# GHOST

**Specifications**:
Wingspan: 62 in.
Wing Area: 675 sq in.
Airframe Length: 49.5 in.
Weight: 4.5 - 6 lb.

CONSTRUCTION MANUAL

## Using the Manual

Be sure to read each step thoroughly before you start the step. Test-fit the parts together to make sure they fit properly. If necessary trim to fit.

Beside each step you will notice a check box (or two). These are so you can keep track of your progress while building your kit. For steps that have two boxes, as in the construction of the left and right wing halves, these steps must be performed two times.

- Your **Old School Model Works** aircraft should not be considered a toy, but rather a sophisticated, working model that functions very much like a full-size airplane. Because of its performance capabilities, this model, if not assembled and operated correctly, could possibly cause injury to yourself or spectators, and damage to property.
- You must assemble this model according to the instructions. Do not alter or modify this model, as doing so may result in an unsafe or un-flyable model. In a few cases the instructions may differ slightly from the photos. In those instances the written instructions should be considered as correct.
- You must take time to build straight, true and strong.
- You must use a R/C radio system that is in first-class condition, a correctly sized power system and components (electronics, batteries, wheels, etc.) throughout the building process.
- You must correctly install all R/C and other components so that the model operates correctly on the ground and in the air. (Installation shown in the manual is a suggestion. You may have to adjust the mounting steps to accommodate the size of your radio equipment.)
- You must check the operation of the model before every flight to insure that all equipment is operating and that the model has remained structurally sound. Be sure to check clevises or other connectors often and replace them if they show any signs of wear or fatigue.

- If you are not an experienced pilot or have not flown this type of model before, we recommend that you get the assistance of an experienced pilot in your R/C club for your first flights. If you're not a member of a club, your local hobby shop has information about clubs in your area whose membership includes experienced pilots.
- While this kit has been flight tested to exceed normal use, if this model will be used for extremely high stress flying, such as racing, or if a power system larger than one in the recommended range is used, the modeler is responsible for taking steps to reinforce the high stress points and/or substituting hardware more suitable for the increased stress.

***Remember: Take your time and follow the instructions to end up with a well-built model that is straight and true.***

Old School MODEL WORKS

www.oldschoolmodels.com

# WARNING

***READ THROUGH THIS MANUAL BEFORE STARTING CONSTRUCTION. IT CONTAINS IMPORTANT WARNINGS AND INSTRUCTIONS CONCERNING THE CONSTRUCTION AND USE OF THIS MODEL.***

***A Radio-Controlled aircraft is not a toy! If misused, it can cause serious bodily harm and damage to property. Fly only in open areas, preferably at AMA (Academy of Model Aeronautics) approved flying sites, following all instructions included with your radio, powerplant, electronics and batteries.***

- Inspect your model before every flight to ensure it is airworthy.
- Be aware of any other radio frequency user who may present an interference problem.
- Always be courteous and respectful of other users in your selected flight area.
- Choose an area clear of obstacles and large enough to safely accommodate your flying activity.
- Make sure this area is clear of friends and spectators prior to launching your aircraft.
- Be aware of other activities in the vicinity of your flight path that could cause potential conflict.
- Carefully plan your flight path prior to launch.
- Abide by any and all established AMA National Model Aircraft Safety Codes.

**IMPORTANT!!!** Two of the most important things you can do to preserve the radio controlled aircraft hobby are to avoid flying near full-scale aircraft and avoid flying near or over groups of people.

WARNING: This product can expose you to chemicals including lead, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

# INCLUDED ITEMS

### Wood parts included in this kit:

- 1 LP1 - laser cut 1/8" x 5" x 24" lite ply
- 1 LP2 - laser cut 1/8" x 5" x 24" lite ply
- 1 LP3 - laser cut 1/8" x 2" x 24" lite ply
- 1 LP4 - laser cut 1/8" x 5" x 24" lite ply
- 1 LP5 - laser cut 1/8" x 5" x 24" lite ply
- 1 LP6 - laser cut 1/8" x 2" x 24" lite ply
- 1 LP7 - 1 laser cut/8" x 5" x 24" lite ply
- 1 LP8 - laser cut 1/8" x 2.5" x 12" lite ply
- 1 LP9 - laser cut 1/16" x 2.5" x 5" lite ply
- 3 DH1 - laser cut dihedral braces 1/8" ply

- 1 BP1 - laser cut 1/8" x 4" x 12" balsa
- 1 BP2 - laser cut 1/8" x 4" x 12" balsa
- 2 BP3 - laser cut 3/32" x 4" x 12" balsa
- 2 BP4 - laser cut 3/32" x 4" x 12" balsa
- 2 BP5 - laser cut 3/32" x 4" x 12" balsa
- 2 BP6 - laser cut 3/32" x 4" x 12" balsa
- 2 BP7 - laser cut 3/32" x 4" x 24" balsa
- 2 BP8 - laser cut 3/32" x 4" x 24" balsa
- 2 BP9 - laser cut 3/32" x 4" x 24" balsa
- 1 BP10 - laser cut 3/32" x 4" x 24" balsa
- 2 BP11 - laser cut 1/16" x 4" x 24" balsa
- 2 BP12 - laser cut 1/16" x 4" x 12" balsa
- 2 BP13 - laser cut 1/16" x 4" x 12" balsa
- 2 BP14 - laser cut 1/16" x 4" x 24" balsa
- 2 BP15 - laser cut 1/16" x 4" x 24" balsa
- 2 BP16 - laser cut 1/16" x 4" x 12" balsa
- 2 BP17 - laser cut 1/16" x 4" x 24" balsa
- 1 BP18 - laser cut 1/4" x 3" x 12" balsa
- 1 BP19 - laser cut 3/16" x 3" x 12" balsa

- 2 1/16" x 4" x 36" balsa sheets
- 4 3/32" x 4" x 12" balsa sheets
- 2 1/2" x 1/2" x 36" balsa strips
- 2 5/16" x 5/16" x 36" balsa strips
- 3 1/4" x 1/4" x 36" balsa strips
- 4 3/16" x 3/16" x 36" balsa strips
- 4 3/16" x 3/8" x 36" basswood strips
- 2 5/16" x 1-1/4" x 36" shaped balsa strips

### Hardware parts included in this kit:

- 4 1/4" x 1/8" magnets
- 10 2-56 x 1/2" machine screws
- 18 2-56 x 3/4" self tapping screws
- 4 3/16" wheel collars
- 4 wheel collars set screws
- 6 control horns
- 2 plastic landing gear straps
- 2 1/4-20 x 2" wing bolts
- 4 2-56 x 5/16" Phillips screws
- 4 #2 x 3/4" Phillips screws
- 2 4-40 x 1" socket head cap screws
- 1 1/4" x 4" dowel

### Other items included in this kit:

- 3 - Rolled plans (fuselage and 2 wing)
- 1 - Construction Manual

# ITEMS NEEDED

### Hardware needed (not included in the kit)

For some of these items there is more than one option which will require a bit of decision making ahead of time. There isn't a right or a wrong choice, so choose the items that work best for you.

We strongly recommended supporting your local hobby shop.

- Powerplant: 450+ watt electric, 3-4s lipo, 60+ amp ESC (or .35-.46 2-stroke glow engine)
- Propeller
- Engine/Motor mount and mounting hardware

- 6-8 ounce fuel tank and fuel tubing (if glow)
- Receiver - (4 channel minimum)
- Servos
  If 4 channel, 4 servos (electric), 5 servos (glow)
  If 5 channel, 6 servos (electric), 7 servos (glow)
  We used standard servos all around.
- 2 servo extensions for aileron servos (8-12")
- 2 "Y" servo harnesses (one for ailerons, and one for flaps)
- Pushrods - two 6" for ailerons, two 6" for flaps, two 28" for elevator and rudder, one 10" for throttle (if glow)
- Clevises for the pushrods.
- Wheels: two 3" for mains *(Du-Bro Chromies look great - hint, hint).*
- Tailwheel assembly
- Covering: If you're using simple color scheme, two rolls of iron-on covering will be enough. You will need more if applying a more complicated livery.

## Additional Required Building Tools and Adhesives

- Drill & assorted drill bits
- Hobby knife and #10 blades
- Sandpaper: coarse (80 or 100 grit) & medium (150-200 grit)
- Pencil or pen
- Ruler
- T-Pins
- Waxed paper
- Building board
- 2-part epoxy (6 or 15 minute), brushes and mixing sticks
- Wood adhesives of your choice. We use medium viscosity CA (cyanoacrylate) , but aliphatic resin and/or carpenter's glues (used correctly) will work just as well and give longer working time.
- Thin CA for attaching the included hinges

## We advise the following:

Closely inspect the supplied laser cut parts for damage. If you find any damaged or missing parts, contact us (not your dealer) immediately.

When removing the laser cut parts from their sheets, you'll notice the parts are held in place by several small "tabs". These tabs are uncut pieces of wood and can sometimes make it difficult to remove a part. Rather than breaking and/or splintering the wood by forcing out the part, we recommend removing any laser cut parts from their sheets by using a hobby knife with a #10 blade. A quick cut of the tab will allow the piece to be removed with no damage. Sand any tab remainders flush with the part so there will be no problem aligning them later.

It's best to not remove parts from their sheets until they are needed. Refer to Appendix A of this manual as a reference to what all the laser cut parts look like and are called.

You'll notice a check box next to each step. Check these off as you go along so you don't miss a step. Note that some steps (in building the wing) have two boxes - this means that the step will be done twice - once for each wing half.

There could be a step or two which leaves you a bit puzzled. If this happens, step back and study the photo(s) for that step - both in this manual and online.

All photos shown in this manual are of different GHOST prototypes. Several pieces may have changed slightly with improvements we've made so parts may look a little different in some steps.

## Online Supplementary Photos

We realize that the smaller black-and-white photos in this manual might not show some of the steps as clearly as you might want. So we've anticipated this and made these photos available on our website. You can either scan the QR code or type this address into your browser:

**www.oldschoolmodels.com/mpics/GHOST/**

## *IF YOU READ NOTHING ELSE IN THIS MANUAL, PLEASE READ THESE FOUR POINTS.*

***#1 - PLYWOOD HAS SLIGHT BOWS IN IT 95% OF THE TIME. We don't like it, but that's the way plywood is. Because of this, we engineered the GHOST to eliminate these warps whenever possible - we'll make recommendations on how to overcome them as we go along.***

***2 - BALSA HAS SLIGHT BOWS IN IT 60% OF THE TIME. We don't like it, but that's the way balsa is. We'll make recommendations on how to overcome them as we go along.***

***3 - It is very important that you assemble the GHOST in the order described. Skipping forward in the steps could leave you without the proper lengths of wood to finish the kit. We've included enough wood to easily complete this kit, but you must take care to properly measure and not waste wood when cutting.***

***4 - Save ALL of the scrap wood as you build - the ends of sticks, the left over sheets, etc. You will use some of this in assembly, and can use other parts if you need repairs.***

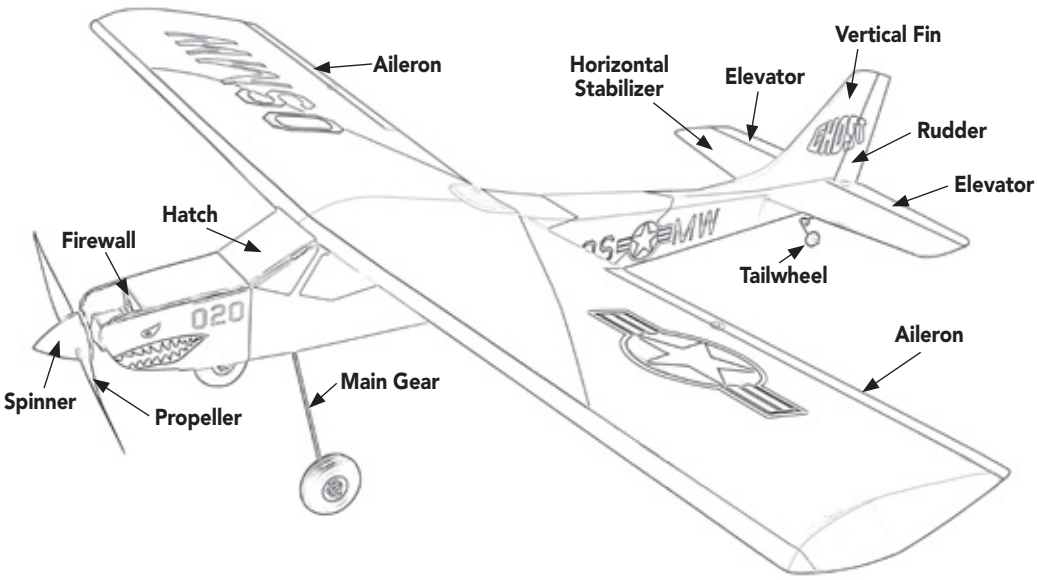
## If this is your first build, congratulations!

What you're about to do is build a flyable airplane - yup, that's a pretty cool thing. All of the techniques that you'll learn here can easily be used for anything else you'll build down the road.

Please read through each step before you start, so you can understand what's needed to be done for that step. We'll try to explain everything along the way, but there might be times you run into something you can't wrap your head around. Help can be found at your local r/c club, or even on the interwebs - lots of forums and videos on building are available to you.

And remember, building is not a race. You are the craftsman and if you take your time, take the time to understand, and make the effort to do good work, it will certainly show when the airframe is built.

# BASIC AIRCRAFT PARTS




# OSMW BASIC AIRCRAFT TERMINOLOGY

**3D FLYING (HOVERING)** - Something that should definitely NOT be done (or attempted) with OSMW aircraft. Our designs are meant to fly like airplanes, not hovering like a helicopter.

**AIRFOIL** - the cross-section shape of a wing. Airfoils can be flat-bottomed (like the GHOST), or other shapes, depending on the style of airplane and what it needs to do.

**AILERONS** - the moving section of the trailing edge (TE) of the wing. Ailerons come in pairs, (left and right) and always work in opposite directions to each other (one up, one down). When used, they cause the airplane to roll to the left or right.

**C/A** - cyanoacrylate glue that bonds quickly compared to woodworking glues. If using C/A with the GHOST, we recommend medium viscosity for the majority of the build, then for the hinges.

**CENTER OF GRAVITY (CG)** - the airplane's point of fore-aft balance, or the point at which all gravitational forces act on the plane.

**CLEVIS** - a plastic or metal clip that is used on the end of pushrods, so the pushrod can be attached to control horns and servo horns.

**CONTROL HORN** - a plastic component that is securely attached to a control surface, onto which the servo linkage is connected to.

**CONTROL SURFACE** - any moving part of flying surface: rudder, elevator, ailerons and/or flaps.

**DIHEDRAL** - the upward 'V' angle of the wings when viewed from the front. An airplane with dihedral (like the GHOST) is more stable in the air than one without.

**DOWN THRUST** - designed into the GHOST, it angles the firewall and powerplant downward to help counteract the natural lift of the flat-bottom airfoil when at higher speeds..

**ELEVATOR** - the moving section at the rear of the horizontal stabilizer, that controls the pitch attitude of the airplane.

**FIN (VERTICAL STABILIZER)** - the vertical surface at the rear of the airplane used to stabilize the plane in flight.

**FLAPS** - moving sections of the trailing edge of the wing, usually found between the ailerons and fuselage. Flaps create more lift at slower flying speeds and also to slow the plane on landing approach.

**FUSELAGE** - the main body of an airplane, excluding wings, tail and everything else.

**HORIZONTAL STABILIZER (TAILPLANE)** - the horizontal surface at the back of the fuselage, to which the elevators are attached.

