Experimental Aircraft Models

"Enhancing the Homebuilt Experience"

Quad City Ultralights

Challenger II

Scale: 1= 5.0
Wingspan: 75" (1905 mm) or 59" (1500 mm)
Chord: 11.75" (298 mm)
Wing Area: 881.25 in^2 (5611 dm^2) or 693.25 in^2 (4414 dm^2)
Flying Weight: 7 – 8 lbs (198 – 227g)
Wing Loading: Long Wing = 21 oz/ft^2 or Short wing 25 oz/ft^2
Length: 43" (1093 mm)
Radio: 4 Channels with 5 servos
Engines: .40 - .46 cu in Two Cycle

Radio Control Scale Model Assembly Instructions

Warranty

Experimental Aircraft Models, LLC (EAM) guarantees this kit to be free from defects in material and workmanship. The warranty does not cover individual parts damaged by modification or abuse. In no case will EAM's responsibility or liability exceed the original purchase price of the kit. EAM reserves the right to change or modify this warranty at any time.

EAM assumes or accepts no liability for the manner in which this model aircraft is used by the user, in any condition of assembly. By the act of purchasing this kit, the purchaser and any subsequent user accepts full responsibility and all resulting liability.

If the purchaser is not willing to accept the above liability associated with the use of this model aircraft, the purchaser is advised to return this kit immediately to the source from where it was obtained.

Please read this manual thoroughly before starting assembly. It includes critical assembly instructions and warnings in regards to the safe and enjoyable use of this scale aircraft model.

Kondor Model Products / E.A.M.
1224 Amber Dr. Thunder Bay, Ontario
P7B 6M5 Canada

About Your Model : You have purchased one of a limited production run of Challenger II Scale R/C model kits in the world. You have a very unique model of an Experimental aircraft.

In the United States, 'Experimental Aircraft' are aircraft that are 51% or more built by an individual (usually at home) and fly under an FAA issued "Flight Permit", rather than "Certification". During the past 20 years the most advanced designs in civil aviation aircraft have come from the 'Homebuilt' arena where, without the burden of certification expense and manufacturers liability insurance, aircraft of amazing performance and safety could be designed and offered to the public.

In our mission to support the homebuilder with a scale model of an aircraft project that may have consumed hundreds/thousands of hours to complete, we have brought together full-scale aircraft kit airframe manufacturers with a state-of-the-art world class ARF (Almost Ready to Fly) model manufacturer. Our intent is to provide as scale a model as possible that is as ARF as possible - within the confines of limited production run sizes and knowledge that a builder will likely customize to match their own aircraft. In that sense, this product caters more to the full-scale builders and scale modelers, than it does 'out of the box' flyers.

Just as the homebuilder customizes their personal aircraft, we have offered the model in pure white, so that you may do the same. If you are not patterning the finished design after a specific aircraft, you can use the high quality graphics that we have supplied with the kit.

Your Challenger II scale model is unique in the ARF world, in that you can actually build the model in 4 different configurations using either of the two nose cones supplied, and choosing to either leave the wings in their full, ultralight, length, or trim them down to the 'Clipped Wing' version.

We were 'slaves to fashion' when we designed this model. We opted to come as close as possible to the scale shape of the aircraft (given our corporate mission of providing scale models to homebuilders), and with the Challenger it was challenging! Most notable is the lead the model requires to balance properly – mimicking the need for a seated pilot to balance the full scale version properly, (note that the model still comes up with a light wing loading and can handle winds fairly well) and the small fuel tank so as to remain concealed under the center pod.

Please note that we use aircraft terminology in our instructions. Specifically 'Port' is left and 'Starboard' is Right, and 'Forward' is to the front and Aft is to the rear. No matter how you may have the model turned Port is always the left side of the aircraft as the pilot sits in the cockpit facing forward. Thus if you are working on the model upside down with the tail facing towards you while installing servos, putting something on the Port side eliminates the confusion that 'left' side might result in.

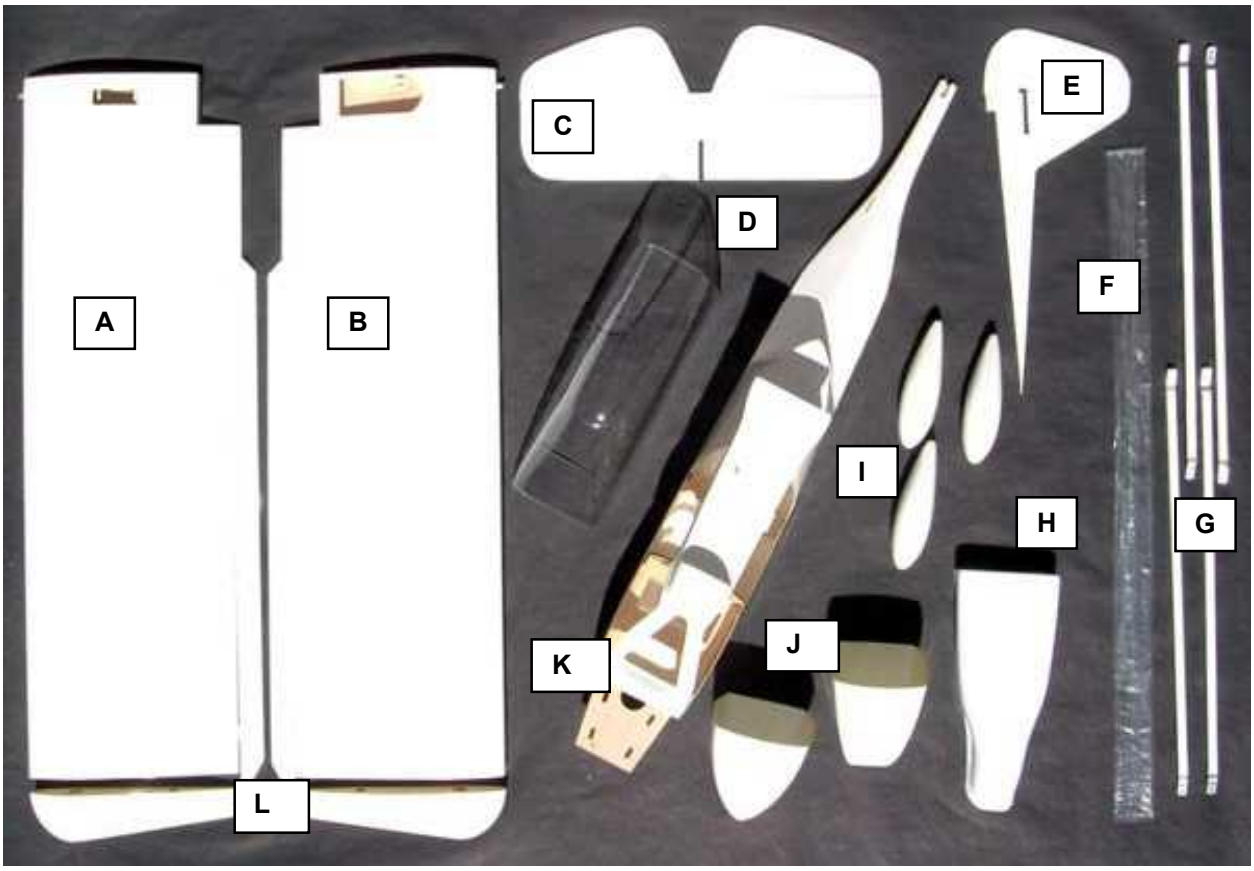
A final point: Because the model is so special and the volumes (by model standards) so low, we need your help. We have tried our absolute best to get everything right the first time. Where we observed less than that in writing of the instruction manual, we do our best to help you out and provide the best hardware available. If there is something during the construction and flying of the model that you feel could be done more easily or better, we'd like to know. This is how it's done in the full size experimental aircraft world, and we want to be sure that the same spirit is carried on in smaller scale. Builders are continually finding ways to improve the full size aircraft, and there is no reason why modelers should not have the same ability to contribute to a better product.

