SPECTRUM™ AWARF SERIES

All Wood–Almost Ready To Fly

ASSEMBLY INSTRUCTIONS

90-DAY LIMITED WARRANTY

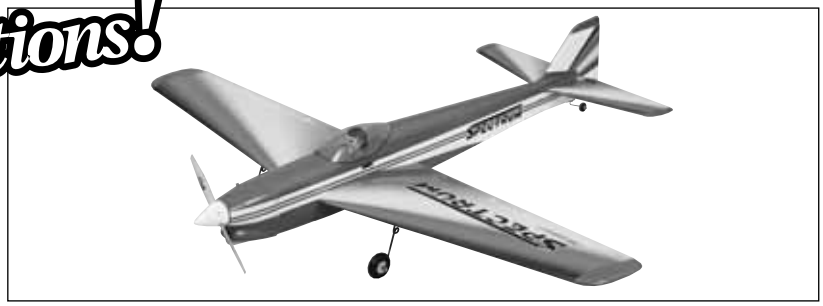
If you, as the original owner of this model, discover defects in parts and workmanship within 90-days of purchase, Hobbico will repair or replace it - at the option of our authorized U.S. repair facility, Hobby Services - without charge. Our liability does not include the cost of shipping to us. However, Hobby Services will pay shipping expenses to return your model to you. You must provide proof of purchase, such as your original purchase invoice or receipt, for your model's warranty to be honored. This warranty does not apply to damage or defects caused by misuse or improper assembly, service or shipment. Modifications, alterations or repair by anyone other than Hobby Services voids this warranty. We are sorry, but we cannot be responsible for crash damage and/or resulting loss of kits, engines, accessories, etc.

Your Spectrum ARF must be returned directly to Hobby Services for warranty work. The address is: Hobby Services, Attn: Service Department, 1610 Interstate Drive, Champaign, IL 61822-1067. Phone: (217) 398-0007. Please follow the instructions below when returning your model. This will help our experienced technicians to repair and return it as quickly as possible.

1. ALWAYS return your entire system, including airplane and radio.
2. Disconnect the receiver battery switch harness and make sure that the transmitter is turned off. Disconnect all batteries and drain all fuel.
3. Include a list of all items returned and a THROUGH, written explanation of the problem and service needed. If you expect the repair to be covered under warranty, also include your proof of purchase.
4. Include your full return address and a phone number where you can be reached during the day.

if your model is past the 90-day warranty period or is excluded from warranty coverage, you can still receive repair service through Hobby Services at a nominal cost. Repair charges and postage may be prepaid or billed COD. Additional postage charges will be applied for non-warranty returns. All repairs shipped outside the United States must be prepaid in U.S. funds only. All pictures, descriptions and specifications found in this instruction manual and on the product package are subject to change without notice. Hobbico maintains no responsibility for inadvertent errors.

Congratulations!



You're about to build in just hours what took aviation pioneers years—a powered machine that flies. Specially created for you and other experienced radio control modelers, Hobbico's Spectrum offers nearly all the excitement of piloting a real airplane...and develops skills that will take you anywhere you want in your hobby.

Know Your Model's Parts

Take a moment now to match the box contents with the items listed below. Following the Spectrum assembly instructions will be quite easy if you identify and organize the parts before you begin.

Landing Gear

Part #		Quantity
5	Landing Gear Blocks	2
6	Landing Gear Struts (L&R)	2
7	Wheels	2
8	Tail Wheel	1
9	Landing Gear Cover Plates	2
10	Plastic Gear Cover	2

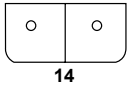
Engine Mounting Parts

Part #		Quantity
1	Engine Mount	1
2	Pushrod Tubes	2
3	Pushrod Wire	2
4	Pushrod Tubes	2

Wing Assembly

Part #		Quantity
11	Wing Joiner	1
12	Right Wing Panel	1
13	Left Wing Panel	1
14	Wing Bolt Plate	1
15	Aileron Servo Covers	2
16	Retract Wheel Wells	2
17	Wing Mounting Plate	1
18	Aileron Servo Tray	2
19	Front Root Ribs	2
20	Rear Root Ribs	2
*	Clevises	2
*	4 x 35mm Bolt	2
*	4mm Washer	2

Clevis



14

4 x 35mm Bolt

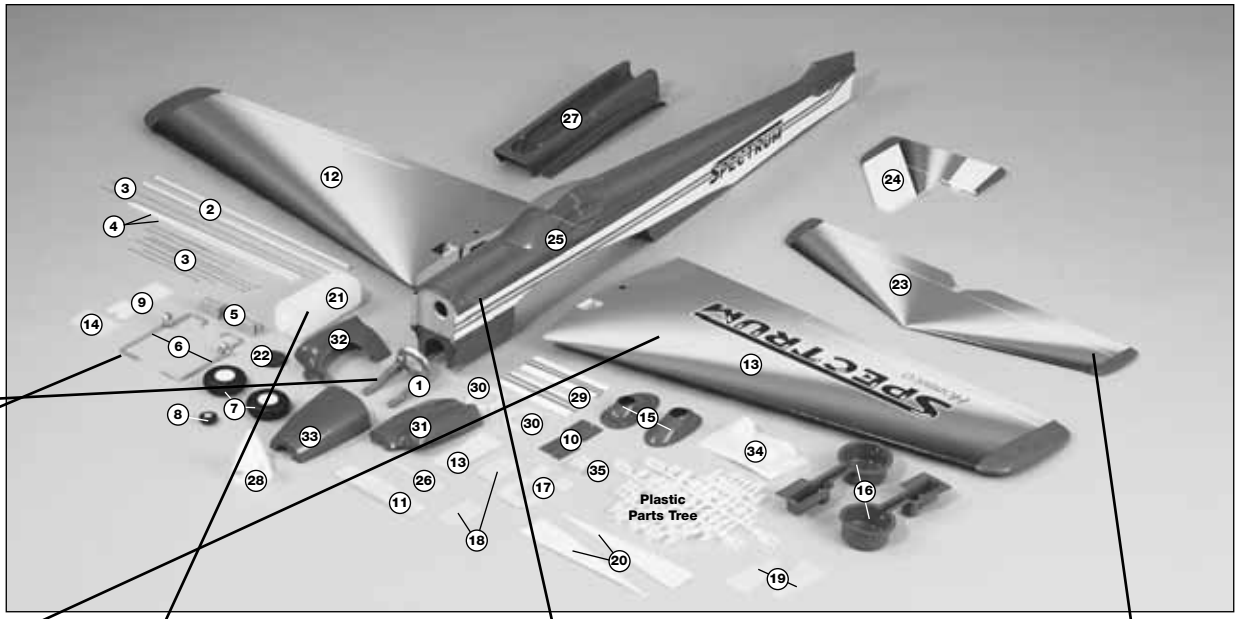
4mm Washer

18

Replacement Parts Available

HCAA3710...Wing Kit
HCAA3711...Fuselage Kit
HCAA3712...Fin Set
HCAA3713...Cowl
HCAA3714....Canopy
HCAA3715....Landing Gear Set
HCAA3716....Spinner

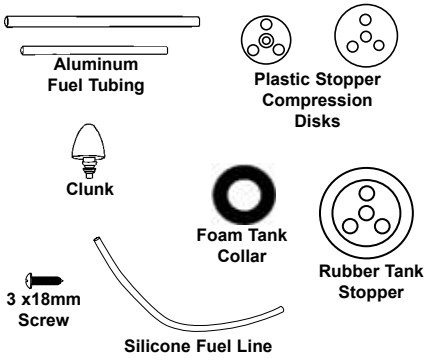
*Parts marked with an asterisk are found on the plastic parts tree.



Fuel Tank & Parts

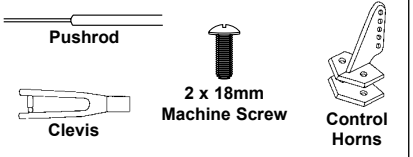
• Parts Shown Below

Part #		Quantity
21	Fuel Tank	1
22	Foam Fuel Tank Collar	2
*	3 x 18mm Screw	1
*	Silicone Fuel Line	1
*	Plastic Stopper Compression Disks (One Large and One Small)	2
*	Fuel Pick-up Weight (Clunk)	1
*	Rubber Tank Stopper	1
*	Aluminum Fuel Tubing (One Short and One Long)	2



Tail Assembly

Part #		Quantity
23	Stabilizer and Elevator	1
24	Rudder and Fin	1
*	Control Horns	2
*	2mm x 18mm Machine Screws	4
*	Clevises	3
*	Pushrod	2



Fuse Parts

Part #		Quantity
25	Fuselage	1
26	Stab Base	1
27	Lower Wing Fairing	1
28	Spinner	1
29	Cowl Decal	2
30	Engine Mount Spacers	2
31	Cowl Side (L)	1
32	Cowl Side (R)	1
33	Cowl Top	1
34	Pilot	1
35	Tuned Pipe Mount	1

Parts shown smaller than actual size (out of proportion).

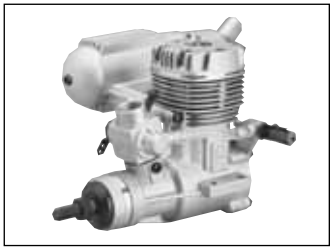
Other Items You'll Need:

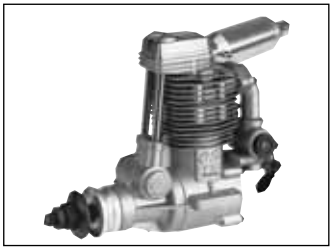
Glues

Choose 6-minute and 30-minute epoxy, such as Great Planes® Pro™ Epoxy, which has been formulated especially for R/C model building. Pro Epoxies offer a strong bond and a variety of curing times suited for every step of assembly. You'll also need a thin instant-setting CA (cyanoacrylate), medium CA+, plus rubbing alcohol for easy epoxy cleanup. Great Planes Pro Threadlocker is also recommended to secure threaded fasteners.

Hardware

Tools and accessories required for assembly include a hobby knife; small and large Phillips screwdrivers; needle nose pliers; drill with 1/16", 5/64", 3/32", 1/8", 11/64", and 7/32" bits; ruler; 2 feet of medium (3/32") fuel tubing; and 150 to 200-grit sandpaper.





Model Engine

Power your Spectrum with a hot 2-stroke such as an O.S®. .46 FX, or SuperTigre® GS-45. If you prefer a 4-stroke, an O.S. FS-70 is an ideal choice. Your choice of 2-stroke or 4-stroke will determine the location of the throttle servo and throttle pushrod exit on the firewall, so plan ahead.