**LANDING GEAR (MAIN GEAR)** - the wires and wheels on the forward part of the fuselage.

**LEADING EDGE - (L.E.)** - the front edge of the wing, tailplane or rudder.

**PILOT ERROR** - any mistake, particularly one that ends in a crash, made by the pilot for whatever reason. Pilot error is rarely never admitted to by the pilot in question. Instead, the incident is usually blamed on radio failure, interference, unexplained gusts of wind, extra fast-growing trees, or gravity having some fun and suddenly increasing its strength.
*Don't be this type of pilot - admit it when there's pilot failure - it happens to all of us.*

**PORT** - the left side of anything.

**PUSHROD** - a piece of metal/ plastic rod (or thread/cable) that connects a servo arm to its control surface or function. Clevises are commonly used at the ends of the linkages, to clip to the servo/control horns.

**RECEIVER** - a component of the radio control gear that lives inside the aircraft and picks up the radio signals being emitted by the transmitter, then sends signals out to attached servos.

**RIGHT THRUST** - designed into the GHOST, it angles the firewall and powerplant to the right to help counteract the natural pull to the left when at higher speeds..

**RUDDER** - the moving section on the back part of the fin. Used to control the airplane's yaw.

**SERVO** - the component of the radio control gear that converts the radio signal into movement.

**SERVO ARM** - a plastic or metal piece fixed to the servo's output shaft, onto which a pushrod (and/or clevis) connects.

**STARBOARD** - the right side of anything.

**TAILDRAGGER** - an airplane that has 2 main wheels and a small tail wheel - like the GHOST. Taildraggers require you to use the rudder when on the ground, a bit more than tricycle gear designs.

**TRAILING EDGE (T.E.)** - the rear edge of the wing, tailplane or rudder.

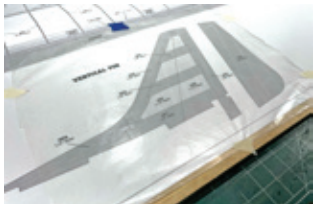
**WHEEL COLLAR** - a small, donut-shaped metal piece that slips on over the landing gear wire and holds the wheel in place - using a small set screw.

**WING** - come on, seriously??

**WINGSPAN** - the overall length of the wing, from tip to tip.

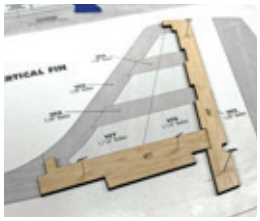
**Let's begin construction by building the vertical fin of your GHOST.**

☐ **Prepare your work area**



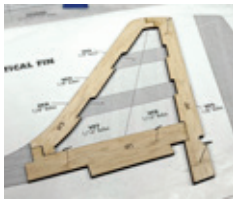
Position the vertical fin plan over your flat building surface and tape it into position. Tear off a length of waxed paper long enough to cover that portion of the plan and tape it over the plan.

☐ **Step 1 - Vertical Fin Assembly (VF1, VF2)**



Locate VF1 and VF2 from BP2. Pin VF1 in place on the plans. Then apply a small amount of glue in the notch of VF2, where it will attach to VF1. Pin VF2 in place as shown here, making sure it's nicely aligned and flat on the building board.

☐ **Step 2 - Vertical Fin Assembly (VF3)**

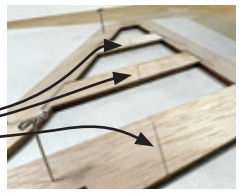


Locate VF3 from BP2. Apply a small amount of glue on each end, where it fits into both VF1 and VF2. Pin VF3 in place as shown here, making sure it's nicely aligned and flat on the building board.

☐ **Step 3 - Vertical Fin Assembly (VF4, VF5)**

Locate VF4 and VF5 from BP2. Apply a small amount of glue on each end of VF4, where it fits into both VF2 and VF3. Pin VF3 in place as shown here, making sure it's nicely aligned and flat on the building board. Then do the same for VF5.

☐ **Step 4 - Vertical Fin Assembly (mark the glue line)**



Grab a pencil and lightly draw a line onto VF1, VF4 and VF5 that corresponds with the sheeting joint line you see on the plans. This will make it easier to apply the right amount of glue in the next step. After you mark this, remove any pins you have holding these parts in place, but don't lift off the assembly. There should be enough glue in place to hold it in position.

☐ **Step 5 - Vertical Fin Assembly (VF7)**

Locate one VF7 from BP17. Lightly sand the top face of this assembly to remove any excess glue so you'll have a smooth surface. Now apply glue to the pieces which are to the left of the line you drew. Then place VF7 on top of the fin framing, making sure it is perfectly aligned, and flat along it's entire length. Use a weight to hold it in position until the glue cures.

☐ **Step 6 - Vertical Fin Assembly (VF8)**

Locate one VF8 from BP17. Apply glue to the rest of the exposed fin framing, and to the edge of VF7 that will touch VF8. Place VF8 on top of the fin framing, making sure it is perfectly aligned, and flat along it's entire length. Use a weight to hold it in position until the glue cures.

☐ **Step 7 - Vertical Fin Assembly (VF7, VF8)**

Carefully remove the fin assembly from the waxed paper. Flip it over and lightly sand the framing's surface.
Locate the other VF7 and VF8 from BP17. One at a time, glue these in place, just as you did in the previous steps.

*That completes the vertical fin assembly. Set it aside and remove the fin plans from your building board.*

☐ **Step 8 - Horizontal Stab Assembly (HS2)**

Tape the horizontal stab plan over your building surface and cover it with waxed paper.
Locate HS2 from BP1 and pin it in position. You might want to grab a straight edge (we use a metal yardstick) and place it along the bottom edge of HS2 to make sure it's perfectly straight when pinned down.

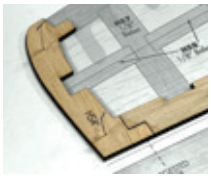
☐ **Step 9 - Horizontal Stab Assembly (HS1B)**

Locate HS1B from BP1. Apply glue to the portion that fits into HS2's center notch, then pin it position as shown here.

☐ **Step 10 - Horizontal Stab Assembly (HS1A)**

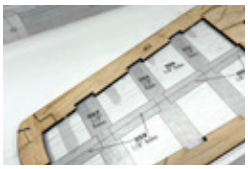
Locate HS1A from BP1. This is glued across the top edge of HS1B, making sure not to get any glue in the center of the HS1B cutout. Pin this in position while the glue cures.

☐ **Step 11 - Horizontal Stab Assembly (HS4)**



Locate both HS4s from BP1. These are glued to each end of HS2 to form the port and starboard stab tips. Apply glue where each HS4 contacts HS2, then pin them in position.

☐ **Step 12 - Horizontal Stab Assembly (HS3)**



Locate both HS3s from BP1 and BP2. These are glued in place to form the port and starboard leading edges of the stab. Apply glue where each HS3 contacts HS1A and HS4, then pin them in position.

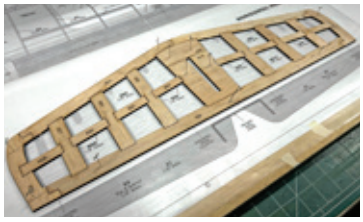
☐ **Step 13 - Horizontal Stab Assembly (HS5, HS6, HS7)**

Locate both HS5s, both HS6s and both HS7s from BP1. These are glued between the leading and trailing edges. Start with the HS5s, applying glue where they contact HS3 and HS2. Push them firmly in place, making sure they are flat. Then do the same for the HS6s and then the HS7s.

☐ **Step 14 - Horizontal Stab Assembly (HS8)**

Locate the eight HS8s from BP1. These are all the same and are glued in between the internal bracing. Starting on the port end, apply glue to where the HS8 will contact HS4 and HS7, then glue it in place, nice and flat. Work your way across the stab, doing the same thing for each HS8 until you reach the starboard tip.

☐ **Step 15 - Horizontal Stab Assembly (sanding)**



You should now hopefully have a stab assembly that looks remarkably close what's shown here.

Now, remove any pins you have holding the stab assembly in place, but don't lift off the assembly. There should be enough glue in place to hold it in position. Lightly sand the top face to remove any excess glue so you'll have a smooth surface.

☐ **Step 16 - Horizontal Stab Assembly (HS10)**

Locate HS10 from BP14. This is glued to the back half of the assembly. Apply glue to the back half only, then carefully attach HS10 so it's perfectly aligned and flat along it's entire length. Again, weights might be a good thing to hold in place while the glue cures.

☐ **Step 17 - Horizontal Stab Assembly (HS9)**

Locate two HS9 from BP15 and BP16. These are glued to the front half of stab, one on each side.

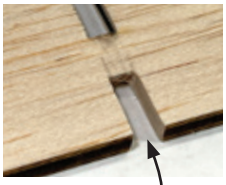
Using the same techniques you've just used, attach one HS9 to the port half, and one to the starboard half. Again, flat and smooth is what we're looking for here.

☐ **Step 18 - Horizontal Stab Assembly (HS9, HS10)**

Carefully remove the stab assembly from the waxed paper. Flip it over and lightly sand the stab's framing surfaces.

Locate the remaining HS10 from BP14, and the HS9s from BP15 and BP16. Glue these in place, just as you did for the other side.

☐ **Step 19 - Horizontal Stab Assembly (rear notch)**



You'll notice that the stab's sheeting has a notch cut into the trailing edge. Use a hobby knife and/or a saw) to remove the internal framing filling up this notch.

*For a few reasons I won't go into here, this is not something that can easily be engineered here at OSMW World-Wide Headquarters. It's just easier to remove this portion of wood after the stab is assembled.*

Once finished, set the completed stab aside.

☐ **Step 20 - Elevator Assembly (E1, E2)**

Locate both E1s from BP2 and two E2s from BP17.

Position the E1s so they are mirror images of each other. Then working with one at a time, apply glue and attach one E2 to each E1, making sure they're perfectly aligned. This should leave you with two mirror image elevator halves, as shown here.

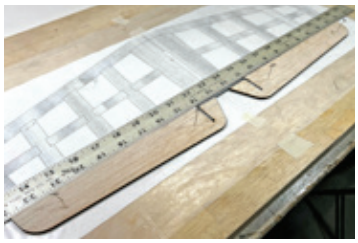
☐ **Step 21 - Elevator Assembly (joiner)**

Locate the pre-bent elevator joiner from the hardware bag. This is used to join the two elevator halves together as shown here.

Use a file, or some sandpaper to rough/scuff up it's surface, where it will fit into the elevator halves.

Because the pre-bent joiners are hand-cut and hand-bent, you might need to adjust the bends slightly to guarantee they are both at 90° and the joiner is perfectly flat. (Two pairs of pliers, one in each hand, should give you the leverage needed to make any bends.)

☐ **Step 22 - Elevator Assembly (join elevator halves)**



Grab that trusty straight edge you used a few steps back.

Pin the port elevator half in place, so that the pre-cut notch in E1 is visible.

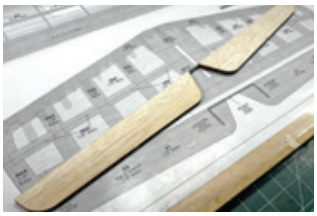
Now, place the other elevator half in position, but don't pin it down just yet. Instead, push the joiner in the grooves of both halves.

Place your straight edge along the leading edge of the halves, as shown here. Then pin the starboard half in place.

(The reason for this is because of the hand-cut nature of the joiner can make it a little longer or shorter). No worries as sanding later on will fix all of this.

Now mix up a little epoxy that you'll use to glue the joiner in place. Remove the joiner, apply the glue, then press the joiner back in place. Clean up any excess epoxy with some denatured alcohol.

☐ **Step 23 - Elevator Assembly (E2)**



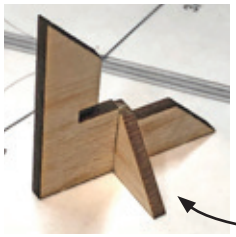
While the epoxy is curing, locate the remaining E2s from BP17 and glue them on to the top of the E1s. Again, make sure everything is aligned and flat along their lengths. Once all the glue has cured, remove the completed elevator assembly from the board and set it aside.

**This completes assembly of the tail surfaces.**

***See, this building stuff isn't as difficult as you though, eh? You've built all the tail surfaces and only needed a few pins, a file, a straight edge and some sandpaper. Not bad.***

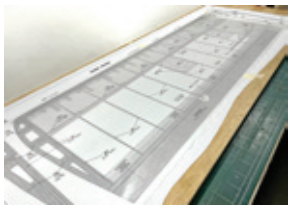
**Time to move on. The wing halves are built next, so clear your board of all everything and let's make a great looking wing.**

☐ **Alignment triangle**



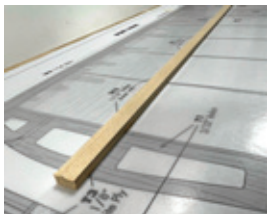
Before we start on the wing construction, there's a couple of tools that are pre-cut into this kit.
One is a 90° triangle in LP1. It can be used to vertically align any of the parts in the construction of your GHOST. LP1 also includes a foot piece that can be used with the triangle to hold it vertically (hands-free).

☐ **Step 24 - Wing Assembly (prepare your work area)**



Position the port wing plan over your flat building surface and tape it in position. Tear off a length of waxed paper long enough to cover that portion of the plan and tape that over the plan.

☐ ☐ **Step 25 - Wing Assembly (bottom spar)**

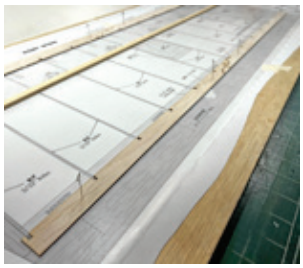


Locate one of the 3/16" x 3/8" x 36" basswood sticks. This is used as the lower wing spar. Position it on the plans so it extends roughly a 1/4" past the tip, as shown here. Now move to the other end and mark the stick about 1/4" past the innermost (root) rib - R1.
Cut this stick to length.
Then it needs to be attached in place over the plans. We use a few drops of medium C/A to tack-glue this piece to the waxed paper to hold it in place, instead of t-pins. Use your long straight-edge to make sure it is aligned properly and is straight over it's entire length. The alignment of this spar is critical as the rest of the wing panel is based off this single piece.

☐ ☐ **Step 26 - Wing Assembly (LE1, LE2)**

Locate one LE1 and one LE2 from BP11. These two pieces will become the lower portion of the leading edge.
Pin LE1 in place first, then apply glue where LE2 and LE1 contact each other - around that modified "scarf" joint.
Pin LE2 in place, using your straightedge to guarantee the straightest of straightnessship.

☐ ☐ **Step 27 - Wing Assembly (TE1, TE2)**

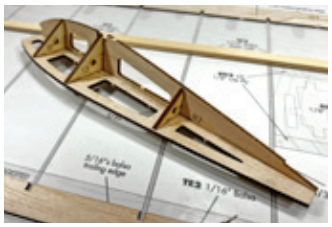


Locate one TE1 from BP11 and TE2 from BP15. These two pieces will become the lower portion of the trailing edge.
Pin TE1 in place first, then apply glue where TE2 and TE1 contact each other - around that modified "scarf" joint.
Pin TE2 in place, using your straightedge to again guarantee the most straightest of straightness that has ever been straight.

☐ ☐ **Step 28 - Wing Assembly (T1, T2, T3, T4)**

Locate T1 from BP10 as well as T2, T3 and T4 from LP4.
Place T1 flat on your building surface, in the same orientation as shown on the plans, then you'll glue T2, T3 and T4 into T1. Make sure each piece is perfectly vertical - remember that 90° triangle?

☐ ☐ **Step 29 - Wing Assembly (R7)**



Locate one R7 from BP6. It is glued to the tip assembly you just made. Test fit it first, making sure you know how all the tabs in each of the T1-4 pieces fit.
When you're ready, remove R7, apply glue in the correct spots and attach R7 in place.

☐ ☐ **Step 30 - Wing Assembly (tip assembly)**

The tip assembly is now glued in place to the spar, as well as the leading and trailing edges. You'll note that there are notches in the leading and trailing edges which help position this rib, as well as the rest of them (as you'll find out).
This tip assembly will also rest on the spar, holding it 90° without the use of tools - yup, another great innovation from the OSMW Design Squadron Think-Tank.
Anyway, once you see how it's attached, apply glue to the spots where the tip assembly contacts the other parts, then glue it in place.