Please feel free to e-mail us with kit comments at: info@RCHomebuilts.com We sincerely appreciate your vote of confidence in purchasing our rendition of Quad City Ultralight's Challenger II and truly wish you the best of enjoyment!

Andrew Kondor
Managing Director
Experimental Aircraft Models, LLC
Kondor Model Products, INC

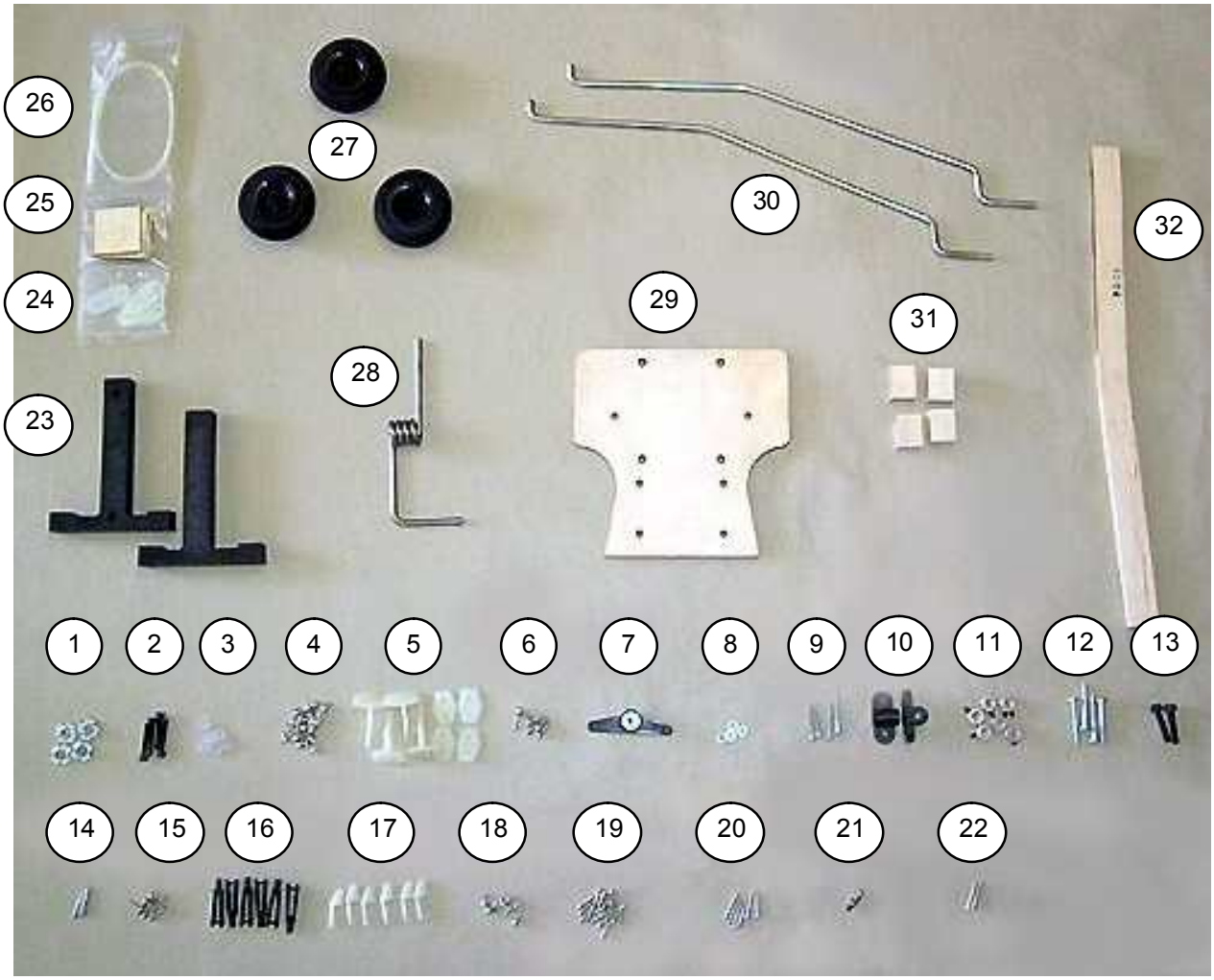
A note about the covering. Your Challenger II wing and tail surfaces are covered in white 'Oracover' – commonly known as 'Ultracote' in the U.S. This is the highest quality polyester covering material available. Through temperature changes during shipping, the model may show wrinkles. This is normal. The material can easily be tightened by the application of heat from a hair dryer/heat gun or hot iron. If using an iron, a piece of lightweight cotton (e.g. sheeting) placed between the iron and the covering helps to even the heating. Pressing lightly will transfer the heat to the covering, shrinking the material.

Airframe Components



Item	Description
A	Port (Left) Wing
B	Starboard (Right) Wing
C	Horizontal Stabilizer & Elevators
D	Canopy
E	Vertical Stabilizer & Rudder
F	Pushrod wires
G	Struts
H	Wing Center Cover
I	Wheel Pants
J	Fiberglass Nose Cones
K	Fuselage
L	Fiberglass Wing Tips

Hardware



Item	Description	Qty
1	M4 Blind Nuts	4
2	6-32 x ¾ " Socket Hd Cap Screw	4
3	Silicon Keeper Rings	6
4	#2 x 1/4" Washer Hd Screw	20
5	Control Horns and Backing Plates	4
6	#2 x 3/8 Screw	6
7	Steering Arm	1
8	M3 Washers (Nose Gear)	4
9	M3 x 20 mm Nose Gear Bolts	4
10	Nylon Nose Gear Brackets	2
11	4 mm ID Collar	8
12	M4 x Engine Mount Bolts	4
13	8-32 x ¾" Wing Socket Head Bolt	2
14	#4 x 5/8" Screw	2
15	#2 x 3/8" Washer Hd Screw	6
16	Rod End Clevis	6
17	Rod Keeper	6
18	#2 x ¼ Washer Head Screw	8
19	#2 x 3/8" Washer Head Screw	16
20	M2 x 15 Control Horn Screws	8

21	Throttle EZ connector	1
22	#2 x 3/8 Screw	16
23	Engine Mounts	2
24	Landing Gear Brackets	5
25	Wheel Pant Ply Backing Plate	3
26	Wire Tie	2
27	Wheels	3
28	Nose Gear	1
29	Ply Firewall	1
30	Main Landing Gear Legs	2
31	Aileron Servo Mounting Blocks	4
32	Wing Joiner	1

Building the Wing

Your first decision is whether you would like to build the long wing version, or the clipped wing version. If you would like the long wing version, which we recommend, that's the way it comes in the box and skip the next paragraph. If you'd like to build the clipped wing version, then read the next paragraph. We suggest converting to the short wing after flying the long wing version first.

For the clipped wing version, look carefully at the end of the wing and count 2 ribs in from the tip of the wing. Note the two ribs glued next to each other.