Radio Equipment

In selecting a radio system for your Spectrum, you'll need at least a 6-channel radio system with five standard servos. Many of the 6-channel radios offered include only four servos, so it may be necessary to purchase an extra servo along with your radio system. Unless you are planning to use a computer radio and mix the throttle servos, you will also need a "Y" harness for your Spectrum. The servos and receiver will be mounted on-board your model and need to be cushioned from shock and vibration. One-half inch thick foam rubber sheets (HCAQ1050) are available from your hobby dealer for this purpose.

Getting Ready for Flight

1. While building your Spectrum, make sure to follow the instructions. Do not alter or modify the model, as doing so may result in an unsafe or unflyable model. In a few cases the instructions differ slightly from the photos. In those instances the instructions are correct.
2. You must install all components so the model operates on the ground as well as in the air.
3. You must check the operation of the model before EVERY flight to ensure all equipment is operating, and the model has remained structurally sound. Be sure to check the clevises and other connectors often and replace them if they show signs of wear or fatigue
4. When you are preparing to go and fly your model, make sure to fully charge the radio system the night before, according to the manufacturer's instructions. Fully prepare your field box, making sure you have the necessary items for starting your engine. Remember to take along spare propellers and glow plugs, as well as some epoxy and CA glue, just in case. Being prepared at the field will make your flying experience much more enjoyable.

Other General Items Required

Epoxy Brushes (GPMR8062)	Mixing Sticks (GPMR8055)	Clothespins	1/4" Foam Rubber (HCAQ1050)
T-Pins (HCAR5150)	Masking Tape	String	Felt-Tip Pen
Sanding Block	Adjustable Wrench	Paper Towels	Builders Triangle Set (HCAR0480)
Plastic Wrap or Wax Paper	Round Toothpicks	Wire Cutter	Thread Locking Compound
70% Isopropyl Alcohol	Small Hobby Clamps	Razor Saw	

Protect Your Model, Yourself & Others... Follow This Important Safety Precaution

Your Hobbico Spectrum is not a toy, but rather a sophisticated, working model that functions very much like an actual airplane. Because of its realistic performance, the Spectrum, if not assembled and operated correctly, could possibly cause injury to yourself or spectators and damage property.

If this is your first low wing sport model, or if you are uncomfortable in making the initial flight of your Spectrum, it is recommended that you get help from an experienced, knowledgeable modeler with your initial flights.

You may also want to contact the Academy of Model Aeronautics (AMA), which has more than 2,500 chartered clubs across the country. Through the AMA, you should either be able to locate a modeler nearby that can help, or at least be able to phone one that can verbally instruct you for any potential problems that could occur. Contact the AMA at the address or phone number below:

Academy of Model Aeronautics
5151 East Memorial Drive
Muncie, IN 47302
Office: (765) 287-1256
Toll Free: (800) 435-9262
Fax: (765) 741-0057
Internet:http://www.modelaircraft.org

AMA SINCE 1936
JOIN THE AMA

WARNING! This is not a Toy! Please follow these safety precautions:

Before you fly:

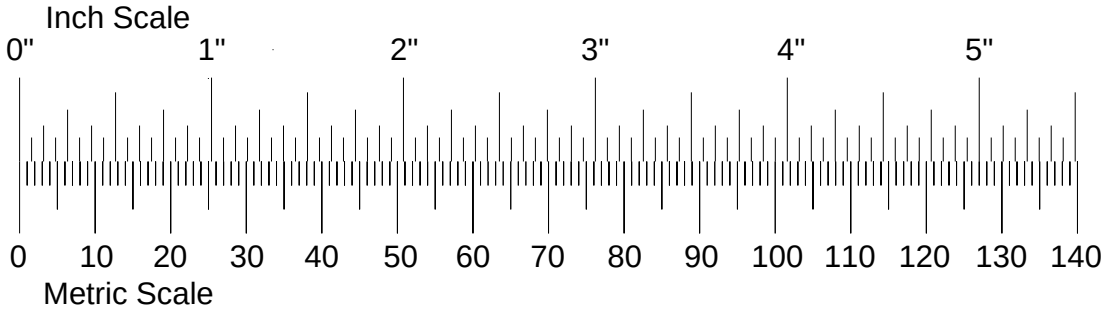
1. Make sure that no other fliers are using your radio frequency.
2. Your radio transmitter must be the FIRST thing you turn ON, and the LAST thing you turn OFF.
3. Double check all control surfaces.
4. Make sure that the transmitter & receiver batteries are fully charged.

Fuel storage and care:

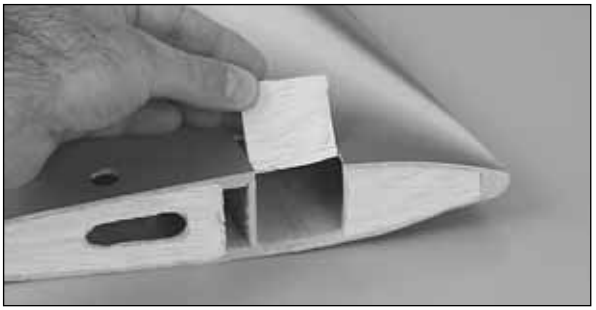
1. Do not smoke near your engine or fuel.
2. Store all engine fuel in a safe, cool, dry place, away from children and pets. Model fuel will evaporate, so make sure that you always store it with the cap secure.

When starting and running your engine:

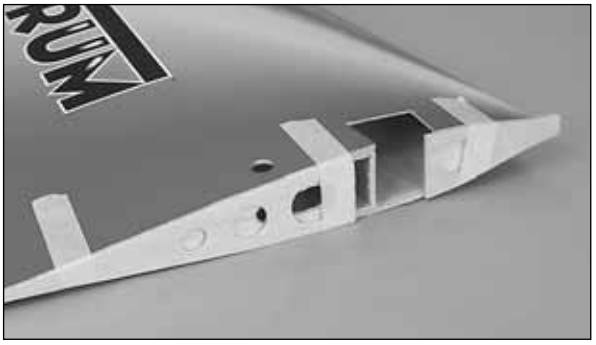
1. Always wear safety glasses.
2. Make certain that your glow plug clip is securely attached to the glow plug and cannot pop off, possibly falling into the spinning propeller.
3. Use a “chicken stick” or electric starter to start the engine – NOT your fingers.
4. Make sure that the wires from your starter and glow plug clip cannot become tangled with the spinning propeller.
5. Do not stand at the side of the propeller when you start or run the engine. Even at idle speed, the spinning propeller will be nearly invisible.
6. If any engine adjustments are necessary, approach the engine only from behind the spinning propeller.



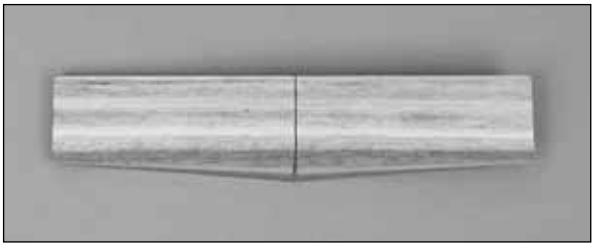
Wing Assembly



❏ 1. If you are planning to install retracts, remove the wood from both wing panels for the retract servo location. The wood has been partially precut for exact location.



❏ 2. Test fit the plywood forward center rib and the balsa aft center rib on the left wing panel. The ribs should not protrude beyond the top and bottom of the wing. The forward plywood rib will extend beyond the leading edge of the wing. This extension will lock the front of the wing into the fuselage. **Do not cut off the extension on the plywood forward center rib.** Use 30-minute epoxy to glue the center ribs to the left wing panel. Repeat this step for the right wing panel.

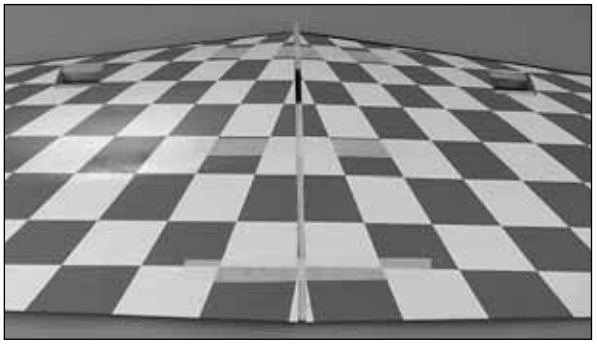


❏ 3. Draw a centerline on both sides of the wing joiner. Test fit the wing joiner into both wing panels. A snug fit is desirable. If the joiner does not fit properly, lightly sand any uneven surfaces from the joiner edges and sides. **Note:** The wing joiner has a slight dihedral angle on one edge. This angle will be on the bottom of the wing.

❏ 4. Test fit the wing halves with the wing joiner. If necessary, sand any high spots on the root end of the wing panels so there is **no gap** when you join them. The top of the wing is flat, with the taper on the bottom of the wing acting as dihedral. Because of this, the wing can be joined with the top of the wing laying flat on your work surface.

Note: The dihedral angle is established by the angle of the root ribs and the dihedral brace. As long as the wing halves fit together tightly, you will have set the correct amount of dihedral.

Make a *dry run* of the following step *without using* any glue so you will know how to clamp your wing together.

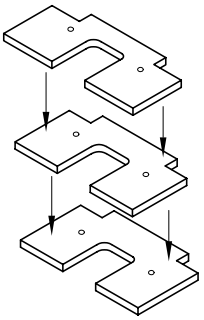


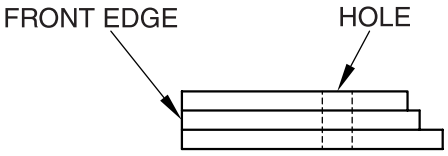
❏ 5. Tape a piece of wax paper or plan protector over your work surface. Thoroughly coat the *joiner pockets* and the mating ends of **both** wing halves with 30-minute epoxy. Set the wing halves aside and proceed quickly. Coat all surfaces of **one half** of the wing joiner with 30-minute epoxy and place it in one of the wing halves. Coat the other half of the joiner with 30-minute epoxy and join the other wing. Use a piece of balsa or cardboard to wipe away excess epoxy. Use masking tape to tightly tape the wing together. Use a tissue dampened with alcohol to wipe away any more epoxy that oozes out of the wing, then set the wing aside. Do not disturb the wing until the epoxy has fully cured.

Wing Installation

❏ 1. Remove the upper fuselage and lower fuselage pieces from the main fuselage. Set these aside in a safe location for use later in the assembly of your model.

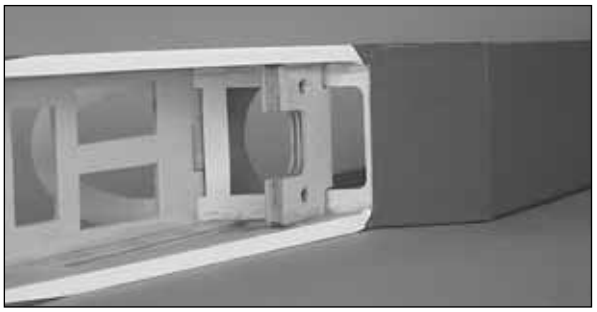
❏ 2. Locate the three plywood wing mounting plates. Separate them and sand off any rough edges. Drill a 7/32" [5.5mm] hole at the punch marks on the plates.