☐ ☐ **Step 31 - Wing Assembly (webs)**

Enter the webs, W3 shear-webs that is.
You'll have a bunch of these on BP11, BP14 and BP15. You'll use one of these along with a rib over the next few steps.
These webs add massive strength to a wing, with very little weight.
These webs do five things at the same time.

1. They give you proper rib spacing with tabs that lock into the rib's pre-cut slots (our exclusive WEB-LOCK construction).
2. They hold each rib perfectly vertical without needing tools.
3. The cutout GHOST face lets you easily know which way is up - an upright face is the correct way.
4. The eye cutouts allow airflow between the different chambers of the wing. This is very helpful in keeping covering from bubbling up when you're covering later on, and when the GHOST is at the field in the boiling sun.
5. *They just look really cool.*

Yup, another bright idea from the warped minds of those who work at the OSMW Development Center.

☐ ☐ **Step 32 - Wing Assembly (W3, R5)**

Locate one R5 from BP4, BP5 or BP6. Also locate one W3 web and test fit it against R7. It should be placed so the face is upright, it's tab is pushed fully into the slot in R7, and this web is flush against

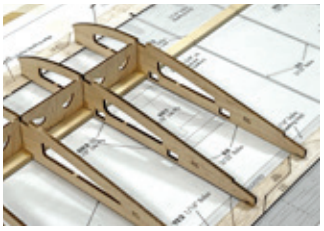
the bottom spar. Now that you know how these work, remove this web, apply glue along the edge touching R7, and along the bottom of the web where it contacts the bottom spar. Glue this in position. Then glue R5 to W3, the spar, the leading and trailing edges.

☐ ☐ **Step 33 - Wing Assembly (R5, W3)**

Locate three more R5s from BP4, BP5 or BP6 and three more W3s. Working your way inward, these webs and ribs are glued in place, one at a time, using the same techniques you just used on the first W3 and R5. Make sure all the tabs, notches and slots are all correctly positioned while the glue cures.

☐ ☐ **Step 34 - Wing Assembly (R6, W3)**

Locate two R6s from BP4 and BP5 and two more W3s. Still working your way inward, these webs and ribs are glued in place, one at a time, using the same techniques you just used on the previous ribs and webs. Make sure all the tabs, notches and slots are all correctly positioned while the glue cures.



☐ ☐ **Step 35 - Wing Assembly (SH2)**

Locate four SH2s from LP7 and LP8. Glue two of them together, one on top of the other, to form a thicker SH2. Make sure they are perfectly aligned when doing this. You'll have two matching, thicker SH2s when finished.

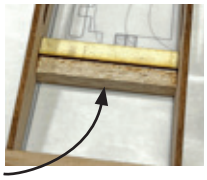
☐ ☐ **Step 36 - Wing Assembly (SH2)**

Now carefully push the two SH2s from the previous step into the pairs of pre-cut holes in the R6 ribs. Glue these in position to both ribs as shown here.

☐ ☐ **Step 37 - Wing Assembly (SH2 trim piece)**

Locate one of the 1/4" x 1/4" strips of balsa sticks - this will be your "small pieces" stick. Cut four 2-3/8" lengths (the distance between the ribs) off of this stick.

You'll glue one of these strips in place now, on the back of the rear SH2 you just installed. Make sure it is pushed flat against the building board as well.

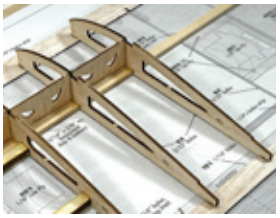


Set the other pieces aside as you'll use one when making the other wing half, and the other two for the flap area.

Note: these are not really structural pieces - it simply completes the back end of the servo areas, and gives your covering something to stick to - trust us, it will make perfect sense later on in the build.

☐ ☐ **Step 38 - Wing Assembly (R5, W3)**

Locate two R5s from BP4 and BP5 and two more W3s. Still working your way inward, these webs and ribs are glued in place, one at a time, using the same techniques you just used on the previous ribs and webs. Make sure all the tabs, notches and slots are all correctly positioned while the glue cures.

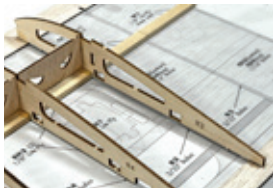


☐ ☐ **Step 39 - Wing Assembly (R4, W3)**

Locate one R4 from BP3 or BP4 and another W3. Still working your way inward, this web and rib are glued in place, using the same techniques you just used on the previous ribs and webs. Make sure all the tabs, notches and slots are all correctly positioned while the glue cures.

☐ ☐ **Step 40 - Wing Assembly (R3, W3)**

Locate one R3 from BP3 and another W3. Still working your way inward, this web and rib are glued in place, using the same techniques you just used on the previous ribs and webs. Make sure all the tabs, notches and slots are all correctly positioned while the glue cures.



☐ ☐ **Step 41 - Wing Assembly (SH2)**

Locate four SH2s from LP7 and LP8. Glue two of them together, one on top of the other, to form a thicker SH2. Make sure they are perfectly aligned when doing this. You'll have two matching, thicker SH2s when finished.

Now carefully push the two SH2s into the pairs of pre-cut holes in the R3 and R4 ribs. Glue these in position to both ribs as shown here.

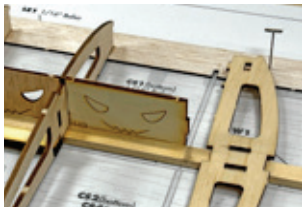
☐ ☐ **Step 42 - Wing Assembly (SH2 trim piece)**

Locate one of the 2-3/8" lengths of 1/4" x 1/4" strips of balsa you cut a few steps back.

Glue this strip in place on the back of the rear SH2 you just installed. Make sure it is pushed flat against the building board as well.

☐ ☐ **Step 43 - Wing Assembly (R2, W2)**

Locate R2 from BP3 and two W2s from LP5 and LP7. Although thicker, the W2 webs are is glued in place just the same as the other webs. The only change is that one is glued on each side of the lower spar. There are additional slots in R2 and R3 to accommodate the extra W2. Then R2 is glued in place, just like the other ribs.

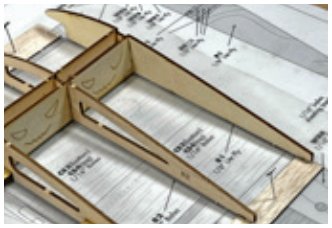


☐ ☐ **Step 44 - Wing Assembly (R1P, W1P)**

Locate one R1P from LP7 and both W1Ps from LP5. You might also want to pop out the 3° dihedral gauges (LP4 & LP5) and it's foot that's part of LP4 as it can be used to help hold R1P at the correct angle.

Note the face etched into both W1Ps - there's a winking eye. This

denotes the side that should be up-against R1 (it's also the side with the 3° angle cut into it).
Glue both W1Ps in place, then glue the R1P in place. You can use the dihedral gauge to make sure you are setting in the proper angle while the glue cures.



Note that there really isn't anything for the front of W1P to glue to right now. That's ok. We'll address that next.

☐ ☐ **Step 45 - Wing Assembly (leading edge)**

Locate one of the 1/2" x 1/2" x 36" balsa strips as it will be used as part of the wing's leading edge.
Measure and cut this to length, making sure it extends about 1/4" past the tip and root (R1) rib.

***If this piece has a bit of a bow to it, don't worry. You'll position it so that when it's pushed into the tip and root ribs, the bow protrudes out from the center (a convex curve). That way, this bow can be steadily removed bit-by-bit as you push this piece into the ribs along the length of the wing.***

This strip will now be glued in place, gluing it to the LE1/LE2 piece, as well as completely into every pre-cut notch of each rib you've just installed. It will just touch the tip of R1 as well - just barely, but enough to get some glue to hold it securely. ***ALSO MAKE SURE R1 FLAT AND STRAIGHT ALONG IT'S ENTIRE LENGTH - NO BOW!***

☐ ☐ **Step 46 - Wing Assembly (leading edge)**

Locate one of the uncut 1/4" x 1/4" x 36" balsa strips to be used as the top of the leading edge.
This will be glued to the top of the 1/2" strip you just installed, up against the front edge of each rib.

☐ ☐ **Step 47 - Wing Assembly (trailing edge)**

Locate one of the uncut 5/16" x 5/16" x 36" balsa strips to be used as the trailing edge.
This will be glued to the TE1/TE2 piece, and to the rear edge of each rib.

☐ ☐ **Step 48 - Wing Assembly (create dihedral box)**

Now it's time to cut-away the center of the R1 and R2 ribs. We've shown before and after photos to help show what needs to be done.
Before cutting this area away, make sure that the W1P and W2's are securely glued to the ribs on the outside of this area - not the inside. This way things won't move as you cut.
After cutting, make sure that the area is completely clean and smooth, as this will form 3 sides of a box where the dihedral brace will slide in to. The cleaner/smoother it is now, the easier it will be to slide in the dihedral brace when it's time.
Take your time and use a gentle touch in this step as you don't want to cut/sand/file more than you should, nor do you want to damage the webs as it could weaken the wing or cause a misalignment.
*Note that if you have a Japanese saw, is the perfect tool for this job. These saws don't have the traditional offset in the teeth, so they can cut smoothly, up-against edges like the webs.*

*Before cutting*

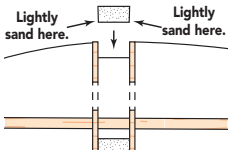
*After cutting*

☐ ☐ **Step 49 - Wing Assembly (top spar)**

Locate one DH1 (ply) another length of 3/16" x 3/8" x 36" basswood strip to use as the upper spar. Measure and trim the spar to length, again, leaving about a 1/4" extra past the root rib (R1).

***It is HIGHLY advised that you take a test run on installing this upper spar before any glue gets out of the bottle.***

First lightly sand the edges of the spar's bottom face as shown in the drawing to the right. This will help the spar slide in easier.



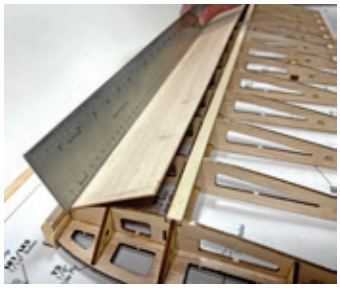

Now start pressing it in place, starting at the tip rib, and working your way towards the root a little at a time. This will be a tight fit and might require "wiggling" the spar from side to side to slip in-between the webs. Be sure to press the spar completely into the slot in each rib, making it flush with the webs.
Once you get to the open area between the R1 and R3 ribs, you'll use the single DH1 as a spacer. Note that it is NOT glued in at this point - just used as a spacer to keep the correct height for the spar.
Gluing this spar in correctly will take a bit of time, so we recommend against using an instant setting glue. If you are using CA, use a thicker formulation that gives you a bit of working time.
Once the spar is in place remove the DH1, then wick thin C/A along the spar to web joints (front and back) along the entire length of the spar.
When fitting the upper spar in the area of the dihedral box, be careful not to drip excess glue into the box formed between R1 and R2 ribs.

☐ ☐ **Step 50 - Wing Assembly (leading edge sheeting)**

Locate one of the uncut 1/16" x 4" x 36" balsa sheets. Trim this to length, similar to the way you cut the spar to length. It should be flush with the outer edge of the tip rib (R7) and extend about a 1/4" past the root (R1) rib.
Now using your trusty straight edge, you need to cut two pieces. One will be 3" x 36" and the other will be 3/4" x 36".

☐ ☐ **Step 51 - Wing Assembly (leading edge sheeting)**

Set the 3/4" width piece aside for now and let's install the 3" piece as the leading edge sheeting.
This will glue to the back side of the leading edge, to the ribs and then gently curve so it can be glued to the top of the ribs, webs and up against the top spar.
To do this, first apply glue along



the edge that will be glued to the back of the leading edge. Press this in place, and use your long straight-edge like we've shown on the previous page. Doing this allows you to evenly press over a long area - pretty cool eh?

Once that glue has cured, then apply more glue to the upper edges of each of the ribs, the top of the webs and to the front edge of the spar.

Slowly drag the straight edge rearwards to press the sheeting in place, evenly working your way from the leading edge, back to the spar.

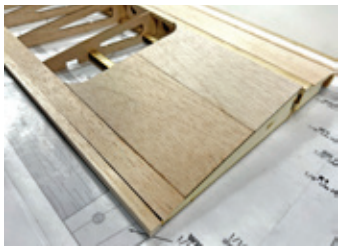
☐ ☐ **Step 52 - Wing Assembly (trailing edge sheeting)**

Grab the 3/4" width and it will be glued into the rear notch of each rib and up against the trailing edge.

Again, using your long straight-edge will help hold everything down evenly along those long spans.

☐ ☐ **Step 53 - Wing Assembly (C4)**

Locate two CS4s from BP13. These are used as the top sheeting, over the R1, R2 and R3 ribs.



These pieces are identical and made just a little wider than needed, so they can be perfectly trimmed to fit between the upper spar and the trailing edge sheeting you just installed.

Take your time trimming these, remembering that it's easier to remove wood than put it back on!

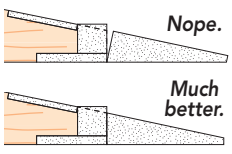
Once satisfied with the fit of these pieces, glue both of them in place, making sure they are firmly attached to spar, the trailing edge, and the total length of where they make contact with the ribs.

☐ ☐ **Step 54 - Wing Assembly (aileron stock)**

Locate one of the 5/16" x 1-1/4" x 36 strips. These are used as the ailerons and also the rear of the wing's center section.

So, to make the rear of the wing's center section, you'll need to measure and cut this piece. The measurement doesn't need to be exact, but does need to be the same on both wings - we cut a 10" length.

Note that this piece's profile is tapered, but not symmetrical. Using the diagram to the right, glue this to the rear of the trailing edge, so the 90° angle is against the building board and the trailing edge.



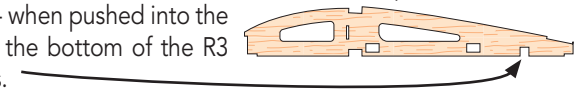

**This completes the top of the wing.**
**Carefully remove it from the board, and flip it over.**

☐ ☐ **Step 55 - Wing Assembly (flap anchor)**

Remember that 1/4" x 1/4" balsa strip that we're using to cut small pieces from? Measure and cut two 7-3/8" lengths. You'll install one now, so set the other aside for use on the starboard wing.

Whether or not you're installing flaps right now, go ahead and install this piece. You could change your mind down the road and this will be VERY hard to install into a finished wing.

First, you'll need to trim the length so that it will fit perfectly between R2 and R5 - when pushed into the cutouts on the bottom of the R3 and R4 ribs.



Technically, this distance is 7.3053" according to the master drawings, but just use your eye to sand/cut/trim the piece.

Then glue this in place, making sure it's glued to each of the ribs it touches, and the strip is completely pushed into the slots.

☐ ☐ **Step 56 - Wing Assembly (CS1)**

Locate one CS1 from BP12. This will be cover the R1, R2 and R3 ribs between the leading edge and the webs. Note that there are small pegs as part of these ribs. These not only help set the height of those ribs, but are now used to properly place CS1 in the right orientation. Make sure CS1 is glued to each of those ribs, to the leading edge and to the webs.

☐ ☐ **Step 57 - Wing Assembly (CS2, CS3)**

Locate one CS2 from BP12, and one CS3 from BP11. These will cover the same ribs, but from the webs back to the trailing edge. Again, note the pegs so you can properly attach CS1. Then attach CS2, referring to the above picture to make sure you have everything in the proper orientation.

☐ ☐ **Step 58 - Wing Assembly (sanding the root rib)**

Time to do some sanding. Take the time to true up the root rib, removing all the excess sticks and sheeting that extend past the R1 rib itself.

