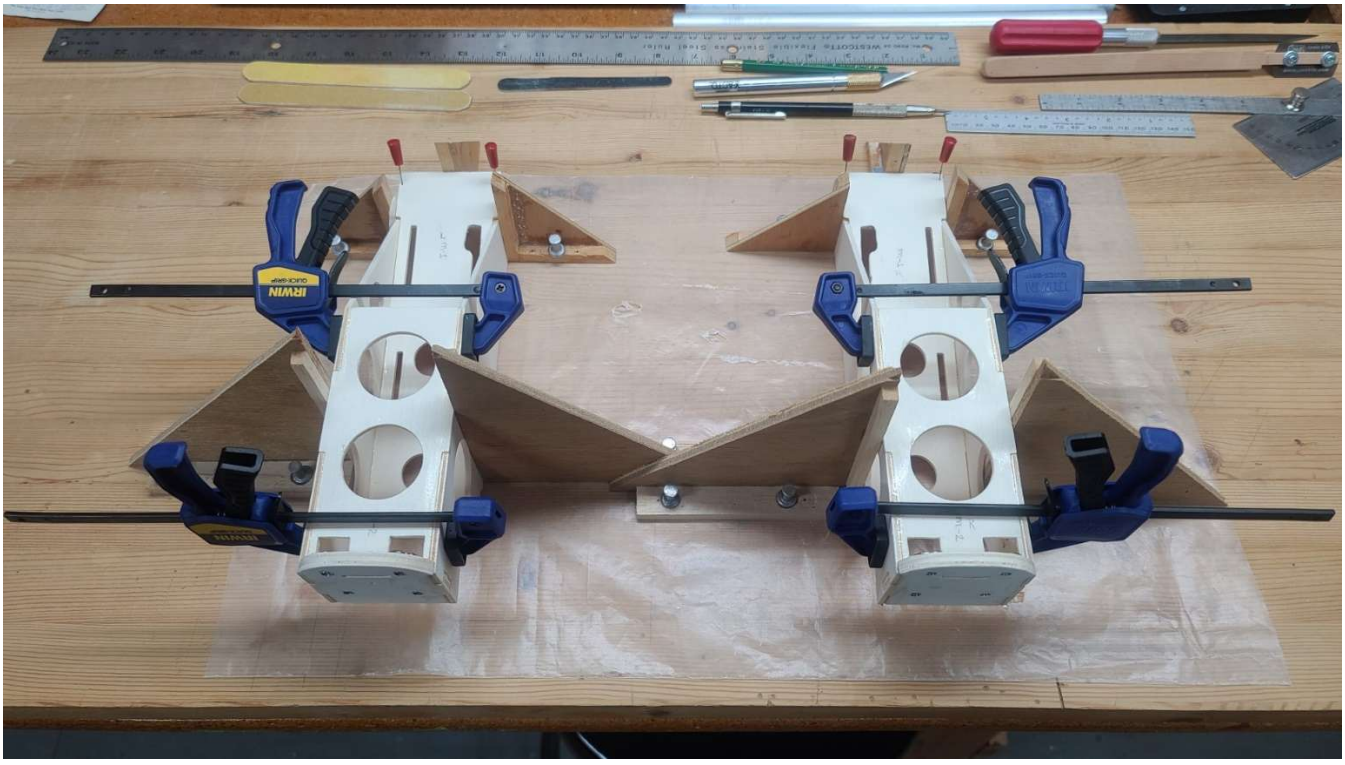
Before I sheeted the bottom side of the inboard-wing panels, I wanted to verify that I had sufficient length of motor power leads temp-stored inside the trailing edge. To do this I needed to dry fit everything in the motor mount. The next two images show the "Left" motor mount with a SunnySky X Series V3 X3120 Brushless Motor https://sunnyskyusa.com/products/sunnysky-x3120/ installed. To get the recommended 82mm spacing from the face of the M-5 firewall to the back of the spinner, I had to custom make a set of 32mm spacers using 12.5mm hardwood dowel center drilled to accept the M4 hex head bolts, which mate to the M4 blind nuts on the back of the firewall.

Builders Notes – 1) Remember when assembling the motor mounts, there is a difference between ribs M-3 and M-4. Rib M-4 must be placed on the outer side of the wing. ***Motor mount M-4 has a 22mm notch on the aft bottom of the ply piece, and M-3 has a 27mm notch.*** Recommend you measure these to ensure you have each of the parts in their correct positions to build the left and right motor mounts. 2) Make a hole in the forward part of the motor mount floor M-1 large enough for the three motor power leads to pass through.





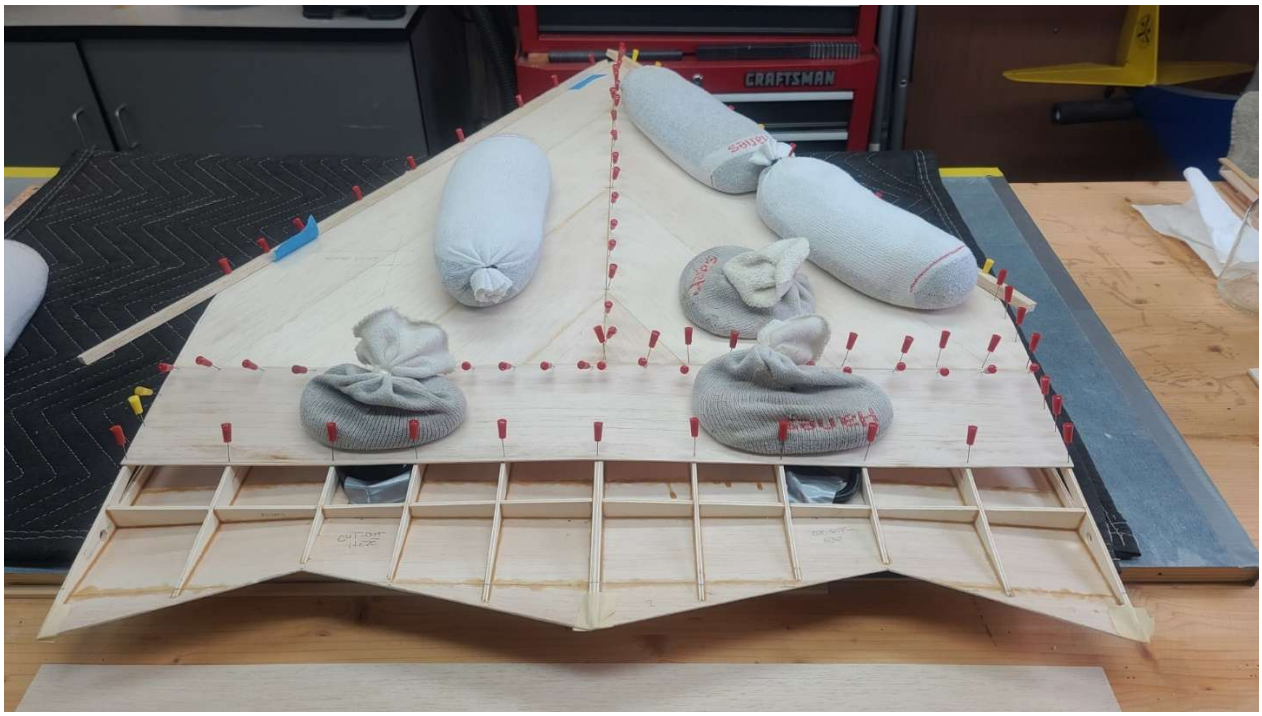
The next image below shows both motor mounts in lay-up jigs after assembly using 30-minute epoxy. Note the larger notches I cut into the aft of the M-2 plywood panels. These are to allow for the installation of M4 locking nuts on the M4x50mm motor mounting bolts. I want to make sure the motors remain nice and secure to the firewalls.



Well, as you can see in the image below, I finally have both mid-wing and outboard-wing panels ready for top sheeting. All panels have 2mm vertical grain sheer webbing (WB-11 and WC-12) installed along the back side of the main spars, and the leading edge, main spar, and aft spars have all been hand planed and sanded to match the rib profiles. Next step is to top cover all these panels with 1.5mm balsa sheets.

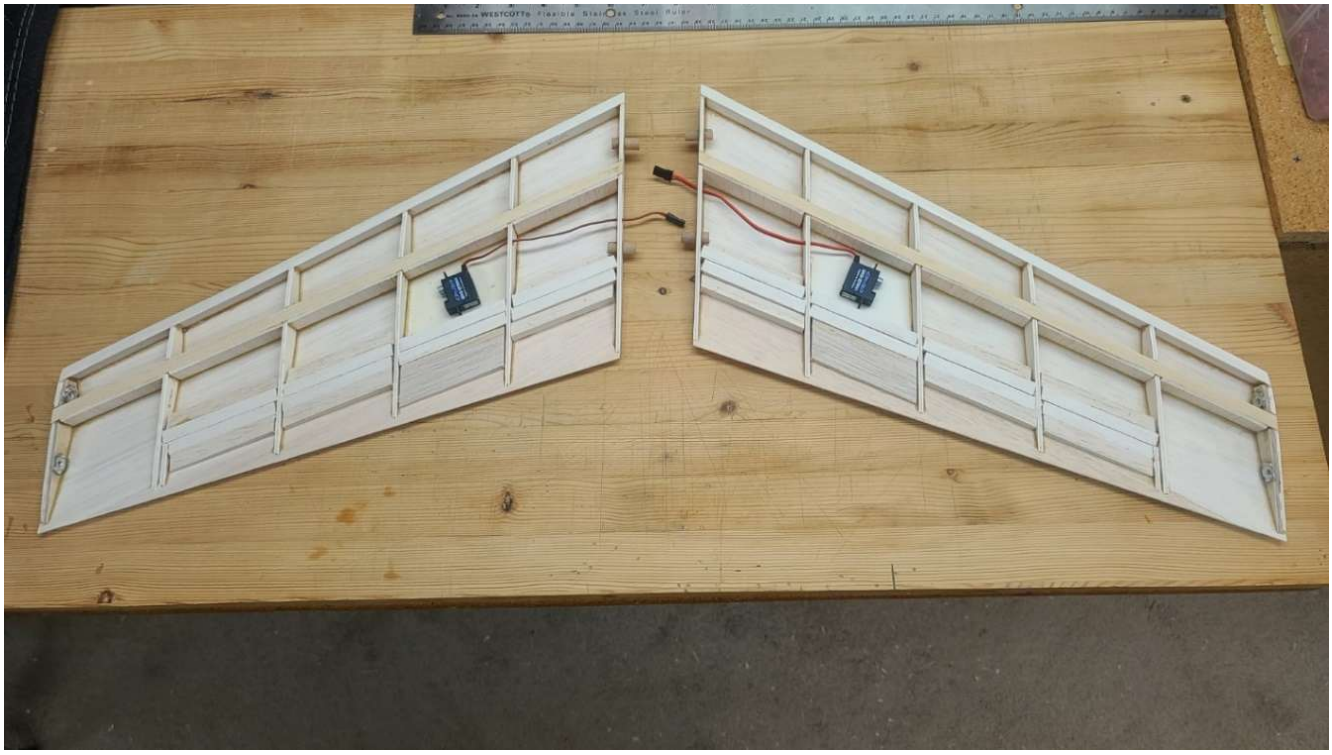
Having successfully completed a sub-system checkout of all the installed cables, I decided to go ahead and sheet the bottom side of the inboard-wing panels. I first joined four 1.5mm balsa sheets together with a stagger of 135mm between each panel at the ends. This allows me to get both forward panels sheeted from just four balsa sheets. I started with one side, and once the glue had set, I took measurements for the position of the MLG retract hardwood mounts off the uncovered side, then drew their location on the first covered side to aid in cutting out the retract opening in the bottom sheeting.

The image below shows my current progress on sheeting the bottom of the inboard-wing panels. The aft portion of the panels can be sheeted using single 1.5mm balsa sheets. Remember that the panel surface slopes inward toward ribs WA-3 and WA-4, so start your pinning with those ribs and work outward.

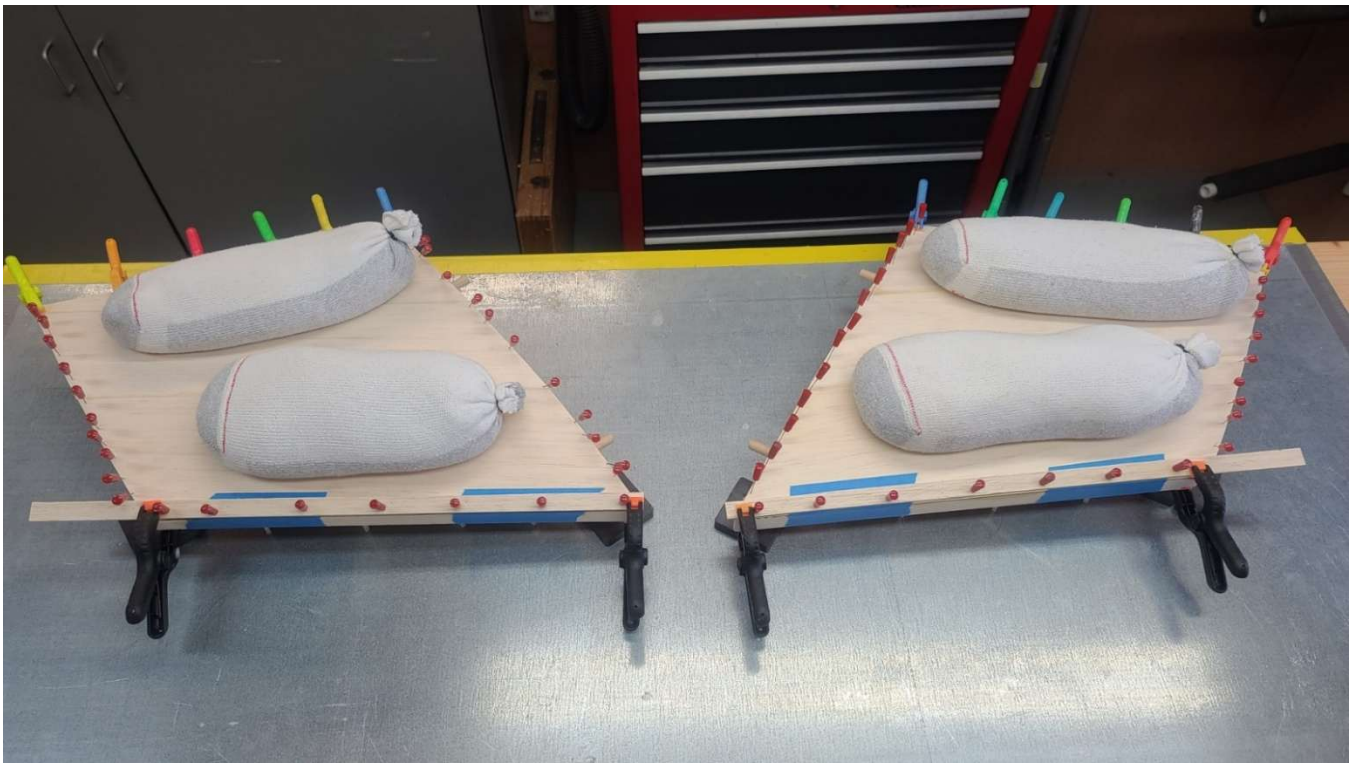


So, how about we move on to getting the rest of the wing panels sheeted. Shown below are both outboard-wing panels on the mag board with the 1.5mm balsa sheeting just glued and pinned in position. Each were covered using a single sheet cut to the required length and a scrap piece of 1.5mm balsa left over from the front wing sheeting. I also glued two WC-14 8mm hardwood dowels in the holes in WC-1 of each panel. These two dowels ensure proper alignment of the outboard and mid-wing panels when epoxied together. The panels will sit overnight to allow the glue to dry before moving on to the next step in the instruction manual.

With the top sheeting installed, I removed all the rib tabs; installed balsa fillers between the ribs for the aileron control horn (WC-13) and the three nylon hinges (WC-16); planed the leading edge; and then sanded everything until I had a nice flat surface across the bottom of the outboard-wing that matches the rib profiles. You can see all this completed in the image below, along with the aileron servo that will be mounted on the servo bay hatch.



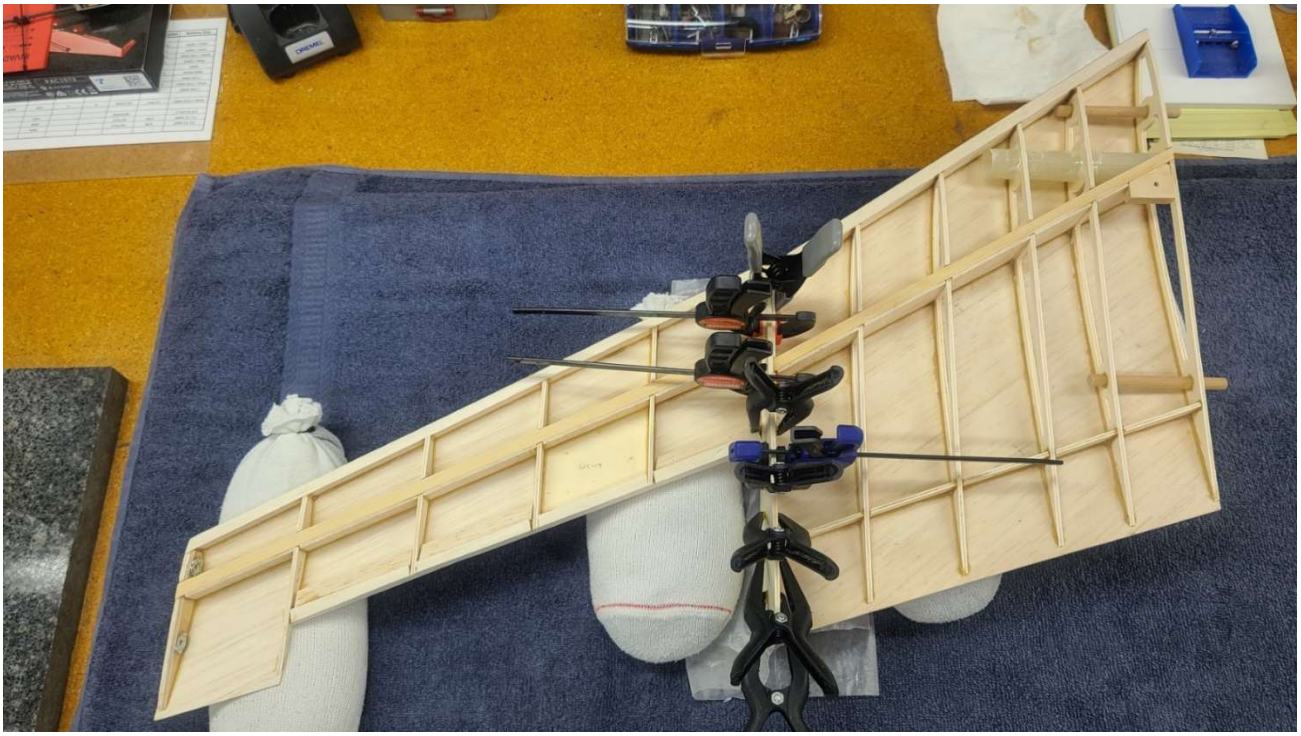
Next, I installed the top sheeting on both mid-wing panels. This was accomplished using one and a half sheets of 1.5mm balsa per panel, cut to the required length and angle, and glued together along their edges prior to sheeting. Just as with the other panels, I started at the leading edge and worked my way back across the curved top surface to pin the sheeting to the underlying rib and spar sub-structure.