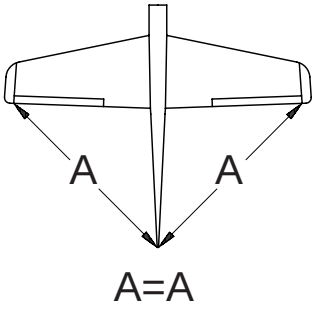


❏ 3. Glue the three plates together in a stack with the shortest on the top. Make sure the holes and front edges are lined up with each other and wipe off any excess epoxy using a paper towel and rubbing alcohol. Use clothes pins to clamp the plates together while the epoxy cures.

❏ 4. Install the blind nuts into the holes from the bottom side of the mounting plate. (The short plate is on the top.) Gently press the blind nuts into position with a pliers or vise. Secure the blind nuts into position with a drop of CA on the flange and prongs of the nuts. Care must be taken not to get CA into the threads of the blind nuts.

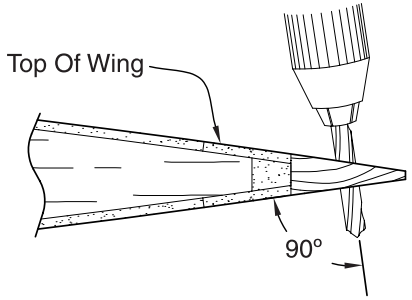


❏ 5. Test fit the wing mounting plate into position. Once satisfied with the fit, secure it using 6-minute epoxy.

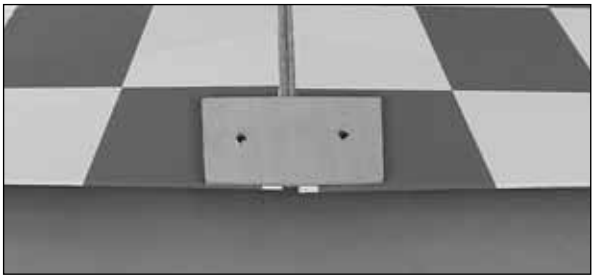


❏ 6. Place the wing on the fuselage. Measure from the aft center of the fuselage to one wing tip and record the distance. Measure from the same point to the opposite wing tip, and compare it to the first measurement. If the measurements are not the same, adjust the wing and re-measure until they are equal. Place a mark on the wing so it can be repositioned for the following step.

❏ 7. Insert the 4mm x 25mm wing bolts from the under side of the wing mounting plate. The bolts should slightly extend above the wing saddle so they can lightly touch the wing when it is placed in position. Paint the tips of the bolts with a slow drying paint. Before the paint dries, place the wing into the saddle, making sure it is in alignment. Press the wing against the bolts so the paint transfers onto the wing, marking the location of the bolts.

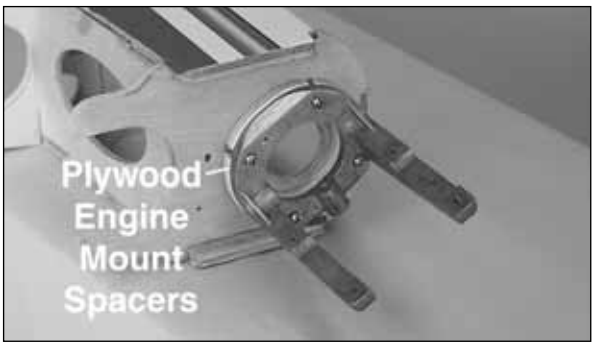


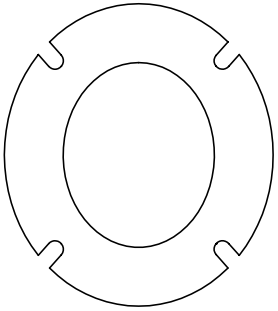
❏ 8. Drill a 11/64" [4.5mm] hole at each paint mark. The drill should be perpendicular to the bottom surface of the wing while drilling. The bolts must thread into the blind nuts squarely.



❏ 9. Position the wing bolt plate onto the bottom of the wing. The plate should be positioned to equally cover both holes. Trace around the outside of the plate using a felt-tip marker. Carefully remove the covering from the wing where the plate will be installed, making sure not to cut into the underlying wood. Secure the wing bolt plate using medium CA. Once the CA has cured, drill the plate using a 11/64" [4.5mm] drill bit using the holes drilled in the wing as a guide.

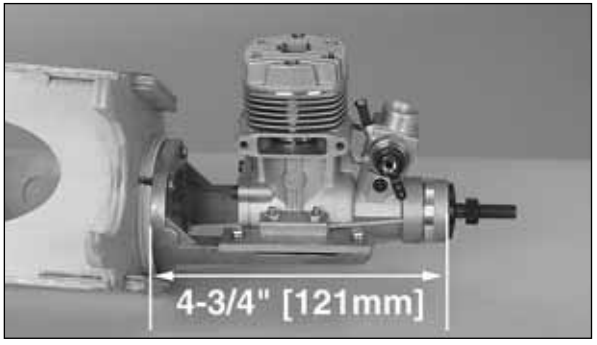
Engine Installation





❏ 1. Place the two plywood engine mount spacers behind the engine mount if you are using a 2-stroke engine. Use four 3mm x 20mm machine screws to secure the engine mount to the firewall. Blind nuts have already been installed in the firewall for this purpose. (If you are using a 4-stroke engine, the spacers are not required.) Coat the firewall, engine mount spacer and all other bare wood around the firewall with fuelproof paint or 30-minute epoxy thinned with alcohol. Fuelproof other areas of bare wood in the fuselage that may be exposed to fuel or engine exhaust such as the fuel tank area and the front and back of the wing saddle. Avoid getting epoxy in the threads of the blind nuts in the back of the firewall.

❏ 2. Temporarily attach the engine mount plates to the engine mount using four 3mm x 12mm machine screws. Adjust the width of the plates to fit the engine, leaving a 1/16" [1.5mm] gap between the engine and plates. Tighten the screws so you can mark the engine mounting holes without moving the plates.



❏ 3. Position the engine on the engine mount plates so the propeller thrust washer (or spinner backplate) is 4-3/4" [121mm] ahead of the firewall. Use a sharpened piece of wire to scribe the four

engine mount holes onto the rails. Use a center punch at the marks to prevent the drill bit from wandering, then drill 1/8" [3.1mm] holes through the plates. Be sure to hold the drill perpendicular to the rails. If you have access to a drill press, this is a good tool for this purpose. Use four 3mm x 14mm machine screws, four 3mm nuts and four 3mm lock washers to secure the engine to the mount. Use threadlock on the nuts to prevent loosening.

❏ 4. Use the four 3mm x 12mm machine screws and four 3mm lock washers to secure the engine mount plates to the engine mount. Use threadlock on the nuts to prevent loosening.

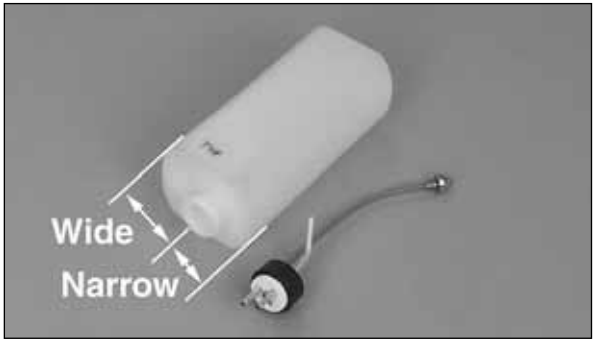
❏ 5. There is a 9/64" [3.6mm] hole in the firewall for the throttle pushrod. Depending on your engine selection, you may drill a new 9/64" [3.6mm] hole for better pushrod placement.

❏ 6. Roughen the outside surface of the 13-3/4" [350mm] throttle pushrod tube with coarse grit sandpaper. Insert the pushrod tube through the hole in the firewall which is in line with the throttle arm on your engine. Push it in until about 1/4" [6mm] of the tube is left exposed forward on the firewall. Use medium CA to glue the tube to the firewall, but leave it free inside the fuselage until the servos are installed.

Fuel Tank Installation

Note: There are three holes in the fuel tank stopper but not all of the holes go all the way through and only two are used for this model. Do not puncture the third hole in the stopper.

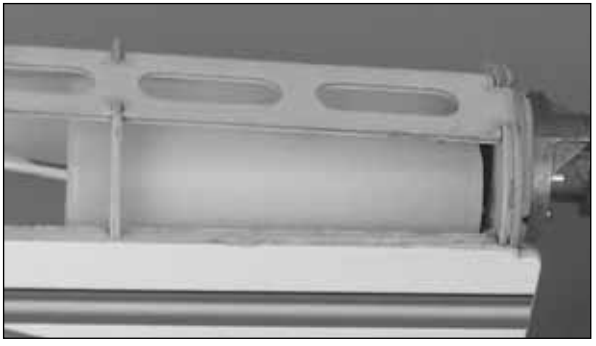
❏ 1. Push the two aluminum tubes through the rubber stopper until 1/2" [13mm] protrudes from the front of the stopper. You will need to puncture the rubber stopper on the back to push the tubes through. Slide the large cap onto the front of the stopper, and the small cap onto the back. Push one end of the silicone pickup tube all the way onto the clunk, and the other end all the way onto the short aluminum tube. Insert the stopper screw into the center hole in the front cap, then screw it through the stopper into the aft stopper cap. Just start the threads in the aft cap or you won't be able to insert the stopper into the tank.



❏ 2. Bend the long aluminum (vent) tube upward at about a 45-degree angle, being careful not to

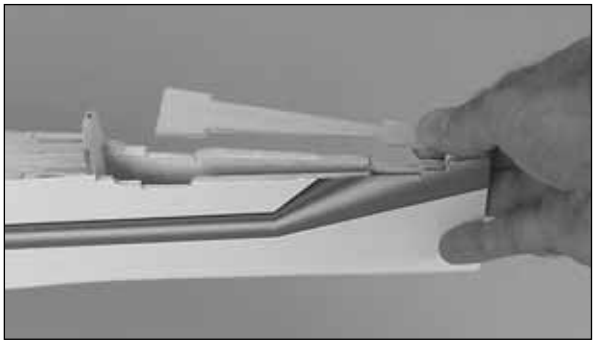
kink the tube. Test fit the stopper into the fuel tank. The seam around the tank should be horizontal and the stopper hole on the left as you look at the front of the tank. By holding the tank up to the light you will be able to see where the vent tube is, in relation to the top of the tank. If necessary, bend the vent tube to position it about 1/8" below the top of the tank. When satisfied with the fit, make sure the stopper is fully seated in the fuel tank. Tighten the stopper screw until the plastic cap is indented about 1/16". Doing so will lock the stopper into position. Check the clunk and pickup tube to make sure they move freely in the tank without binding or stopping.