A large, flat sanding block is best for this as you'll need the surface to be completely flat and free of any extra sheeting, balsa or basswood sticks.

*Set the port wing half aside and begin work on the starboard half. Tape the starboard wing plan and fresh wax paper on your board. Then follow steps 24 through 58 to complete the starboard wing half. Once finished, then move on to step 59.*

***Note that when building the starboard half that many of the parts will need to be glued to the opposite side (the shear webs, for instance). Always refer to the plans to make sure you're gluing the parts together in the correct way.***

☐ **Step 59 - Wing Assembly (DH1)**

Locate all three of the DH1s.

They will be glued together to form the wing's dihedral brace.

Note that if there is a bow to these pieces, that's OK.

Mix up some 15 or 30 minute epoxy and apply it to the concave

surfaces of each DH1. Carefully align them, weight them down and allow the glue to cure to form a solid, one-piece dihedral brace. Make sure these parts are perfectly aligned and hopefully one of the two sides will show the etched center line, as shown here, but it's not a problem it is doesn't show - you can draw your own centerline with some measuring, some creative penciling and a straight edge.

☐ **Step 60 - Wing Assembly (DH1 test fit)**

Locate the DH1 assembly, WH1 from LP1, and the two wing halves. There is a possibility that you'll have to sand DH1 to allow it to fit properly into the box you've made in each wing. Test fit DH1 into each wing half, but don't JAM it in. Make notes on where the DH1 might get stuck. Take some time test fitting and sanding DH1 as necessary to get a good fit in both wing halves. ***Don't take off too much, too fast.*** Carefully sand as necessary to make sure everything fits properly and the root ribs in each wing half are touching along their entire length when assembled into a single wing. ***Take your time and get a good fit that doesn't require a lot of force.***

Remember you may also have to file inside the boxes built into each wing half to get that perfect fit. Make sure each box is smooth and DH1 doesn't catch on any extra glue.

☐ **Step 61 - Wing Assembly (join wing halves)**

Test fit the wing halves together one last time and sand as necessary for a good fit. After test fitting, now it's time for the big one - joining the wing halves together into a single wing.

To do this, you'll need both wing halves, the DH1 and locate WH1 from LP1.

You'll join the wing halves permanently with 30 minute epoxy. Remove the dihedral brace and apply the epoxy into the pockets in each wing half and also coat the faces of each root rib.

Slide all the dihedral brace into one of the wing halves and you'll also slide WH1 into place, making sure it's tabs fit into the pre-cut slot in R2.

Now slide remaining wing half in place. Using a couple of clamps (or tape), hold wing halves firmly together. Wipe off any excess epoxy and remove the clamps only after the epoxy has fully cured. Remember, any twist in the alignment of the panels cannot be fixed after the epoxy cures and will lead to a poor flying model.

☐ **Step 62 - Wing Assembly (WH4, WH5)**

Locate WH4 from LP4, and both WH5s from LP1 and LP2. The WH5s are glued to either side of the WH4, making a sandwich of sorts. But unlike most sandwiches you've made (or eaten) in your life, this one needs to be perfectly aligned - with no condiments running into the pre-cut holes. And by condiments, I mean glue.

☐ **Step 63 - Wing Assembly (WH2, WH3)**

Locate WH3 from LP1. It is glued to the bottom of the WH4/5 assembly, making sure it pushed up against the flat surface - (the tabs are pushed all the way into WH3). Then do the same for attaching WH2 (not shown here).

☐ **Step 64 - Wing Assembly (dowels)**

Locate the 1/4" dowel from the hardware bag. Measure and cut two 1-3/4" lengths that you'll use as the wing-hold pegs.

Before gluing them in, round the ends of each one, either by hand, or do it like we do - lightly chuck them up in a drill and spin it like a little lathe. Use sandpaper to quickly round off one end, then the other.

Once rounded off, insert the dowels into the WH3/4/5 assembly as pictured here. On one side, the dowels should stick out about a 1/8" or so, then the other side is where the bulk of the dowels will be.

***It is crucial that you glue these dowels so they are perfectly perpendicular to the WH3/4/5 assembly - and in line with each other.*** This will make mounting the wing quite a bit easier later on.

☐ **Step 65 - Wing Assembly (WH assembly)**

Now you can glue the completed WH assembly into the bottom of the wing - into WH1 you installed when joining the wings. Test fit it first, making sure that it clears the sheeting.

Then when you're satisfied, glue it in place, making sure it is completely inserted into WH1 and that both dowels stick out past the leading edge of the wing.

☐ **Step 66 - Wing Assembly (WH assembly)**

Use some of the scrap balsa you have to fill in the areas on each side of the WH assembly as we've done here. It might not come out to the perfect level of the wing sheeting, but it's better to be a little thicker and sand it off later, than be a bit short and have dips in the sheeting that show after you cover the wing.

☐ **Step 67 - Wing Assembly (WH6)**

Locate both WH6s from LP9. These are glued on wing's top surface, along the trailing edge, on each side of the centerline.

***PLEASE PAY ATTENTION TO THE ORIENTATION OF THESE PIECES - the longer edge should be against the centerline, and the shorter edge along the trailing edge.***

Glue these in place, keeping glue out pre-cut hole area.

☐ **Step 68 - Wing Assembly (ailerons)**

Locate both leftover lengths of 5/16" x 1-1/4" tapered balsa sticks. These should now be trimmed to form the ailerons. To easily get the proper length, grab a piece of scrap 3/32" balsa (from BP3-6). Use it as a spacer between the tapered stock already attached to the wing, and to the edge of the aileron strips. Move to the outer edge and mark the balsa strip where it should be cut. Hopefully

both ailerons will be the same length, but just in case they need to be slightly different, mark the port aileron by sticking a piece of tape on it so you'll know which is which for later on.

**This completes assembly of the GHOST wing.**
**Now it's time to start construction of the fuselage.**

☐ **Prepare your work area**

Now it's time to assemble the fuselage. You won't necessarily need to tape down the fuselage plan to the board. Instead you can simply use it as a reference. However, you may need to put down some fresh waxed paper as you'll need it for a few of the steps.

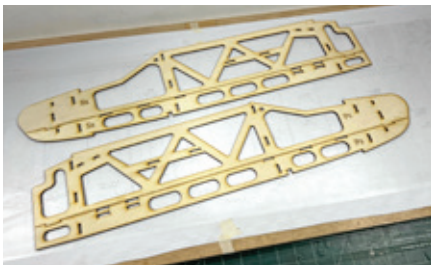
☐ **Step 69 - Fuse Assembly (P1, P2, S1, S2)**

Locate P1 from LP1, P2 from LP3, S1 from LP2, and S2 from LP6.

Start with P1 and P2 to make the port side of the cabin area. Make sure you remove any leftover ply from when you cut them free from their sheets, as this can get in the way of proper alignment. Test fit P1 and P2 together and make sure the notches all properly fit into the tabs.


Don't worry about any bowing along the length of these parts, as that can actually aid in the fuselage assembly down the road. Yup, I said that the bowing could aid down the road, as these pieces have been designed and cut so that can actually happen - another fine example of forward-thinking from the Ohio Division of OSMW.

Because of the length of these glue joints, we found it best to glue a little at a time, keeping it weighed/pinned down as we went along. Your mileage may vary, but make sure both parts are firmly glued together and the joints are flat.



Do the same to join S1 and S2, forming the starboard side of the cabin.

☐ **Step 70 - Fuse Assembly (FS2, FS3)**

Locate both FS2s from BP8 and both FS3s from BP9. These are glued together to make two identical front halves of the fuselage sides.

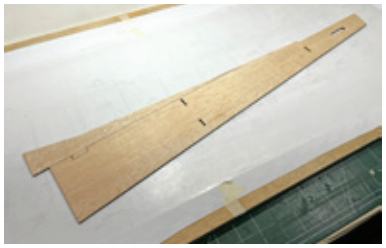
Similarly to what you did when gluing the cabin sides together in the last step you'll need to make sure you remove any leftover balsa from when you cut them free from their sheets, as this can get in the way of proper alignment. Test fit one FS2 and FS3 together and make sure the notches all properly fit into the tabs.

When you're satisfied, then glue these together along their entire length. You may have to do this a little at time, but that's your call. Make sure all the joints are nice and flat along their entire length while the glue cures. Again, a weight, tape and/or pins could be of benefit here.

Do the same to make the other matching side sheeting.

☐ **Step 71 - Fuse Assembly (FS1, FS4)**

Locate both FS1s from BP7 and both FS4s from BP9. Just like you did in the previous step you'll join FS1 and FS4 together to make two identical pieces that form the back half of the side sheeting.



Make sure you remove any leftover balsa from when you cut them free from their sheets, as this can get in the way of proper alignment. Test fit one FS1 and FS4 together and make sure the notches all properly fit into the tabs.

When you're satisfied, then glue these together along their entire length. You may have to do this a little at time, but that's your call. Make sure all the joints are nice and flat along their entire length while the glue cures. Again, a weight, tape and/or pins could be of benefit here.

Do the same to make the other matching side sheeting.

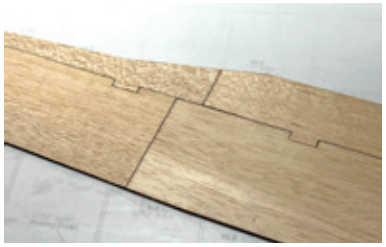
☐ **Step 72 - Fuse Assembly (side sheeting)**

Now you'll glue one FS2/3 and one FS1/4 assembly together to form the completed fuselage side sheeting as shown here.

Do this to make both side sheets and take the time to make sure they both match when stacked on top of each other. This is crucial for a good flying GHOST.

☐ **Step 73 - Fuse Assembly (port side sheeting)**

Take one of the side sheets that you just made. Lightly sand over the joints on both sides to remove any glue.



Then place is on your building surface like we've pictured here - nose to the right, tail to the left.

Now you'll glue the P1/P2 assembly to the sheeting. Alignment is very crucial here, as being off even a little will really make things difficult in a few steps.

So, you'll make sure these are aligned, paying close attention around the curvature of the nose, and in the area of the wing saddle. Thats were these pieces are identical. If those are in alignment, the rest will be in the right spot.

You might want to play with this before squirting out some glue to make sure you understand just where this goes.

When you're ready, apply glue to the back side of P1/P2 and then stick it in place. We strongly suggest using weights over the entire area to keep things in contact.

☐ **Step 74 - Fuse Assembly (starboard side sheeting)**

Now do the same thing to create the starboard side, except as a mirror image.

This time, place the nose to the left and the tail to the right, then work with the alignment of S1/S2.

When you're ready, apply glue

to the back side of S1/S2 and then stick it in place. We strongly suggest using weights over the entire area to keep things in contact.

☐ **Step 75 - Fuse Assembly (bottom fuselage framing)**

Locate two of the 3/16" x 3/16 x 36" balsa sticks.
You'll need to measure and cut them so they'll run from F3, all the way back to the start of TW1 (there's a notch in the sheeting at the point).
Now you'll glue one to the inside of each fuselage side, starting at F3 - up against the bottom of the plywood sheeting, then running along the bottom side of the fuselage sheeting. It needs to be flush with that edge and make sure it also matches the curvature of the fuselage.
You probably should do this a little at a time, rather than trying to do it all in one big step.

☐ **Step 76 - Fuse Assembly (top fuselage framing)**

Locate the other two 3/16" x 3/16" x 36" balsa sticks.
You'll need to measure and cut a piece from each stick, starting at the point marked "sheeting break point" on the plans, extending back to the start of the stabilizer.
Glue this in place making sure it is flush with the top edge of the fuselage sheeting.
Make sure you do this for both sides.

☐ **Step 77 - Fuse Assembly (top fuselage framing)**

Using the scrap 3/16" x 3/16" x 36" balsa stick, measure and cut a piece that spans the distance from the sheeting break point" up to F4.
Glue this in place making sure it is flush with the top edge of the fuselage sheeting. Make sure you do this for both sides.

☐ **Step 78 - Fuse Assembly (top fuselage framing)**

Using the scrap 3/16" x 3/16 x 36" balsa stick, measure and cut two pieces that are 5-1/2" long. These will run along the horizontal stab cutout, from the leading edge to 3/4" from the rear of the sheeting.
Glue this in place making sure it is flush with the top edge of the fuselage sheeting.
Make sure you do this for both sides.

☐ **Step 79- Fuse Assembly (bottom fuselage framing)**

Using the scrap 3/16" x 3/16" x 36" balsa stick, measure and cut two pieces that go from the front of the landing gear blocks, forward to the notch in the plywood sides, as shown here.
Glue this in place making sure it is flush with the bottom edge of the fuselage sheeting.
Make sure you do this for both sides.

*Over the next several steps we're going to make several sub-assemblies that will be used when joining the fuse sides together, so set the fuselage sides, to the side, for now.*

☐ **Step 80 - Fuse Assembly (F5A, F5B, F5C)**

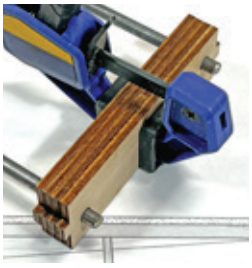
Locate F5A and both F5Bs from BP10. F5Bs are glued the upright sides of F5B to strengthen them. One goes on the left side, one on the right, making sure they are aligned with the upright edges of F5A - not covering up any of F5A's tabs.

☐ **Step 81 - Fuse Assembly (F3A, F3B)**

Locate F3A and F3B from LP4. F3B is glued across the top of F3A to strengthen it, where the wing dowels will slide through. Make sure it is aligned, with the bottom edge of F3B lined up with the top of the center cutout of F3A. Also make sure that the pre-cut holes are aligned. Glue this in place, as shown here.

☐ **Step 82 - Fuse Assembly (LG2)**

Locate the four LG2s from LP1. These are glued one on top of each other to make the landing gear block.
Epoxy is a good choice here, but be careful not to introduce any glue into the pre-cut holes in the LG2s.



*Hey, here's a simple tip on how to align these. Grab both pre-bent main gears from the hardware bag. Then slip each of the LG2s in place over the gear and then use a clamp to keep everything from moving while the glue cures.*

☐ **Step 83 - Fuse Assembly (WH6, WH7)**

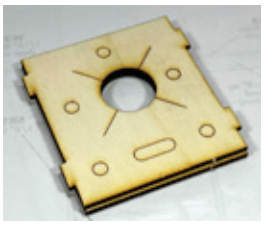
Locate WH6 from LP4 and the four WH7s from LP5. These are glued one on top of each other to make the wing hold down block.
Think of this as another sandwich, this time with Texas toast for bread. You'll use WH6 as the meat and two WH7s on each side for the extra thick bread.
Again, epoxy is a fine choice here. Clamp everything together and make sure it's all nice and aligned.

☐ **Step 84 - Fuse Assembly (CG8, CG9)**

Locate both CG8s and four CG9s from LP4 and LP5.
These are sandwiches again, but back to normal thickness - but now you're making two matching sandwiches.

Glue one CG9 to each side of CG8, making sure they're nice and perfectly aligned. Then do the same to create the other CG8/CG9 sandwich - *mmmmmm, yummy!*

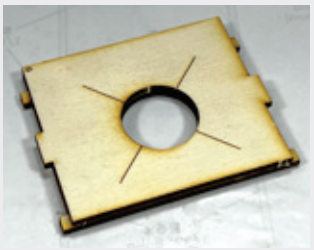
☐ **Step 85 - Fuse Assembly (F1, F2)**



Locate F1 and F2 from LP5. These are glued together, but a little care needs to be taken here.
Note all the fancy etching on the front of F1. This needs to show once the parts are glued together. So F2 will be attached to the back of F1. Also, the hole in the center of these pieces match up, but are not symmetrical. Test "fit" them together to make sure how they align. The cutout circles will match, the left and right sides will align, as will the top edge.
The bottom edge however, will not.
So, when you're ready mix up some epoxy and make these two pieces become one. Clamp things up to make sure they stay in the right place while the glue cures.