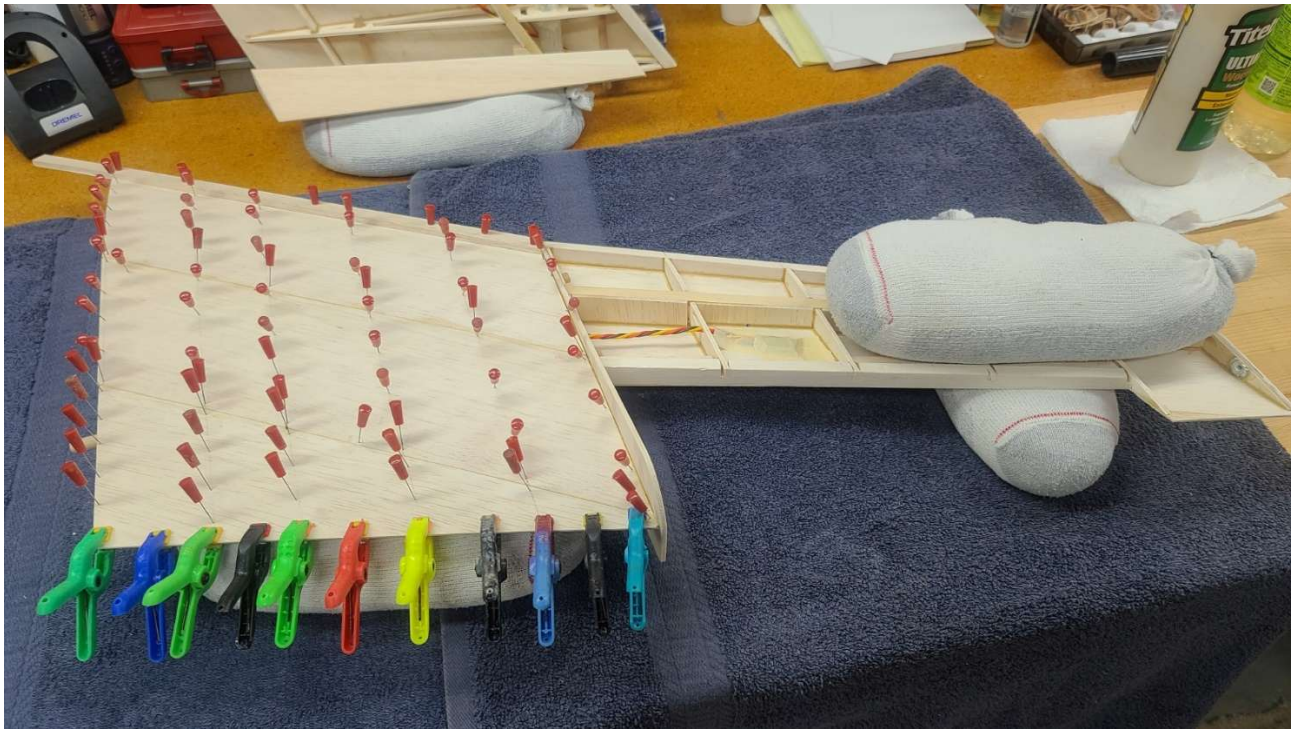


While waiting on the mid-wing sheeting to dry, I decided to install the motor mounts into the openings between ribs WA-3 and WA-4 in the inboard-wing using 30-minute epoxy.

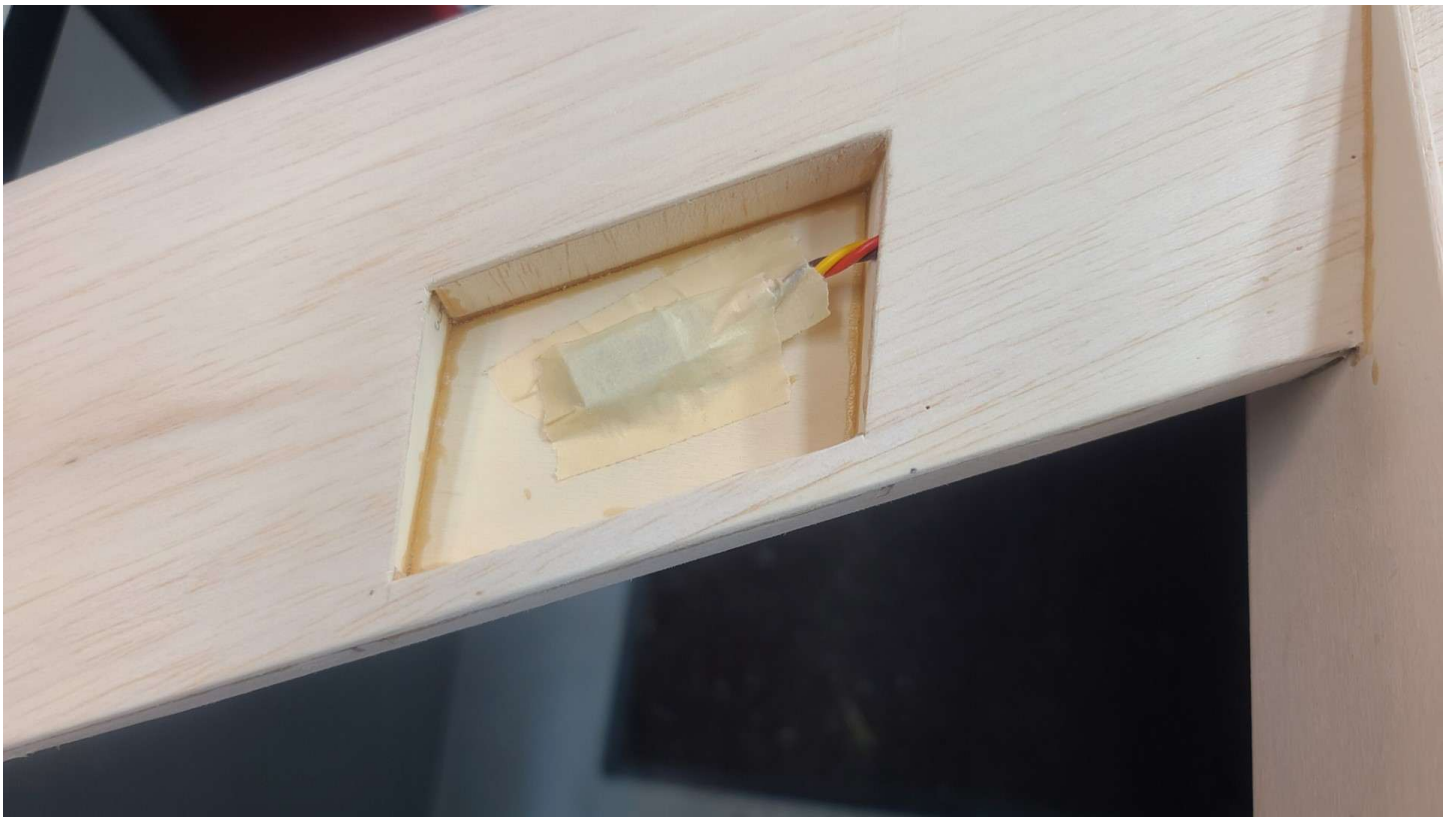
Once the mid-wing panels top sheeting had set overnight, I removed all the rib tabs; planed the leading edge; and then sanded everything until I had a nice flat surface across the bottom of the mid-wing that matches the rib profiles. I followed the advice that Saul provided in his Starship build video and sheeted the bottom of just the ailerons on both outboard-wing panels, and then cut the ailerons out before proceeding any further.

With the mid-wing and outboard-wing panels ready, I moved on to the next "major join." Shown below are the right-side wing panels epoxied and clamped together with WB-13 inserted between them. Now on to installation of the aileron servo extension cables and the sheeting of the panel bottoms as shown below.





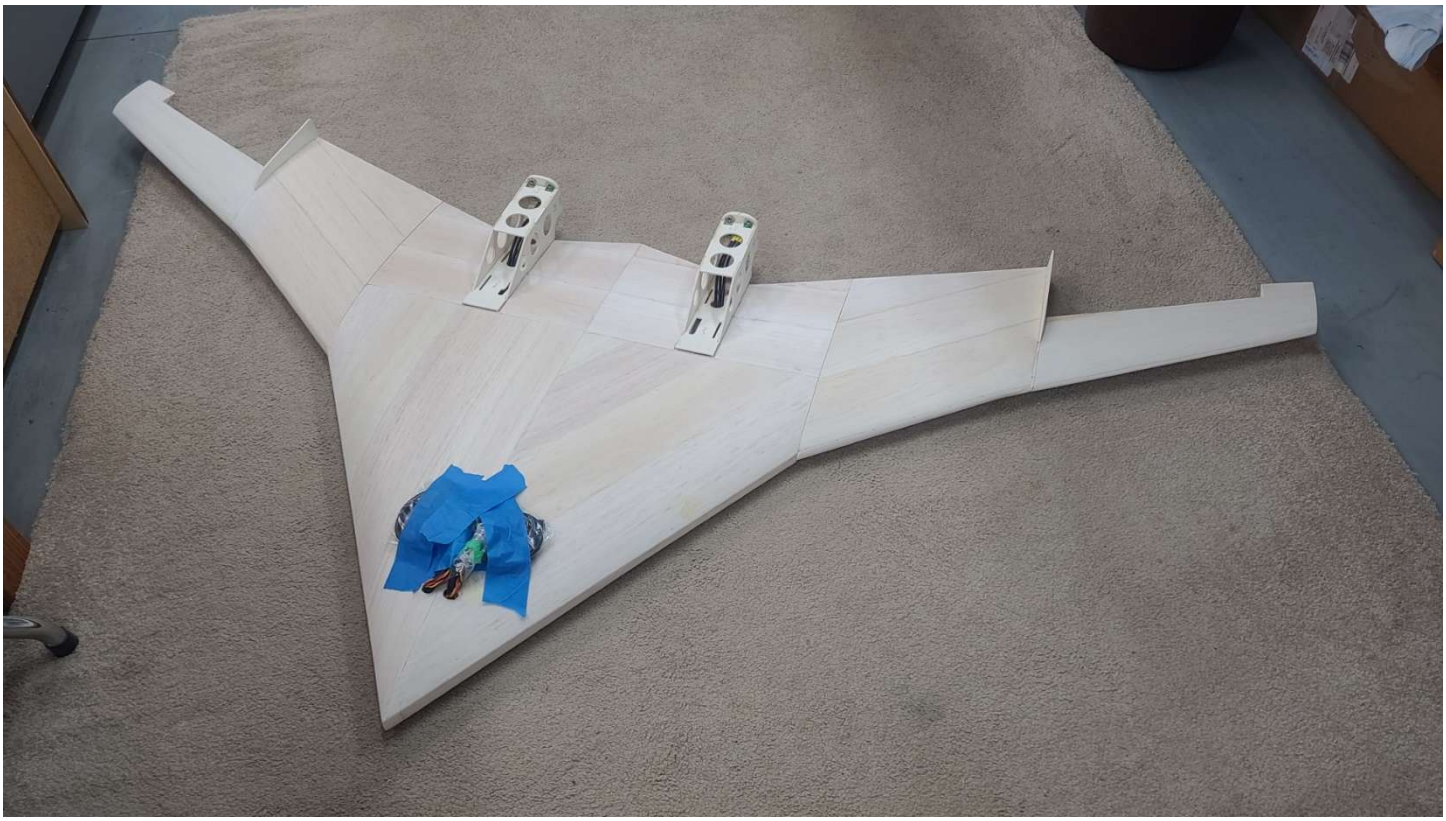
With all panels fully sheeted, I trimmed the sheeting flush with the ribs, rear spars, and leading edges. Then, as seen below, I cut-out the sheeting covering the aileron servo bays, and to make the wing mounts nice and flush to the sheeting I cut out the shape of the connection piece away from the sheeting.



Now for the leading edges. These will take you some time to properly shape because you do not want to remove too much material otherwise you will create an opening between the leading edge and the 1.5mm balsa sheeting. You will most likely have some slight mismatches between the panel surfaces and leading edges of the mid-wing and the outboard-wing panels at the transition point where WB-13 is mounted. But with some small balsa filler pieces, some Model Lite Balsa Filler, and some light sanding these can easily be addressed.

Builders Note – Remember the leading edges on the ailerons will need to be beveled to allow room for rotation. Just as shown for the elevators in the front wing on page 12 of the instruction manual, this bevel should be on the bottom side of the aileron. Do not make the mistake I did on my left aileron and bevel the leading edge in the wrong direction. I had to scratch build a new left aileron.

The image below is the entire Main wing, *finally*. I still have leading edge shaping to finish on the inboard-wing before it can be mounted to the fuselage. This beast is coming together real nice and without the winglets installed she spans just under 2030 mm (80 inches).



How about we now move on to the fuselage. First thing I did was remove all the required fuselage pieces from the large Lite ply and balsa sheets and lightly sand all the edges and cut-outs to make assembly go easier. I then went through the assembly manual parts list to check off I had everything needed. The next two images show the ***long*** two-part fuselage base plate, all the various upper/lower fuselage formers, balsa wing saddles, a drop-down vertical tail, 6x6mm balsa stringers, and 1.5mm balsa sheeting.

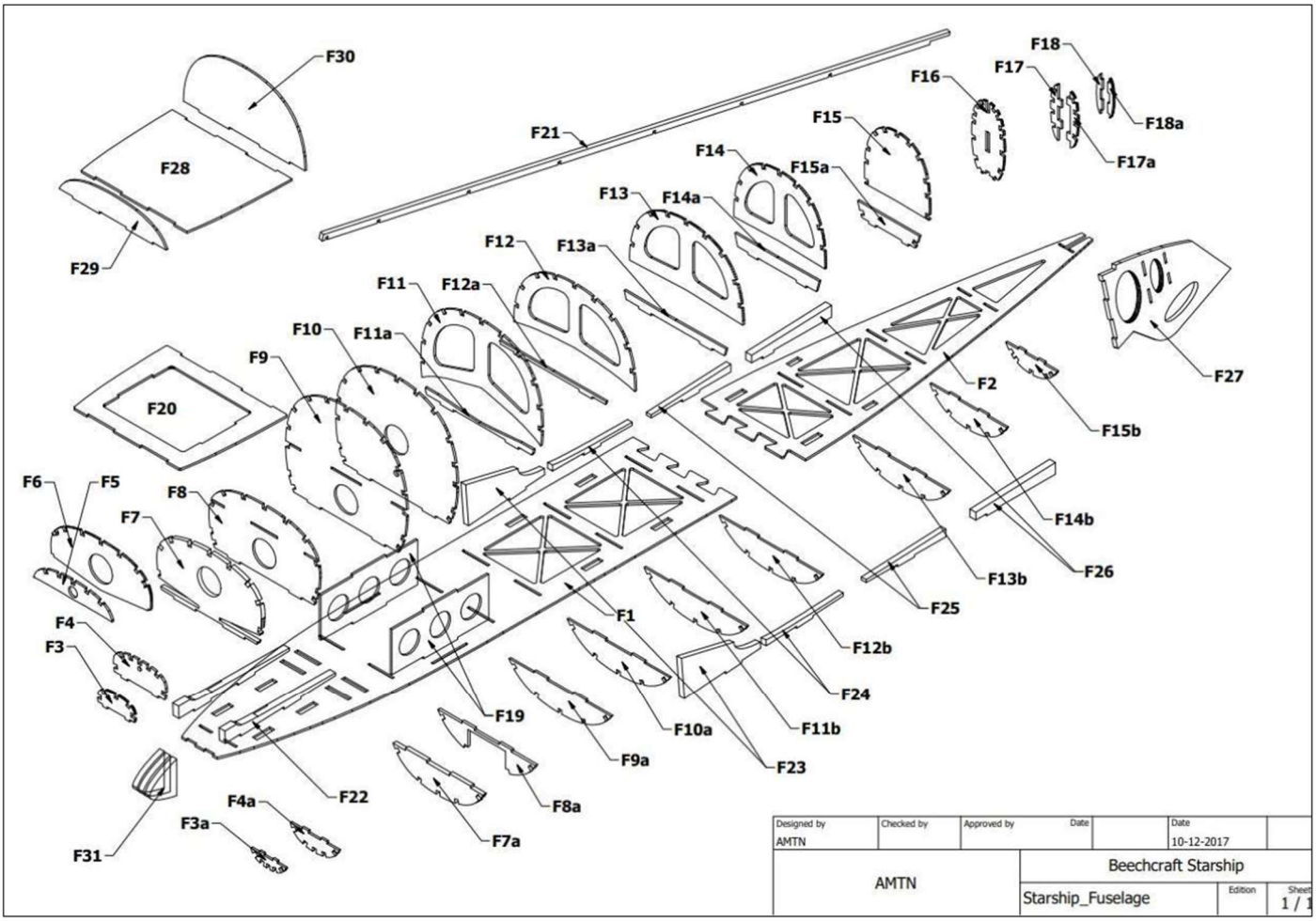


Image Source: A .png extraction from AMTN Instruction Manual.

Before we start the upper fuselage build, there are a couple things that need to be reviewed and some modifications made to a couple parts. As discussed earlier on pages 19 and 20, we decided to place the batteries and ESCs in the bay area between formers F8 and F9. Doing this requires that we use the small bay area between fuselage formers F9a and F10a to mount the receiver, and the small remote receiver unit can be placed in the forward part of the nose landing gear (NLG) bay between F7a and F8a. Therefore, we need to put some cable routing holes in F1 and F9a and make photocopies of F9a and F10a to use as templates to make the receiver bay access hatch when we get to the lower fuselage build. I also decided to make an access hole (like that in F11) in the upper part of former F9 to aid in having access to the bay area between F9 and F10 for routing the various cables down through F1 to the receiver bay. To maintain structural strength when making the new routing/access holes, I will add some 1/32-inch plywood doublers to the modified area of fuselage base plate F1 and the backside of former F9.