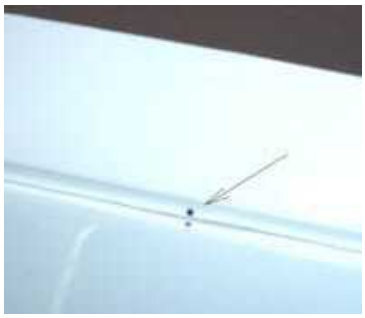
1. Using a warm iron, seal the Oracover to the innermost rib all the way around the wing. This will become the outermost wing rib and you want to be sure the covering is secure.
2. Pull the aileron away from the wing making sure not to lose any hinges.
3. Using a sharp razor knife slit the covering between the ribs around the circumference of the wing.
4. Using a razor saw or hacksaw blade, cut the leading edge, trailing edge and main spar between the two ribs, flush with the outer edge of the inner rib. (Note that the wing tip will sit against the end of the wing, so cut the leading and trailing edges square to minimize gaps. Better yet, cut with a little extra length and sand flush with the new end rib.)
5. Seal any loose edges of Oracover with the iron and reinforce the bond from the rib to the main spar with a little extra thin CA in the joint.
6. Replace the aileron on to the hinges
7. Cut the aileron so that it extends past the end of the wing by 1 3/8" (35mm). You can later cut the angle into the tip of the aileron at the step where you will install the fiberglass wing tips

Additional components you may need from the hobby store:

CA Adhesive (Thin)
CA Adhesive (Medium)
(2) 12" Servo wire extensions
(1) "Y" Servo wire harnesses
(4) Extended length servo arms to fit your brand of servo (Optional)

Installing Ailerons Hinges

The control surfaces on the wings and stabilizers are not yet permanently attached. We have pre-cut and positioned the 'CA' hinges for you. In this step you will be removing the ailerons from the wings, prepare them for gluing, and permanently re-installing them on the wings. Do one wing first, then the second.



1) Pull the aileron slightly away from the wing and mark the location of the center of the hinge on both the aileron and wing. This will ensure you are trimming away the material in the correct spot in the next step.

2) Remove the aileron. Trim away the Oracover from the hinge slot, equally from both sides of the mark on both the wing and aileron.

- The objective is be sure adhesive can later wick into the slot. You don't want an edge of film sitting against the hinge, which may prevent the adhesive from flowing into the slot. Our favorite method is to use an old soldering iron with a point on the end. This seals the Oracover to the wood at the same time as it melts back the covering from the slot. Otherwise a razor knife can be used to trim away the material.

3) Drill a small (1/16" or 1.5mm) hole in the center of each slot to help 'wick' the adhesive onto the hinge in the next step.

4) Insert the CA hinges halfway into the slots on the wing or aileron and insert a pin into the center of the hinge to prevent the hinge from sliding any further into the slot.

5) Position the control surfaces up to the wing, inserting the other half of the hinge into the opposing slots. Check side-to-side alignment so that the space between the wing and the position relative to the fiberglass wing tip, which you can trial position, are where you would like it. Remove the pins and place about 4 –6 drops of Thin CA into the slot on both the wing and aileron for each hinge, on both top and bottom side of the wing. Check for free movement.

6) Finish the installation on the opposite wing.

7) Pull on the control surfaces to test their strength.

Preparing the wing tips.

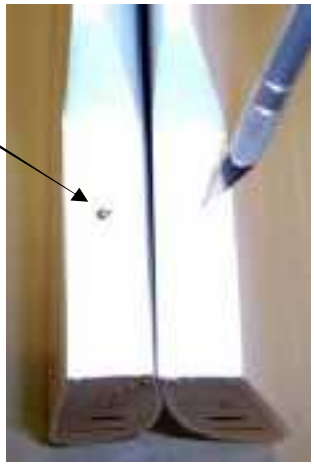
At the end of the next section you will be bonding the wing tips into place. Thinking ahead, now is a good time to wet sand and then paint the tips. Use soapy water and 360 or 400 grit sandpaper. (Soap water removes the mold release better than any solvent.) You can skip this step if you just wish to use the white gel coat finish.

Prime and paint the wing tips. We like Krylon "Fusion" at the hardware store or Top Flight "Lustrekote" paints at your hobby shop.

Opening Wire, Servo Slots and Bolt Holes in Covering

The Oracover must be removed in certain areas to allow mounting of the wing, clearance for servo pushrod operation and exiting of servo wires from the wing into the fuselage. We will also prepare the servo covers for mounting of the servos.

1) Referencing the picture, use either a sharp pointed razor knife or hot soldering iron and open the two wing mounting bolt holes on the trailing edge of the wing to expose the blind nuts. Also open the two ½" wire exit holes located on the bottom of the wing.



If using the razor knife, you'll get better results if you cut on the downward stroke – pushing the covering against the underlying wood for support as you cut.

2) Locate the servo bay covers on the bottom of each wing.

- Note: The slots for the aileron servos are 'outboard' from the plane's center line, and are left and right (opposite) to each other. This is because the ailerons operate in opposite directions. .

3) Trim the slot opening of each servo cover with a sharp razor knife. (Don't use the soldering iron trick, as it will show the melted edge where it would be visible from the bottom side of the plane.)

4) With the covers in place, drill a 1/16" (1.5mm) hole at each corner. Install # 18 #2 x 3/8" washer head screws, then remove and place a few drops of Thin CA into the holes in the wing to strengthen the threads.

Threading Servo Wire Extensions and Installing Servos

For ease of serviceability we secure the servos directly to the underside of the servo covers, mounting them to wooden blocks. Verify that the servo arms are electrically centered with trim centered and you are using the length of arm you intend to use. (Refer to your Radio owners manual for techniques for centering the servo arm.)

1) Install the rubber pads and eyelets into the servo mounting lugs (supplied by servo mfg.)

2) Position a servo on the back side of a servo cover, with the arm pointing at about 15 degrees (one or two splines) forward of perpendicular, through the slot, and the face of the arm parallel to the slot. (You are going to want more “up” aileron than ‘down’ aileron)

3) Test fit two wood blocks (supplied) under the servo mounting lugs. Double check position of the servo arm in the slot, and allow room for compression of the rubber pads, if necessary, when the mounting screws are tightened.

4) Bond the wood blocks to the servo cover using at least a medium thickness CA adhesive, or better yet, epoxy.

Before securing the servo, replace the output arm with an arm long enough to allow clearance of the pushrod when operated to extreme positions. If you do not have longer servo output arms steps 4 & 5 in the next section will address a method to widen the slot and bend the pushrod to enter the slot) The approach will bend the push rod so that it enters the slot slightly more vertically. Like this instead of (You’ll be keeping this angle as shallow as possible to minimize bending of the rod under load.)

5) Test fit the cover with the blocks & servo into the wing to ensure clearance.

6) Repeat the above process for the other aileron servo.

7) Plug a 12” servo cable extension on to the Aileron servo cables. Use a piece of heat shrink tubing or electrical tape to keep the connection secure.

8) Using the pre-installed monofilament pull string, draw the servo cable through the wing and out the bottom hole.
   - If the cord is missing or has been pulled through by accident, the metal pushrods in the kit make great ‘snakes’. Insert into the root rib hole, push through to the servo bay and attach the servo cable extension end to the pushrod snake using electrical tape.

9) Repeat the servo installation process for the other wing.

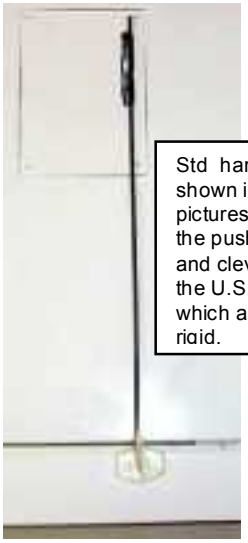
10) Plug the servos into the receiver and test their operation to be sure wire connections inside the wing remained tight.

Installing control arms, horns and pushrods

1) Plug an aileron servo into the receiver and turn the transmitter 'on' and set the trim to center. Turn the receiver on and let the servo find neutral. Turn off the receiver and transmitter, in that order.