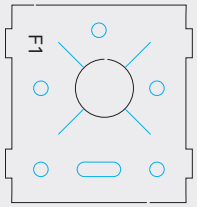
***IF, AND ONLY IF - you are going to use electric power for your GHOST, you'll need to make this assembly - the electric firewall.***
***If going glow, sounds good - skip to step 88.***

☐ **Step 86 - Fuse Assembly (electric firewall - E1, E2)**



Locate EF1 from LP7 and EF2 from LP5. These are glued together, but a little care needs to be taken here.
Note more of that fancy etching on the front of EF1. This needs to show once the parts are glued together. So EF2 will be attached to the back of EF1. Also, the hole in the center of these pieces match up, but are not symmetrical. Test "fit" them together to make sure how they align. The cutout circles should align when all the sides line up.
So, when you're ready mix up some epoxy and make these two pieces become one. Clamp things up to make sure they stay in the right place while the glue cures.

☐ **Step 87 - Fuse Assembly (glow firewall)**




Also, if you're using electric you'll need to cutout a few holes in the glow firewall (F1/F2). We've etched the areas that should be cutout. The holes are simple 1/4" holes that can be handled by drilling them out. The elongated hole on the bottom can be drilled out with the same 1/4" on each end, then the area between the holes can be filed/cut away. Most of these holes allow for air to flow over the battery and ESC. The elongated hole on the bottom allows the motor's three wires to enter the fuselage.

☐ **Step 88 - Fuse Assembly (F4A, F4B, F4C)**

Locate F4A, F4B and both F4Cs from LP5. F4B is glued across the center of F4A, making the sets of holes are aligned between the two parts.
The F4Cs go across the top and bottom of F4A. Note their positions in the photo.
The top F4C is just below the upper tabs. The lower is aligned with top of the lowest cutout.

☐ **Step 89 - Fuse Assembly (F3, TR1)**

Locate TR1 from LP4 and the F3 assembly. TR1 is pushed through the center of F3 at an angle, then rotated so the left and right uprights of F3 fit into TR1's slots.
TR1 should rest on the two small triangle supports when it's glued in place, with it's etched circle in the corner, positioned on the starboard side. Also note the orientation of F3B, it will face the larger portion of TR1.
Make sure these two pieces are exactly 90° to each other when gluing them together. (Remember that triangle from earlier?)

☐ ☐ **Step 90 - Fuse Assembly (servo rails)**

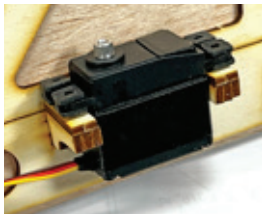
Now here's another cool thing that's designed into each and every GHOST. Those smart folks in the OSMW Department of Awesomeness have integrated our exclusive Multi-Size Servo mounts into the GHOST - they're everywhere, including the sides of the fuselage.
So, let's do this thing. You're gonna need a few things for this. The first is to grab one of the fuselage sides - doesn't matter which one.
Next you'll need your elevator or rudder servo - again doesn't matter which one. You'll need to pop out six of the small "**h**" shaped servo rails and two of the small servo rectangles. They're all over the LP sheets - ***BUT DON'T USE THE ONES ON BP8 - Those are "L" shaped and used for the wing's servos.***
Lastly, you'll need one of the SHGs from LP1 or LP2. Yup, that's a lot of stuff, but it'll all make sense in just a little bit.


Put three of the "**h**" shaped rails into the SHG as shown here. This little guide/jig/thing-a-ma-jig makes it easy to align these three small pieces - just make sure you don't glue the rails to the SHG.
Make two rails.

☐ ☐ **Step 91 - Fuse Assembly (servo rails)**

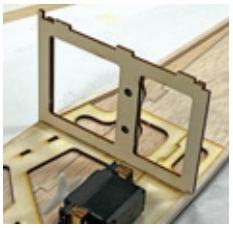
Those two servo rails can now be pushed into the pre-cut slots in the fuselage ply framing. Push in the rail that'll be more "forward" first, then use your servo to gauge where the other rail should be placed. Mark this on the fuselage, remove the rails, apply glue to them and then fix them in place permanently.
Also glue a small rectangle on top of each rail, as we've shown here.

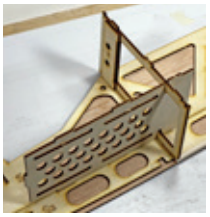
☐ ☐ **Step 92 - Fuse Assembly (mount the servo)**



Now you can drill and attach the servo to the inside of the fuselage, using the servo's mounting screws.
This might seem like a strange time to do this, but it works quite well, as you have more room to make this happen than you will later on.

☐ **Step 93 - Fuse Assembly (servo rails)**
Now go back to step 89 and repeat everything you just did, so now you can mount the servo into the other fuselage side.

☐ **Step 94 - Fuse Assembly (F4)**

Locate the F4 assembly and the starboard fuselage side. Place the fuse side with the plywood upwards, nose pointed to the left and tail to the right - just as in this photo.
Glue F4 in place, into the slots pre-cut into the plywood sides. Note it's orientation and make sure that the F4's support pieces face towards the rear of the fuselage, as pictured here.

☐ **Step 95 - Fuse Assembly (F3)**

Locate the F3/TR1 assembly. Glue F3 in place, into the slots pre-cut into the plywood sides and the bulk of the TR1 facing towards the nose.
Note that TR1's tabs will not necessarily fit into the fuselage side yet, as it tapers toward the front. Don't worry about this right now, as that will be taken care of in a few steps.

☐ **Step 96 - Fuse Assembly (CS8/CS9)**

Time to glue in the CS8/CS9 sandwiches.
Make sure they are completely inserted into the plywood sheet. Also make sure they are perfectly perpendicular to the ply in both directions.

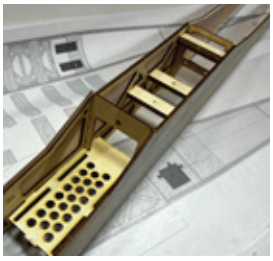
☐ **Step 97 - Fuse Assembly (WH6/WH7)**

Now it's time to glue in the Texas toast assembly of WH6/WH7. Make sure the tabs in Wh6 are completely inserted into the plywood sheet's slots. Also make sure it is perfectly perpendicular to the ply in both directions.

☐ **Step 98 - Fuse Assembly (F1/F2)**
Remember that we told you not to worry about the taper in the TR1 piece? Well, now we're going to tackle part of that.

Grab the F1/F2 firewall assembly and test fit this to the front of TR1. At the same time you can bend the front of the fuselage sheeting see that the tabs in the tray and the firewall will fit into the slots pre-cut into the side sheeting.
When you see how this will work, mix up a little epoxy to glue these pieces together. ***Make sure you do NOT introduce any twist into the fuselage side when doing this.***

☐ **Step 99 - Fuse Assembly (port fuselage side)**
Now it's time to attach the port fuselage side to the starboard assembly. This is gonna take a bit of time, and we recommend doing this in two steps.


First, glue in all of the pieces from F3, rearwards. They're all flat which makes holding the port side in place as easy as clamping the two sides together around the cabin area.
Also, place the fuselage upright on the table, as pictured. Push down on both sides to make sure they're flat against the board. We're trying to eliminate any twists while the glue is curing. You can check this by pulling the balsa sides together at the rear - they should match up, aligning with each other.


Second, work from F3 forward, using epoxy and clamps to make this work. Note, that if you are going to use electric power, you'll also need to glue in the EF1/EF2 assembly during this same time. Note it's etched circle that should be on the starboard side.
As just stated, use epoxy for this, and clamps. Epoxy for the strength, and clamps to make sure it all stays as you left it.

☐ **Step 100 - Fuse Assembly (rear fuselage pins)**
This next step doesn't require any glue - you're simply holding things in place to help in the next few steps.
Grab the vertical fin and a few pins. You'll now put the vertical in between the fuselage sides, then squeeze the two sides together so they are aligned and are touching the fin.

Now push in a few pins at various angles to hold this all together.
What we're looking for are two matching tapers on the fuselage sides, if you were to sight down the fuselage from the front and back. Also the sides should be level with each other.

☐ **Step 101 - Fuse Assembly (F5)**

Locate the F5 assembly from several steps back.
You'll now glue this in between the fuselage sides, making sure it's tabs are fully inserted to the corresponding slots pre-cut into both sides of the fuselage.

☐ **Step 102 - Fuse Assembly (F6)**

Locate F6 from BP10. You'll now glue this in between the fuselage sides, making sure it's tabs are fully inserted to the corresponding slots pre-cut into both sides of the fuselage.

☐ **Step 103 - Fuse Assembly (bottom fuse sheeting)**

Locate a couple of the uncut 3/32" x 4" x 12" sheets. You'll use this to start the sheeting on the bottom of the fuselage.

Measure and make a mark on both side of the fuselage - 3-7/8" forward of F4 (or 7.4" behind F3 if you prefer). This is the start of the sheeting - a piece at a time. Hold the sheeting against the fuselage, making sure the grain is cross-ways. Mark, cut and glue the first 4" section of sheeting in position. Using this same technique, work your way backward 4" at a time, until you get close to the TW1 cutout. Then you'll have to trim the piece to fit the remaining distance.

Be careful to waste as little of the sheeting as possible.

☐ **Step 104 - Fuse Assembly (TW1)**

*Now before you start this step, there's a few things shown installed in this photo - things that we haven't asked you to do - don't worry, you haven't missed anything - just part of making prototypes, then figuring the steps on how best to put it together.*

Locate both TW1s from LP2. These are glued in place at the rear of the fuselage, into the pre-cut notch in the fuselage sides. One goes on top (or bottom) of each other, nicely aligned as always.

***At this point you can remove the pins and vertical fin.***

☐ **Step 105 - Fuse Assembly (elevator/rudder pushrods)**

Before the top sheeting is installed, we recommend installing the elevator and rudder pushrod guides inside the fuselage. Pushrods are not included and we recommend a set of flexible pushrods, similar to those by Du-Bro, Sullivan, etc. These have an outer tube which is permanently installed in the fuselage. You'll push these tubes in through the pre-cut holes in F4, F5, F6 and then out of the fuselage side's elongated cutouts, similar to what's shown in this pic.

☐ **Step 106 - Fuse Assembly (top fuselage sheeting)**

Locate more of the uncut 3/32" x 4" x 12" sheets. You'll use this to start the sheeting on the top of the fuselage.

Start at the F4 and work your way back to the horizontal stab cutout - a piece at a time. Hold the sheeting against the fuselage, making sure the grain is cross-ways. Mark, cut and glue the first 4" section of sheeting in position. Using this same technique, work your way backward 4" at a time, until you get close to the stab cutout. Then you'll have to trim the piece to fit the remaining distance.

Be careful to waste as little of the sheeting as possible.

***Time for a couple of big steps. These require a bit of time to make sure you get them right, as they can DRASTICALLY change how well, or how bad your GHOST will fly.***

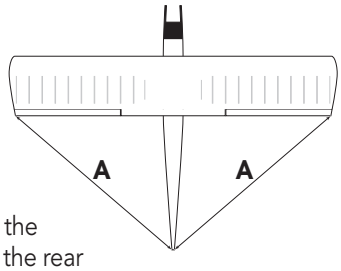
☐ **Step 107 - Fuse Assembly (fit the wing)**


It's been awhile, but remember the wing - that really long thing you made with the slight bend in the middle? Well it's time to mate it up to the fuselage. Before you can do that properly, you'll need to sand the leading edge of the wing - you don't have to do all of it right now, but you do have to do a few inches either side of the center, so it will sit properly in the fuselage's wing cradle.

Luckily, the brilliant minds over at the OSMW Department of Sanding and Finishes have developed this little LE Jig (from LP5) that will show you when you've got the correct leading edge shape.

Also you'll need to test fit the wing pegs into the pre-cut holes in F3. They should slide in with little effort, but you might need to use a file to slightly sand the holes to get a good fit - again not sloppy! ***DO NOT SAND THE DOWELS - as it will weaken them.***

☐ **Step 108 - Fuse Assembly (wing alignment)**




With the wing now properly fitting into the fuselage, it's time to align it.

To align the wing properly on the fuselage, place the wing in position, then allow the wing to rest in the wing saddle. The wing is perfectly aligned when the distance from the port wing tip to the rear of the fuselage is the same the distance when measured from the starboard wing tip to the rear of the fuselage. You shouldn't need to twist the wing much at all for this to match up.

☐ **Step 109 - Fuse Assembly (wing bolt holes)**

With the wing aligned, drill two 3/16" holes for the wing bolts, using the pre-cut holes in WH6 as a guide. Use caution to make sure the wing does not move until both holes are drilled.

When drilling, take your time and make sure the drill is held so the bit is in the center of the wing holes and perpendicular with the wing's sheeting.

This will make it so the wing bolt goes in at an angle, but the screw's head will be flat on the wing surface. Remove the drill, remove the wing and clean up around the new holes you drilled.

Run a 1/4x20 tap through the WH5/6 pieces so that the wing bolts will thread into this block. A few drops of thin CA will help strengthen and secure the threads you've cut.

We've found this to be a very secure way of holding the wing in place for all of our prototypes, but... if you don't want to go this way, you can also use 1/4x20 t-nuts (not included). If you go that route, you may also need slightly longer bolts, but that's something you'll have to find out for yourself.

Once you have the holes drilled and tapped, mount the wing to the fuselage and bolt it in place.

### ☐ Step 110 - Fuse Assembly (fin, stab)

Locate the vertical fin and stab from way back at the start of the build. It's time to join them together into a single unit.

Test fit the two together first, as you might need to do a little sanding of the cutouts in the stab to make the fin slide in as it should. You want it to be easy to slide in, but not a sloppy fit. Once you have it fitting properly, it's time to glue them together, and you might want to grab that 90° triangle to make sure the two pieces are perfectly perpendicular to each other.

### ☐ Step 111 - Fuse Assembly (fin, stab)

Now it's time to fit the complete tail assembly on to the rear of the fuselage.

Again, this will require a bit of test fitting, as you might need to sand a few things to make sure it fits as it should.

What we're looking for is for the stab and fin to fit completely into the fuselage. Also, the stab should be level with the wing, as well as aligned side to side.

To do all of this, push the stab in place, then sight down the fuselage. It should hopefully be level, and level with the wing. If it needs a little adjustment, note which side it high, then remove the stab and lightly sand the cutout in the fuselage on the appropriate side.

Refit the tail assembly, and keep doing this until you have it as perfect as you can. You shouldn't need to do much of anything here, but remember - you can easily take wood off, but it's much harder to put back on!

Now with the tail assembly level, you want to make sure that it's straight. Sight down the fuselage and make sure that the vertical fin isn't pointing to the left or to the right - you want it bang-on-straight.

Once you have the tail assembly all lined up, make a few marks on the stab with a pencil so you can easily re-align this to the fuselage.

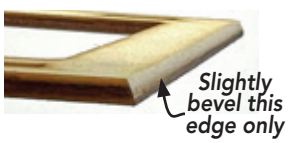
### ☐ Step 112 - Fuse Assembly (VF6)

Locate VF6 from BP18. It is glued in place to make up the front of the vertical fin as it blends into the top of the fuselage.

When gluing this in place, make sure that it is straight along the top of the fuselage.

### ☐ Step 113 - Hatch Assembly (H1, H2, H3)

Locate H1 and H2 from LP4 and both H3s from LP1 and LP2. These pieces make up the framing for the hatch.




Before test fitting them, you'll need to sand a bevel on the edge of H1, where it will touch H2. This angle is not something we can cut on the laser-gizmos we have.

Sanding this angle will allow H1 and H2 to touch each other when fitted to the H3 side rails.

Glue these pieces together like we've shown here.

### ☐ Step 114 - Hatch Assembly (H4)

Locate both H4s from LP2. These are glued to the inside edges of the H3s. Make sure they are nicely aligned and flat against the surfaces of H1 and H2 as shown here.