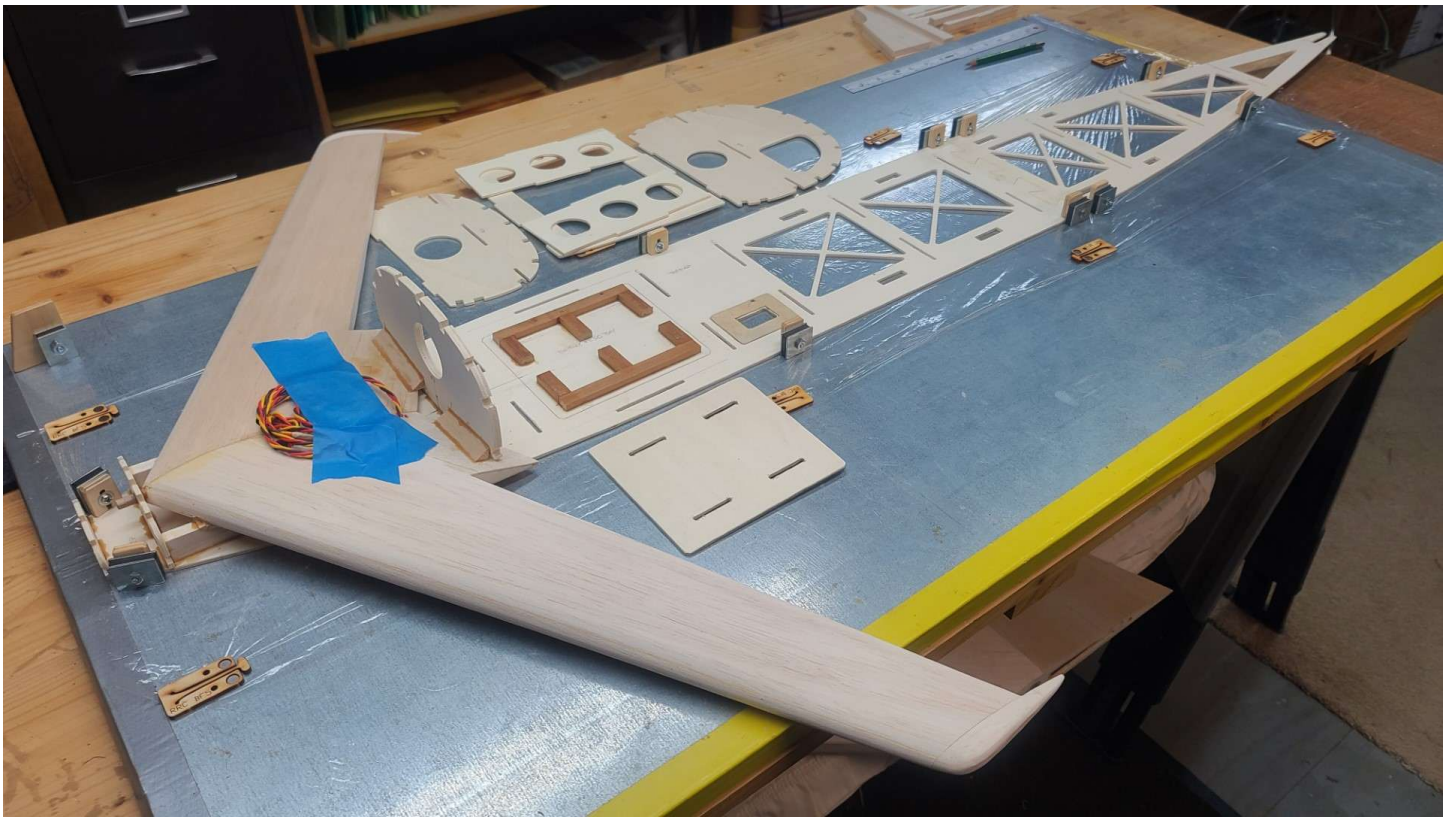
Placing the batteries in the forward fuselage also requires a removable elevated floor in the bay area between formers F8 and F9 to pass elevator cables through the bay under the batteries, and to allow for the installation of the battery tie-down straps. All this design and build work will need to be accomplished during the upper fuselage build. So, with all that said we can now get started.

With the fuselage base plates F1 and F2 glued together and solidly attached to the magnetic building board, I started the upper fuselage build. Former F4 and the forward wing (canard) saddles F22 are the first three parts glued to F1. I then took the canard and dry mounted it using F7 to check the fit against the

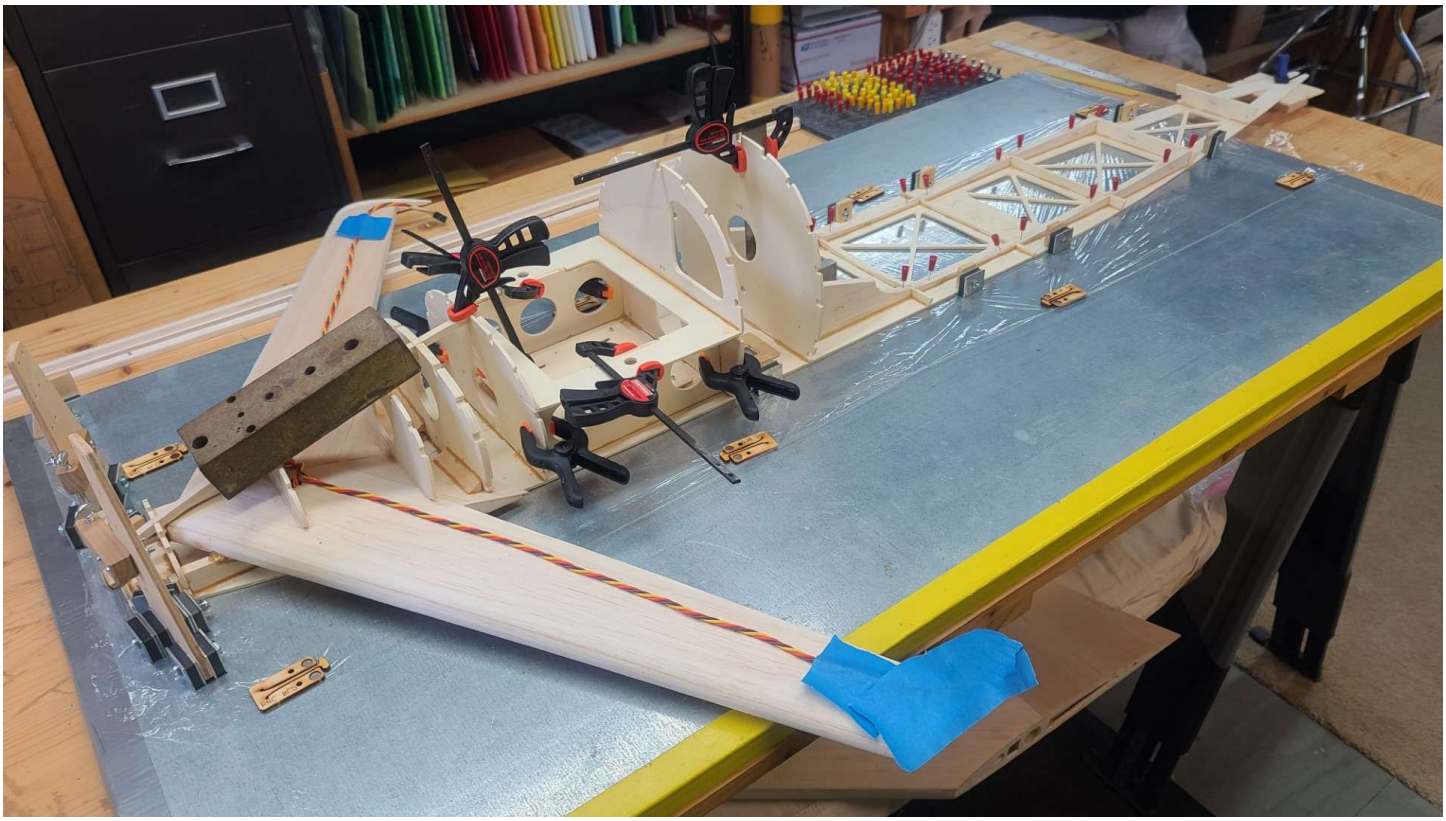
saddles. Some soft balsa filler and sanding of the saddles was needed for a good fit. The canard was then glued to the saddles along with former F7. I also added some balsa triangle along the canard/F7 joint. Make sure the canard centerline is aligned with the center of F7 and that all formers are perpendicular to F1. Former F3 was then glued to F1.

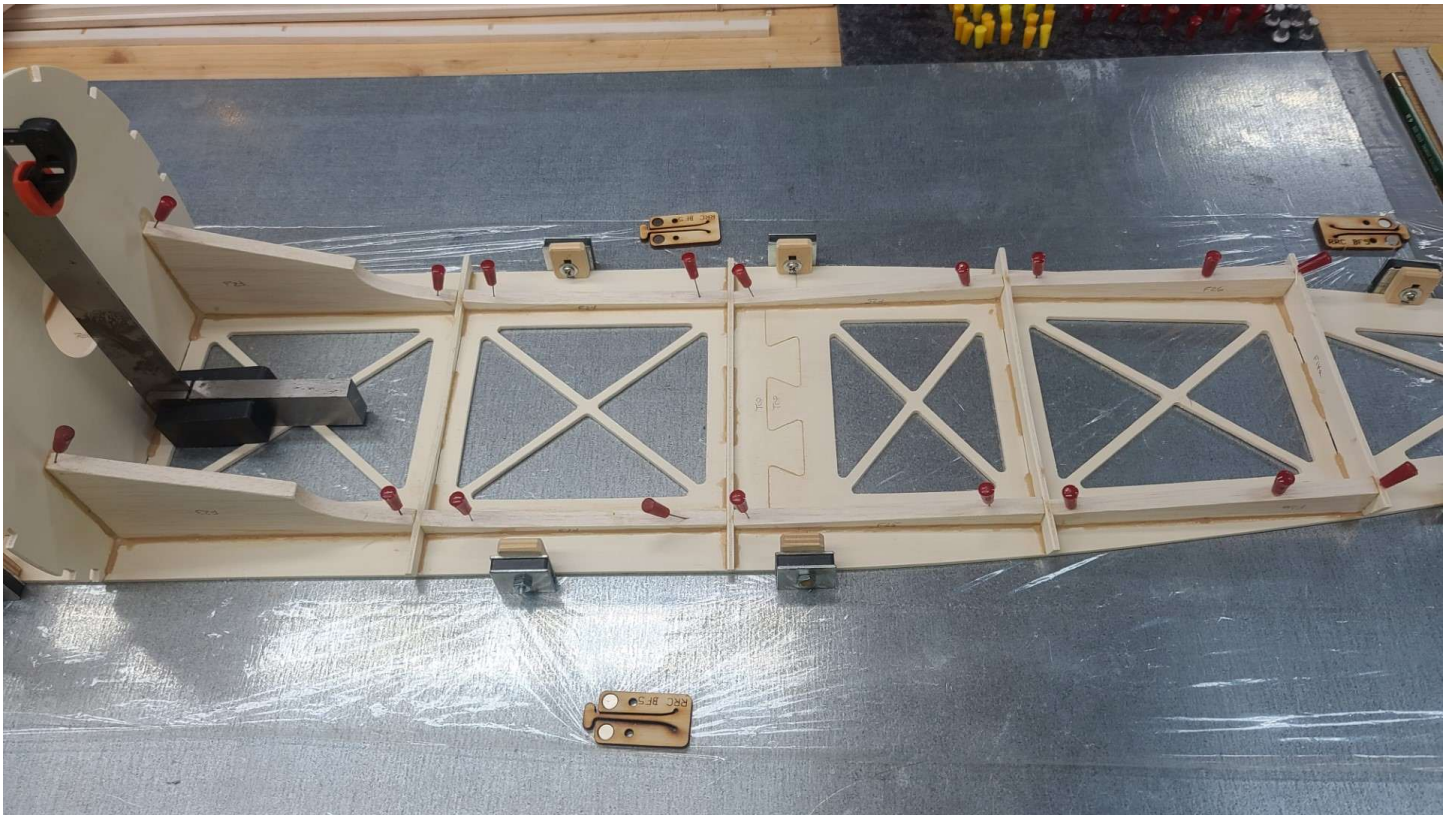
Builders Note – Before you glue the canard to the saddles, I would highly recommend you do two things first. 1) Install the elevator servo extension leads. 2) Cut out the elevator hinge slots. It is much easier to work with the canard for cutting out the hinge slots while it is separated from the fuselage.

The image below shows this stage of the build along with the modifications I made to F1 for the control cables pass-thru between F9 and F10, the access hole in F9, and the removable elevated floor in the battery bay area between formers F8 and F9. The removable elevated floor standoffs are the dark hardwood pieces and the slots in the removable floor are for the battery tie-down straps.

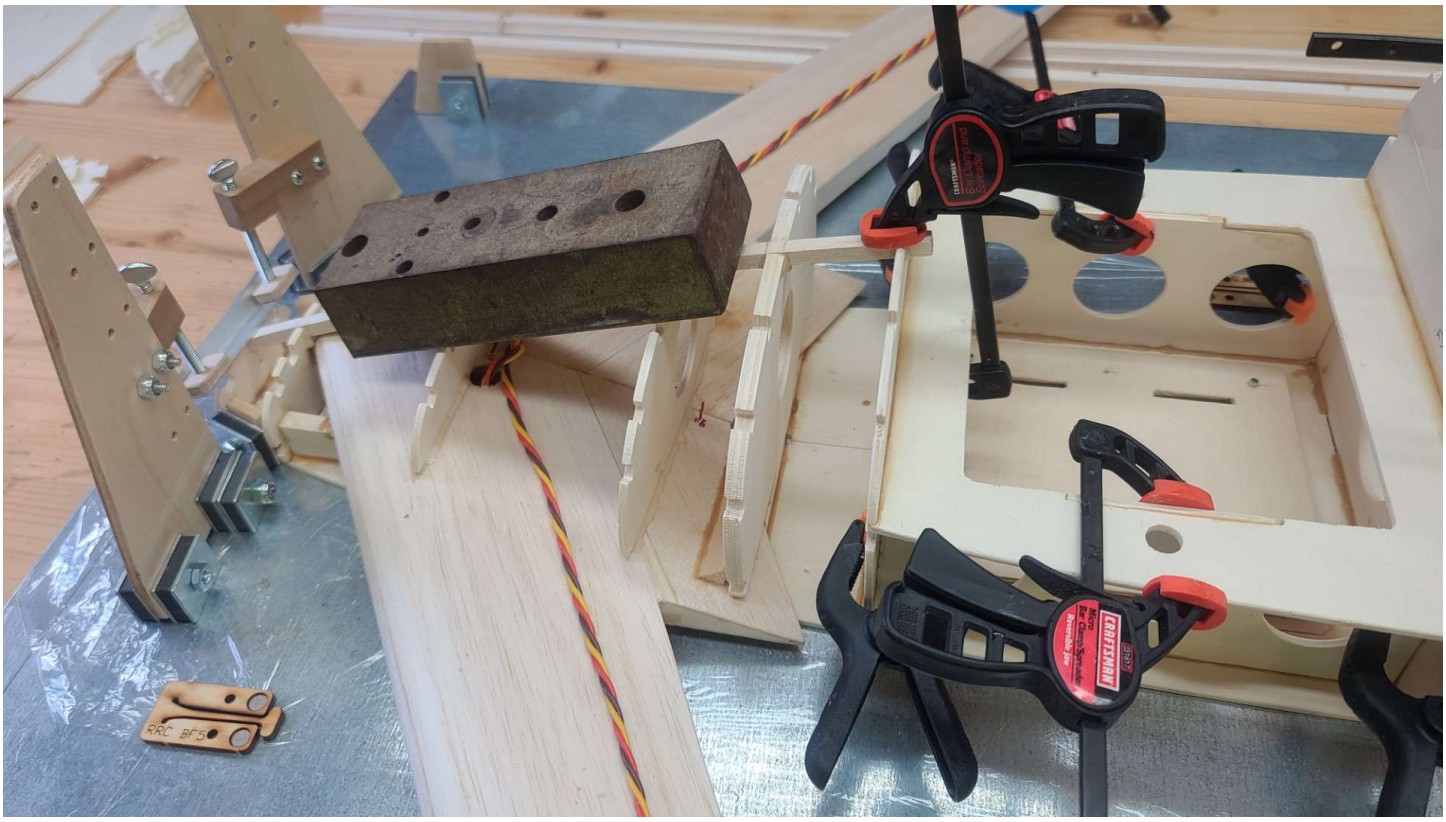


Making good progress on the upper fuselage build. The AMTN kit is outstanding, even for an old scratch builder. Started out today with putting the battery bay elevated floor in, and then assembled the large bay area below the canopy using F8, F9, two F19s, and F20. With that all clamped together I next moved on with putting former F10 in place followed by the installation of all the Main wing bearers and soft balsa saddles. You can see all this in the two images below.





Following the instruction manual (yes, I know that is hard to believe) I started the upper nose build with installation of formers F5 and F6 on the top of the canard in the positions called out in the manual. Everything was aligned to the centerline using the 6x6mm balsa stringer along the top from F3 - F8. In the image below you can see all the clamping and the steel weight required to hold everything in place as the Titebond III Ultimate wood glue dries overnight.