2) With the servo cover in place, but not screwed down, double check that the servo arm exits the slot 10 to 15 degrees to forward. Offsetting both servo arms in the same direction will ensure that you get more 'up' aileron and less 'down'. The full scale Challenger experiences some 'adverse yaw' (i.e. the lowering of an aileron banks the plane in the correct direction, but drags the nose in the other direction) and we attempt to minimize this by having both ailerons travel more 'up' than 'down'.

3) Retrieve one of three 8" Sullivan (203 mm) pushrods from the U.S. pack and lay alongside the protruding servo arm to help locate the position of the nylon control horn. Secure the control horn to the aileron with two M2 x 20 mm machine screws (#20) into a nylon backing plate.



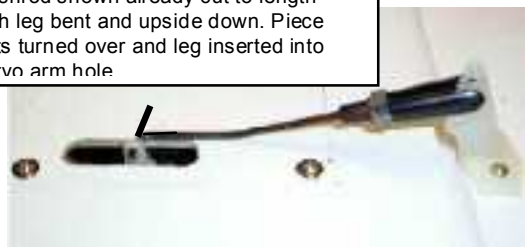
Std hardware shown in the pictures. Use the pushrods and clevises in the U.S. pack which are more rigid.

4) We are going to check to see if your servo arm is long enough to operate the aileron without the pushrod contacting the slot in the servo cover (Most are not.) Thread a Sullivan metal clevis to the pushrod (minimum ¼" or 6 mm) and temporarily attach the clevis to the control horn on the aileron in a middle hole. Cut the pushrod to a length 5/8" (15 mm) past the servo arm. With the rod laying along side the arm, you can 'eyeball' whether the servo arm is long enough to not have the rod hitting the ends of the slot in the cover (including when a #17 rod keeper will be in place.) Likely you will have to do the next step.

5) To size and cut the pushrod to length, leave the clevis threaded on to the pushrod and:
   a. If you have used a short servo arm you will need to make a shallow bend in the pushrod so that it can enter the slot and still have room for the keeper. Make a shallow bend (10 to 15 degrees) midway between the horn and servo arm.

   b. Rotate the rod 180 degrees so that the bend lays flat along the wing – allowing you to determine where to mark, and in the next step bend, so as to fit the servo arm hole.

Pushrod shown already cut to length with leg bent and upside down. Piece gets turned over and leg inserted into servo arm hole



6) Mark the location of the servo arm hole on the wire and subtract 1/16" (1.5mm) for a bend allowance. Carefully bend a right angle (<u>pointing away from the arm</u>!), so that when you rotate the rod back into position it will fit into the arm. Cut the leg to 5/16" (6mm)

7) Cut off and deburr the bent end of the pushrod so that the right angle short leg measures at least 3/16" from the inside of the bend. The servo arm may require drilling of the hole to accept the pushrod wire diameter.

8) Rotate the pushrod back into the correct position and install into the servo arm using a # 17 Rod Keeper.

9) Repeat steps 1 – 8 for the other wing's aileron servo pushrod.

10) Now is a good time to attach the wing tips that you previously painted. This will protect the exposed ends of the ailerons.
    a. Position and bond the wing tips into place using a few spots of 5 minute epoxy. We don't recommend using a lot of epoxy to attach the wing tips, as you may wish to remove them later should you decide to cut downs the wings to make the 'Clipped Wing' version.

    b. Match the leading edge and top edges of the wing tip to the tip rib and bond in place. Hold the tips in place to dry with masking or electrical tape.

    c. To cover the joint between the wing tip and wing consider using two strips of white Ultracote/Oracover or vinyl ¼" x 23" (6mm x 585 mm) to apply over the joint.

Permanently Assemble the Wing Halves

The two wing halves are joined using the plywood wing joiner and 30 minute epoxy. The wing mounting bolts at the trailing edge and dowls at the leading edge are used with rubber bands to help hold the halves together while drying.

1) Locate the Wing Joiner – this piece strengthens the joint between the wings and sets the wing dihedral.

2) Test fit the Joiner into both wing halves and slide the wings together to be sure both root ribs meet at the center. Mark the center of the Joiner as a reference mark. Sand if necessary to get a smooth close fit.

3) Locate the two #8-32 x 3/4 " socket head cap screws (#13) and start these into the blind nuts at the trailing edge (where you cut away the covering earlier.)

4) Separate the wings and using a piece of scrap wood, Popsicle stick or tongue depressor, apply 30 minute epoxy to the inside of the Joiner box on both wings

and one end of the Joiner. Slip the Joiner into the wing.

5) Coat the root ribs on both wings and the remaining portion of the Joiner, and slip the wings together.

6) Wipe away the excess epoxy (Isopropyl – Rubbing - alcohol does a good job) and clamp the leading and trailing edges together to prevent twisting while drying using two heavy-duty rubber bands. Use one around the dowels at the leading edge, and one around the two socket head cap screws. A clamp at the trailing edge will hold that edge in alignment.

7) Set aside to dry in a location away from the dog and cat and some place flat. Check back after a few minutes to be sure the wings have not twisted

Building the Fuselage

The logic behind the fuselage design of the Challenger model:
Your Challenger model was designed to use a 2 cycle engine to minimize the weight aft of the planes' center of gravity (CG). Most flying fields require a muffler on 2 cycle engines. Because the Challenger is a pusher aircraft, the muffler must point forward, away from the propeller. (The prop would not turn very fast with the muffler in the way!) The forward pointing of the muffler (over the trailing edge of the wing) would create difficulties in removing or installing the wing. We have addressed this challenge by securing the trailing edge of the wing to the firewall, and bolting the firewall in place after the leading edge is slipped into place. This design keeps all throttle linkage and fuel system components intact. Thus requiring only the 'plugging in' of the throttle servo wire when disassembling the model for transport. We have used U.S. standard fasteners where there is field assembly/disassembly.

Firewall Assembly, Test Wing Fit and Engine Mount Installation

1) Locate the plywood firewall. It has been fuel proofed at the factory. Inspect to verify that it meets your building standards.

2) The firewall is held to the fuselage by (4) 6-32 x ¾" socket head cap screws (#2). Retrieve these screws, and the 6-32 Blind nuts in the U.S. pack. Install the blind nuts from inside the fuselage. Pull the four blind nuts into place using one of the washers and a 7/64" Allen key.

3) With the firewall held in place with at least two screws, use the two lower engine mount holes as guides, and drill through the fuselage with a 13/64" (5 mm) drill bit. Refer to the picture at left. (These

are non-critical clearance holes for the lower engine mount bolts that will pass through the blind nut. The holes allow room for the end of the bolt.

- If you don't have a 13/64" bit you may drill slightly oversize with a 7/32" bit.

4) To attach the engine mounts you will install 4 supplied metric blind nuts into the back of the firewall. The horizontal distance between these nuts is designed to mount an OS Max .40, Webra .40 or similar engine with the same size crankcase dimensions.
    - We suggest you locate the four M4 x 25 mm machine screws (#12) and insert through the holes of the engine mounts (#23) into the firewall to trial fit and check the spacing for your engine. (They will fit loosely as the holes are designed to allow the fit of the blind nuts.) If spacing is incorrect for your engine you may need to slot the holes horizontally to properly space the blind nuts. The blind nuts can span the slot.

5) Locate the M4 x .7 blind nuts (#1) and pull the nuts into place from one side of the firewall (either side is fine) using the M4 x 25mm machine screws (# 12). Put a few drops of medium CA under the T portion of the nut as you pull it into the wood. (We like using a flat blade screw driver for pulling the nuts.) Remove the screw(s) after you have set the nuts.