### ☐ Step 115 - Hatch Assembly (H5)


Locate H5 from BP19 and test fit to the top of H2, noting that the side tapers of both pieces should match. Now you'll need to sand another bevel, this time on the edge of H5 that will touch H6. Again, something that we can't do with the laser-gizmos we have here at OSMW International.

Now glue H5 to the top of H2, making sure it's perfectly aligned and the beveled edge is facing upward, like we've shown here.

### ☐ Step 116 - Hatch Assembly (H6, H7)

Locate H6 and H7 from BP19.

Note that they have small arrows etched in to them, and these are the two edges that should be touching when installed on top of the hatch (on top of H1).

Test fit them, noting the taper of the sides again.

When you're sure how everything lines up, glue these pieces in place.

### ☐ Step 117 - Hatch Assembly (magnets)

Locate the four magnets from the hardware bag as these are used to hold the hatch in position.

One is pressed and glued into the pre-cut hole inside the port and starboard fuselage sides.

The other two are installed into the pre-cut holes inside the hatch (both H3s). Makes sure the magnets are oriented properly to attract, not repel each other.

### ☐ Step 118 - Hatch Assembly (H8)

Locate H8 from LP4. This is glued across the top of the fuselage, creating a lip for the hatch to "catch" on.

Note that this piece is tapered slightly. This is to account for the slant that the firewall has because of the built-in right-thrust.

We'd advise putting the hatch in place, then test fit H8. It's etched circle should be on the starboard side, but it will also be on the underside, so it's doesn't show. It aligns nicely with the hatch and covers up the leading edge of the firewall. The apply glue and glue it to the fuselage. Make sure it's properly glued, as it's the only thing holding the front of the hatch.

☐ **Step 119 - Fuselage Assembly (LG2)**

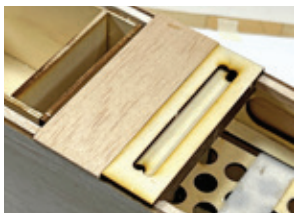
Flip the fuselage on to its top it's top so you can now install the LG2 assembly into the bottom of the fuselage.
Test fit this first and sand things as necessary to get a good fit. Then mix up some epoxy and glue LG2 in place, making sure it is fully pushed into the fuselage sides.

☐ **Step 120 - Fuselage Assembly (LG1)**

Locate LG1 from LP1. This is glued to the exposed surface of LG2. Make sure it's properly aligned and that none of the glue drips into the holes in LG2.

☐ **Step 121 - Fuselage Assembly (bottom fuselage sheeting.)**

Grab some of the unused 3/32" sheeting, like you used when sheeting the fuselage.
You'll need to cut a piece that is the width of the fuselage, but only 1-3/8" deep. It will be glued to the bottom of the fuselage, as a part of the sheeting - up against the back of LG1.



***IF, AND ONLY IF - you are going to use glow power for your GHOST, you'll need to make this assembly - the throttle servo mount.***
***If going electric, sounds good - skip to step 125.***

☐ **Step 122 - Fuselage Assembly (throttle servo mount)**

Locate six of the many "**h**" shaped pieces scattered around LP1, LP2 and LP4. Also two of the small rectangles and grab the SHG that you used when making the elevator and rudder servo mounts. (There's another one in either LP1 or LP2.)

Put three of the "**h**" shaped rails into the SHG, like you did for the other servo mounts. Just make sure you don't glue the rails to the SHG. Make two rails.

☐ **Step 123 - Fuselage Assembly (throttle servo mount)**

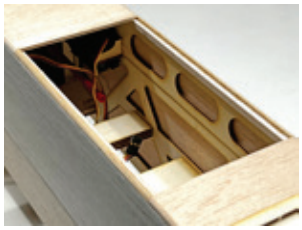
Locate F3C from LP2 and your throttle servo. Push in one of the rails first, then use your servo to gauge where the other rail should be placed. Mark this F3C, then remove the rails, apply glue to them and then fix them in place permanently.
Also glue a small rectangle on top of each rail, as we've shown here.

☐ **Step 124 - Fuselage Assembly (throttle servo mount)**

Now you can drill and attach the servo to the mount, using the servo's mounting screws.
Do a little planning here - depending on the engine you're using, the carb arm might be on the port or starboard side. Typically it's on the starboard side, but double check.
So, make sure to mount the servo so the servo arm will be on the same side of the fuselage as the engines' carb arm.

☐ **Step 125 - Fuse Assembly (bottom fuselage sheeting)**

Now you might notice that you have a large hole on the bottom of the fuselage. This is on purpose, as our Fun Fly Bay Accessory Kits (available separately) will bolt up into this area - into the CG8/9 rails that are already in place.



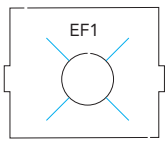
If you have one of those kits, great. Leave this area open.

If you don't have one of those kits and never plan on buying/installing one, no problem. Cover over this area by cutting the remaining 3/32" x 4" x 12" sheeting to cover this area, and glue the sheets into place.

If you don't have one of those kits yet but want to possibly add one later, than do this. You'll still use the remaining 3/32" x 4" x 12" sheeting to cover this area, but don't glue it in place. Just tape it in position for now.

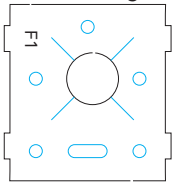
☐ **Step 126 - Fuse Assembly (powerplant mounting)**

Mounting your powerplant is a fairly straight-forward thing - drill 4 holes and bolt it in place. However, you need to take a little time to get the powerplant in the right spot.




For electrics with a typical "X" mount, the lines on EF1 should be all you need. Center up the mount so the etched lines show through four mounting holes in the "X" plate and that should center everything on the center hole. Then mark the holes to be drilled on to the firewall with a pencil.

For glow engines, the lines on F1 may or may not line up with whatever mount you have purchased, as different manufacturers do things differently. These lines are centered on 45° angles around the center hole.
The engine should mount upright so plan this out before drilling any holes.
When positioning the mount, you should end up with the engine and mount centered over the hole, with the engine's crankshaft center directly over the hole. When you have it in the right spot, use a pencil to trace the holes to be drilled on to the firewall.



What you see in our prototype is an ASP .46 mounted to a Dave Brown Products engine mount (now available from Ohio Superstar as of the time this manual was written). Other mounts will work just as well - use what's best for you.

Regardless of electric or glow, now you can drill out the mounting holes, typically for 6/32 sized bolts (not included). Usually that's a 5/32 size drill. Also typically you'd attach matching size t-nuts (not included) to the rear of the firewall.

***IF, AND ONLY IF - you are going to use glow power for your GHOST, you'll probably need to do this next step. If going electric, sounds good - skip to step 128.***

☐ **Step 127 - Fuselage Assembly (carb / muffler relief)**

If you're using a 2-stroke glow engine, there's a pretty good chance that you'll need to make a couple of relief cuts so the muffler and parts of the carburetor will clear the side of the fuselage.

There's no real magic trick here - just good ol' trial and error. Just remember not to remove too much too soon.

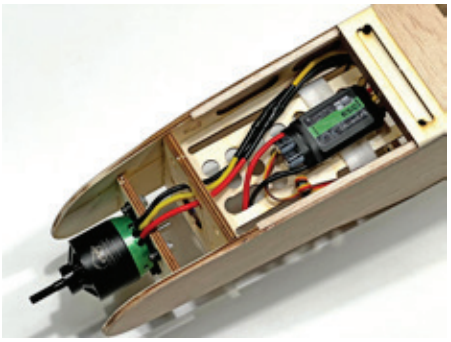
☐ **Step 128 - Fuse Assembly (bottom fuselage sheeting)**

Now bring your attention to the one last open area on the bottom of the fuselage - the area underneath the tray.

You could modify this area to be a removable hatch, but we didn't see that as needed. Typically, anything that you'd put in the area will probably not need to be touched by hands once properly installed.

If going glow, you could put the flight pack battery in this area to help with the balance. (But we put our battery above the tray, in with the tank.) This is your call.

If going electric, the ESC would be here.



Regardless of what may go in this area, it needs to be fastened securely.

We use hook and loop tape to do this.

*(You know - that plastic stuff that has hooks on one part of it, and loops on the other part - we really can't use the name here without paying some big bucks....)*

We also use longer pieces of this to hold the battery in place. As a general practice, we thread this through the holes on either side of the tray floor, then glue it to the bottom of the floor so it' won't pull out.

So once you mounted whatever you'd like to mount in this space, cover this area with more of the 3/32" x 4" balsa sheeting. And make sure it's still cross grained. It should run from the front of the LG block, to just covering up the bottom of the firewall.

***IF, AND ONLY IF - you are going to use electric power for your GHOST, you'll need to do this next step. If going glow, sounds good - skip to step 130.***

☐ **Step 129 - Electric air exits**

Mark and cut two or three 1/2" holes on the bottom of the fuselage, between F5 and F6. Mark them down the centerline of the fuselage, spaced apart, something like the example we have here.

The size and spacing isn't critical, but what is critical is to have holes like these so the hot air from the batteries and ESC can exit the fuselage.

☐ **Step 130 - Sanding**

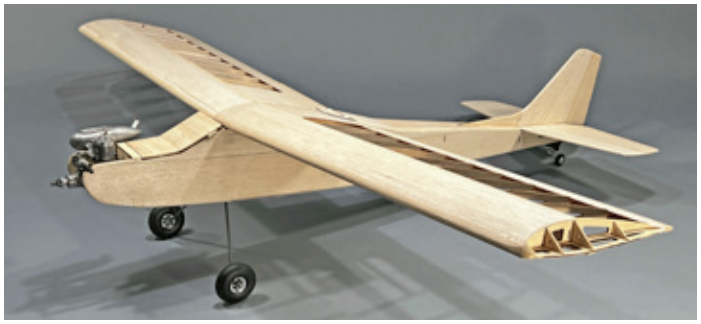
Remove the powerplant from the frame because now is the time to get quite familiar with the sanding tools of your choice. Take the time to perform a good sanding, rounding the wing's leading edge and blending it into the wingtips. Go over the entire wing, making sure the sheeting is smooth and the trailing edges are blended into the ribs, continuing the curvature of the wing. Pound out the extra time on those leading edges, using the L.E. JIG template we provided - to make sure they are smooth and perfect works of art along their entire lengths.

Smooth out the edges of the fuselage. Because of the 3/32" sheeting and the 3/16" balsa support installed around the fuselage's perimeter, you can be a little more aggressive in rounding the corners if you'd like.

Round the leading edge of the stab as well as the trailing edges of the elevator and rudder (from BP18). When rounding the leading edge of the vertical fin, blend it into the top of the fuselage.

Sand bevels into the leading edge of both elevator halves, the rudder, and the ailerons. And speaking of the ailerons, round off the back outer corners with a nice radius.

The idea is to spend some time caressing this awesome airframe you've created so what you end up with will be a thing of beauty - something that looks pretty darn close to this (but without the landing gear which I haven't told you how to install yet.)

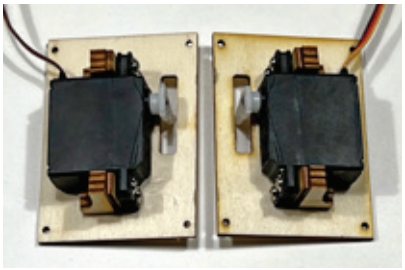


☐ **Step 131 - Aileron Hatches (mounting beams)**

Locate twelve of the "**L**" shaped pieces from LP8, as well as four small rectangles. Also locate one of the SHG jigs you used previously.

Just as before you'll use the SHG to make four mounting beams for the aileron servos.

☐ **Step 132 - Aileron Hatches (mounting beams)**
Now locate two of the SH1s from LP7, and your aileron servos.
Position your aileron servo on the inside of the aileron hatch so the servo arm output shaft is centered in the opening.
On the inside of each aileron hatch, glue two of the servo mounting beams you just created on each side of the servo as shown in the photo.



Note that the left hatch is a mirror image of the right hatch.
Once the glue has cured, drill the beams and then mount the servos using the servo's hardware.

☐ **Step 133 - Aileron Hatches (drill mounting holes)**
Now fit the servo hatches into position on the bottom of the wing, into the openings for the ailerons. Using SH1's pre-cut holes as a guide, drill four 1/16" mounting holes into the plywood beams you installed when building the wing. Harden the wood around the holes with a bit of thin CA. No need to mount them at this point.

☐ **Step 134 - Flaps (FL1, FL3)**
Locate both FL1s and both FL3s from BP10. You'll glue FL1 to FL3 as shown here. Note the orientation of the cutout in FL1, as this is important. Make two of these.

*Also, the FL3 you glued in this step will now be referred to as the* ***flap's leading edge*** *over the next few steps.*

☐ **Step 135 - Flaps (FL2)**
Locate both FL2s in BP10. You'll glue FL2 to FL1 and FL3 as shown here. Make two of these.

☐ **Step 136 - Flaps (FL3)**
Locate the other two FL3s from BP10. You'll glue this trailing edge to FL1 and FL2 as shown here. Make two of these.

☐ **Step 137 - Flaps (FL4)**
Locate the two FL4s from LP9. Note the etching on one side that goes over the hole pre-cut into FL1. When aligned properly, you should be able to see the etched rectangle inside the hole, and the arrow pointing to towards the leading edge. Glue these in place, the same orientation for each flap.

☐ **Step 138 - Flaps (hinges)**
Locate the CA hinges. Trim a couple of these so they're still 1" long, but roughly a 1/4" wide. You'll need 6 lengths total.

☐ **Step 139 - Flaps (hinges)**
Now flip each of the flaps over so the FL4 is facing down, and the leading edge is facing you - similar to this photo.
You'll make three marks along the leading edge where the hinges are glued - one in the center, the outer two roughly a 1/2" in from each edge.
Using medium CA (not thin), glue the first third of each hinge to the leading edge of each flap, centered on the marks you just made.

Make sure the hinges are straight and *also make double-sure that you are creating two identical flaps - NOT mirror images this time.*

☐ **Step 140 - Fuselage (fuel proofing)**
If you're using a glow engine to power your GHOST, it is strongly recommended that you fuel proof the inside of the battery compartment. Fuel has a nasty way of penetrating wood, causing it to disintegrate over time. We use clear polyurethane, but you could also use dope, or other similar paints.

*BTW, the fuel-proofing doesn't have to be clear, but that's just our preference - maybe something in a hot-pink or fluorescent purple?*
Spray (or brush) on this coating, remembering to also coat the underside of the hatch and the powerplant compartment (firewalls and inside of the fuselage cheeks.

***This completes assembly of the GHOST airframe.***
***These next few steps can be done in most any order, but it's probably advisable that you do the covering first.***

***Whether you're hinging, mounting, gluing, sanding, soldering or installing, chances are we've got a video tip to make the task easier.***
***OSMW has created a series of videos to help you not only build your aircraft, but build it better. These Bright Idea videos can come in handy for some of the following steps.***
***Check them out today - they're FREE and we're adding to them all the time!***
***Visit oldschoolmodels.com/tips.htm or scan this QR code.***

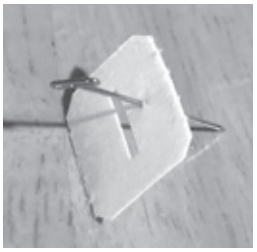
☐ **Covering**
Now it is time to cover the GHOST. Remove the power-plant and any other components that would get in the way when applying the covering.
Double check that all surfaces are smooth and ready to cover. Sand as necessary, then cover the entire airframe with the covering/finish of your choice.

To cover the GHOST as shown in our prototypes takes 2 rolls of iron-on covering, more if your doing a more complicated livery.
If you are going to install the flaps and/or a Fun Fly Bay Accessory at a later time, cover over these areas. The covering can be cutout and items added well after you've flown the GHOST.