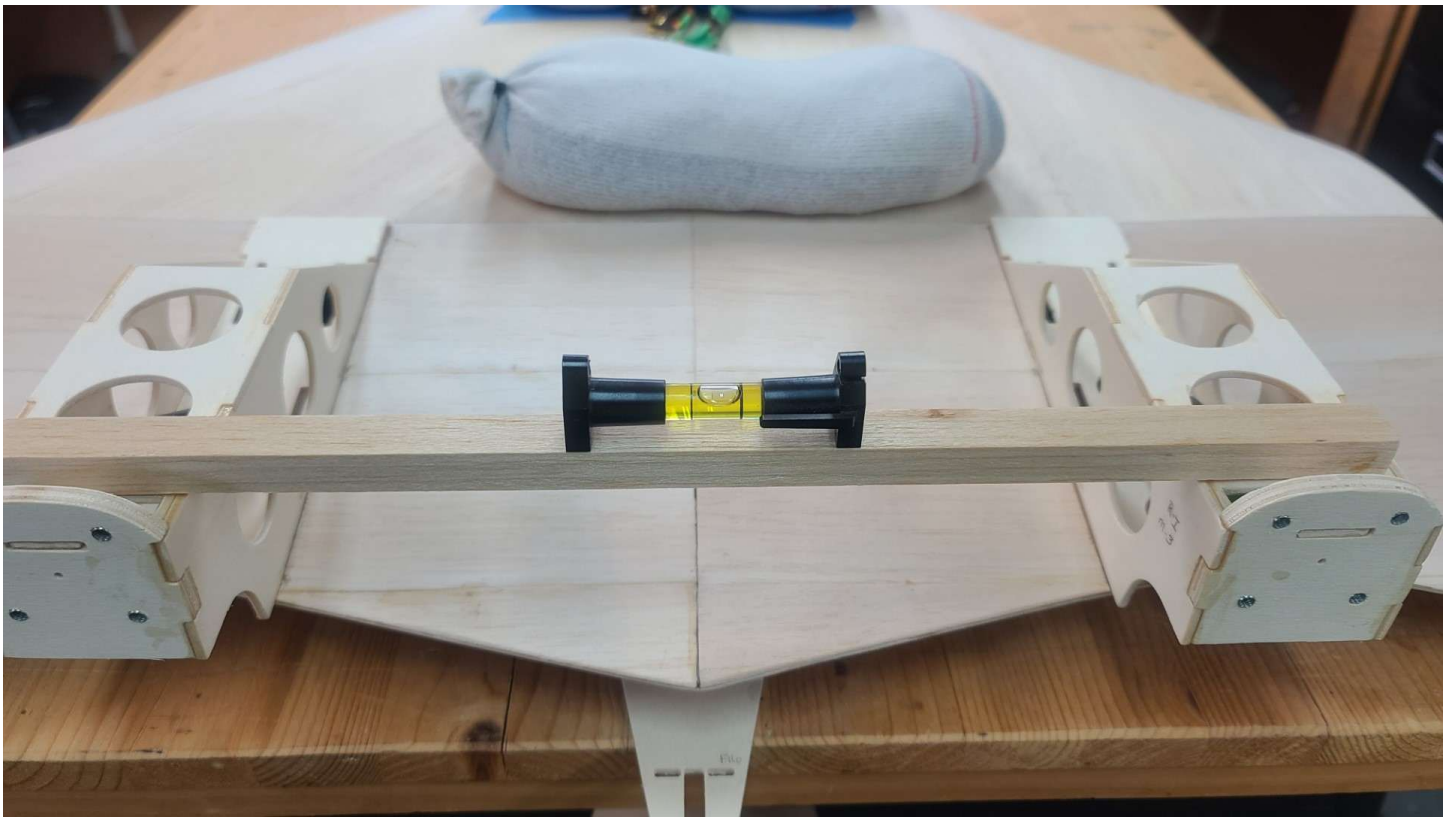


In preparation for the next "major join", I had to move the build off my magnetic build board because things would no longer fit. I checked the level of my building table, and adjusted as required, so I would have a good reference surface to check the Main wing installation into the fuselage. I also took measurements for the positions of all the Main wing bearers and soft balsa saddles relative to the centerline and F10, and transferred those to the bottom surface of the Main wing so I would know where to apply the 30-minute epoxy/micro balloon mixture.

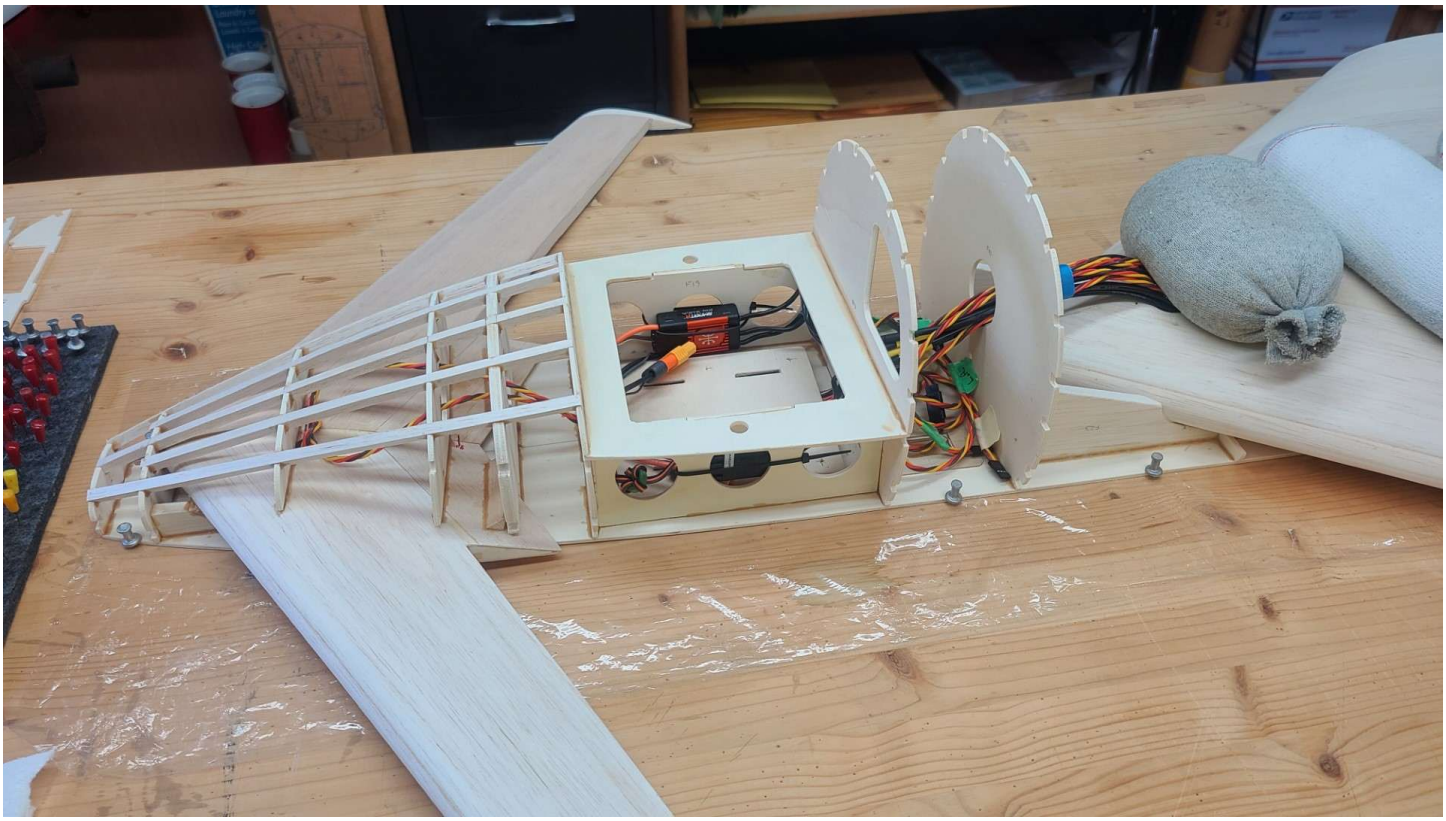
Builders Note – I would recommend you mark the location of the center-of-gravity (CG) on the wing bottom surface, which is 380mm aft of the leading edge at the nose of the Main wing, and transfer that out past the sides of the fuselage so you can later mark the CG location when covering the wing.

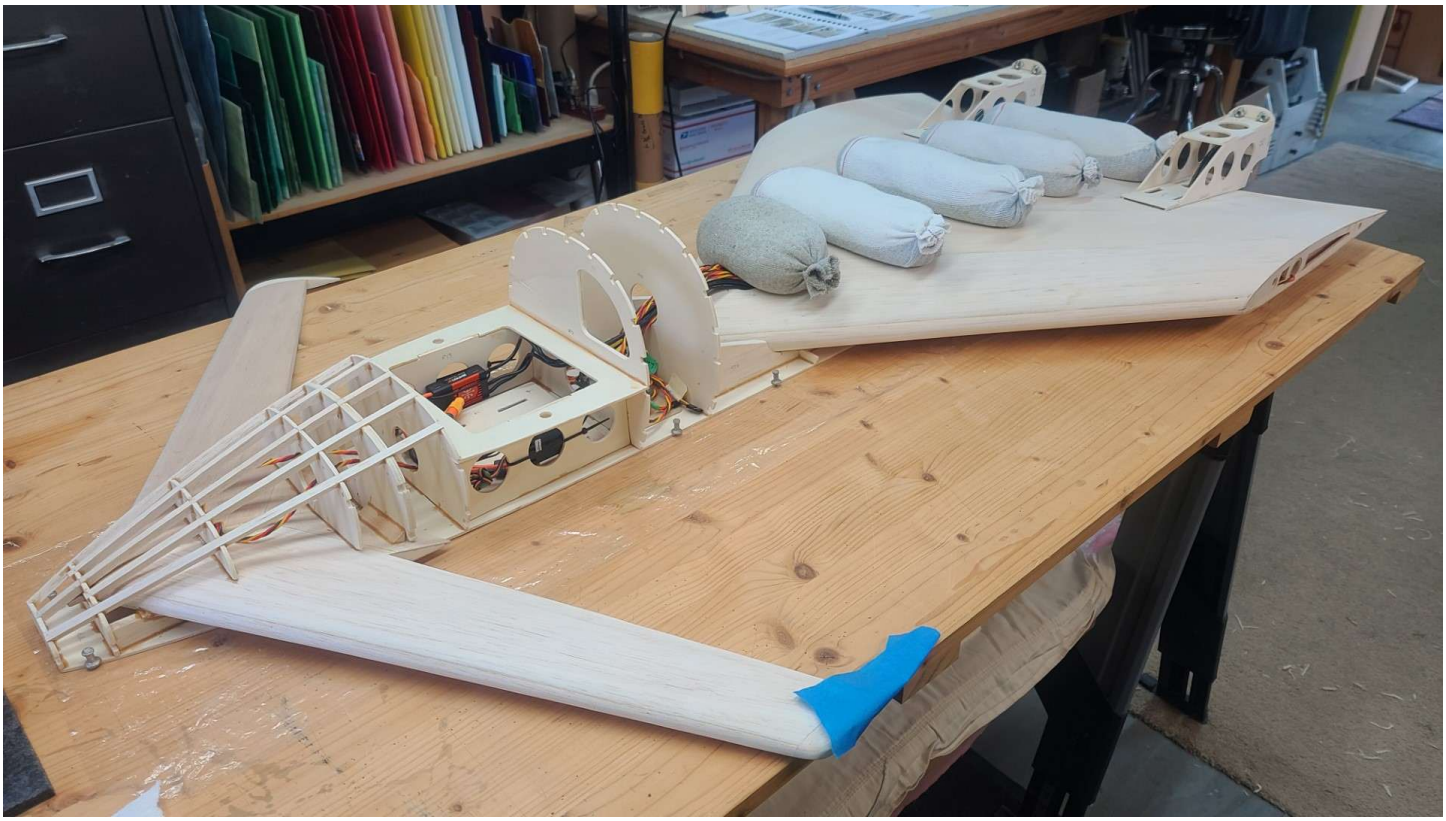
The next image below shows these various measurements drawn on the bottom surface of the wing along with the MLG retracts cut-outs.

The instruction manual states the Main wing is mounted to the fuselage at a zero-degree angle-of-incidence. To check this, I ran a balsa stick along the side of ribs WA-6 parallel to the zero-degree angle-of-attack chord line, and then put a small level on the stick. There were some minor adjustments to the wing saddles required. The next two images show the final checks for a zero-degree angle-of-incidence, and the overall horizontal level of the Main wing.



With that verified, the Main wing was epoxied to the wing bearers and soft balsa saddles. I then glued the other 6x6mm balsa stringers to formers F3 - F8, and mounted the ESCs to each side of the battery bay walls on F19's using cable ties. The next two images show the progress of the build at this stage.



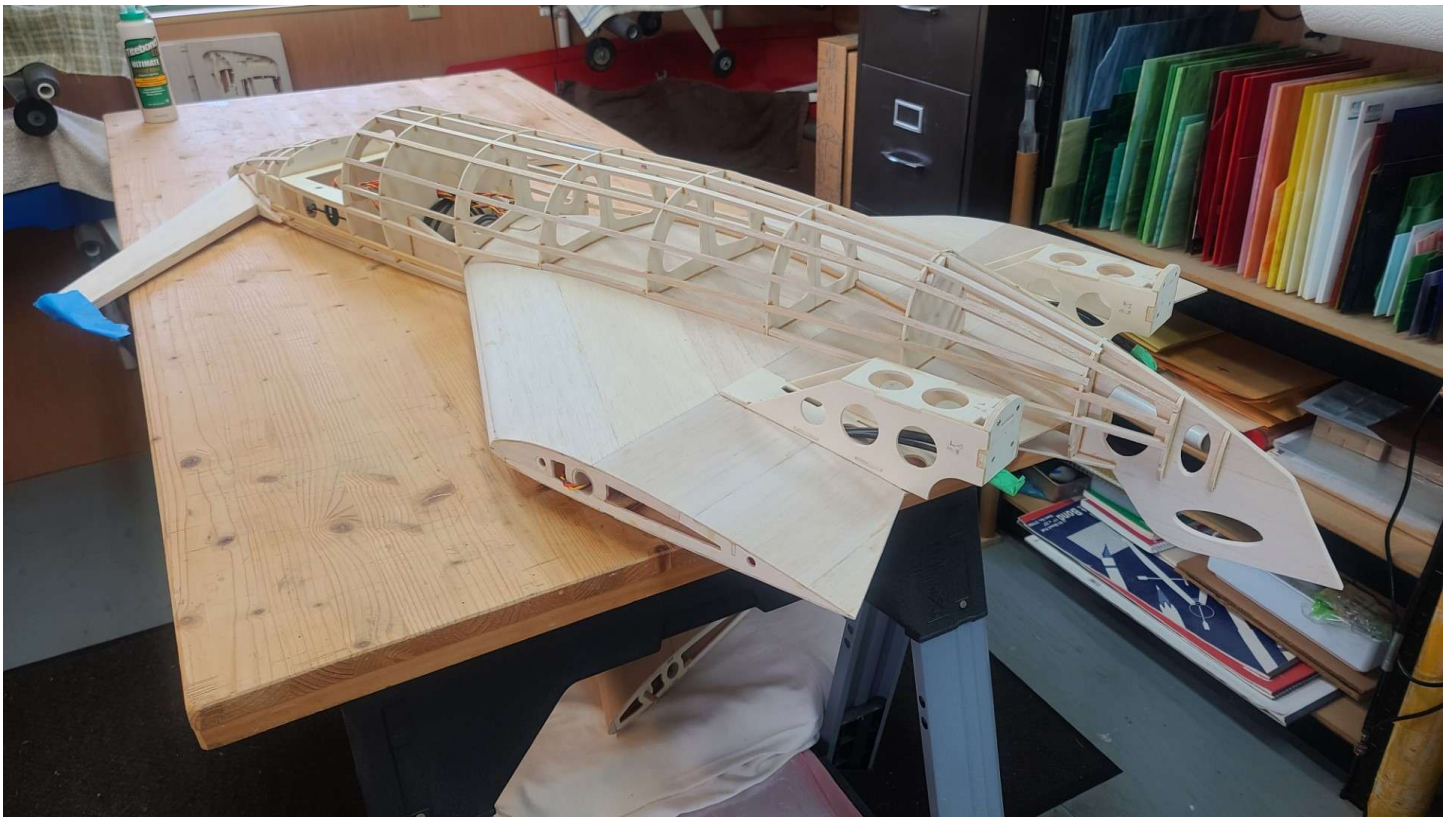


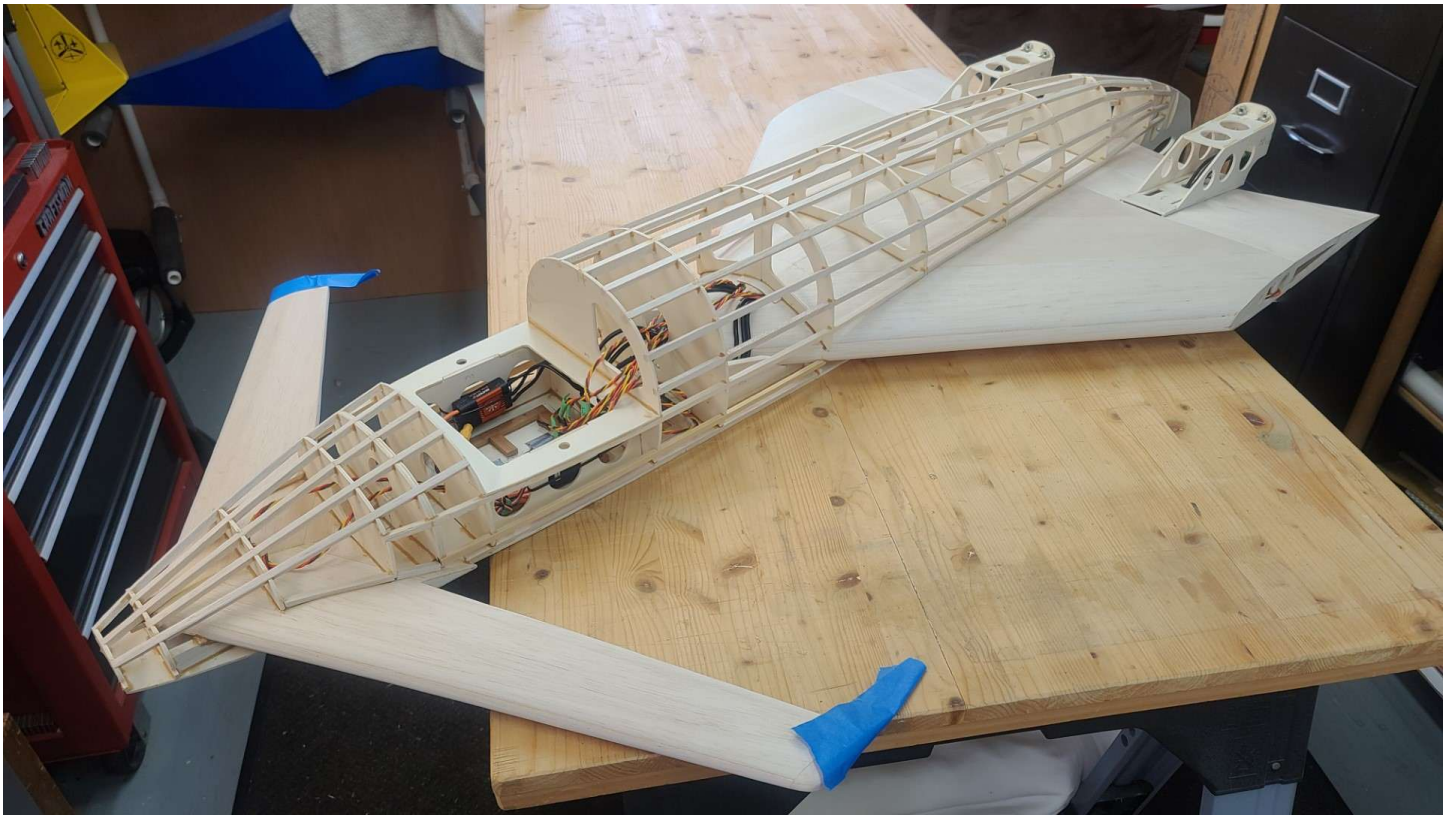
Well, as of today I am two months into this build, I have learned a lot, and made some mistakes along the way. To reinforce the structure between the canard and Main wing the instruction manual has you glue an 8x4mm pine wood spar on formers F7 - F11a. Next, I moved on to the build of the topside of the fuselage with the installation of fuselage formers F11 - F15 along the top of the Main wing. The spacing between each former is established by the notches in a pre-cut *long* 8x6mm balsa stringer F21 *(incorrectly labeled as F20 on page 6 in the manual)* which runs from F9 all the way aft to F16 and is also used to center all formers on the wing.