6) Retrieve the six (6) 3/16" washers from the U.S. Pack. Secure the engine mounts, short legs up, by using the (4) M4 x 25 mm (#12) bolts into the firewall blind nuts.
    - Shim the angle of the engine mount by inserting three (3) 3/16" washers (in the U.S. Pack) under the lower leg of each motor mount.

7) Position your engine on the motor mounts, as close to the firewall as possible to mark and drill mounting holes. Do not secure in place yet. Be sure that there is clearance between the back of the propeller and the end of the engine mounts. You may cut the engine mounts as necessary to allow moving the engine closer to the firewall. (Engines without bearings in the front will have shorter crankshafts.) Engines vary, be sure you have room to hook up you your fuel line or move the throttle arm as you position your engine close to the firewall. Mark and drill the engine mounting holes to fit the DuBro 4-40 mounting bolts and locknuts that we've supplied. We recommend marking the mounts, and then drilling the clearance holes with a drill press if available. The clearance hole for a 4-40 bolt is 1/8".) Do not mount the engine yet, as the throttle pushrod installation in the next section is easier if the engine can be removed.
    - After all fits properly consider Loctiting the M4 Engine Mount bolts installed in step 6 above. (We did not Loctite them then in case you had to remove and cut the mounts.)

8) Trial fit the firewall with the 6-32 socket head cap screws (#2) and No.6 washers. Note that the lower M4 blind nuts will contact the fuselage. This is normal and allows enough space to slip the wing in place if you don't have an engine with a muffler that overhangs the trailing edge.

9) Trial fit the wing by inserting the leading edge dowels into the forward facing holes above the cabin. Assembly tolerances may have added up to require adjustment. Slot the holes horizontally carefully and as necessary to snugly fit the distance between the wing dowels.

10) Drop the trailing edge into place and verify hole spacing in the firewall for the 8-32 firewall to wing mounting bolts. You may slot horizontally, equally and as necessary to match the blind nuts mounted in the trailing edge of the wing. Install the #13 8-32 socket head cap screws and snug all bolts and satisfy yourself that all fits well.

11) You should now be able to test remove the entire wing and engine as one unit by removing the four 6-32 firewall-mounting screws. (Although we're going to ask you to put it back on in the next step) You will need to pull straight backwards to unplug the leading edge of the wing, and the engine mount bolts that passed into the clearance holes in the fuselage.

Installation of Fuel Tank and Throttle Servo

The fuel tank and throttle servo are mounted in the wing forward of the engine. The tank mounted in the wing eases disassembly and prevents having to use a fuel pump if the tank were mounted down in the cabin. We are assembling it now (even though this is the fuselage section of the instruction manual) because it's easier to work on the top surface of the wing when the firewall/engine mount is attached and it sits on top of the fuselage.

1) If you removed the wing in step 12 above, temporarily re-fit it in place on top of the cabin.

2) Assemble the 4 oz fuel tank following the package instructions. (The kit was originally designed for the Sullivan Slant 4 tank, however their factory had a fire just before we needed to purchase tanks. We have supplied an equally high quality DuBro tank in the kit.) Assemble with two tubes (fuel line and vent.) Be sure to mark the cap on the outside of the tank to identify which tube is the fuel pick-up and which is the vent.

   a. We know this tank is on the small side. The area will fit a 6 oz tank, however a 6 oz tank would not fit under the cover. If you'd like to install a larger tank the Sullivan Slant 6 will fit in this space, although not fit under the cover. You can easily change the tank in the future. Using a fuel pump you can install an even larger tank down inside the fuselage.

3) Cut the supplied 24" of Silicone fuel line into two pieces – (1) 11" (280mm) and (1) 13" (330mm). Push the 13" line on to the fuel pick-up tube. Push the 11" line

on to the vent tube. Mark the opposite end of the tube so that you will know which is which in the future.

4) Before installing the fuel tank we recommend fuel proofing the tank and servo compartments with dope, thinned epoxy or water based urethane varnish.

5) Drill two holes in the firewall to allow the two silicon lines to pass through. Refer to the picture in step 5.
   - Drill the holes slightly smaller than the diameter of the fuel line.
   - Cut the ends of the tubing at a sharp angle and you will be able to pass the tubing through the holes.
   - After pulling the line through it will expand to seal the hole around the tubing.

6) Install the tank by applying a couple of strips of foam servo tape or adhesive backed Velcro$_{tm}$ to the bottom of the fuel tank. Route the silicone lines down and to the starboard (right) side of the fuel tank and then up and out at the rear corners of the fuel tank near the firewall. You will find it easiest to route the tubes if you hold the tank forward slightly while you position the tubes. Then slide the tank rearward and press in place to trap the tubes in the corners.

7) Position the throttle servo in the servo bay, slipping the servo wire through the hole in the bottom of the wing. Drill and secure with screws supplied by the servo manufacturer.

8) Remove the servo arm. Locate the throttle pushrod EZ Connector (#21) and fit into the servo arm so that it may rotate easily but not loosely. (Barrel side up!) Enlarge the hole in the servo arm if necessary. Use thread locker to keep the knurled nut in place.

9) Replace the servo arm and electrically position the servo to full throttle position. (Typically the arm is rotated towards the rear of the aircraft with most 2 cycle engines.)

10) Locate the throttle pushrod wire (.050 dia x 12") (1.3 mm x 305mm) and its corresponding plastic housing tube.

11) Eyeball a straight line between the servo and your engines throttle arm. Drill a 1/8" hole (3.2mm) through the firewall for the plastic pushrod housing and insert into the hole.

12) Bend a right angle bend in the end of the pushrod wire, thread the wire through the plastic housing (cutting the housing as needed) from the engine side. Slide the straight end into the barrel on the EZ connector and fit the bent angle into the throttle arm of your engine - placing the engine on the engine mounts. Retain the wire in the engine throttle arm using a #17 Rod Keeper.

13) Bench adjust the throttle linkage throw with your radio and/or position of the rod in the barrel, or the location of the barrel on the servo arm. Tighten all fittings.

14) Secure the engine to the engine mount if not already done.

Fitting Fuselage Servos (Rudder & Elevator), Pushrod Housings and Receiver.

Remove the wing/engine assembly from the top of the fuselage.
If you would like to paint the plywood inside the model a different color – we like black or silver, this would be a good time to do it. Fuel proof paint is not required.

1) Retrieve the two DuBro 31" rudder and elevator pushrods and their plastic housings. These are stiffer than the standard pushrods supplied in the kit.

2) Slip the housings into the fuselage from the slots at the rear of the fuselage and thread them through the holes in the two bulkheads as shown below. Open the slots and holes as necessary to accept the slightly larger size. (Pictures show standard pushrods installed.)

3) Position the housing tubes so that they extend approximately ¼" forward of the center bulkhead and apply 5 min. epoxy to each place where the tube passes through a bulkhead and the fuselage at the rear. Carefully wipe away excess, making sure you clean under the tube also. Return a few minutes later with alcohol on a cloth and clean away any residue. Wait until the epoxy is fully dry to trim the tubing flush at the fuselage. You will be slicing it at an angle using a sharp razor knife.

4) While the epoxy dries you can locate & secure the position of the two servos.
    a. Electrically (with your radio) center the servo arms.
    b. Slide the pushrod wire into the tubes (The ends don't have to be trimmed yet)
    c. Position the servos so that the outermost hole in the servo arm is directly under the pushrod wire.
    d. Drill and secure the servos using fasteners supplied by the radio manufacturer.
        - To drill the holes, which may be hard to reach, try sharpening a chisel point on the end of the 7" pushrod wire and using it as a 'flexible jobbers length drill'.