❑ 3. Locate the foam fuel tank collar and remove the center portion. Install the collar to the front of the fuel tank.

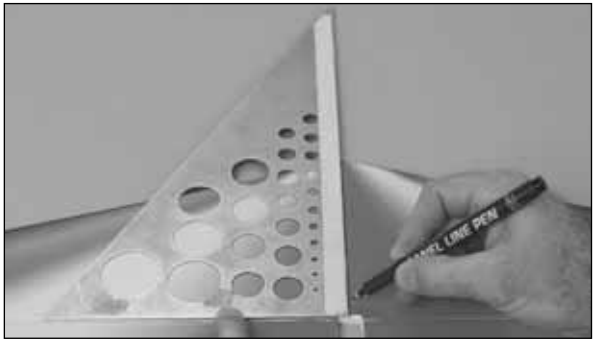


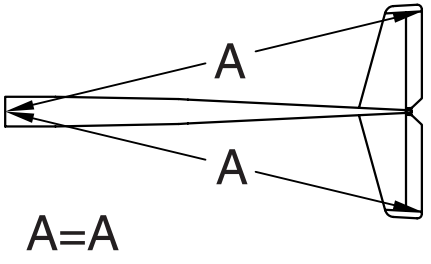
❑ 4. Before installing the tank, make sure the bent vent tube points toward the top of the fuselage. Apply a bead of 100% silicone sealer around the sides of the rubber stopper and the front edge of the fuel tank. Insert the tank fully into the tank compartment while working the stopper into the hole in the firewall. The silicone will seal the opening and help hold the tank in position after it has cured.

Install the Tail Components



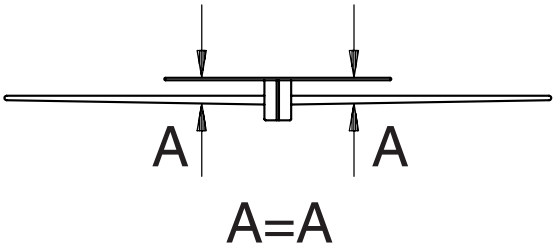
❑ 1. Locate the 1/8" [3mm] plywood stabilizer mounting base and test fit to the fuselage. Lightly sand the base if necessary to obtain a good fit. Remove the base from the fuselage. Reinstall the base using a generous amount of 30-minute epoxy. Be sure there is enough epoxy to properly secure the base to the fuselage. Remove any excess epoxy from the outside of the fuselage with a paper towel and rubbing alcohol.



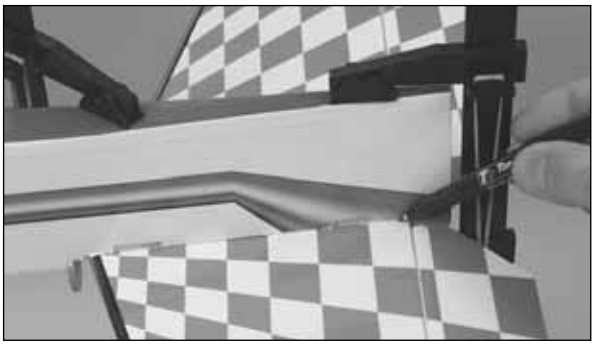


❑ 2. Draw a centerline on the top of the horizontal stabilizer (stab) from the aft edge to the leading edge. Center the stab on the stab saddle using the centerline, and slide it forward until the leading

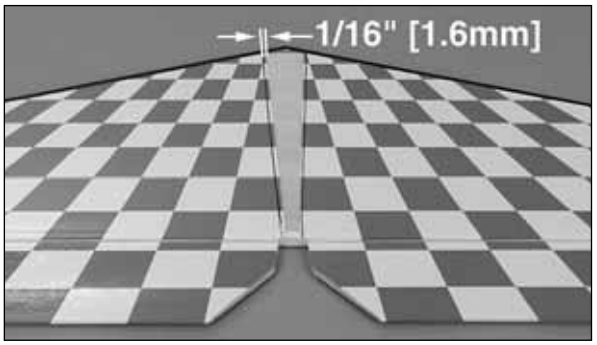
edge contacts the fuselage. Perform the same technique for aligning the stab as was used for aligning the wing. This time, the center on the fuselage is at the front, rather than the rear. Mark the stab so it can be returned to its aligned location.

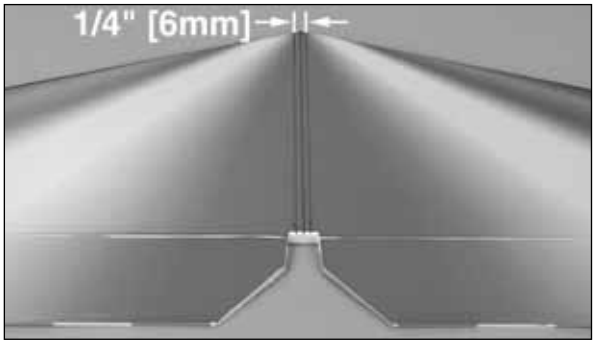


❏ 3. Mount the wing to the fuselage using the nylon bolts. Stand back 8 to 10 feet and view the model from the front and rear. The stab tips should be equally spaced above the level of the wing. If not, lightly sand the high side of the stab saddle to correct the problem. Work slowly and check the alignment often.



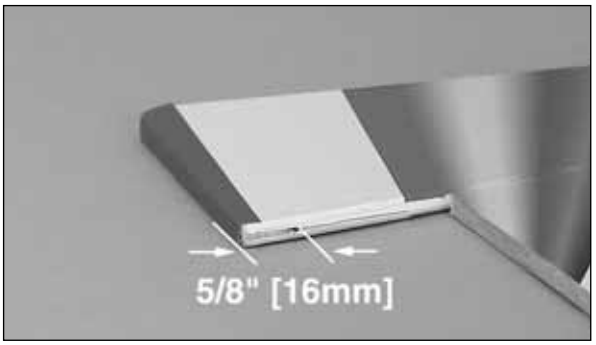
❏ 4. Use a felt-tip pen to mark the sides of the fuselage on the bottom of the stab. Remove the stab from the fuselage.



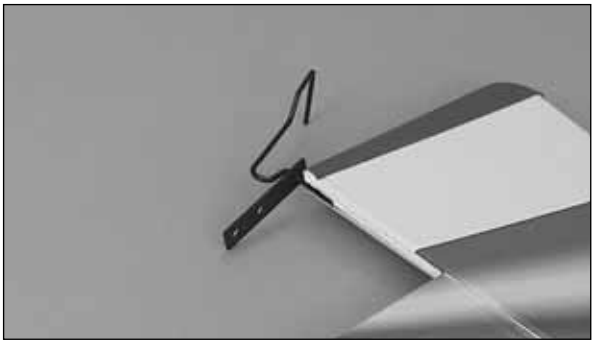


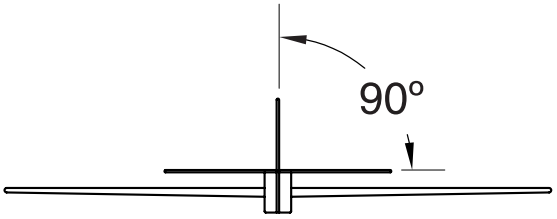
❏ 5. Use a **fresh** #11 blade to carefully cut through the covering 1/16" [1.6mm] inside the lines you marked on the bottom of the stab that indicate the fuse sides. **Do not cut the wood under the covering! This will weaken the structure and may cause the stab to fail in flight.** Remove the covering from the center of the stab within the lines you cut. Remove a 1/4" [6mm] wide strip of covering from the top of the stabilizer along the centerline.

❏ 6. Use a liberal coating of 30-minute epoxy to glue the stab in position. Hold the stab in position with weights and clamps while the epoxy cures. Double check alignment with the wing and fuse while the epoxy cures. **Important:** Form a thin epoxy fillet along the fuse sides where the epoxy squeezes out to create a fuel proof seal between the stab and fuselage.



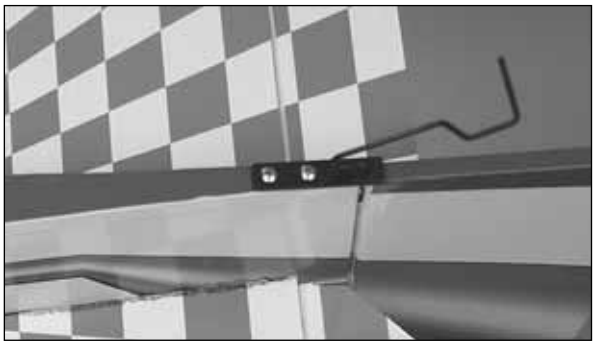
❏ 7. Drill a 3/32" [2.4mm] hole, 5/8" [16mm] up from the bottom of the rudder. Cut a groove in the LE of the rudder down to the bottom to accommodate the tail gear wire. **Hint:** Use a 3/32" [2.4mm] brass tube sharpened at the end to cut the groove. (The Groove Tube™ Grooving Tool **(GPMR8140)** works great for this task.) Use 6-minute epoxy to glue the tail gear wire to the rudder.





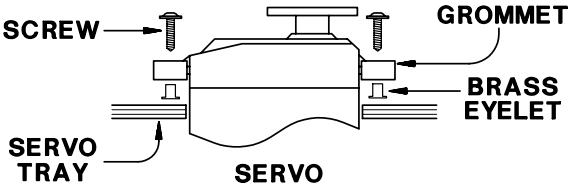
A=A

❏ 8. Slide the Tail Gear Wire Brace onto the tail gear wire. Use 30-minute epoxy to glue the fin in position. Check the alignment of the fin to the stab with a triangle, then secure it in position with masking tape until the epoxy has cured. Double check the alignment of the fin with the stab while the epoxy cures.



❏ 9. Attach the tail gear wire brace to the fuselage using two 3mm x 10mm sheet metal screws.

Radio Installation



❏ 1. Mount the rudder, elevator and throttle servos in the fuselage. Use the following sequence for mounting the servos into the servo tray:

A. Install rubber grommets and brass eyelets in the servos using the provided sketch.

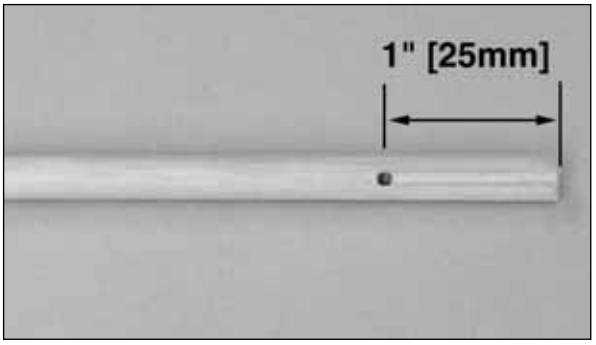
B. Test fit the servos in the tray. Enlarge the openings if needed to create a 1/32" gap around the servo.