Builders Notes – 1) To ensure all fuselage formers are perpendicular to the wing and parallel to each other transfer the measurement between each former notch in F21 to the top of the wing at the centerline and at the outer ends of each former. 2) Also, the bottom of each former needs to match the top curvature of the wing. I had to adjust formers F11 – F14. You can easily transfer the wing top surface curve to a former using a closed drawing compass, and then use a small drum sander to adjust the former to match the line drawn.

I assembled the vertical tail F27 by gluing parts F16, F17, F17a, F18, and F18a in their assigned cut-outs. Once this was dry, I mounted the vertical tail assembly to the aft of fuselage base plate F2 and stringer F21. Next, I glued 6x6mm balsa stringers into formers F6 - F12, and along the bottom side of F20 on each side.

I continued by glued 6x6mm balsa stringers into the notches in formers F9 - F17. Four of the stringers will need to be spliced to extend them by 80mm so they are able to run from F9 all the way aft to F17. Follow the AMTN drawings provided to clearly understand which stringer goes into which notch in each former. Finally, I glued 6x6mm balsa stringers on top of the Main wing between formers F12 - F13 and F13 - F14, along the fuselage side in formers F8 – F11a, and on top of the canard between formers F5 - F6. The results of all this assembly can be seen in the two images below. The next step is to start sheeting the fuselage with 1.5mm balsa sheets.

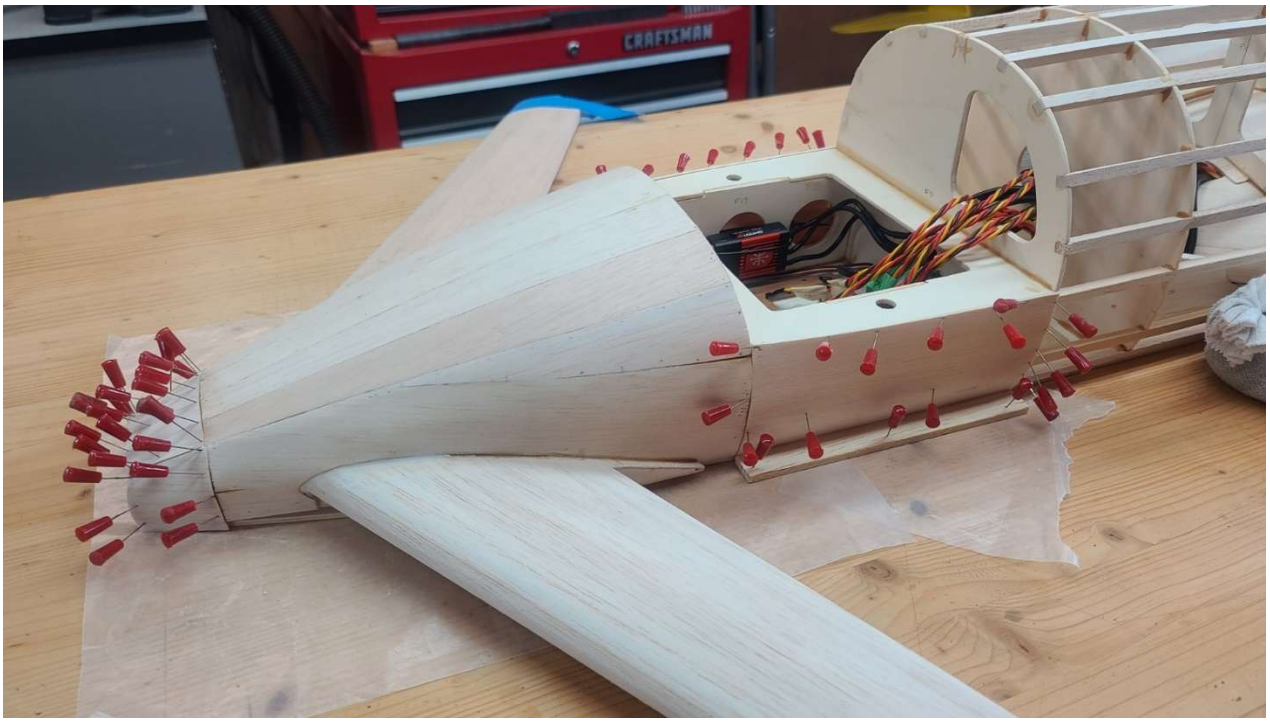




The Quality Control (QC) Inspector stopped by the workshop to examine the build. I think I passed his inspection.

I started the sheeting on the front fuselage along the bottom and worked my way up on each side. Using the large 3mm Lite ply sheet that had all the canard ribs, I selected S3 to use as a template to cut-out the canard profile in a piece of 1.5mm balsa sheeting and then cut the sheeting to fit from former F4 back to F8. I trimmed the sheets such that the joints between sheeting pieces would fall in the center of a stringer wherever possible. Once I filled in all the pieces from F4 to F8 up to the center stringer, I then sheeted the nose from F3 to F4 with some smaller pieces. The area under the canard will be sheeted when I turn everything over to build the bottom fuselage. The large semi-flat fuselage sides between F8 and F9 were each covered using a single sheet of 1.5mm balsa cut to fit from F1 up to the top of F20.

All this can be seen in the image below. It turned out fairly well, will require some balsa filler and lots of sanding, but all that will be done once I have all of the fuselage sheeted. Next is to start at the bottom again and work my way up to sheet the aft fuselage from F9 all the way back to F17.



Again, using the large 3mm Lite ply sheet that had all the Main wing ribs, I selected WA-3 to use as a template to cut-out the Main wing profile in a sheet of 1.5mm balsa and then cut the sheeting to fit from former F11 back to F14, and from the top of the wing up to the first stringer. I then measured and cut sheeting pieces to fit from the center of a stinger up to the center of the next string, and running from F9 back to various formers such that the joints between the ends of sheeting pieces did not all fall along the same former. Like as you would do when installing wooded flooring boards. I used a mixture of water and isopropyl alcohol to spray the balsa sheeting that needs to bend over any curved sections. The sheeting goes really slow because of all the hand fitting of each piece to a given area on the upper fuselage, but it is coming out nice and should not need a lot of sanding to get the final curved surface needed. The next image shows the progress so far.

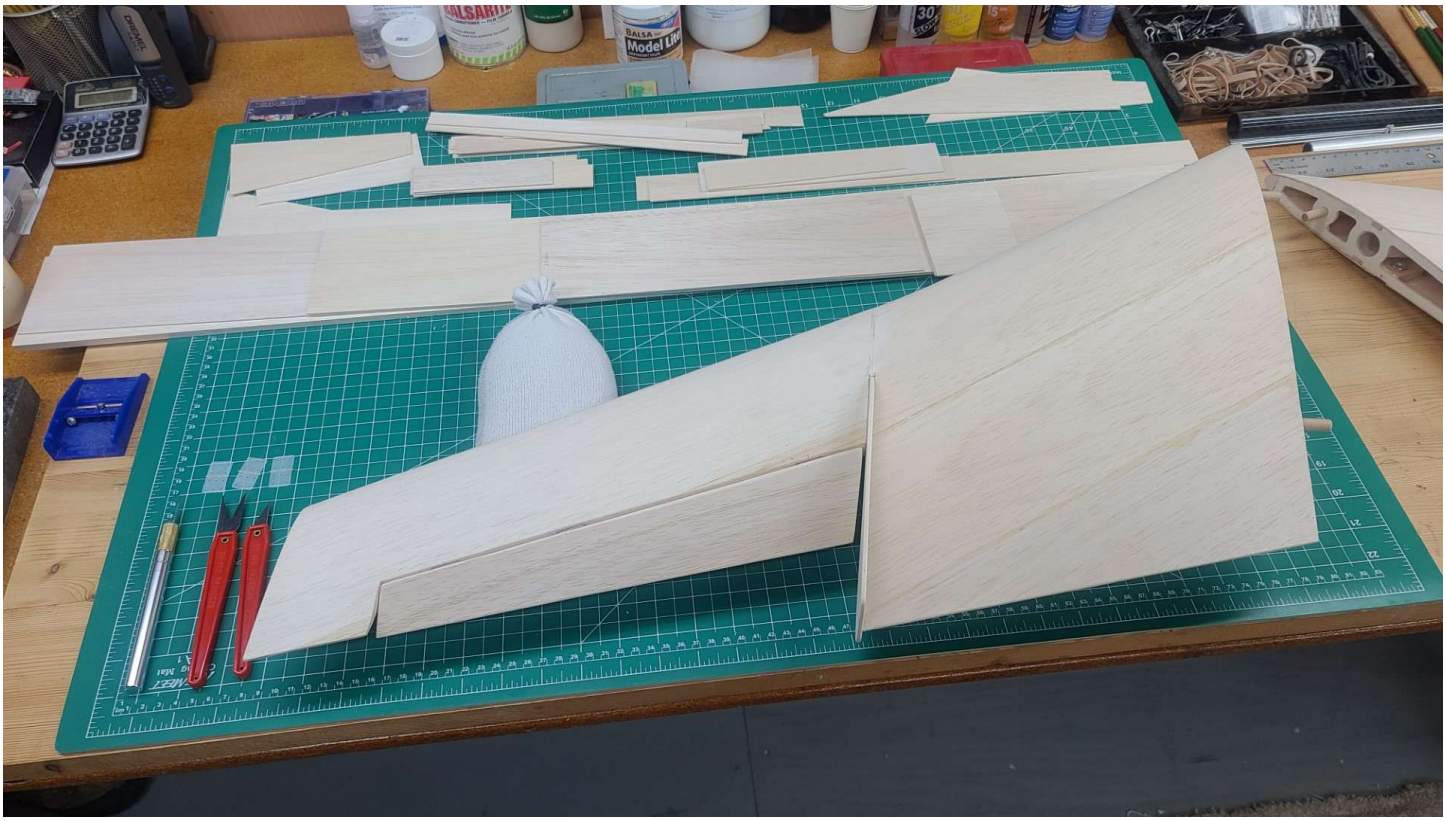
Well, after lots of cutting, fitting, gluing and pinning, the top fuselage is finally sheeted. The results are in the image above. Next step is to build the bottom fuselage, but before I can do that, I needed to make some Styrofoam cradles to place the fuselage in upside down. I used the 3mm Lite ply cut-outs for formers F9 and F10 as templates to cut the Styrofoam sheets.

With the model turned upside down and resting in the cradles I started the build of the bottom fuselage. First up was installation of all the bottom formers (F3a through F15b) into assigned slots in F1 and F2.

Builders Notes – 1) If you are going to put the LiPo motor batteries in the fuselage and move the receiver to the bottom side of the fuselage as we have, there are modifications needed to F8a, F9a and F10a. To place the remote receiver in the forward NLG bay, a 6mm hole is needed in F8a for the remote receiver lead pass thru. F9a needs a hole to pass the NLG retract, NLG steering servo, and the remote receiver leads through to the receiver bay between F9a and F10a. 2) Before gluing F9a and F10a to the fuselage base plate, use them as templates to make extra copies of each which will be needed for the receiver bay access hatch.

This next image below shows the bottom fuselage with all 6x6mm balsa stringers installed and ready for sheeting. If you take a close look, you will see some modifications I made to the original kit design. First, to mount the NLG retracts, I epoxied two pieces of 4.5mm 5-layer maple plywood to F1 between formers F7a and F8a. This will provide a solid mounting surface for the retract, allows room for the servo wires on the bottom of the retract base, and places the retract even with the fuselage bottom profile. Second, the receiver bay access hatch which you can see positioned between formers F9a and F10a. This will be held in place using small screws because I'm leery of putting hatch magnets that close to the receiver antenna. Finally, even though we are hoping to NOT add ballast to the nose of the model to obtain the correct C.G., I made new formers F5a, F5a-h, and F4a-h to create a ballast bay with access hatch near the nose of the model. This will be sheeted over, but if needed, the hatch can easily be removed by just cutting through the balsa sheeting and three stringers.

While waiting on the glue to dry after installing the bottom fuselage stringers, I cut and temporarily installed the hinges on both ailerons. Each aileron was beveled on the lower leading edge to allow clearance for the required rotation, and the three Du-Bro hinges were installed along the upper side of the wing surface.



As with the fuselage top, I started the fuselage bottom sheeting along the bottom and worked my way up on each side and started at the front and worked my way aft. I again used the large 3mm Lite ply sheets that had all the canard ribs and Main wing ribs and selected S3 to use as a template for the canard profile and WA-3 for the wing profile. The NLG Bay from F7a back to F9a does not get sheeted, but will be covered later with a NLG bay hatch. The spacing between the bottom stringers is wider than that on the top, so I split the distance in half for each sheeting piece and made small balsa strips that run along the underside of the joints between sheeting pieces to help hold the sheets even. This can be seen in the next image below. Lots of cutting and fitting to get each sheeting piece just right, so the bottom sheeting is going slow.

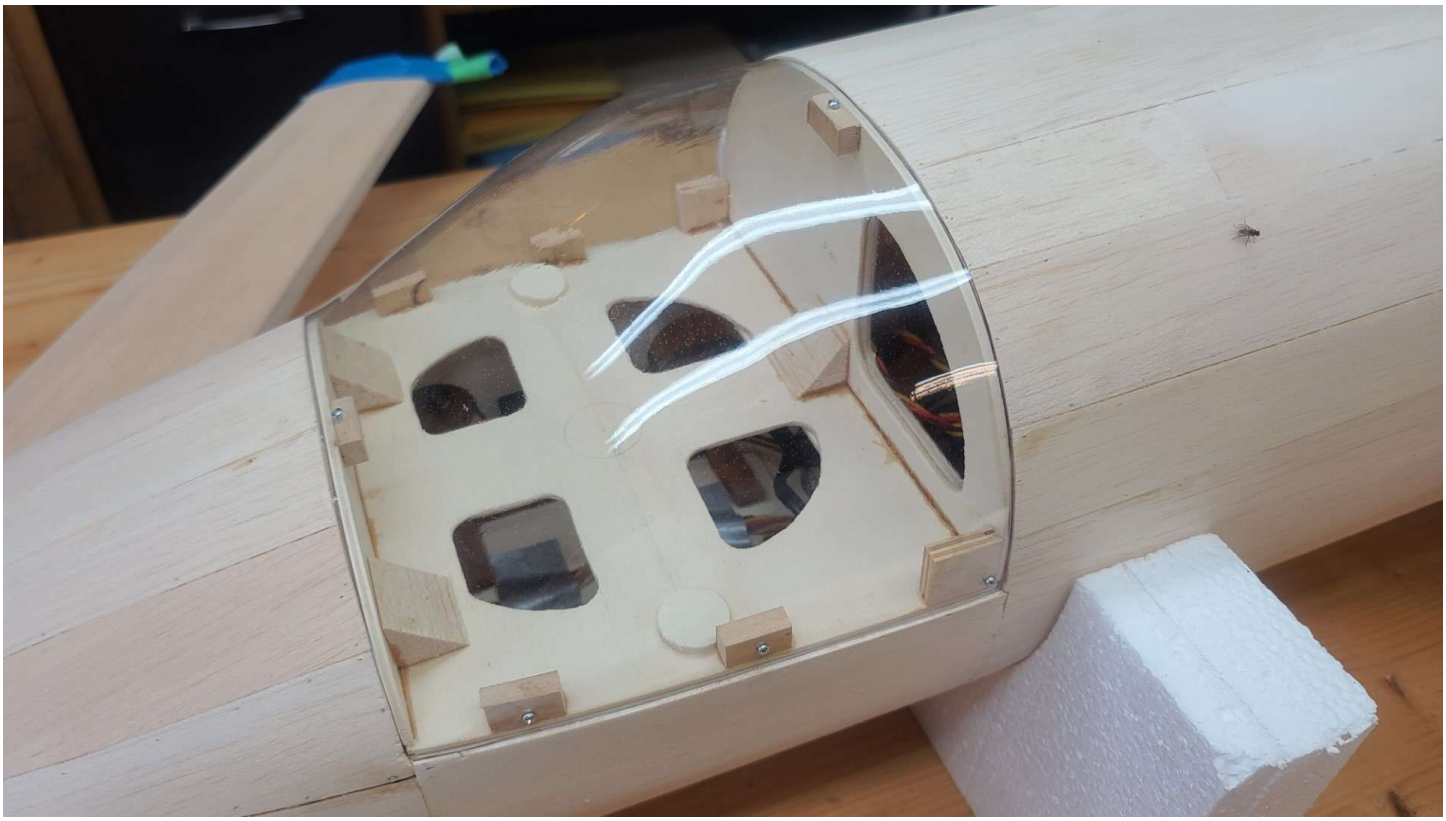
Before I sheeted over the nose ballast bay, I took the image below and measured the distance from the back side of former F7a (on the right of the image below) forward to the space between each of the ballast bay hatch formers so it would be easier to cut the hatch out if needed. The distance to the middle of formers F5a and F5a-h is 107mm. The distance to the middle of formers F4a and F4a-h is 170mm.

Well, I finally made it. ***All the fuselage sheeting is done!*** Next up is to make the nose cone from a balsa block and then use Deluxe Materials balsa filler and lots of sanding to smooth out the areas that need some work.