**Logos, numbers, etc.**
If you want to use graphics similar to the ones we used, Old School Model Works has teamed up with Callie Graphics as a supplier for pre-cut vinyl. They are a very well known provider of custom graphics for R/C models.
We have supplied them with the artwork needed and you can order straight from them, choosing the colors that work for you.
Contact Callie Graphics at this link:
https://callie-graphics.com
or scan the QR code.

*Note that Callie Graphics is not affiliated with Old School Model Works, nor does Old School Model Works generate any income from this partnership.*

**Attach the Control Surfaces**
We've supplied C/A hinges to use in your GHOST, but you can also use other types of hinges that are available on the market. How you slot the hinges will vary somewhat depending on the type of hinge you use, so the following is mainly for using the supplied hinges. Also, you need to use thin C/A with this type of hinge - no other type of glue or viscosity will work the same.
First, matching slots need to be cut along trailing edges of the wing, stab and fin - where the control surfaces will be hinged. We've noted suggested hinge locations for each of the control surfaces on the plans.
There are several tools to cut the slots for the hinges - from using a simple hobby knife, up to electric powered tools.
Hold your tool straight to the surface you're slotting and cut straight into the piece. The slots should be about 1/2" deep and about a 1/2" wide (wide enough for the hinge to fit into).
Trial fit by pushing the hinges (no glue) into the slots to make sure you have cut the slots wide enough and deep enough.
Repeat this process for the rest of the hinge locations, making sure the slots match were the control surfaces touch the airframe.



When using the CA hinges, first push a pin through on side, at the center of the hinge as shown here. This will keep the hinge centered as it's pushed into the surfaces.
Using the ailerons as an example, you'll now push each of the four hinges you cut into the aileron so the pins are touching the leading edge of the wood. Then you'll push carefully push the other side of the hinges into the wing, until all the pins are also up against the trailing edge of the wing.
When you've got all the hinges for a surface in place, remove the pins. You can then flex the aileron up and down to make sure it moves as it should and doesn't bind.
When all that is good, you'll push the aileron down and expose the hinges at the joint, but at the same time, making sure the aileron is still pushed up against the wing (it didn't slide out little when flexing).
Glue each of the hinges in place with several drops of thin CA - making sure that the drops are placed on the hinges themselves - you don't want to glue the aileron to the wing, do you?
Give the glue a few seconds to bond, then flip the wing over, flex the aileron the other way, and place several drops onto the other side of the hinges.
Finally, work the aileron back and forth several times - you might hear a little cracking as the glue in the center of the hinge loosens up - that's ok.
Now repeat this procedure for the other aileron, the elevator, and then the rudder.
***NOTE: you will have to install the elevator BEFORE you install the rudder. It can't be done in reverse order.***

☐ **Main gear**

With the wing removed, place the fuselage upside down (be careful of the vertical fin).
To attach the main gear, you'll need to locate the two gear straps and four of the 2-56 x 3/4" self tapping screws.
Push both main gear legs into the holes in the LG assembly, until they are fully seated in the slots. Then place the two plastic mounting straps over the gear as we've shown in this picture.
Using a 1/16" bit, drill through the holes in the plastic straps and into the LG block. Then use the screws to mount it all in place.

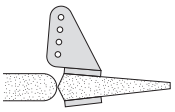
☐ **Attach wheels**

Use the included 3/16" i.d. wheel collars to hold each wheel (not included) on the axles. For a maintenance free installation, file a small flat on the axle where the set screw of the wheel collar touches. Also use a touch of thread-locking compound to keep the screw from loosening over time.

☐ **Control horns, servo & pushrod installation**
Now it's time to install your receiver, power switch and hook up all the radio for the first time.
Take a bit of time to plan things out, including how you'll run the throttle pushrod.
Attach the aileron servo hatches (with the servos mounted) into position on the bottom of the wing using the supplied 2-56 x 1/2" self tapping screws to secure the hatches in place. Run the wires through the cutouts in the ribs, and then out through the pre-cut circle in the center sheeting. *(You will probably have to use a servo extension for the aileron servos, depending on the brand you use.)*
Finish the layout of your radio gear by adding the receiver, flight pack battery and the switch. We mounted the receiver using a bit of self-adhesive hook-and-loop (not included). The radio's switch should be mounted to the opposite side of the muffler (to help keep the goop out of it). Or, for an even cleaner installation, it could be installed inside the tank/battery compartment - hidden under the hatch - ***VERY NICE!***

Now it's time to mount all of the control horns - one for each control surface. A control horn consists of the horn, it's plastic backer plate and two 2-56 x 1/2 machine screws - you'll find all of that in the hardware bag.

Each control horn should be mounted so it's in-line with the pushrod opening and the holes in the control horn should be in-line with the hinge, as shown in this diagram.

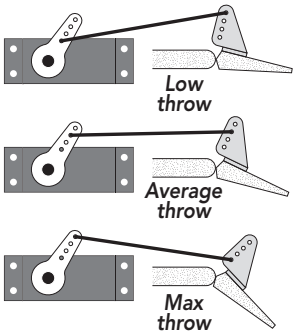


You'll need to carefully mark and drill the mounting holes using the control horn as a guide. Then you insert the screws and thread them into the backer plate from the other side. Tighten the screws to firmly hold the control horn in place, but not crush the wood of the control surface.

As for the pushrods, we're not going to do in-depth on how they work, as that's covered in their included instructions. Basically you'll measure and cut the pushrods to length, taking into account the length of any clevises on the end of the pushrods.

We typically have one end of the pushrod (the exposed end for the elevator and rudder pushrods) that has an adjustable clevis. The other end is usually a simple z-bend that attaches into the servo horn. Doing it this way allow fine adjustment at the field without having to get inside the plane, taking things apart.

Also, when setting up the pushrods, the various holes in the servo arm and the control horns can drastically change the amount of throw that the surfaces will have. Here's a rudimentary diagram that shows how you can remove or add throw to a surface mechanically - simply by changing the holes used.




*Typical aileron pushrod install on the left.*

*Typical elevator and rudder pushrod install on the right.*

**Recommended Control Throws:**

The amount of control throw should be adjusted as closely as possible using mechanical means, rather than making large changes electronically at the radio.

By moving the position of the clevis at the control horn toward the outermost hole, you will decrease the amount of control throw of the control surface. Moving it toward the control surface will increase the amount of throw. Moving the pushrod wire at the servo arm will have the opposite effect: Moving it closer to center will decrease throw, and away from center will increase throw. Work with a combination of the two to achieve something relatively close to these throws that are good for everyday sport flying. If competing in pattern, you'll probably want to dial these down a bit to give a smoother appearance to your maneuvers.

**Aileron 1/2" up/down (25% expo)**

**Elevator 1/4" up/down (20% expo)**

**Rudder 3/4" left/right (15% expo)**

*(Expert tip: Once the control throws have been set, cut a few pieces of medium silicone fuel tubing (or heat shrink tubing) to go around each of the clevises. This will keep them from opening during flight.)*

Finish the layout of your radio gear by adding the receiver, flight pack battery and/or ESC, and the switch (if using one). We mounted the receiver to the tray by using a bit of self-adhesive hook-and-loop (not included).

***Please, please, please!***

***Check the direction that each control surface moves.***

***Then double check the directions.***

***Walk away for a while, then come back and check the directions again.***

***The number one cause of a crash of any brand new airplane on its maiden flight is having the wrong throw for one (or more) of the control surfaces.***

***This completes the assembly of the GHOST. Now you'll need to adjust the control throws and check for balance.***

*Now you may ask yourself:*
***What about the flaps?***
***What about the Fun Fly Bay accessories?***
*Those will not change the balance enough to matter - and those can be added well after you've flown the GHOST.*
*We'll cover these items later on.*

**Recommended C.G. setting:**

An important part of preparing the aircraft for flight is properly balancing the model. This is especially important because of the various motor/battery combinations that can be used.

## CAUTION! DO NOT SKIP THIS STEP!

The recommended Center of Gravity (CG) for the GHOST is 3.3" from the leading edge of the wing, and you'll see this marked on the fuselage plan with this symbol.

C.G. BALANCE POINT

If necessary, move the battery, receiver, and/or add weight to either the nose or the tail until the correct balance is achieved. Stick-on weights are available at your local hobby store and work well for this purpose.

We recommend balancing it at the forward point for the first flights, then moving it backward if you'd like it to be a little more maneuverable.

**Preflight:**

Charge both the transmitter and receiver pack for your airplane. Use the recommended charger supplied with your particular radio system, following the instructions provided with the radio. In most

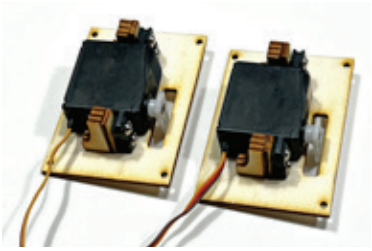
cases, the radio should be charged the night before going out flying. Check the radio installation and make sure all the control surfaces are moving correctly (i.e. the correct direction and with the recommended throws). Test run the engine and make sure it transitions smoothly from idle to full throttle and back. Also ensure the engine is tuned according to the manufacturer's instructions, and it will run consistently and constantly at full throttle when adjusted.
Check all the control horns, servo horns and clevises to make sure they are secure and in good condition. Replace any items that would be considered questionable. Failure of any of these components in flight would mean the loss of your aircraft.

**Range check your radio before flying**
Before each flying session, range check your radio. This is accomplished by turning on your transmitter with the antenna collapsed. Turn on the radio in your airplane, but do not attach the arming switch.
With your airplane on the ground, you should be able to walk 30 paces away from your airplane and still have complete control of all functions.
If not, don't attempt to fly! Have your radio equipment checked out by the manufacturer.

**Installing the Fun Fly Bay Accessory kits** *(available separately)***:**
As you probably know by now, we are developing several accessory kits that can be mounted inside the GHOST's fuselage. Each of these will mount the same way.
With the wing removed, you can look down on the two CG8/9 rails that were installed during the fuselage build. There are two holes pre-cut into them. Run a 3/32" bit through these holes to make sure they're free of glue.

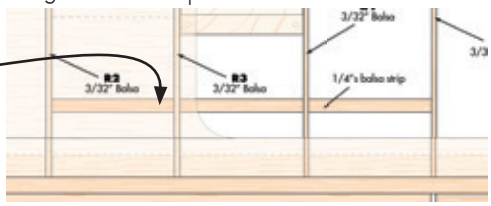
Now with that finished, each of the accessory kits will push in from the bottom and mount using the two supplied 4-40 x 1" socket head cap screws from the hardware bag, as shown here. Simply bolt in the module with the screws (through the wing saddle after the wing is removed), then plug the servo into a spare channel that you'll use to control the module. Do the reverse to swap out to another module.

**Installing the flaps:**
Locate the other two SH1s from LP7, as well as twelve of the "**L**" shaped pieces and 4 of the small rectangles from LP8.
Using the same techniques you used when creating aileron servo rails, you'll make 4 servo rails, then glue the rectangle on top.
***This time however you won't make two mirror images - these both need to match, as shown here in the pic***.
Center the servo arm as before, then glue the rails on each side of the servo.

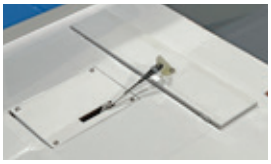


These finished hatches can then be covered, and mounted into the wing. Note: you may have to remove the covering in the flap servo bays, if you haven't already. And the servo wires are run through the ribs and exit out the same center holes the aileron wires are exiting. These servos should be connected to a "Y" harness, then into a spare channel of your receiver - hopefully one that works via a 3-position switch on your transmitter.

In the wing, there was a single 1/4" x 1/4" piece that was installed between ribs R2 and R5, on the underside of the wing.
This is the piece that the flap's hinges will be mounted to.




Using the same hinging technique as before, mark the three places where you'll need to cut slots to match the hinges already glued to the flaps. Then insert one of the flaps and make sure the hinges are all the way into the wing. Use drops of thin C/A glue to attach the flap.
Then do the same to mount the remaining flap under the other side of the wing.
Now you'll connect the control horns and the back to the FP4 plate, using two of the 2-56 x 5/16" screws for each flap.
Short pushrods are then hooked up between the servos and control horns. When the servo is at one extreme, both flaps should be flat against the bottom of the wing. When the servo is extended, the flap should be at roughly a 45° angle, as shown here.



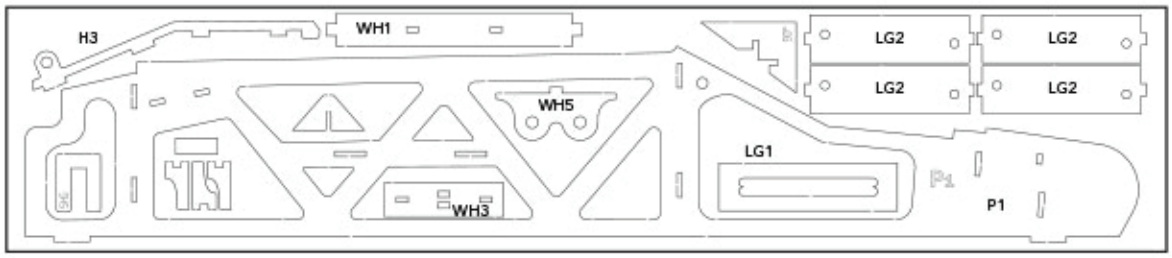
Flaps are meant to be used at slower speeds to increase the lift dramatically - and allowing for higher rates of climb and much slower flight. ***DON'T DEPLOY THESE AT SPEEDS OVER 1/2 THROTTLE, as you could damage them.***

Also, when deploying them, the GHOST will tend to climb, and sometimes climb significantly, so you'd need to hold more down-elevator to keep it flying level. This is not unique to the GHOST - it's the way flaps effect most designs - but if your radio allows, you can add some mixing to automatically add down elevator when the flaps are deployed.

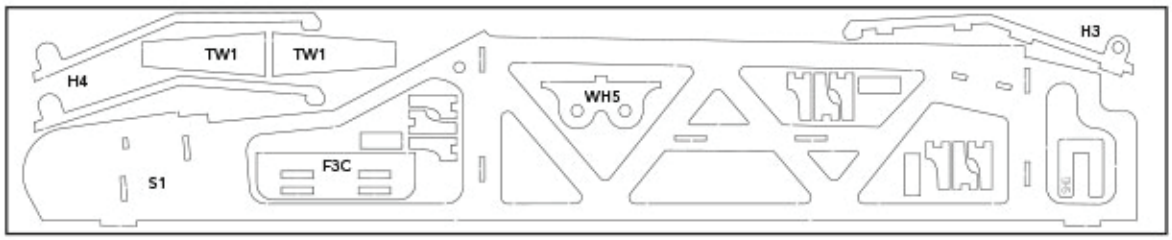
We found it best to use flaps on channel with a 3 position switch. When retracted completely, no need for elevator trim. When the flaps were half-way extended, we mixed in 10% down elevator. With full flaps, we mixed in 25% down elevator. You're mileage may vary, but these are good starting points.