5) Locate and install the two black nylon nose gear mounts on the front bulkhead using four M3 x 20mm bolts (#9), M3 washers (#8) and M3 blind nuts. Seat the nuts and then loosen them so as to allow alignment of the two pieces later.

6) Install the receiver:

a. Install the switch harness. (We put ours on the bottom Port side just aft of the nose cone. If you think you'll rip off the landing gear, then this is not the best location – but it does hide it nicely!)
b. Plug a "Y" connector into the Aileron port of your receiver, and a 6" or 12" extension into the Throttle port. (A 6" extension will allow you to reach the hanging throttle servo wire, a 12" extension will allow you to route the wires so they are less visible.)
c. Wrap the receiver in foam and plug in the Switch harness, Rudder and Elevator servos.
d. Secure the receiver in the bay forward of the servos. (We like sticky back Velcro$_{tm}$ - or hold in place with wire ties through holes in the ply platform.
e. Route the throttle and aileron servo wire either up between the rudder and elevator servo, or along the sides if you have enough length.
f. The batter pack will mount later on the forward platform. You will need additional weight on this platform, the amount of which will be determined when you balance the model.

Installing the Landing Gear

The fuselage sits nicely upside down on three points, so we will install the landing gear before attaching the Vertical and Horizontal stabilizers.

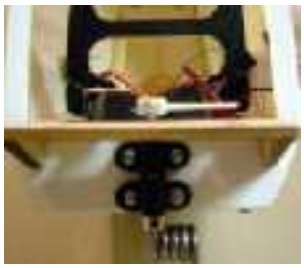
1) Locate the collars we have supplied in the U.S. pack (We will not use the collars originally packed with the model. The production collars did not fit over the gear wires as we wrote this manual.)

2) Slide a collar over the straight leg of the nose gear and slide it down to the coil and secure it.

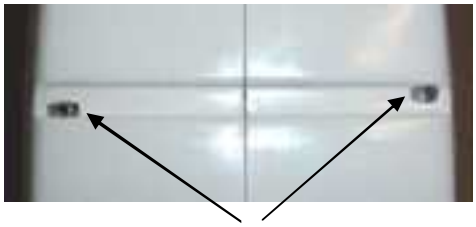
3) Slip the 3/16" dia. x 1 1/8" brass bearing tube in the U.S. Pack over the end of the nose gear, and slide it up to the collar. Insert the assembly into the bottom nose gear bearing block and slide it up into the upper block. Align the blocks as necessary to minimize friction, and then tighten the four bolts into the blind nuts.

4) Retrieve the DuBro Steering Arm and a collar. Slide the collar over the top of the nose gear wire so it sits on top of the bearing block. Slide the wire gear up as far as it will go in the bearing blocks, and tighten the top collar so as to keep in place, but still allow turning freely.

5) Place the DuBro steering arm on the top of the nose gear wire, extending towards the port side. Align the axle portion of the gear so that the wheel, if there, would be pointing straight forward, and adjust the steering arm so that it is parallel with the axle. Tighten the set screw on the steering arm.



6) To position the main gear legs (# 30) you will drill two 5/32" holes on opposite sides of the fuselage in the recessed area on the bottom. Note that one hole is towards the front, the other towards the rear of the recess, allowing the two legs to lay next to each other.



7) Trial fit the main gear legs into the holes with the short legs entering the holes. You will need to radius the inside edge of the hole towards the center line of the model so that the leg will sit flush on the bottom of the fuselage. (A Dremel$_{tm}$ tool or small round works well here.)

8) The hole should fit the wire tightly. Install the landing gears. We recommend mixing some epoxy and 'potting' the short leg in the hole. Coating the short leg with light oil will help if you ever want to remove the leg (recommended.)

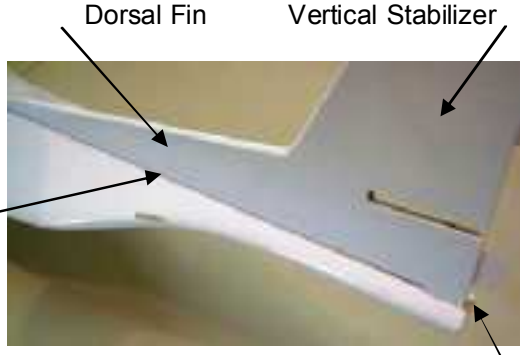
9) Retrieve two nylon landing gear straps (#24) place them over the landing gears as shown, and pilot drill with a 1/16" drill. Secure the straps over the landing gear wires with the #2 x 3/8" washer head screws. (#6)

10) From the U.S. Pack retrieve the landing gear cross brace and copper wire.

a. Cut the wire in half.
b. Scuff sand the ends of the brace and wire gear area where the brace will contact the gear leg.
c. Place the brace across the landing gear so that it is parallel with the bottom of the fuselage and
d. Wrap each end with a piece of copper wire.
e. Solder or epoxy/bond the wire in place. If bonding, set aside to dry.

Installing the Vertical Stabilizer, trimming the Windscreen, prepping the Wheel Pants & trial fitting the nose cone.

The vertical stabilizer is CA and epoxy bonded to the top aft portion of the fuselage.
Prepare the aft top edge of the fuselage for bonding by first washing the area with soap and water to remove any remaining mold release, then scuff sand the edge to improve bonding adhesion.



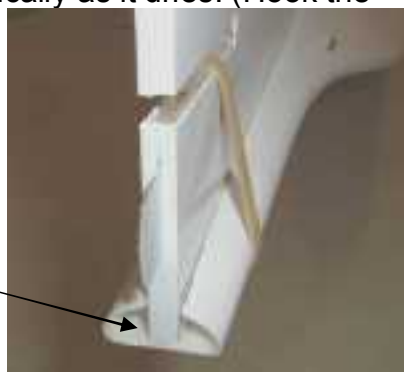
1) Locate and remove the rudder from the vertical stabilizer (E). Trial fit to compare the bottom edge of the long dorsal fin with the top edge of the fuselage. Sand, with a straight edge, the bottom of the dorsal fin and Vertical Stabilizer as appropriate to minimize gaps.

2) With the vertical stab removed, turn the fuselage over and, on the bottom, ¼" from the end of the fuselage, drill a 5/64" hole. (You'll use this to anchor the bottom of the vertical stabilizer.)

Retrieve a #2 x 3/8" (#6) screw to have ready for bonding in the next steps. You will apply CA to a small portion of the forward end of the dorsal fin to temporarily hold the fin. You'll then bond the rest of the length in place with epoxy and hold the fin in place with the screw from the bottom.

3) Apply ½" bead of medium CA to the bottom forward ('pointy end') of the dorsal fin. Place the rear edge of the vertical stabilizer flush with the end of the fuselage, and press and hold the forward tip of the dorsal fin in place for 10 seconds.

4) Mix up some 15 or 30 minute epoxy and carefully apply to the top edge of the fuselage, or under the dorsal fin and vertical stabilizer. Also apply to the bottom of the 'tab' on the vertical stabilizer where it will sit against the inside of the fuselage when the bottom screw is tightened. Seat the fin and turn the assembly over and install the screw into the fin, pulling the assemblies together
    a. Use a rubber band to keep the fin aligned vertically as it dries. (Hook the rubber band through the slot where the horizontal stabilizer will be and around the fuselage. Position the vertical stab vertically using the friction of the rubber band in the slot to maintain squareness with the fuselage.



    b. Apply additional epoxy fillets inside the end of the fuselage where the fin sits against the bottom of the fuselage.

The following 'unrelated' instruction steps will give the above assembly time to dry thoroughly before continuing with the tail end.