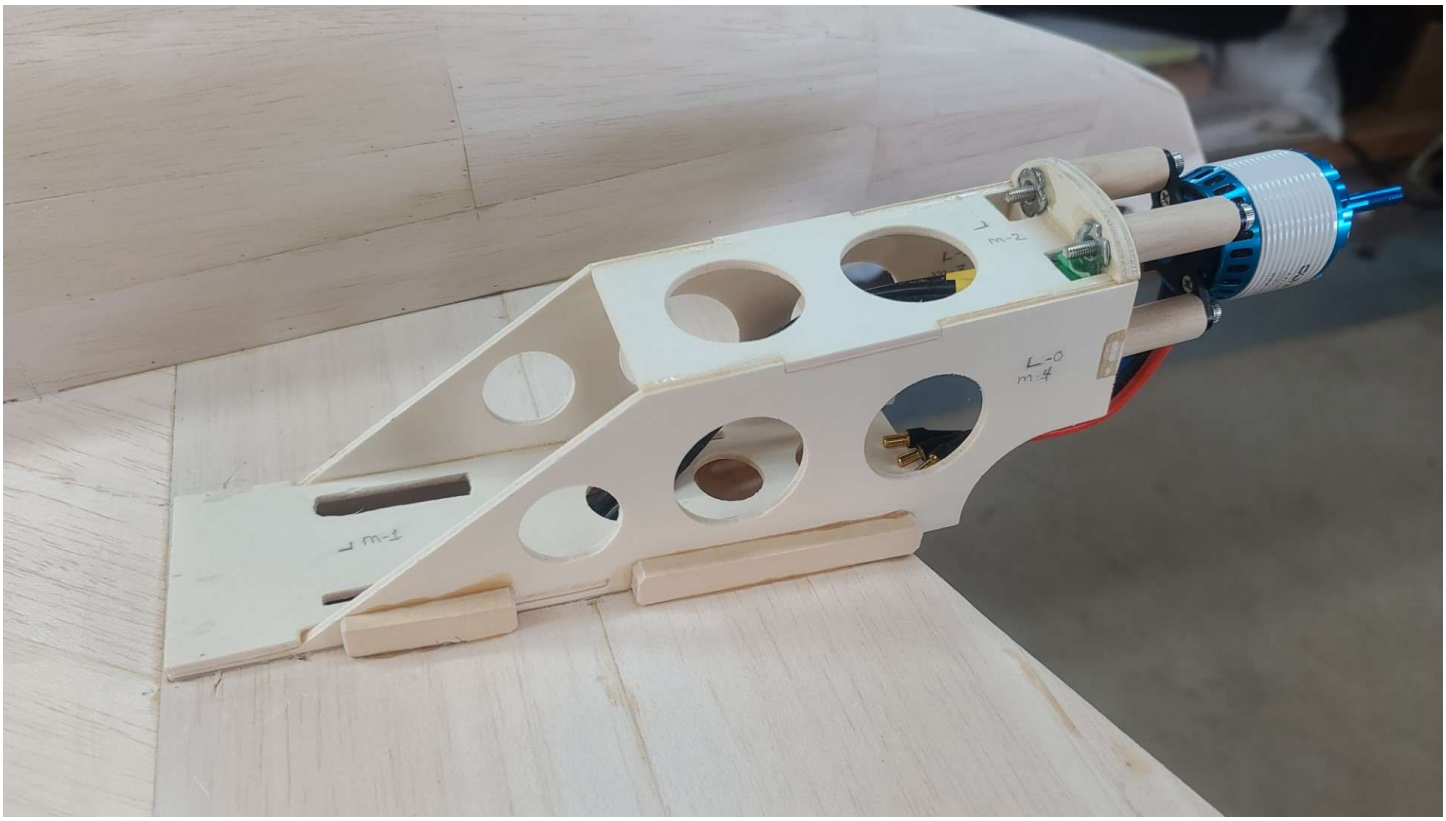
After some initial fuselage balsa filling and sanding, I decided to move on to some other items and will return to final filling and sanding later. The first couple items were the nose cone and vertical stabilizer fillers. I made the nose cone out of a solid block of balsa and cut it down to an approximate shape using my table bandsaw. I then glued it to the fuselage and continued to taper and shape to match the fuselage nose profile using a sanding block with 120 grit sandpaper. With some balsa filler and more sanding, I have what you can see in the next image below.

For the vertical stabilizer I used some of the 8mm balsa left over from F31. Pieces were cut to match the shape of the stab and then glued aft of former F18a and to the vertical stab F27. I then used my Dremel for initial shaping and finished up with some sandpaper.

Next came the cockpit and windshield. I modified the cockpit bottom plate F28 and the backside F30 to allow for airflow out of the battery bay to help cool the ESCs. I epoxied the hatch magnets in the holes provided, and after that had hardened, I assembled the cockpit 3mm Lite ply pieces in place in the opening of the fuselage. I also added some plywood corners and triangle stock to give the substructure some rigidity, and small hardwood blocks to attach the windshield using #1 wood screws. All of this will end up being painted to match the white Ultracoat covering, and cockpit window decals applied. The results as of today can be seen in the next image below.



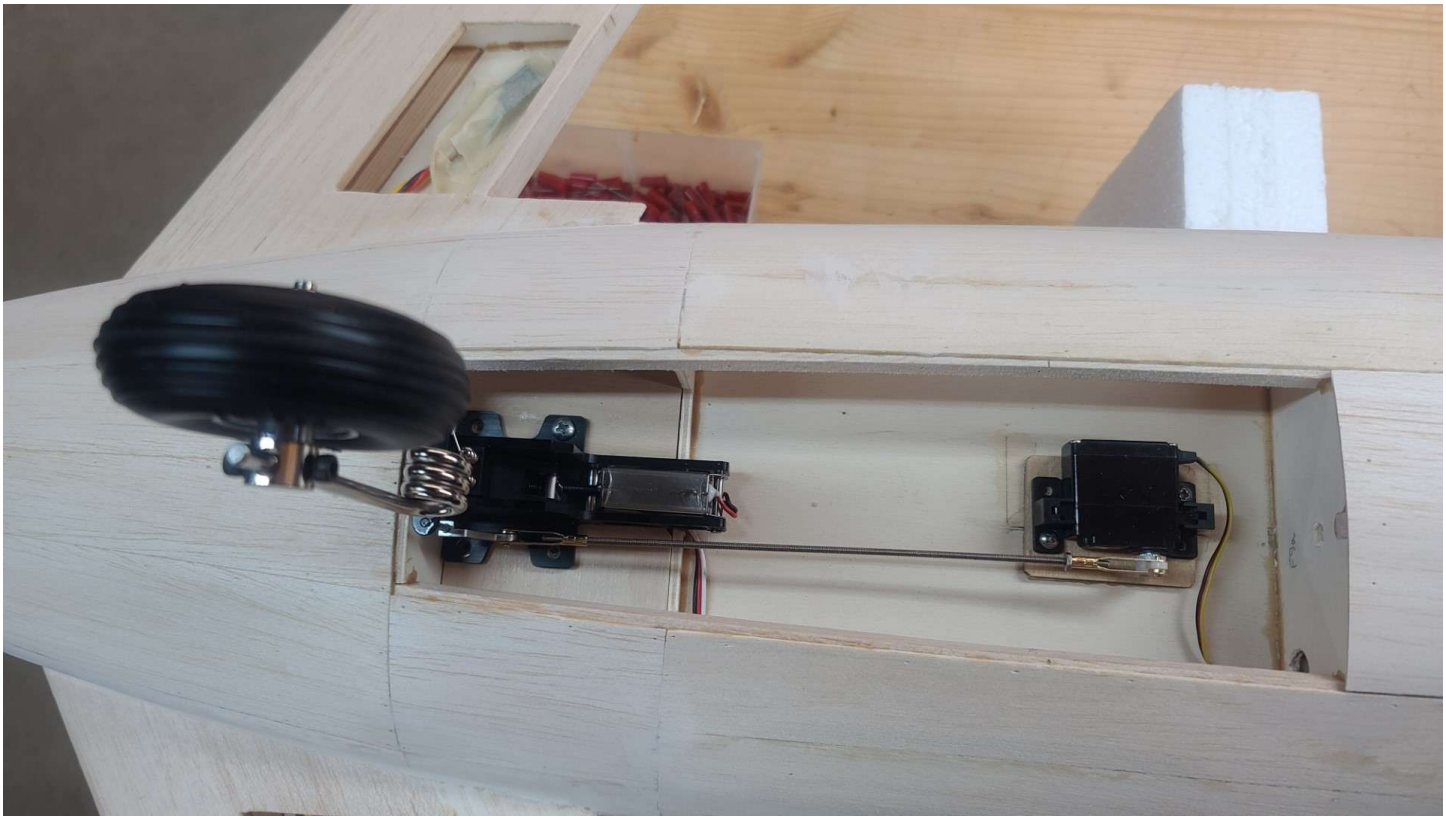
Let's now move on to the motor cowlings. Here I differed some from the instruction manual because we placed the motor ESCs and batteries in the forward fuselage. The supplied cowlings did not need to be cut in half as called out in the instructions since there should be no reason to remove the cowls once installed. I used basswood to make the cowling mounting blocks. After cutting a 30mm diameter hole in the back of each cowling, and installing the motors on the motor mounts, I slide each cowling in place to obtain the correct clearance for the propellers and to mark the locations for the six #2 mounting screws. You can see this in the next two images below.

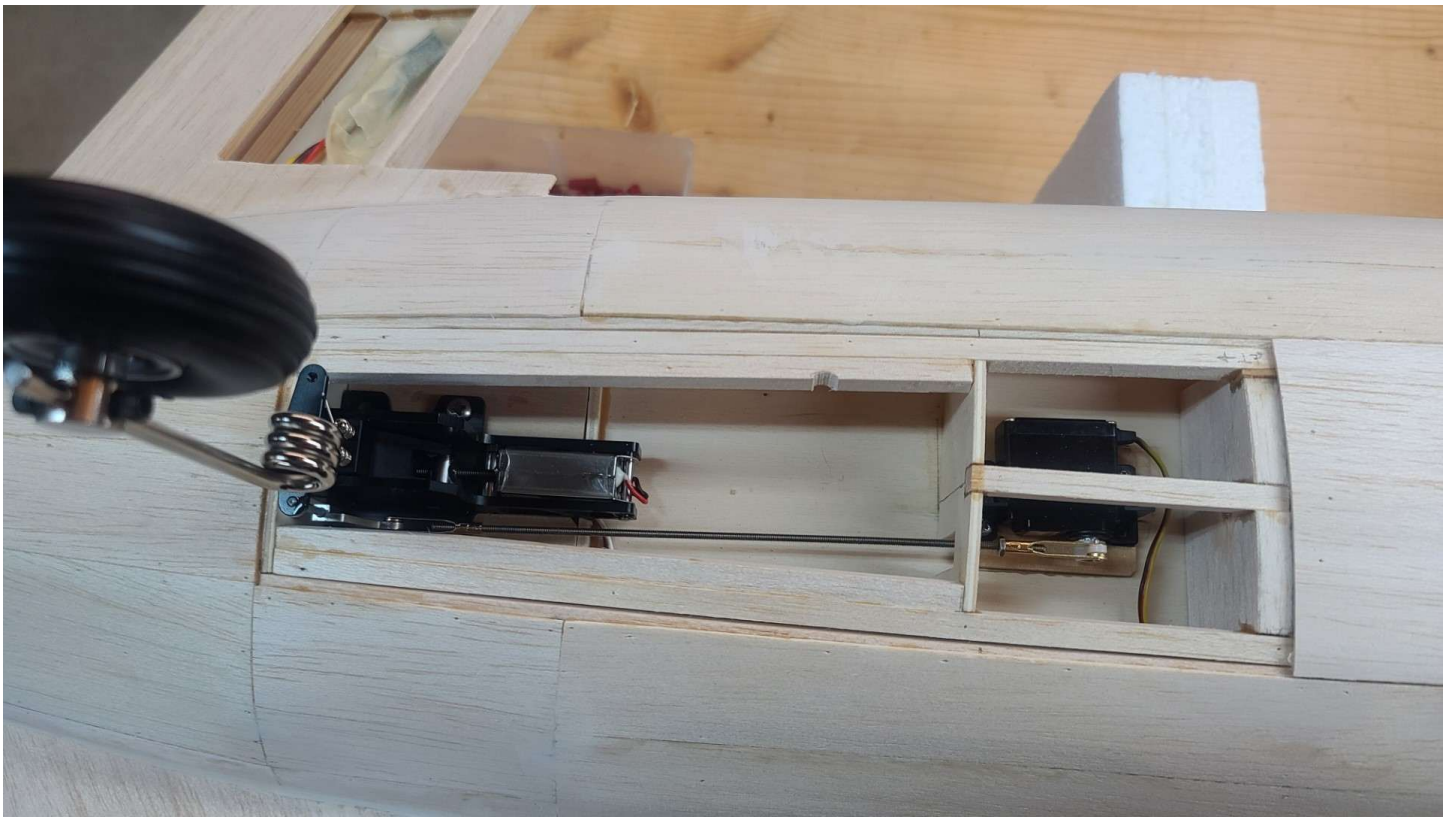


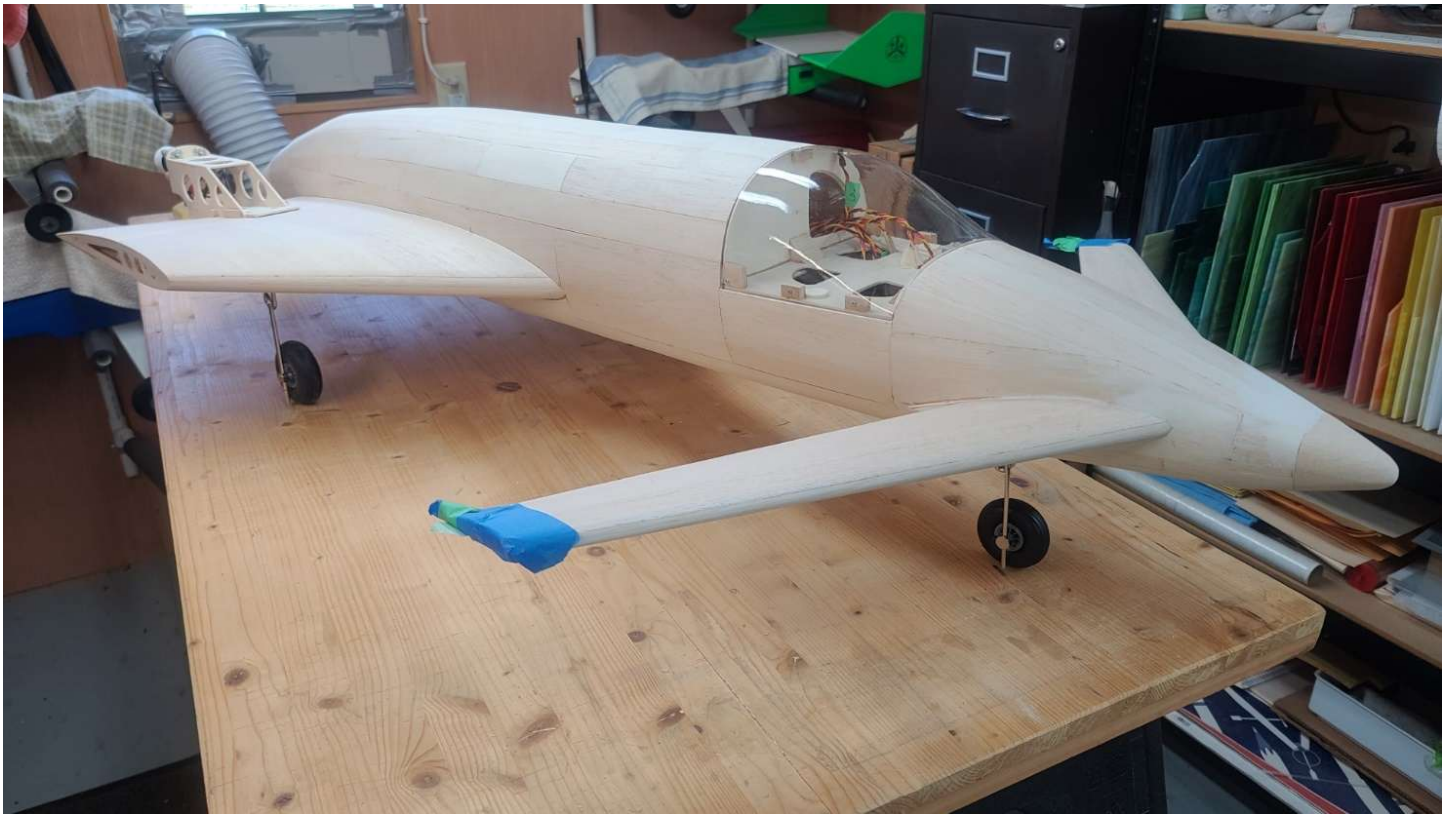
Let us move on to the MLG retracts installation. Using the lines I had drawn when sheeting the bottom of the Main wing, I removed the balsa sheeting that was covering both WA-16 MLG hardwood mounts and opened an 82mm diameter hole for the wheel well. Then I took my Dremel tool with a small sanding drum and removed portions of the wing spars and ribs to form the wheel well. The results are shown in the next two images. Now all I need to do is use some 1.5mm balsa sheeting to make the wheel well bottom and sides, and the retract can be installed using four #6 wood screws.

For the NLG retract installation I first epoxied two pieces of 4.5mm 5-layer maple plywood to F1 between formers F7a and F8a or the retract mounts, and another small piece of ply just forward of F9a to mount the Hitec HS-5087MH steering servo. The steering linkage is 2-56 threaded rod with Du-BRO quick connects at each end. I then fabricated the NLG bay hatch so that it would attach to F9a with a small

hardwood dowel, and then be secured to hardwood mounts using #2 wood screws at the front two corners on each side of the retract. The next two images show you the NLG bay with hardware installed.