***Shot of our DX18 transmitter's flap setup for the GHOST.***

## LP1
1/8" Lite Ply

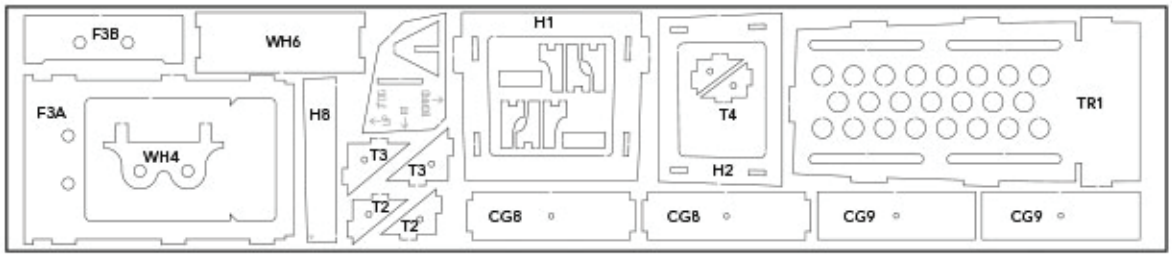



## LP2
1/8" Lite Ply

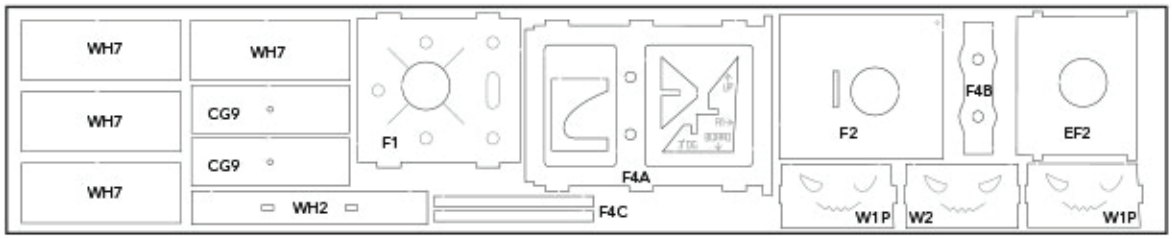



## LP3
1/8" Lite Ply

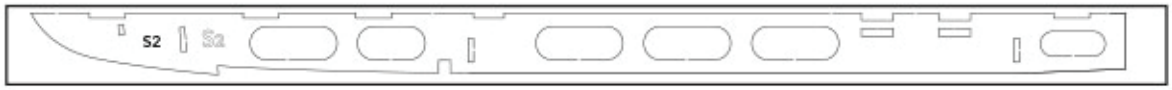

## LP4
1/8" Lite Ply



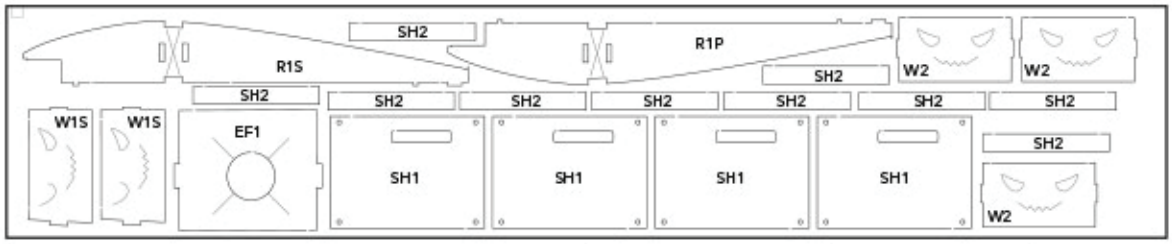

## LP5
1/8" Lite Ply



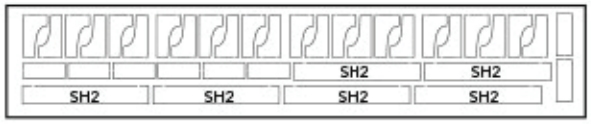

## LP6
1/8" Lite Ply



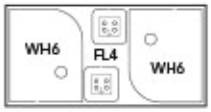

## LP7
1/8" Lite Ply




## LP8
1/8" Lite Ply

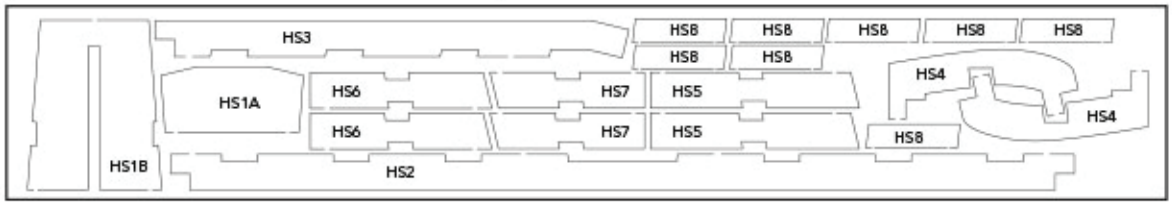



## LP9
1/16" Ply

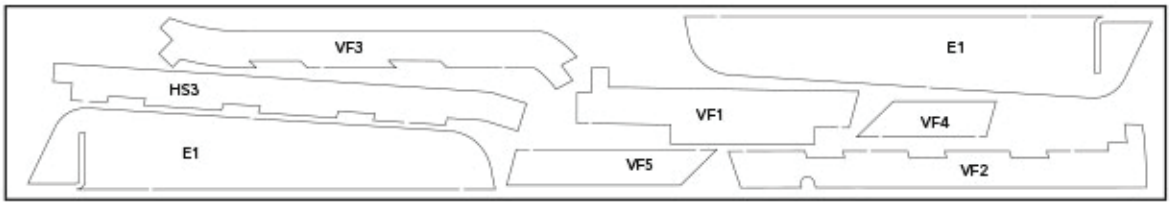



## DH1
1/8" Lite Ply

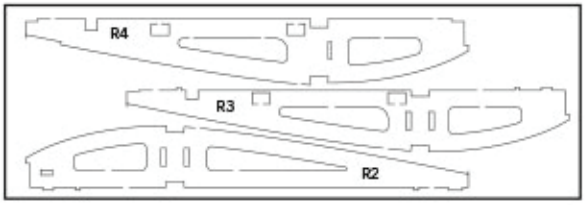
## BP1
1/8" Balsa



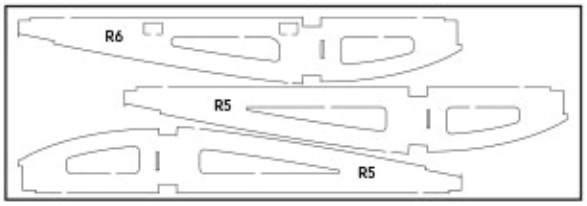
**BP2** 1/8" Balsa



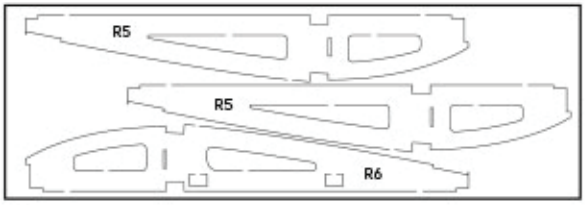

**BP3** 3/32" Balsa



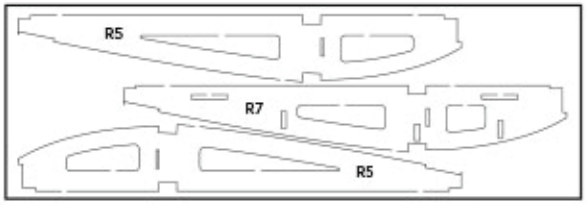

**BP4** 3/32" Balsa




**BP5** 3/32" Balsa

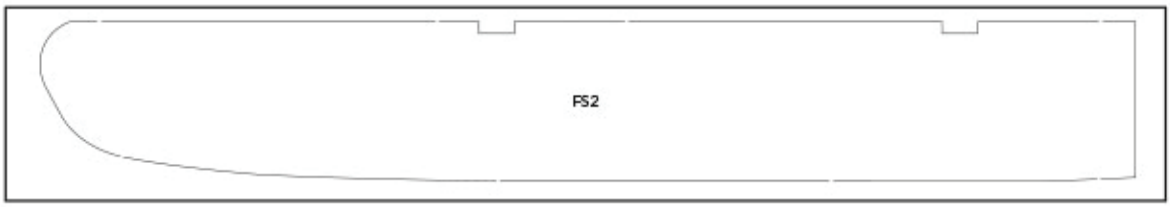



**BP6** 3/32" Balsa

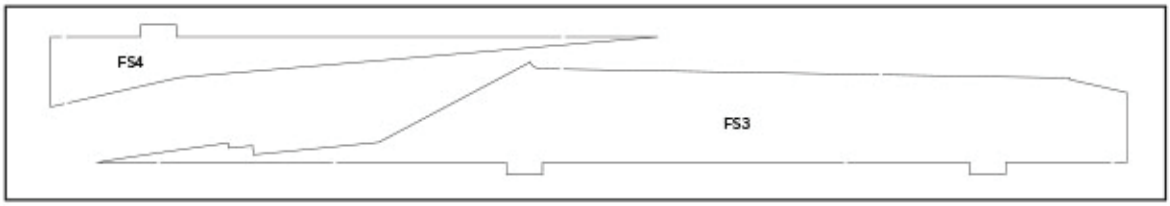



**BP7** 3/32" Balsa

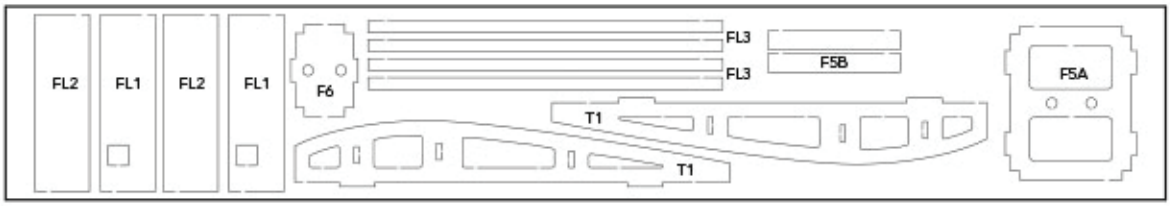

**BP8** 3/32" Balsa



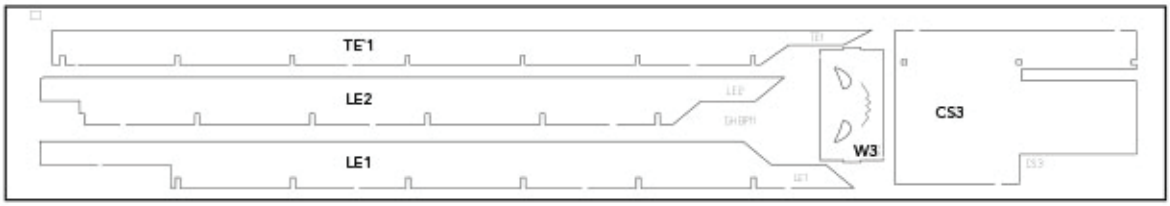

**BP9** 3/32" Balsa



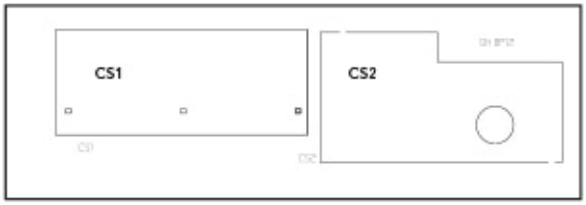

**BP10** 3/32" Balsa



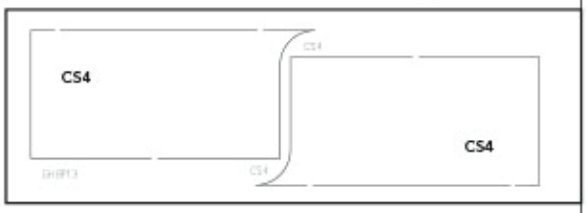

**BP11** 1/16" Balsa

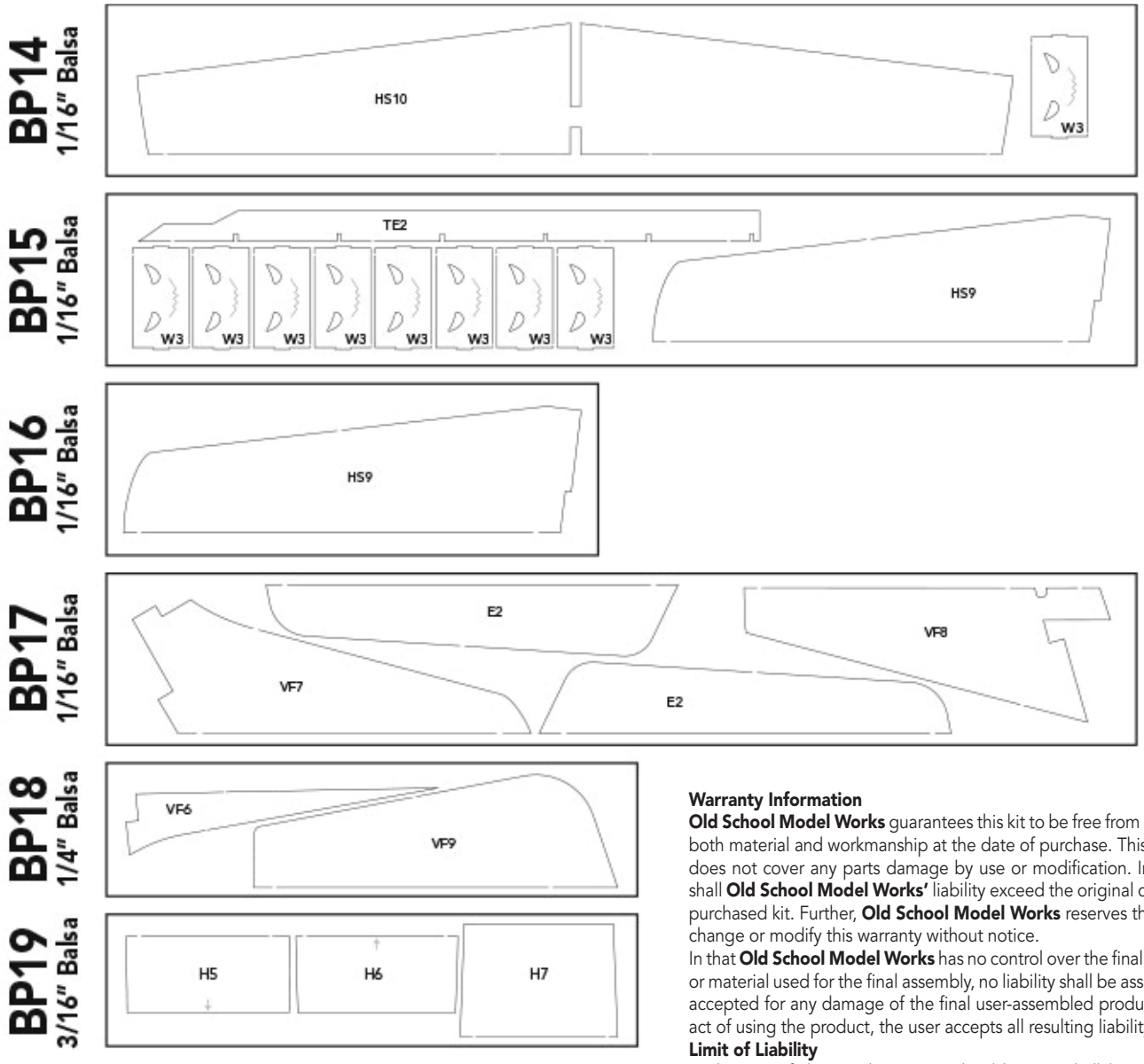



**BP12** 1/16" Balsa




**BP13** 1/16" Balsa








**Warranty Information**

**Old School Model Works** guarantees this kit to be free from defects in both material and workmanship at the date of purchase. This warranty does not cover any parts damage by use or modification. In no case shall **Old School Model Works'** liability exceed the original cost of the purchased kit. Further, **Old School Model Works** reserves the right to change or modify this warranty without notice.

In that **Old School Model Works** has no control over the final assembly or material used for the final assembly, no liability shall be assumed nor accepted for any damage of the final user-assembled product. By the act of using the product, the user accepts all resulting liability.

**Limit of Liability**

In the use of this product, our only obligation shall be to replace such quantity of the product proven to be defective. The user shall determine the suitability of the product for his or her intended use and shall assume all risk and liability in connection therewith.

If the buyer is not prepared to accept the liability associated with the use of this product, the buyer is advised to return this kit immediately in new and unopened condition.

As of this printing, you are required to register with the FAA if you own this product.

For up-to-date information on how to register with the FAA, visit: https://registermyuas.faa.gov .

For additional assistance on regulations and guidance of UAS usage, visit: http://www.knowbeforeyoufly.org .

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