C. Mark servo mounting hole locations on the tray, then drill 1/16" pilot holes through each mark.

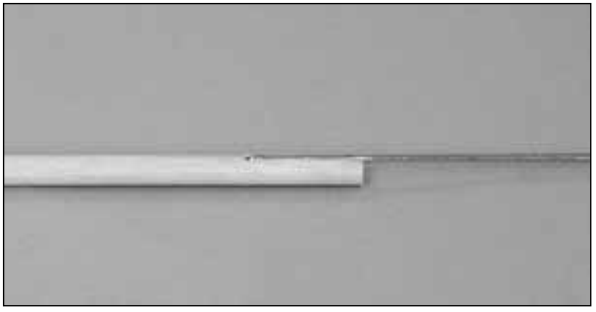
D. Mount the servos with the screws provided with your radio system.

❏ 2. Install and hook up - following the manufacturer's recommendations - three servos, the receiver, switch and battery as shown in the photo. We added a Great Planes Switch Mount & Charge Jack **(GPMM1000, not included)** for convenience and ease of use at the field, installed on the side of the fuselage. Center the elevator, rudder and throttle trims on the transmitter.

❑ 3. Locate the two pre-bent, non-threaded pushrod wires and the three threaded, pre-bent pushrod wires. The rudder pushrod will use one threaded, and one non-threaded wire. The elevator pushrod will use one non-threaded and two threaded wires.

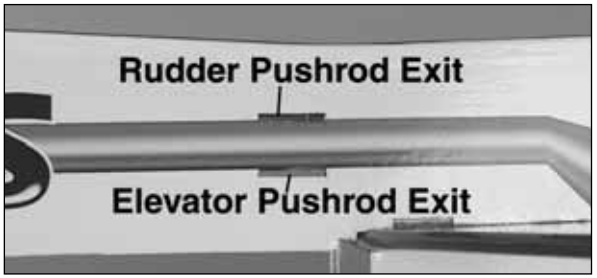


❑ 4. Drill a 5/64" [2mm] hole 1" [25mm] in from both ends of each pushrod. Cut a groove in the dowel from the hole to the end of the dowel. For the elevator, one end will be grooved on either side to accept two pushrod wires.

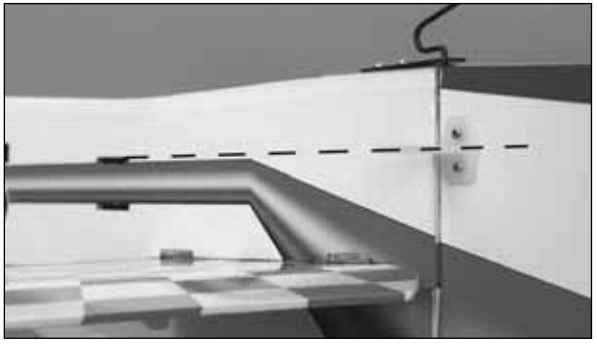


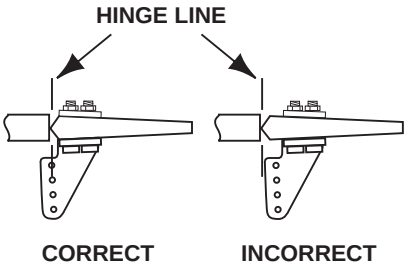
❑ 5. Insert the bent end of one threaded piece of wire into one end of each pushrod. (Two for the elevator pushrod.) Insert the bent end of the non-threaded wires into the other end of each pushrod. CA the wires in place.

❑ 6. Cut the heat shrink tubing into 1-1/2" [38mm] lengths. Use the heat shrink tubing at each end of the pushrod to hold everything in place as shown in the photo. Apply a few drops of thin CA to each end of the heat shrink tubing to secure it.



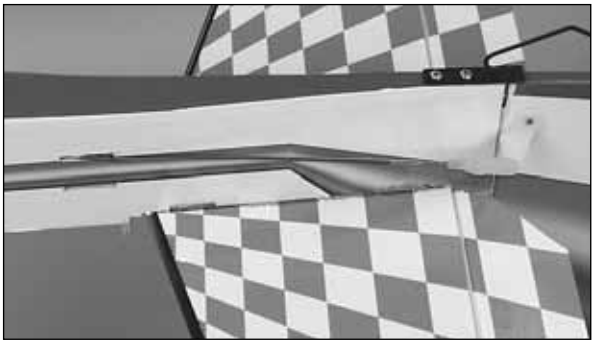
❑ 7. Use a sharp hobby knife to remove the covering from the pushrod exits. The photo shows both the rudder and elevator exits cut out on the right side of the fuselage. Remove only the covering from the elevator exit on the left side.





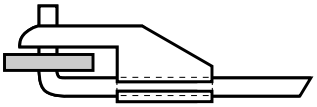
❑ 8. Install the rudder nylon control horn in line with the pushrod exit. Hold the horn in position and

mark the location of the mounting holes. Drill 3/32" [2.4mm] mounting holes through the marks. Wick two to three drops of thin CA into the holes to harden the underlying balsa, then re-drill the holes. Attach the horn using two 2mm x 15mm machine screws and a nylon nut plate. **Do not over-tighten the screws, crushing the underlying balsa.**

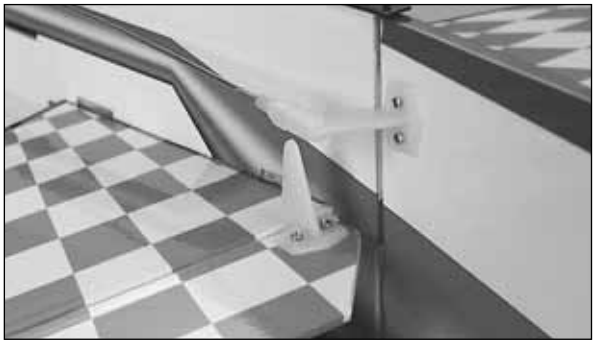


❏ 9. Install the rudder pushrod. Cut the 1-3/4" [44mm] tubing into 1/4" [6mm] pieces to be used as clevis retainers. Place a clevis retainer onto a clevis. Thread the clevis 14 turns onto the pushrod. Attach the clevis to the outside hole on the control horn. Slightly bend the pushrod as necessary to allow for free movement.

❏ 10. Center the rudder and rudder servo and mark the pushrod where it crosses the servo arm. Enlarge the servo horn hole with a 5/64" [2mm] drill bit. (The Hobbico Quick Drill set **(HCAR0699)** works well for this purpose.)



❏ 11. Make a 90-degree bend in the pushrod on your mark, then insert it through the enlarged hole in the servo arm. Secure the wire in place with a nylon pushrod keeper. Trim the excess wire 1/16" [1.6mm] above the pushrod keeper.

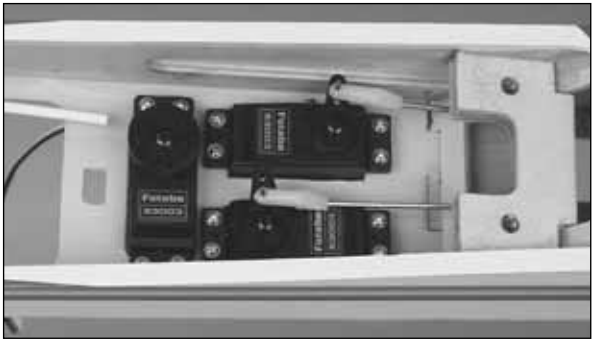


❏ 12. Install the elevator control horns by positioning the horns as close to the inboard edge of the elevators as possible and mark the location of the mounting holes. Drill 3/32" [2.4mm] mounting holes through the marks. Wick two to three drops of thin CA into the holes to harden the underlying balsa, then re-drill the holes. Attach the horns using four 2mm x 15mm machine screws and two nylon nut plates. **Do not over-tighten the screws, crushing the underlying balsa.**

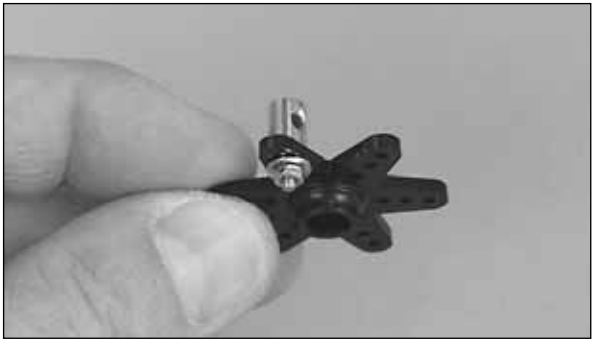
❏ 13. Install the elevator pushrod. Place two clevis retainers onto two clevises. Thread the clevises 14 turns onto the pushrod. Attach the clevises to the outer holes of the control horns.

Slightly bend the pushrod wires as necessary to allow for free movement.

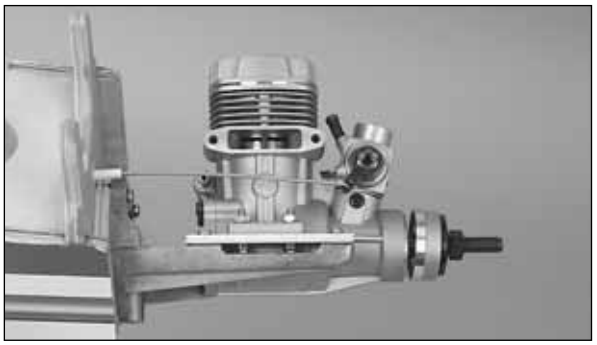
❏ 14. Center the elevators and elevator servo and mark the pushrod where it crosses the servo arm. Enlarge the servo horn hole with a 5/64" [2mm] drill bit.



❏ 15. Make a 90-degree bend in the pushrod on your mark, then insert it through the enlarged hole in the servo arm. Secure the wire in place with a nylon pushrod keeper. Trim the excess wire 1/16" [1.6mm] above the pushrod keeper. Use a straightedge to line up the elevators. Adjust the clevises if necessary if the elevators are not aligned.



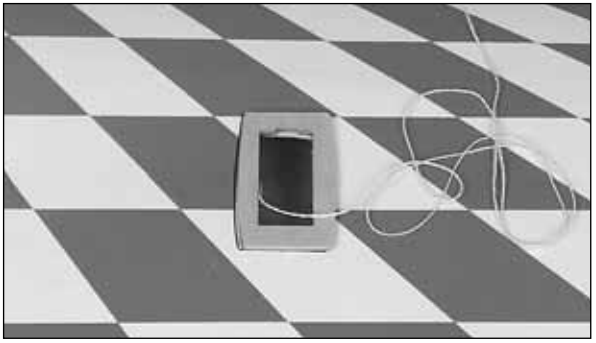
❏ 16. Attach the throttle pushrod connector to the throttle servo arm. The 2mm washer and 2mm nut are located on the bottom of the servo arm. Use threadlock on the nut to prevent loosening.