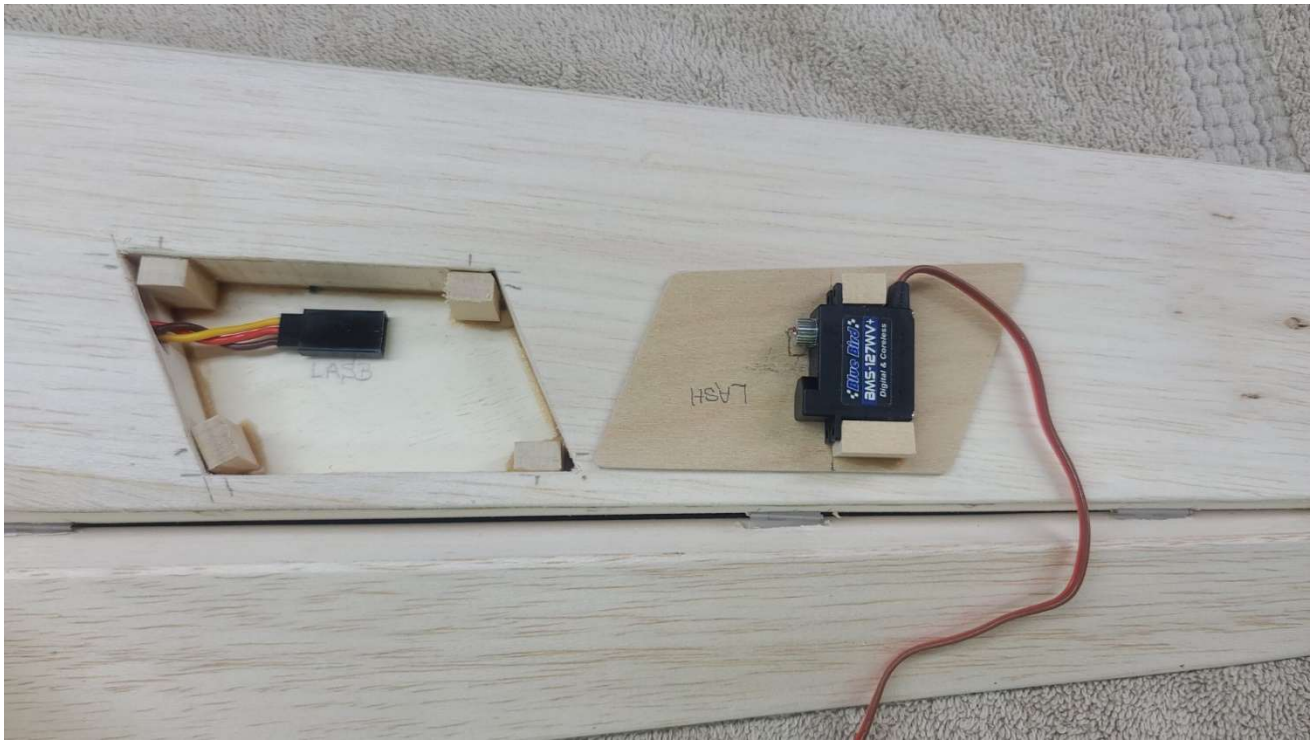




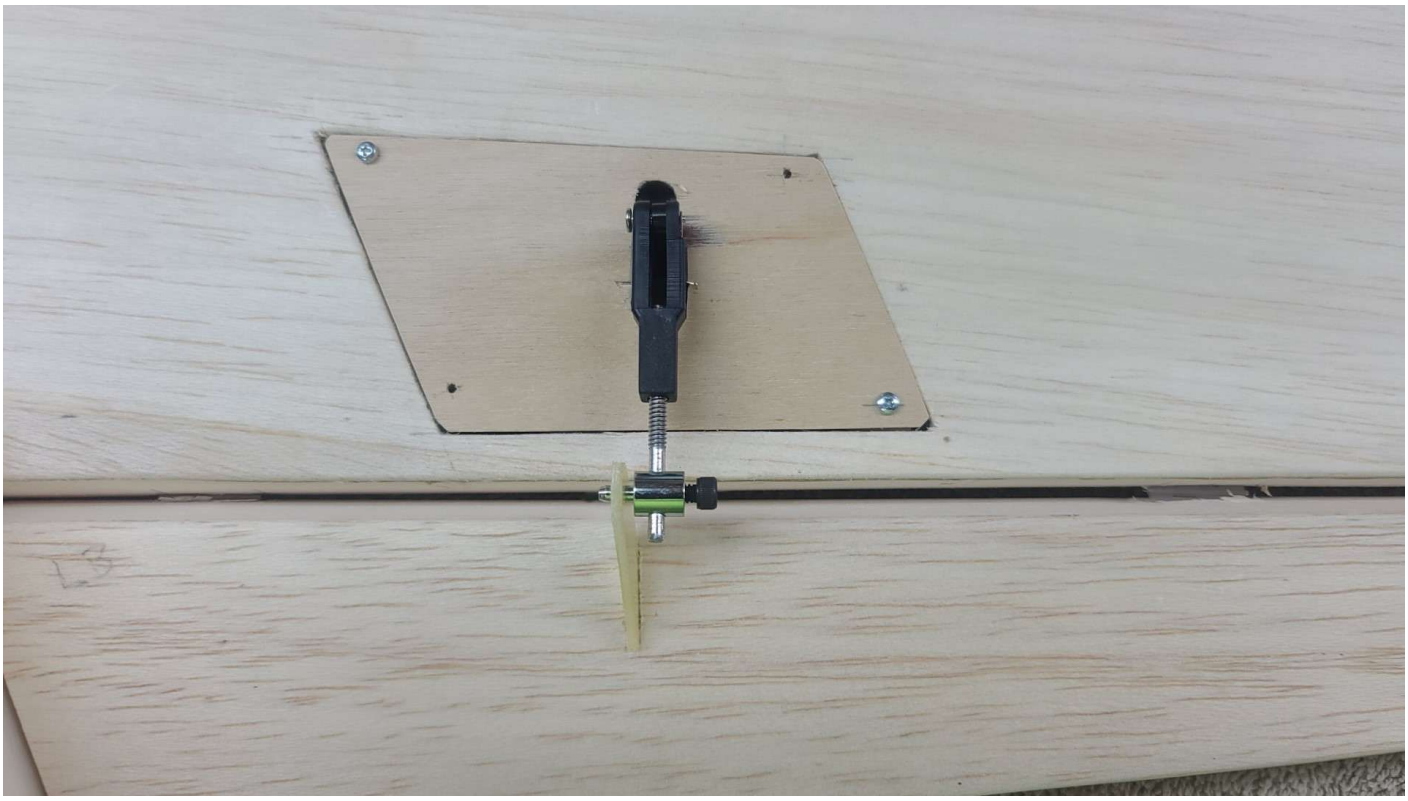


Well, as you can see in the above image, she can now finally stand on her own three feet. All that remains for the retracts is a minor adjustment to the front wheel position to get her sitting level, and then the final cutting of all the retract struts to their require lengths.

Now to install the four control surfaces servos. I cut all servo bay cover plates from 1.5mm maple plywood. Due to the small size of the servo bays, we used Blue Bird BMS-127WV+ servos for both the elevators and ailerons. These are mounted to the servo bay cover plates using basswood blocks and the servo screws. Basswood blocks are also used in each of the servo bay corners to attach the cover plates over the servo bays with #1 wood screws. The next image below shows this set-up for the left aileron servo.

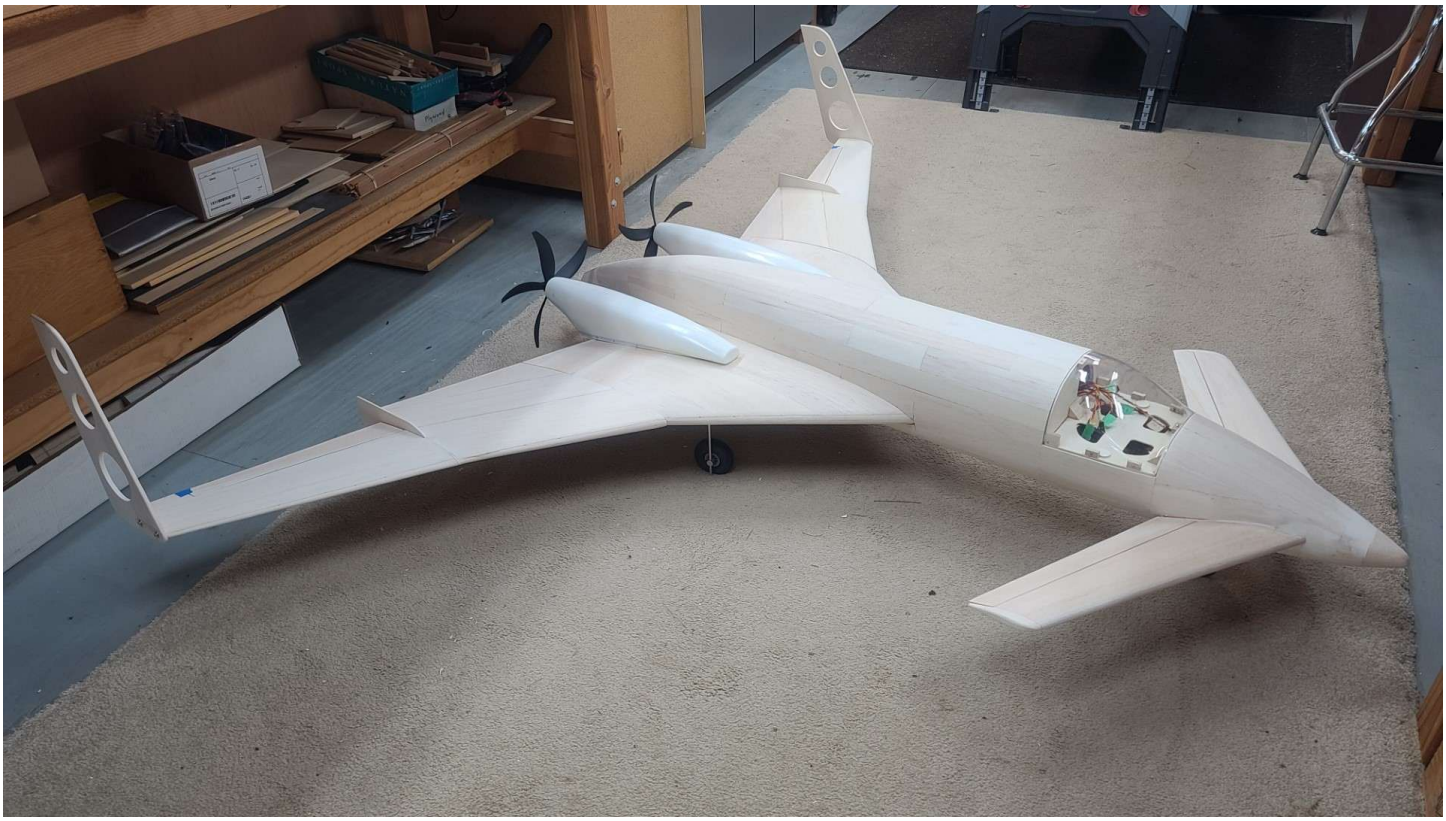


Builders Notes – 1) When positioning the servos on the cover plates, make sure they are mounted so the servo arm movement is perpendicular to the control surface hinge line to minimize binding of linkages. 2) Since the connectors to the servo lead extensions will need to be pushed out of the servo bay and inside the wing, use servo extension safety cable connector clips on all the servo cable connectors.



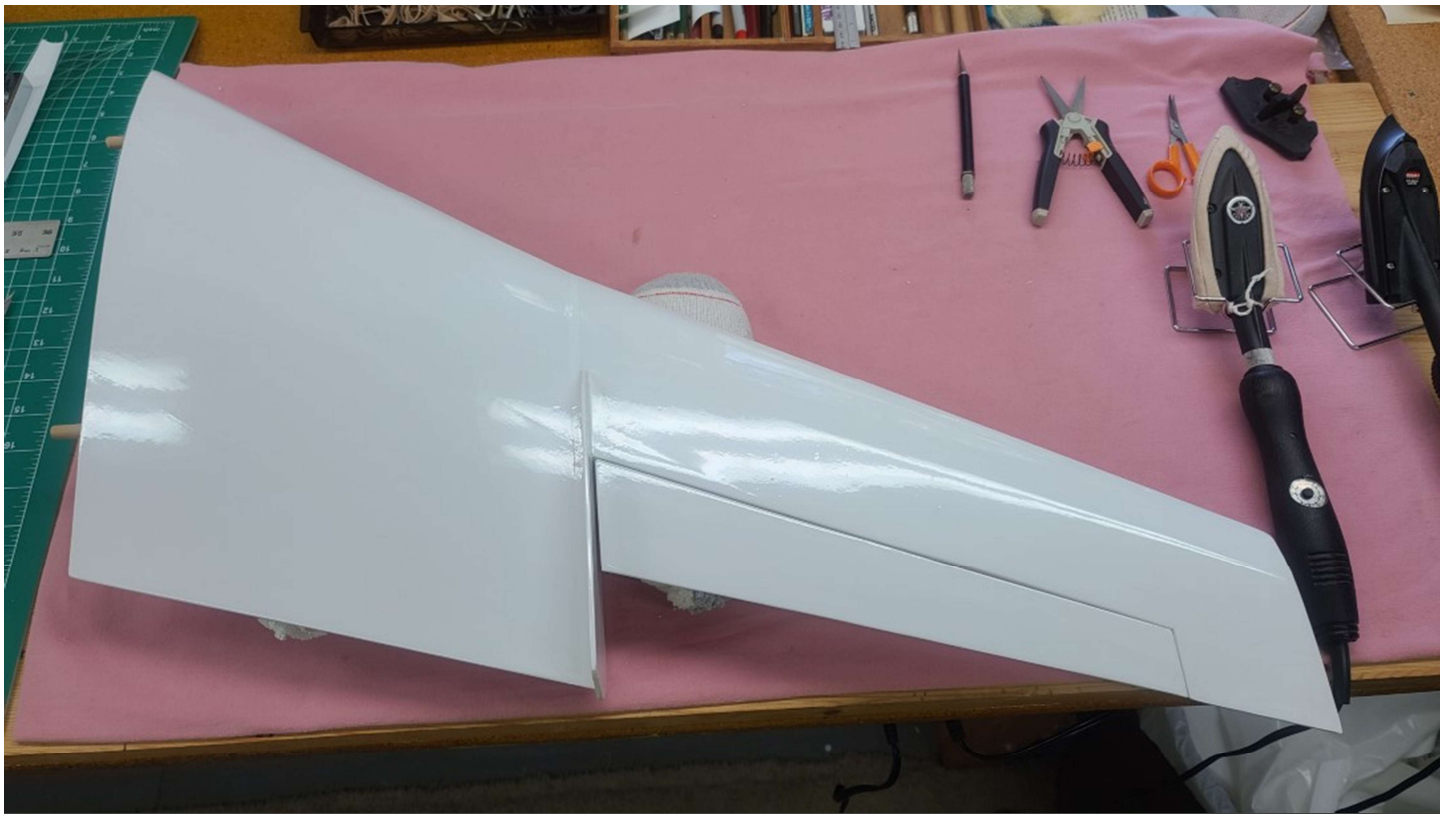
The image above shows the left aileron servo plate mounted to the servo bay. The servo arm extends out through a small slot cut into the plate, where the arm then is connected to the control linkage. The AMTN provided fiberglass control horn is positioned such that the linkage pin hole is directly over the hinge line. The next image below shows the installation of the servos and linkages for the canard elevators. All control horns and control surface hinges will all be installed using epoxy after the Ultracoat covering is finished.

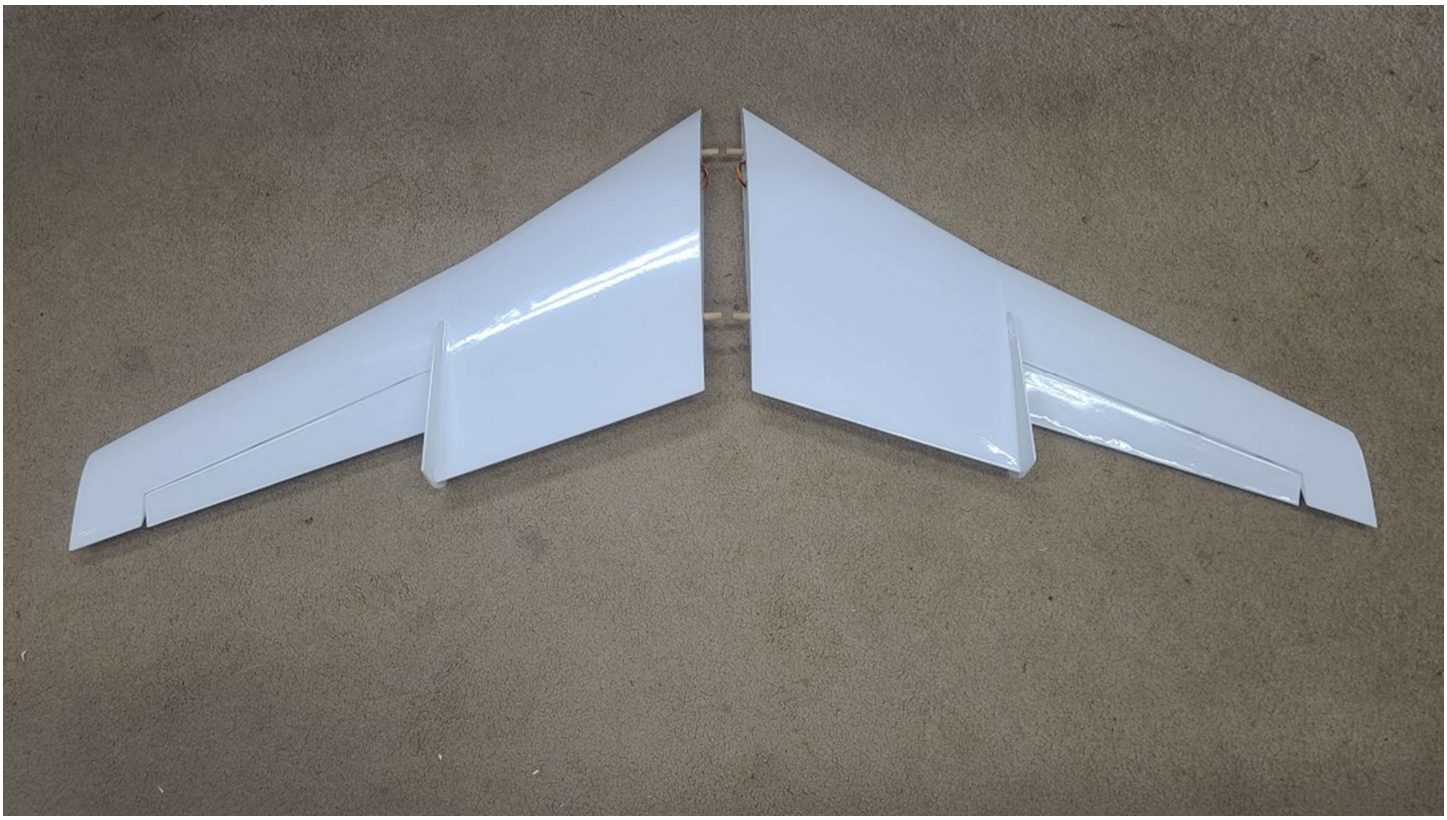
I accomplished the first complete fit check this morning. As you can see in the image below, she is a unique model and is looking good. I think I need to get a larger workshop. I have some leading-edge flaring to do at each of the mid-wing to Main wing joints, but other than that all she needs is a good final sanding with 320 grit sandpaper, a wipe-down with a painter's tack cloth, and we can start the next major task of applying white Ultracoat covering.



After breaking out my trusty old Century covering iron and trim iron, I started applying Ultracoat white covering to the winglets. Once those were complete, I then moved on to the elevators and ailerons. The image below shows these completed with Du-Bro hinges and fiberglass control horns temporarily installed.

With my covering iron set to 275 degrees, I started the outer wing panels by covering the ribs at each end and applying small strips of covering along the edges of the aileron opening and the corners formed between the wing surface and strake WB-13. The bottom surfaces were covered next from the leading edge back to the trailing edge. Then the top surfaces were covered wrapping the covering around the leading edge and trailing edges to join with the lower surface covering. Once the entire outer wing assembly was covered, I turned my covering iron up to 350 degrees to firmly seal and shrink the Ultracoat. Finally, I covered each aileron servo hatch cover, connected the servos to the servo extension leads, and mounted each hatch cover over their respective aileron servo bay. The completed outer wing panels are shown in the next two images below. Not too bad I must say so myself.





With the outer wing panels finished, I decided to tackle the fuselage and Main wing starting on the bottom side. Just as I did on the outer wing panels, I started by covering the WA-6 ribs at each end of the Main wing, followed with small strips of covering along the edges of the elevators openings in the forward wing (canard), and then small strips of covering along the corners formed by the Main wing and forward wing bottom surfaces and lower fuselage sides.