5) Trim the windscreen. Use the molded-in lines to trim the windscreen (D) to the correct shape. (Scissors work, but our favorite tool for this is an aviation tin snip.)

6) Prepare the wheel pants for later installation. Retrieve the three 1 1/8" (30mm) square plywood backing pieces (# 25)

   a. Scuff sand the inside of the wheel pant on both sides of the 'bump'. Apply epoxy to each plywood piece and bond to the inside of each wheel pant, centered over the bump. (It will span over the bump created by the molded in recess, so be sure you get epoxy to the corners of the piece.)

   b. Set aside to dry.

7) Fit the nose cone of your choice. The original Challenger nose cone had a flat square front end created by the fabric covering of formed tubing. Later models utilized a fiberglass nose cone that came to a point. Select the one you would like to use.

   a. Position the nose cone on the front of the fuselage, centered and held in place by a piece of tape. The bottom edge will not fit, as it will rest against the nose gear.

   b. Mark the bottom of the nose cone where you will cut away clearance for the nose gear.

   c. Notch the nose cone to fit around the nose gear. It should seat fully on the recess molded into the fuselage.

   d. Fit the nose cone in place and drill four 1/16" pilot holes for the #2 x ¼" washer head mounting screws through the nose cone into the fuselage. We like placing 4 screws, 1 each at the base of the wind shield struts and at the bottom corners under the model.

   e. Remove the nose cone and set aside.

Installation of Horizontal Stabilize, Rudder Elevator and Pushrods

1) Retrieve the horizontal stabilizer with elevator and mark the hinge locations. Mark one surface of each to maintain relationship. (Assembly is symmetrical, but hinges may not be symmetrical around the centerline.) Install the hinges using the same technique you used to install the ailerons.

2) Prepare both sides of the Rudder hinge locations for later CA gluing. You will install the rudder after fitting the horizontal stabilizer in place.

3) Slide the horizontal stabilizer/elevator assembly into the slot in the vertical stabilizer. (The stabilizer is symmetrical, so either side can face up.)
   a. Using the back of a razor knife scribe a line on both the vertical stabilizer and horizontal stabilizer where you will remove the covering so that the two can later be bonded together.
   b. Temporarily slide the stabilizers together without glue.

4) Turn the model over, letting the tail overhang the workbench, to trial fit the stabilizer brace.
   a. Retrieve the stabilizer brace and two #2 x 3/8" washer head screws (#4).

   b. Remove the screw securing the vertical stabilizer at the bottom and place a few drops of thin CA into the hole to reinforce the threads in the hole

   c. Place the brace into position and replace the screw. Bend the brace as necessary to meet with the stabilizer. Do not secure the outer ends yet.

5) Slide the vertical and horizontal stabilizer apart, apply epoxy to the bare wood and reassemble.
   a. Using the two #2 x 3/8" washer head screws (#4) set the stabilizer square with the fuselage and secure to the brace.

   b. Clean up any excess epoxy. Double-check the hinge line of the elevator to be sure you have not bonded the elevator to the stabilizer!

   c. After the stabilizer is cured, remove the brace screws, drop in some thin CA to harden the hole and reattach.

6) Test fit the rudder onto the hinges, with pins to keep the hinge from sliding in too far. Make sure there is room for the elevator cross piece to rotate in the notch, and that the rudder can fully move side to side. Trim as necessary. Remove the pins and bond the rudder hinges with thin CA.

7) If not yet done, trim the now dry pushrod tubes flush with the outside of the fuselage. Use a gently sawing motion with a razor knife flush with the fuselage.

8) Insert the pushrods into the tubes from the rear of the fuselage.
   a. With the rudder horn on the port side, and the elevator horn on the starboard side, position and install both the

rudder and elevator horns. They should be in line with the clevis on the pushrods. The row of holes should line up with the hinge line of the surfaces. Use the nylon backing plates and 2mm machine screws (#20)

9) Connect the clevis to the 4th hole out from hinge as an initial setting. Slip the silicon keeper in place.

10) Fit the Elevator and Rudder pushrods to the servos:

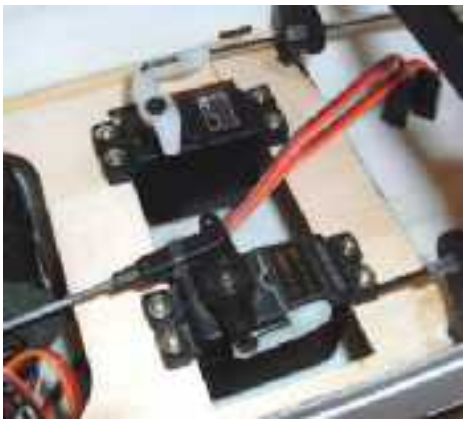
a. Electrically center the servos with the trim centered.

b. Physically center the rudder and elevator

c. Mark the pushrods where you will bend a 90 degree angle to fit the servo arm.

d. Cut the pushrod 5/16" (8mm) past (longer) than the marks

e. Bend the rods 90 degrees at the marks.
   i. It's a little difficult bending the wire end inside the fuselage. Make your life easy and don't worry about getting the leg to point directly downward into the servo. You can rotate the rod/leg to vertical, so that it fits into the servo arm, at the control surface clevis outside the fuselage after you make the bend.



f. Retrieve two #17 rod keepers. Insert the legs into the servo arms and clip the keepers in place.

g. Final pushrod length adjustment will be done at the control surface clevises.

11) Fit the steering pushrod.

a. Electrically center the rudder servo

b. Retrieve an 8" Sullivan 2-56 pushrod and thread a supplied clevis to the threaded end of the rod. Slip a #3 Silicon clevis keeper over the rod.

c. Insert the rod into the fuselage from the front and clip the rod clevis to the servo arm about half way out the arm.

d. Lay the rod over the steering arm, mark the rod and cut 5/16" past the mark.

e. Bend the rod 90 degrees at the mark and rotate so that it points upwards.

f. Fit the rod to the innermost hole and secure with a # 17 rod keeper.

g. Adjust the steering pushrod length at the servo end.

Now is a good time to make sure that your receiver antenna is properly 'strung' out.

You can extend it aft inside the fuselage, running between the two servos and into the rear portion of the fuselage. Be sure to secure it in place so that it does not fall forward over itself. Alternatively, you can run the wire out the bottom of the model and aft to the stabilizer brace, securing the end with a rubber band. Use the cut off ends of a servo arm to create a strain relief.

Fitting Wheels and wheel pants

1) Retrieve the wheel pants and drill a 5/32" (4 mm) hole at the bottom of each slot. (You should have two Right wheel pants and one Left.)

2) Chamfer the inside of the slot into the hole to allow room for the radius of the bend in the wire gears. Be careful not to open the diameter of the hole. Trial fit the wheel pant on each gear leg to be sure the wire leg lays fully into the slot provided.

3) Slide the wheel pant on to the landing gear, followed by a DuBro collar, the wheel, and a second collar.

4) Retrieve three Nylon gear straps # 24

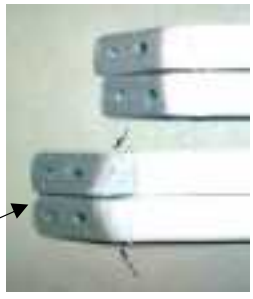
5) Position the wheel pant against the gear leg, lay a Nylon strap over the leg and mark and drill 1/16" mounting holes using the strap as a template.

6) Secure the wheel pants in place using two (#19) #2 x 3/8" screws.

Fitting Struts

The struts on your Challenger model are mostly for scale effect. You can choose to attach them with only one screw on each end to speed field assembly.