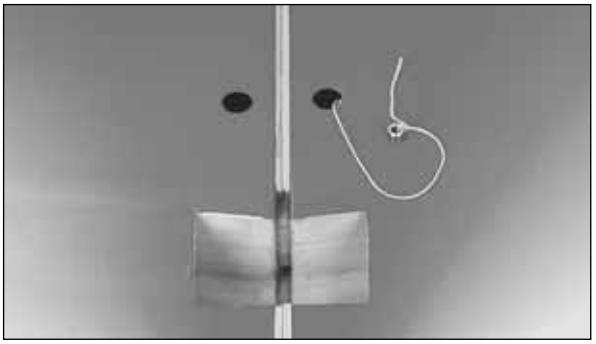


❏ 17. Install the throttle pushrod into the pushrod tube. Connect the pushrod to the throttle arm of the engine using a “Z” bend. Bend the throttle pushrod as necessary to reach the throttle arm without binding. When satisfied with the fit, insert the pushrod through the pushrod connector on the servo.

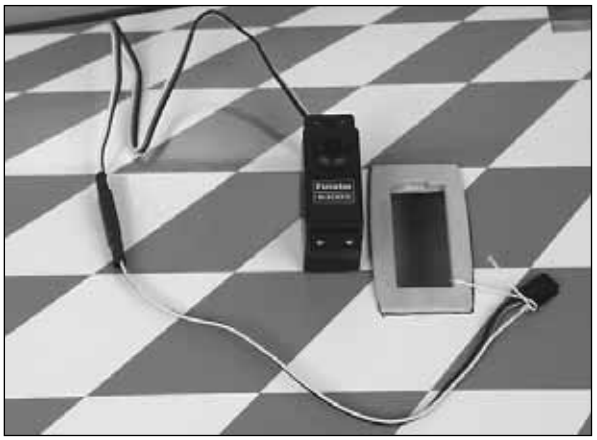
❏ 18. With the radio on move the throttle trim and control stick to the fully closed position, by pulling them back (or downward) all the way. Manually close the throttle on the carburetor completely. Tighten the 3mm x 6mm screw on the pushrod connector. Check throttle operation with the radio and make adjustments to the linkages as necessary for smooth operation. Use the appropriate holes in the servo and throttle arms to provide the correct amount of throttle movement and to prevent the servo from binding at its end points. Cut a notch in the plywood former to support the pushrod tube inside the fuselage as shown in the photo. Use threadlock on the screw to prevent loosening.

❏ 19. Locate the two plywood aileron servo trays. Position the aileron servo trays onto the bottom of the wing, centering them over the holes in the wing for the aileron servos. Trace around the outside of the servo tray using a felt-tip marker. Remove the covering from the wing where the tray will be installed. Secure the aileron servo trays using medium CA.





❏ 20. Tie one of the wheel collars onto a string. While holding onto the end of the string, drop the end with the wheel collar into the wing from the servo opening. The wheel collar and string can then be retrieved from the hole in the center of the wing. Repeat the step for the other wing panel.

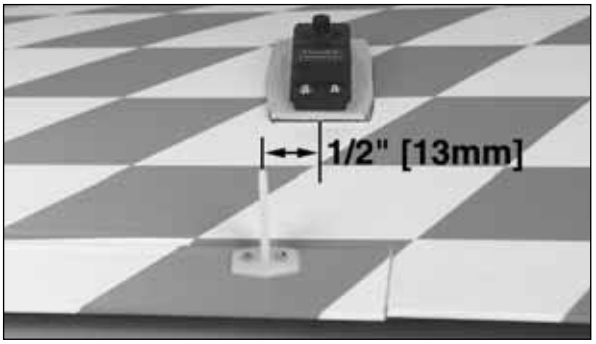


❏ 21. Install the rubber grommets and eyelets in your aileron servos. Attach a servo extension to the aileron servo. Use heat-shrink tubing or electrical tape to secure the servo cord to the extension so they don't unplug in flight. Pull the string part way out of one of the aileron servo compartments in the wing. Remove the wheel collar and tie the string to the servo cord on one of the aileron servos. Gently pull the servo lead through the wing panel. Repeat the step for the other wing panel.

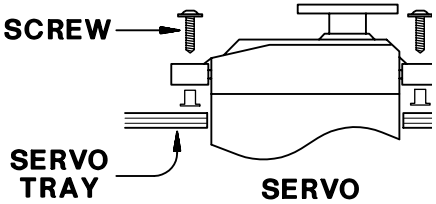
❏ 22. Fit one of the aileron servos in the wing. Hold the servo in the wing so the sides don't contact the tray and drill 1/16" [1.6mm] holes for the servo mounting screws. Mount the servo to the wing with the screws included with your servos.

❏ 23. Mount your other aileron servo in the opposite wing panel using the same procedures

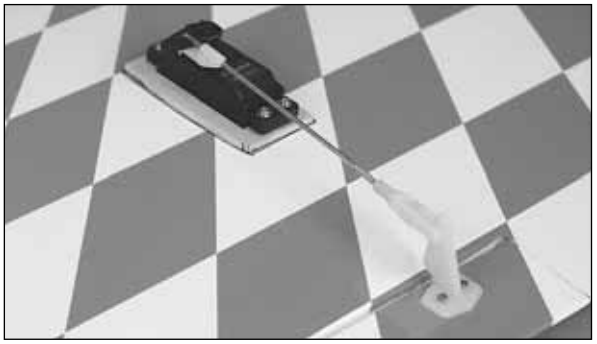
as above.



❏ 24. Install the aileron nylon control horns. The control horns are positioned 1/2" [13mm] towards the tip of the wing from the centerline of the servo. Hold the horn in position and mark the location of the mounting holes. Drill 3/32" [2.4mm] mounting holes through the marks. Wick two to three drops of thin CA into the holes to harden the underlying balsa, then re-drill the holes. Attach the horns using four 2mm x 15mm machine screws and two nylon nut plates. **Do not over-tighten the screws, crushing the underlying balsa.**

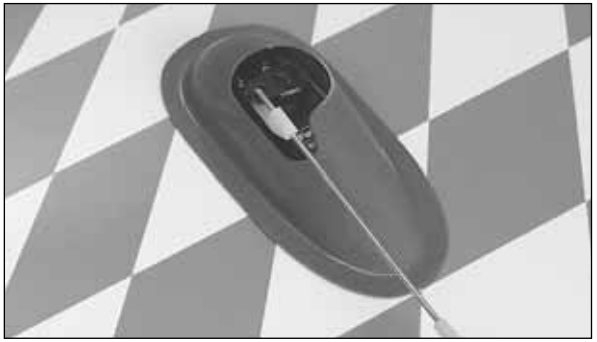


❏ 25. Connect the aileron servos to the receiver, turn on the radio, then center the servo horn. The servo horns should be facing opposite each other as shown in the sketch if you are planning on using a “Y” harness for the aileron servos or a computer radio. Place a clevis retainer onto a clevis. Thread the clevis 14 turns onto one of the 7-7/8" [200mm] pushrods. Attach the clevis to the second hole from the outside hole on the control horn.



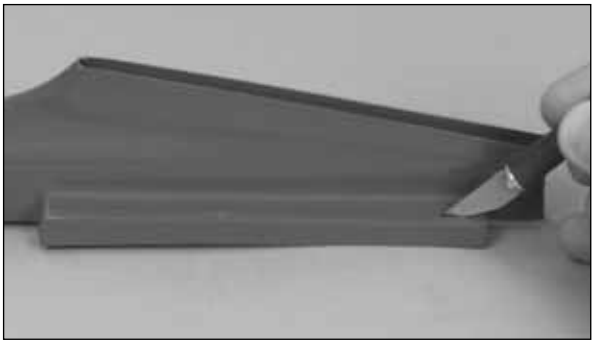
❏ 26. Attach the clevises to the second hole from the top of the control horns. Center the ailerons, then mark the pushrods at the point where they meet the holes on the servo arm. Make a 90-degree bend in the wires at this mark. Cut off the excess wire 3/8" [9.5mm] above the bend. Enlarge the servo horn holes with a 5/64" [2mm] drill bit. Insert the bent wire pushrods into the servo horn, then secure them with nylon pushrod keepers.

Final Assembly



❏ 1. Test fit the aileron servo covers. Carefully trim any portion of the covers that interfer with the operation of the aileron pushrods and servo horns. Tape the covers into position. Wick thin CA between the cover and wing to secure each of

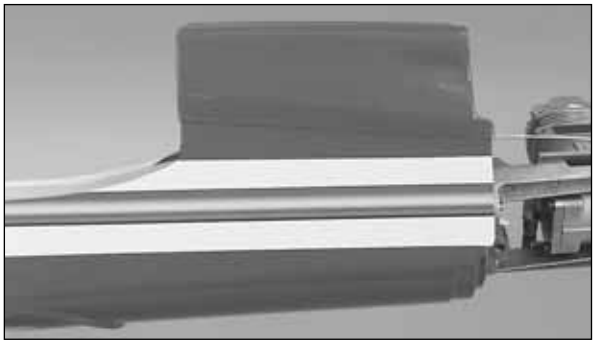
them to the wing.



❏ 2. Use a sharp hobby knife, scissors or Lexan® shears to trim the upper fuselage at the rear for the fin and stabilizer.

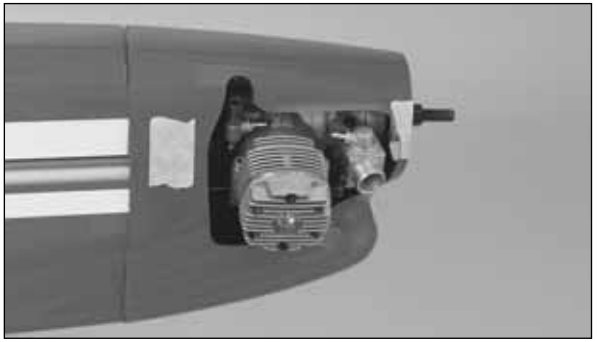
❏ 3. Test fit the upper fuselage to the stabilizer and rudder, as well as the main fuselage. Trim as necessary to prevent any binding of the control surfaces. Remove the upper fuselage, and roughen the bottom 1/8" [3mm] of the inside edge. Glue the upper fuselage to the main fuselage using 30-minute epoxy or R/C-56 glue. Use masking tape to hold it in position until the glue has cured. Use a tissue dampened with alcohol to wipe away any epoxy that oozes out, then set the fuselage aside.

Note: The upper fuselage can also be glued using thin CA. Tape the upper fuselage into position, spacing the tape about 3" [75mm] apart. Place a drop of thin CA between the pieces of tape to tack the upper fuselage into position. Remove the tape, and wick thin CA along the seam between the upper fuselage and main fuselage. There is a chance the CA may drip along the upper fuselage and ruin the finish, so work slowly to obtain the best finish.