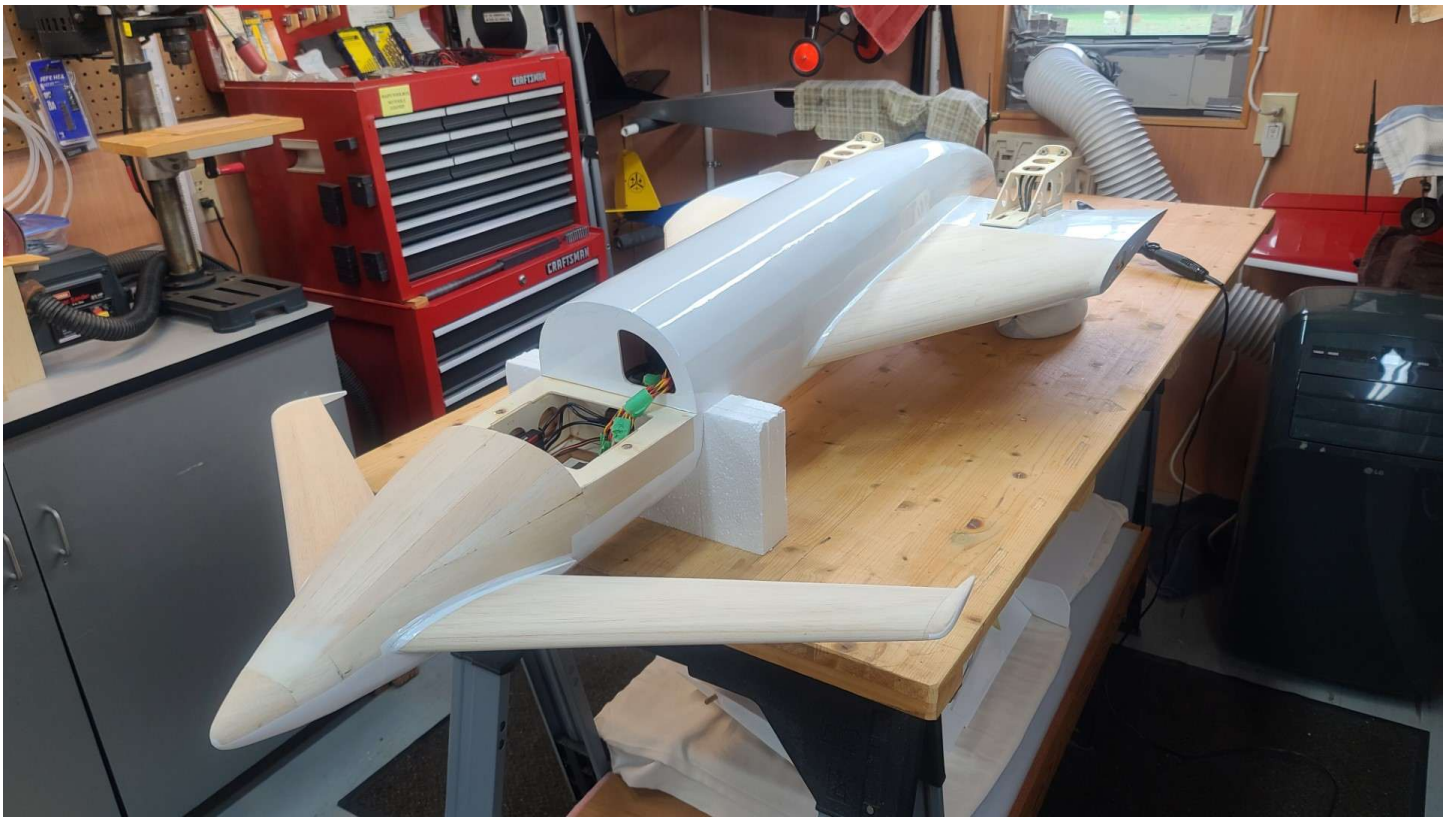
Builders Note – Start applying covering at the rear of the fuselage bottom and work forward. This is done so any overlapping joints in the covering have the top sheet covering the joint upstream of the airflow to prevent lifting of the covering at the joints during flight.

I then covered the vertical fin and worked forward on the fuselage bottom starting along the wing joint and worked up and forward using as large of pieces of covering as I could to not get wrinkles due to the curved surfaces. The next two images show this work in progress.

The bottom side of the fuselage, forward wing, and Main wing are now all covered. Getting a nice smooth non-wrinkle finish on that nose was a real trick, but it came out looking nice. I then installed the MLG retracts and will move on to install the NLG retract, finish the NLG bay cover, cover and install the elevator servo hatches, and finish the receiver bay hatch. The two images below show the latest status of the build.

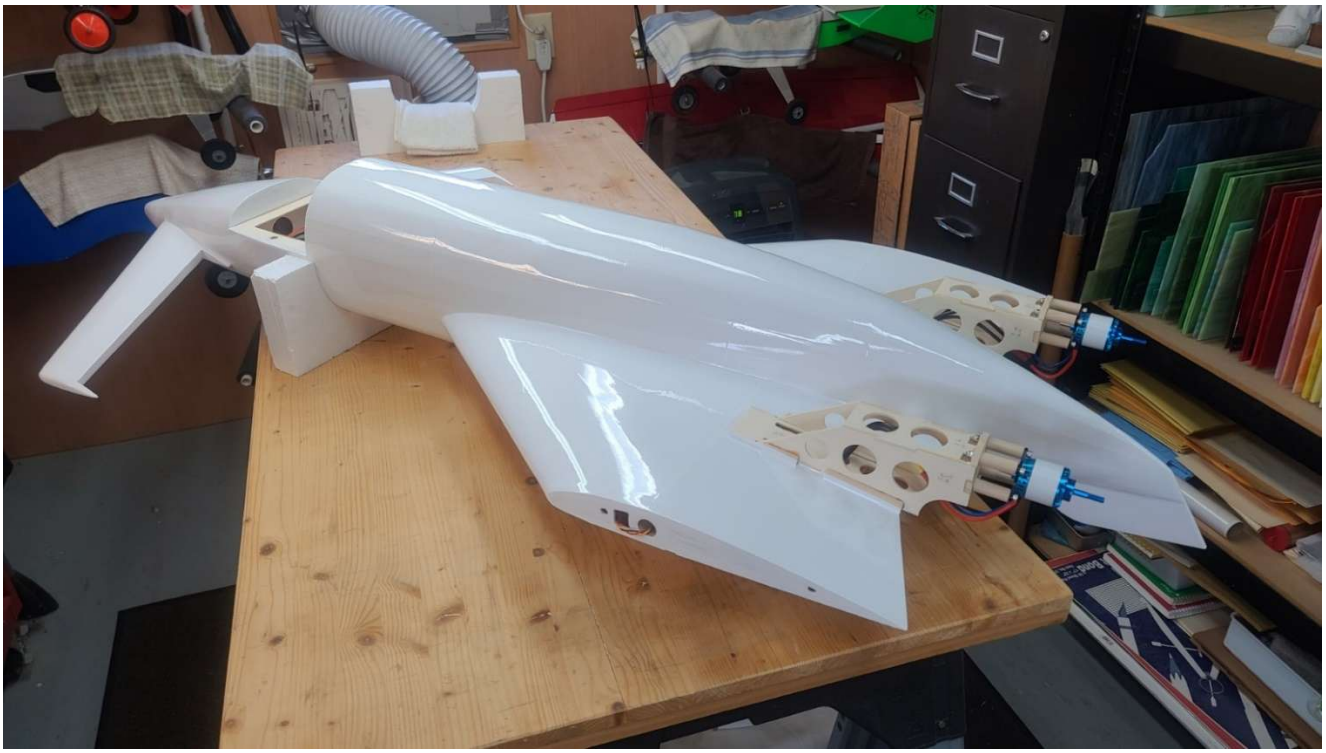
Alright, after having installed the remote receiver module in the forward NLG bay, I mounted the NLG retract and steering servo. I then cut the NLG bay cover to fit around the retract and NLG tire, covered and installed the elevator servo hatches and mounted them to their respective elevator servo bays in the forward wing, and finished the main 8-channel Spectrum SPMXAE1060 receiver bay hatch. I then flipped the model over to start covering the fuselage and Main wing top surfaces.

Just as I did on the bottom side, I started with small strips of covering along the corners formed by the Main wing and forward wing top surfaces and upper fuselage sides, and around the two motor mounts. I also covered the backside surface of former F8 and forward surface of former F9 above the canopy base plate F20. Then I started covering the aft fuselage above the vertical fin and worked my way up from the Main wing fuselage joint and forward using as large of pieces of covering as I could to not get wrinkles due to the curved surfaces. The next image shows this work in progress.



Well, the second major task for this build is now complete. All covering is applied except for the NLG bay cover which will be completed once I have verified the position of the NLG wheel on the retract strut. I put thread lock on the motor hub and back cross plate screws, and then attached the motors to the motor mounts using my hand made hardwood stand-offs, socket head machine screws thru blind nuts on the firewall with nylon locking nuts as extra insurance. I set-up the motor power lead connections so the right motor rotates counterclockwise, and the left motor rotates clockwise.

The next items on my "to-do" list are to finalize the position of the NLG wheel hub so I can grind flat spots on the retract strut for the set screws; finish, cover, and install the NLG bay hatch cover; epoxy all the control surface hinges and control horns; apply small strips of covering across the hinge lines on the bottom side of each control surface; spray paint the cockpit canopy and motor cowlings white; and then the application of all the Callie-Graphics (https://callie-graphics.com) decals. We are almost on the home stretch for this build.

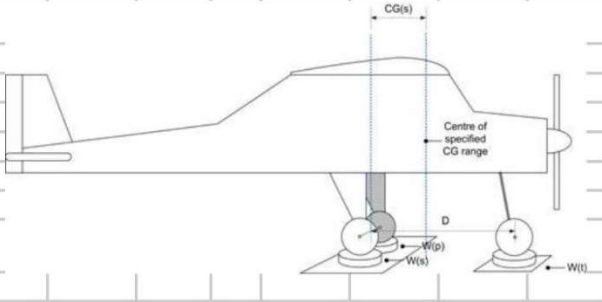


I continued to work off the items on my list. The NLG wheel position was finalized, the NLG bay hatch cover finished and installed, all control surface hinges and horns are now epoxied in place with control surface linkages attached. Ran functional checks on retracts and all three work great with good clearance in each wheel well. Hooked up the LiPo batteries and ran checks on each motor with the five blade props attached. Man, those Sunnysky X3120-KV880 motors turning 10x9 Scimitar 5 Blade Props put out some tremendous thrust running on 4S LiPos.

With only having some spray paint and graphic decals to add to the model, I wanted to run an initial CG check to see where we stand. I decided to use a CG calculation based on measurement of the Starship weight at each of the MLG and the NLG. The top image below shows the CG measurement set-up using three kitchen digital scales. These weights are then plugged into an Excel spreadsheet which calculates the CG location and its variance from the AMTN specified CG location using the MLG as the datum line. The bottom image below shows the resulting calculations with no motor LiPo batteries installed in the forward bay. As you can see from the resulting CG calculation, we will need to add some ballast weights inside the motor mounts to obtain the correct CG location with the motor LiPos installed.

Starship CG Calculation by Weight

Model			Details	Gear	Weight:	11.3	lbs
Starship			No LiPos Installed	Tricycle			
D	780.0	mm	Distance between center point of main wheels and nose or tail wheel				
CG(s)	78.0	mm	Distance of specified CG location from main wheels				
W(p)	2305.0	g	Measured weight at left wheel				
W(s)	2335.0	g	Measured weight at right wheel				
W(t)	485.0	g	Measured weight at nose or tail wheel				
W(total)	5125.0	g	Total weight of plane: W(p) + W(s) + W(t)				
CG(a)	73.8	mm	Actual CG location from main wheels: W(t) x D / W(total)				
W(t)	512.5	g	Weight required at nose or tail wheel for balanced CG: W(total) x CG(a) / D				
CG(diff)	-4.2	mm	Difference between actual and specified CG: CG(a) - CG(s)				



Legend:		
		Aircraft-specific; enter once and do not alter for this aircraft
		Measured weights; change with every weight session
		Calculated value; do not edit these fields

Started application of the Callie-Graphics decals with the winglets. Some items that may be helpful during the application process will include scissors, sharp X-Acto knife, soapy water solution, sponge/towel and a soft squeegee. The graphics were shipped with transfer tape on top, to aide in the application process. This is a semi-transparent carrier paper which prevents the graphics from stretching during application, as well as keep any cut numbers/letters together, so you don't have to apply each one individually. You can apply the graphics wet or dry. Dry is quick and easy, however, can lead to bubbles or a mis-positioned graphic by accident. Applying the graphics wet does take a bit longer but ensures you will have plenty of time to align the graphics before they stick. Being an old fart that moves slow, I decided to use the wet method. You can find detailed instructions for graphics application on the Callie-Graphics website.

After applying the Callie graphics for the winglets, I decided to add some outlines for the rudders. I did this using 1.5mm (1/16 inch) Gloss Black Hanger 9 Ultrastripe™ tape. The image below shows this in progress along with all the tools I used during the application.

With the winglets finished, I moved on to the outer wing panels. For these I first outlined the flaps using 1.5mm (1/16 inch) Gloss Black Hanger 9 Ultrastripe™ tape. Then I applied Gloss Black Ultracoat covering along the outer wing panel top and bottom leading edge to represent the anti-icing boot. The results are shown in the image below.

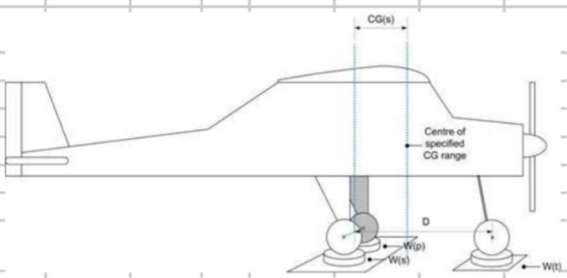
With the outer wing panels finished, I turned my attention to the forward and main wings. As with the outer wing, I outlined the main wing flaps using 1.5mm (1/16 inch) Gloss Black Hanger 9 Ultrastripe™ tape, and then applied Gloss Black Ultracoat covering along the forward and main wings top and bottom leading edges to represent the anti-icing boot. With that finished I started the application of the Callie-Graphics decals that run along the entire length of the fuselage sides. When I used the soapy water mixture to apply decals to the winglets, I had issues with them sticking firmly to the Ultracoat and could not do any repositioning. I knew this would not work for the long decals, so I purchased some "Rapid Tac" which is a fluid used to help aid in applying large decals to cars. I also broke the long decals down into four sections which helped greatly. The image below shows the results for the left side of the fuselage.

Over the past few days in early mornings, before the temperature rose above 80 degrees, I worked on spray painting the motor cowlings and cockpit canopy. I first lightly sanded everything with 400 grit sandpaper and then washed the motor cowlings with dish soap and the cockpit canopy with Windex. I applied four light coats of Krylon Gloss White spray paint allowing them to dry between applications.

Builders Note – Before you start to spray paint something, it would be a good idea to take the can of spray paint you are getting ready to use and spray a piece of cardboard to see what that can of paint will look like. I say this because I used one can of Krylon Gloss White spray paint for the first three coats and then moved to another can of Krylon "Gloss" White spray paint for the final coat only to end up having a "Flat" White finish on the motor cowlings and cockpit canopy. The spray can was either mislabeled or the high humidity contributed to my finish issue.

To try and correct the finish issue for the canopy and cowlings, I purchased a can of Rust-Oleum Clear High Gloss spray paint. Now all I need is the humidity to drop below 65%, which will not happen for several days based on the weather report. So, while waiting on the weather I decided to finalize how much ballast would be needed on each motor mount to establish a correct CG location. Just as I had done earlier, I used the same CG measurement set-up with three kitchen digital scales, and placed large lead fishing weights on the rear portion of each motor mount until the calculated CG was within acceptable limits of the AMTN recommended CG location. The resulting spreadsheet output is shown below with two SMC 4S 2,800 mah LiPo batteries installed in the forward battery bay. The 285 grams of lead fishing weights were melted down into a flat rectangle that sits along the top rear of each motor mount and is secured with double sided servo tape and a cable tie. I figured I'd leave her a little nose heavy for now. Not knowing the model would build-out almost balanced with no motor batteries installed, if I were to build this model again, I would leave the ESCs in the motor mounts and put a battery bay on the bottom side of the fuselage located just slightly

ahead of recommended CG location. This would then eliminate the need for any ballast in the motor mounts or the fuselage nose and drop the final ready-to-fly weight by 570 grams.

Starship CG Calculation by Weight								
Model			Details	Gear		Weight:	13.9	lbs
Starship			LiPos Installed plus 285g. in each motor mount	Tricycle				
D	780.0	mm	Distance between center point of main wheels and nose or tail wheel					
CG(s)	78.0	mm	Distance of specified CG location from main wheels					
W(p)	2814.0	g	Measured weight at left wheel					
W(s)	2799.0	g	Measured weight at right wheel					
W(t)	692.0	g	Measured weight at nose or tail wheel					
W(total)	6305.0	g	Total weight of plane: W(p) + W(s) + W(t)					
CG(a)	85.6	mm	Actual CG location from main wheels: W(t) x D / W(total)					
W(t)	630.5	g	Weight required at nose or tail wheel for balanced CG: W(total) x CG(a) / D					
CG(diff)	7.6	mm	Difference between actual and specified CG: CG(a) - CG(s)					
Legend:			Aircraft-specific; enter once and do not alter for this aircraft					
			Measured weights; change with every weight session					
			Calculated value; do not edit these fields					

Well, I was finally able to get a nice gloss finish on the canopy and both motor cowlings. Using the AMTN supplied window templates, I cut out the four cockpit windows from a roll of gloss black adhesive backed vinyl. These were then carefully applied to the cockpit canopy. To finish off the motor cowls I first masked off a small portion of the nose and painted that with gloss silver, and then applied a gloss black decal to the very front of each cowl. I finished up with the application of the remaining Callie-Graphics decals on the canopy and both cowlings. The results of these efforts are shown in the image below.

The last items needed were AMA and FAA UAS numbers applied to the outside of the model, and a name and phone number on the inside. I used water decals for this and applied them on the receiver bay hatch. With that done, I reassembled the model. The two images below show the build completed and ready for David to pick up. He will then finish the set-up of the receiver to his transmitter. I hope all of you have enjoyed this build as much as I have over the past four months. I learned several new things during the build, which just verifies the old saying "you can always teach an old dog a new trick."

Latest update received from David on 24 Aug 2024. As you can see in the two bottom images, he has installed his Spektrum AR8360T receiver with all eight data ports and the remote receiver port filled. He indicated he has installed the batteries, verified all the servos are correct to the flight control mapping he established for the Starship, set all control throw directions and travel. You can also see the two antenna leads will go into small plastic tubes to ensure they remain 90 degrees to each other. More to come from David, I'm sure.