1) Lay the four struts on your workbench. Note that there are two longer ones with a compound angle bent at one end. These long struts are the rear struts, and the end bent in two directions will be inserted into the fuselage.



2) Test fit a rear strut. As the compound bends are opposite, select the strut that points and lays aft best. Adjust the bends if necessary to ensure the ends lay flat against the wing pad at the trailing edge of the wing just past the aileron servo, and at the plywood pad inside the fuselage. Mark and drill a 1/16" hole in the plywood pad located at the trailing edge of the wing just past the aileron servo. (Use care so as not to poke through the covering on the topside!)

3) Secure the end of strut to the wing with a #2 x 3/8" screw. Mark and drill the location of the other holes using the ends as a template. You may just want to mark the hole location inside the fuselage and drill the hole after you remove the wing. (We suggest using the drill bit that you made from sharpened wire you may have made when installing the servos.)

4) Mount the remaining struts in the same fashion – test fitting in both directions for best fit.

5) Leave the wing attached while you trim the Center Cover Pod in the next section.

Convenience tip: Next time you disassemble the model:

a) Mark one end of each strut to identify the position of the strut when you re-assemble the model. (e.g. On the right rear strut mark, under the end that inserts into the fuselage, "RR" for 'Right Rear'. We use 'SA' for 'Starboard Aft' . . .)
b) Put a few drops of thin CA into the screw holes in the wing and fuselage to reinforce the threads in the wood.

Installing Wing Center Cover and Windshield

1) Carefully trim the Wing Center Cover along the score lines on the cover. We suggest using the lines on the inside surface as a cutting guide, as these are easier to see. Cut slightly outside the line at the aft end of the cover – this will give you some 'wiggle' room for fitting

2) Test fit the cover. When satisfied drill four (4) 1/16" holes to secure the cover to the fuselage. Two holes just forward and below the leading edge, and two into the firewall at the aft end of the cover.

3) Remove the wing to allow drilling of the remaining strut mounting holes and installation of the windshield.

4) Position the trimmed windshield in place and hold with a few pieces of tape.

5) Observe the 10 small plywood pads mounted inside the fuselage around the edges of the windscreen location.
6) Drill a 1/16" hole through the windshield and through the plywood pads.

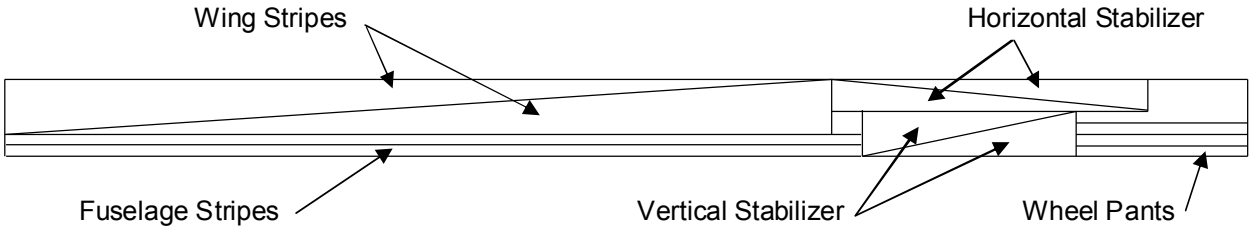
7) Install the windshield using ten (10) #2 x ¼" washer head screws (# 4).

Applying Trim

Your Challenger model comes with two trim stripe colors. Refer to the pictures to see how we chose to apply the trim. Both the 'Primary' color and Dark Grey are laid out identically on the computer cut strips – only the width of the stripes are different. Below we have reproduced a 'map' of the cutting to assist with finding the correct stripes.

Note: This is the incorrect stabilizer position.

When applying the stripes our favorite technique is to hold the narrow end of a stripe over the starting point with the tip of a razor knife, and then gently lay the stripe into place. If you get it wrong you can peel it up and try again.



Recommended Propeller Sizes

We recommend a 10 x 6 pusher propeller for .40 2 cycle engine. The model will accept propellers up to 11" in diameter.

Control Throws

We recommend the following control surface movement for the initial flights:

Rudder, measured at the top of the Rudder trailing edge, each side of center: 5/8 – 7/8" (15mm – 22mm)

Elevator, measured at the trailing edge near the rudder, each direction from center: ½ - 5/8" (12mm – 16mm)

Ailerons, measured at the wing tip end, each side of center: 5/8 – 7/8" (16mm – 22mm).

Weight and Balance – **This is probably the most critical assembly step you do!**

You will have to add nose weight to the model. (Probably close to 1 lb 4 oz.) We buy lead at a local gun store or wheel balancing shop. You can strap most of the lead weight to the platform provided and mix up some lead shot with epoxy and pour it into the nose cone for small additional amounts. Adding weight is to be expected, as the full-scale aircraft is designed to carry a 200 lb pilot in the front seat – which is well forward of the aerodynamic CG. The 21 oz/ft^2 long wing loading specs on the model include this weight. We recommend setting the balance of the model at 2 7/8" (73 mm) aft of the leading edge, which is just slightly forward of the 25% chord line. Moving the balance point further forward, up to 1/4", will increase the pitch stability of the model. Err in that direction if you must, for the first few flights. Moving the balance point aft will decrease the pitch stability, giving a livelier feel - at the risk of being able to easily over-control the aircraft. Try our setting and then feel free to experiment.

Bench Pre-Flight

In case we didn't mention it before:

- Make sure all clevises have their silicone keeper rings in place and as close to the servo or control arm as possible.
- Make sure all servos have their output arms held in place by the center screw
- Be sure the steering arm has been tightened – consider using loctite to secure
- Check that all control surfaces move freely
- Check that control surfaces are at the same relative angles – i.e. in line with the flying surface to which they are attached.
- Check that all control horns are firmly attached
- Check that all control surfaces are firmly hinged by tugging on them
- Put some fuel in the tank and make sure the plumbing is correct
- Check correct operation of control surfaces with your radio – that left is left, etc..
- Go have fun and enjoy safely!

Flying Tips

One reason you may have purchased our Challenger model is because it's different. Well, it doesn't stop at the looks! The scale model flies in many ways similar to the full scale aircraft – without the benefit of having your butt in the seat! We suggest having a good pilot fly the model to get it into initial trim.

Your Challenger model flies like the full scale aircraft, in that it has a high lift wing, a high thrust line, full span ailerons that create a certain amount of adverse yaw and a design that is short coupled and puts prop wash over the top of the stabilizer, and not under it. (So, up is responsive, down a little less so.) You might consider off-setting the elevator servo arm similar to the aileron servo arms to give more 'down than up' after you've tried a few test flights.

If you are using an engine larger than a .40, you may consider take-offs at less than full power. Full power tends to push the nose over, making it hard for the nose wheel to lift

off, especially in grass. When the model reaches flying speed all the control surfaces are effective and it will lift off just fine.

On landings, watch out for the effect of rapid power changes. Powering in for a landing and chopping the power will yield a surprise – the model will want to nose up. This is normal for any high thrust line aircraft.

Flying the Challenger will give you practice for similar high engine float planes and let you practice softness in throttle control.

If you have trouble taking off from grass we suggest you remove the wheel pants. If you want to hand launch the model, it's possible, but have the person launching the model balance it in their hand with full power before the launch – again the high thrust will want to rotate the model in their hand and if not prepared for it, will point the model at the ground! Launch the model straight ahead, not upwards into a stall!

At flying speeds you'll enjoy the model as it sails around, looking for all the world like the full scale aircraft!

Enjoy.

EAM Experimental Aircraft Models
www.RCHomebuilts.com

33924 Cotswold Rd
Farmington Hills, MI 48335
Ph. 248-473-7232 Fax 248-615-3690