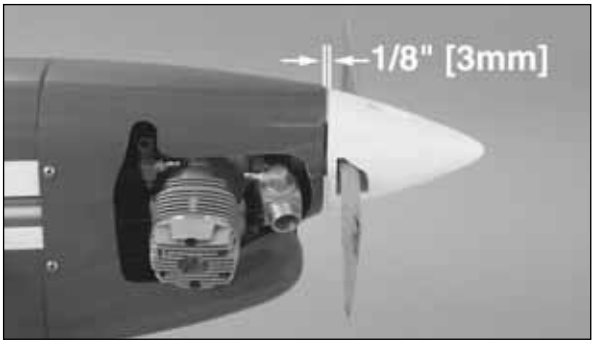
❏ 4. Use the same gluing technique to glue the lower fuselage to the main fuselage as shown.

The following steps cover fitting the cowl to an O.S. engine using the stock muffler. This is the most often used engine configuration as it allows for adequate engine cooling and muffler installation.

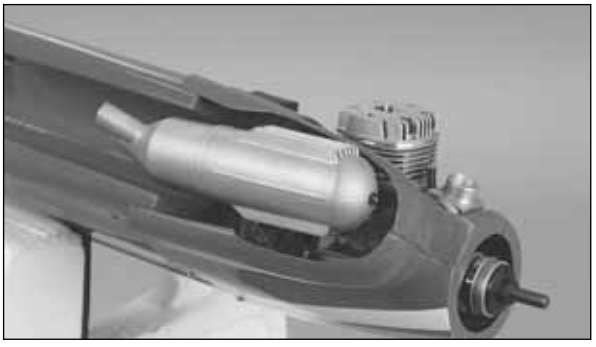


❏ 5. Tape the upper, left and right cowl pieces together to check the fit. Test fit the cowl to the fuselage. Slowly trim the cowl to fit into position. Once satisfied with the fit of the cowl onto the fuselage, wick thin CA along the seams to glue the cowl together. If the cowl is a tight fit, the seam at the bottom can be left slightly apart, as this area

will be removed for the muffler.



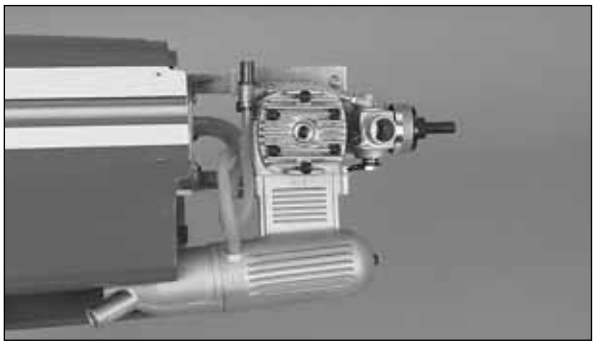
❏ 6. Slide the cowling into position. Temporarily attach the propeller and spinner to the engine. Position the cowling to have 1/8" [3mm] clearance between the spinner backplate and the front of the cowling. Drill 1/16" [1.6mm] pilot holes for the cowl screws. Remove the cowling, and drill the locations for the cowl mounting screws using a 1/8" [3mm] drill bit. Wick thin CA into the holes on the fuselage to harden the wood, which will prevent the screws from stripping the underlying wood. Attach the cowling to the fuselage using four 3mm x 10mm sheet metal screws.



❏ 7. Attach the muffler to the engine. Carefully trim the cowl, removing small amounts of material as you progress to allow for a 1/4" [6mm] clearance gap between the cowl and the muffler.

❏ 8. Apply the decals to the cowling, lining them up with the trim scheme on the fuselage.

Note: Use scraps from the plastic sheets to make reinforcements behind the holes of the cowling. It is also suggested to apply a strip of fiberglass cloth along the inside seam of the cowling for added strength and durability.



❏ 9. Attach and install the fuel lines to the carburetor and muffler as shown in the photo. Attach the vent line to the muffler, and the fuel line (with the clunk) to the carburetor (or needle valve assembly).

Note: If your engine's carburetor is inaccessible with the cowl in position, now would be a good time to add a Great Planes Fuel Filler Valve (not included, **GPMQ4160**) to the side of your aircraft. Instructions for installation are included with the valve.

Finishing the Cockpit

Use a sharp hobby knife, scissors or Lexan® shears to trim the pilot figure. Lightly sand the mating surfaces. Hold the two parts of the pilot

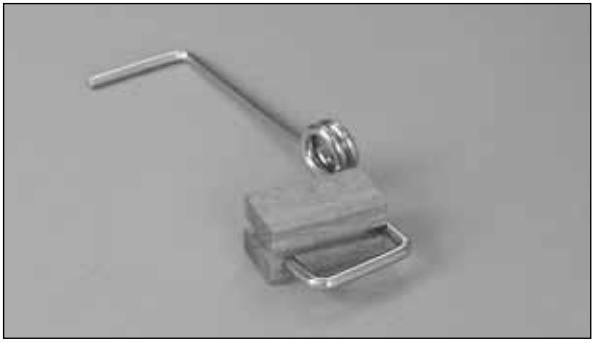
together, then wick thin CA into the joint.

Paint the pilot and cockpit to your liking with enamel model paint, then glue it into the cockpit using medium CA or 6-minute epoxy.

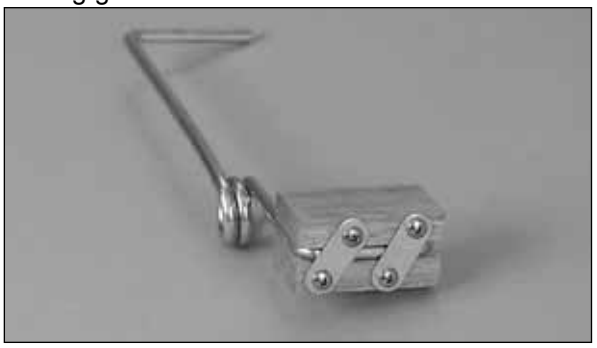
Roughen the bottom 1/8" [3mm] of the inside canopy edge, being careful not to scratch any exposed areas. Glue the canopy into position with 6-minute epoxy or R/C-56 glue. Apply a piece of trim tape to the outside of the canopy to add detail and hide the glue joint.

Wheel Installation

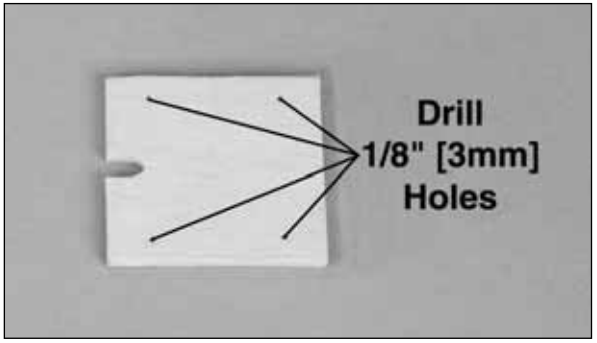
Fixed Gear Installation



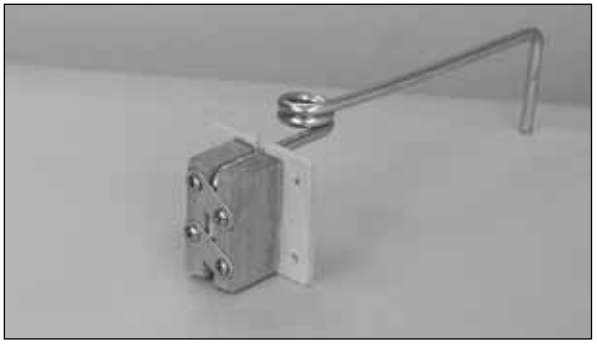
❏ 1. Place the landing gear mounting blocks in between the U-bend on the top portion of the main landing gear struts.



❏ 2. Using a pen, place marks on the mounting blocks using the flat metal straps as templates. Pre-drill the screw holes using a 1/16" [1.6mm] drill bit and secure the strut with four metal straps and eight 3mm x 10mm sheet metal screws.

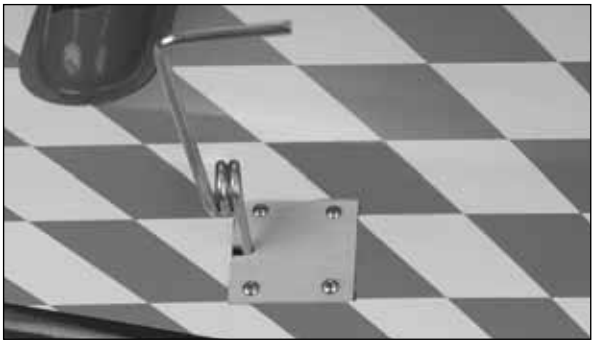


❏ 3. Locate the plywood landing gear cover plates. Drill four holes in each plate at the punch marks using a 1/8" [3mm] drill bit.



❏ 4. Use 6-minute epoxy to glue the plywood

landing gear cover plates to the mounting blocks.

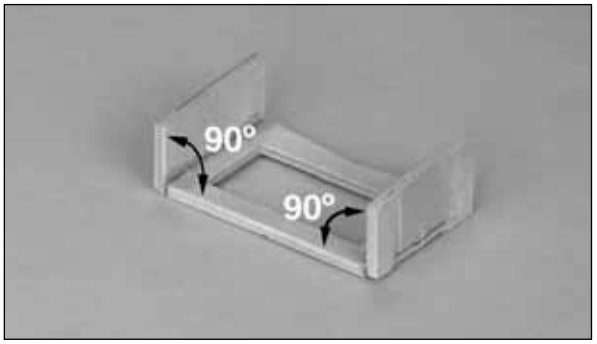


❏ 5. Position the landing gear assemblies into the wing. The struts will be placed towards the tip of the wing. Drill 1/16" [1.6mm] pilot holes into the landing gear rails using the holes in the landing gear cover plate as a template. Secure the landing gear into position using eight 3mm x 10mm sheet metal screws.

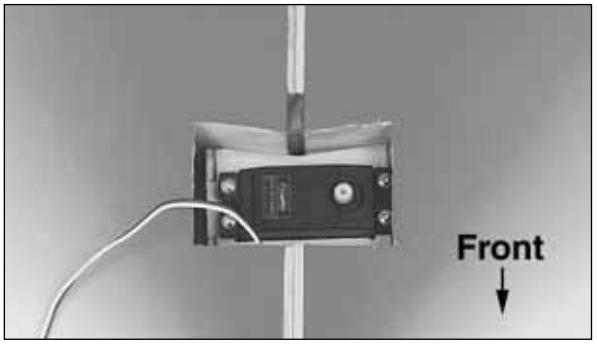
❏ 6. Install the main wheels using four 4mm wheel collars and four 3mm x 6mm machine screws. Grind or file a flat spot at the point of set screw contact. This provides a better area for the screw to bite and helps keep the wheel in place. Trim off any excess axle wire after installing the outer wheel collars. Use threadlock on the screws to prevent loosening.

Retract Installation

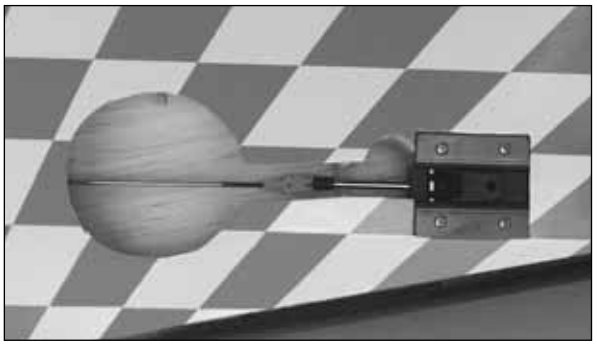
Note: None of the hardware used in the retract installation is included in the kit. All hardware must be purchased separately.



❏ 1. Locate the plywood retract servo tray. Separate the supports from the main tray and sand off any rough edges. Use medium CA to glue the supports to the tray at 90-degree angles to the tray.



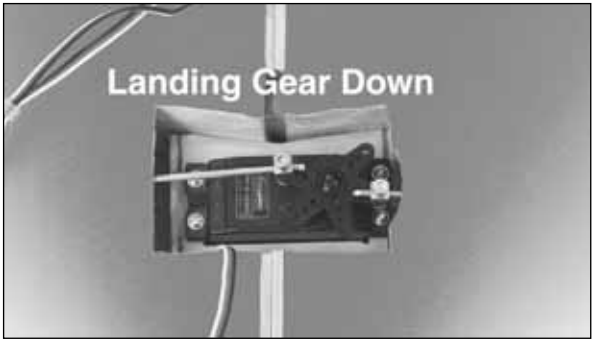
❏ 2. Glue the retract servo tray assembly into the wing as shown using 6-minute epoxy. Test fit the retract servo in the servo tray after the epoxy has cured. Enlarge the opening in the tray if necessary to provide a 1/32" [1mm] gap around the servo when installed. Mount the servo into place using the hardware supplied with the servo.



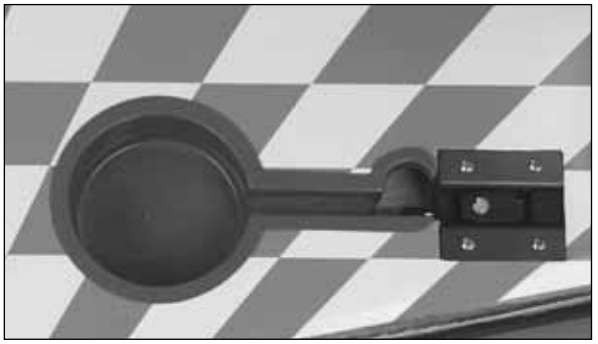
❏ 3. Using a sharp hobby knife, remove the material from the bottom of the wing for the wheel wells and retract struts. The outline for the wells

are embossed into the wing sheeting, and can be seen easier if the covering is pressed down against the sheeting in the area of the wheel well using your index finger. (Be careful not to accidentally break the sheeting.)

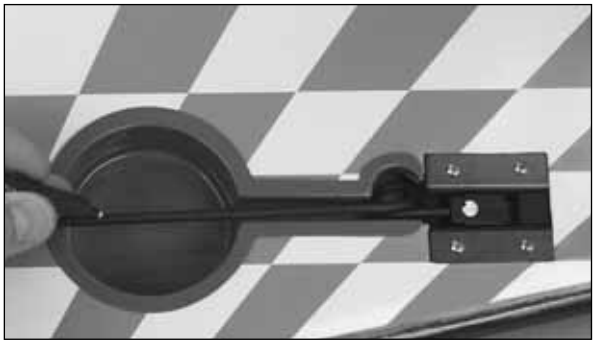
❏ 4. Place a clevis retainer onto a clevis. Thread the clevis 14 turns onto a 12" [300mm] pushrod. Attach the clevis to the actuating arm on the retract. Test fit the retract into the wing. Trim the wing sheeting as necessary to allow the retract to seat fully onto the retract rails. Drill 1/16" [1.6mm] pilot holes into the landing gear rails using the holes in the retract as a template. Secure the retract into position using four 3mm x 10mm sheet metal screws. Repeat the step for the opposite side.



❏ 5. Use Quick Connectors on the servo arm to connect the retract pushrods. Using the radio, cycle the retracts to make sure they will lock in both the up and down positions. Adjust the positions of the quick connectors on the servo arm if necessary to allow the retracts to lock in both the up and down positions.



❏ 6. Once you have adjusted the linkages, test fit the retract wheel wells into position. Use medium CA to glue the wells to the wing.



❏ 7. Install the landing gear struts into the retracts. Using a pen, mark the strut 1/4" [6mm] past the center of the wheel well when the retracts are folded into the wing. Cut the landing gear struts off at the mark and file the edges of the wire to remove the rough edges.

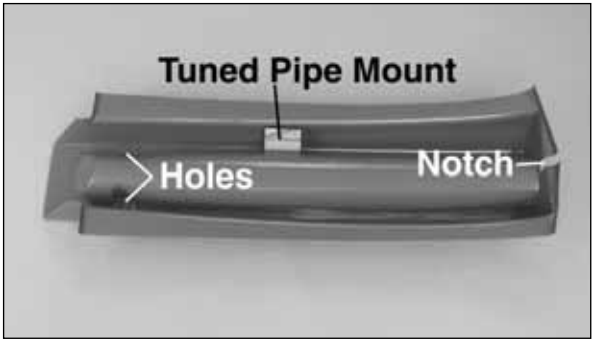
❏ 8. Use an adjustable axle to mount the wheel to the landing gear strut. Place the axle onto the strut, and secure its location using the set screw provided with the axle. Install the main wheels using eight 4mm wheel collars and eight 3mm x

6mm machine screws. Grind or file a flat spot at the point of set screw contact. This provides a better area for the screw to bite and helps keep the wheel in place. Trim off any excess axle wire after installing the outer wheel collars. Cycle the retract and adjust the position of the axle and wheel to prevent any binding of the wheel in the well. Mark the location at which the set screw in the axle contacts the strut, and grind or file a flat spot at the point of set screw contact. This provides a better area for the screw to bite and prevents the axle from rotating on the strut. Use threadlock on the screws to prevent loosening.

Tail Wheel Installation

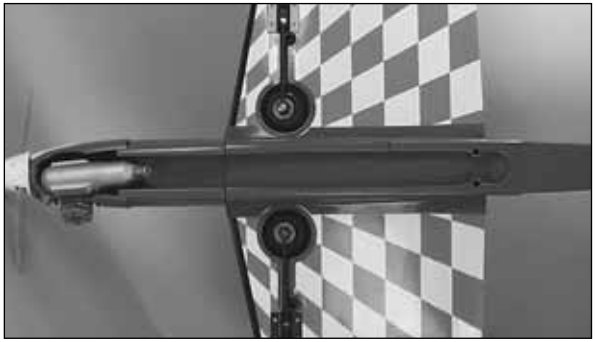
❏ 1. Just so you don't forget, the tail wheel must be installed in order to taxi the aircraft. Slide the tail wheel onto the tail gear, and use a 2mm wheel collar and the 3mm set screw to keep the wheel attached to the gear.

Lower Fairing Installation



❏ 1. Prepare the lower wing fairing by drilling the indentations at the rear of the fairing for the wing bolts using a 1/4" [6mm] drill bit. Cut a notch in the front of the fairing to allow for clearance of the center ribs on the wing.

Note: If you plan on installing a tuned pipe, use 6-minute epoxy to glue the hardwood mount to the lower wing fairing.

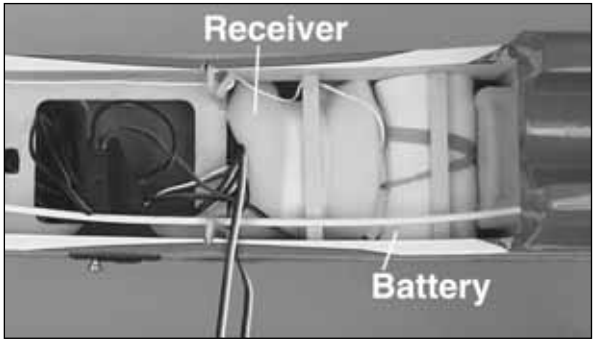


❏ 2. Attach the wing using two 4mm bolts. Position the lower wing fairing onto the bottom of the wing, and align it with the fuselage. Use 30-minute epoxy or R/C-56 glue to attach the fairing to the wing (but not the fuselage!)

Note 1: If you are installing a tuned pipe, remove a section of the wing covering to glue the hardwood mount to the wing sheeting. Use 6-minute epoxy to glue the mount to the wing sheeting.

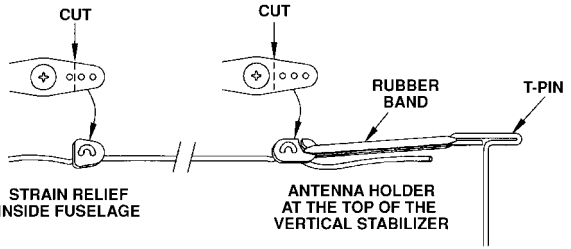
Note 2: If you are installing retracts, the lower wing fairing must be trimmed as shown in the photo to allow for clearance of the wheel wells.

Battery & Receiver Installation



❏ 1. Hook up the receiver, switch and battery, (following the manufacturer's recommendations),

as shown in the photo. We added a Great Planes Switch Mount & Charge Jack **(GPMM1000, not included)** for convenience and ease of use at the field, installed on the side of the fuselage. At this time, it is suggested to allow the receiver and battery the option of being moved until after the aircraft has been balanced. Once balanced, the receiver and battery should be secured into the aircraft to prevent them from moving during flight.



❑ 2. Route the antenna to the tail of the model. You may use your preferred method or the method we use in the Great Planes model shop. Drill a 15/64" hole through the fuse side in the proximity of the receiver. Cut a 1/2" long piece of fuel tubing and install it in the hole. Install a strain relief (as shown in the sketch), then route the antenna through the fuel tubing to the bottom of the fuse at the tail. Use a rubber band to attach the antenna to a T-pin at the aft end of the fuselage. **Do not cut or shorten the antenna wire.** Leave any excess to hang free.

Control Throw Adjustment

By moving the position of the clevis at the control horn toward the outermost hole, you will decrease the amount of throw of the control surface. Moving it toward the control surface will increase the amount of throw. If these adjustments don't accomplish the job, you may need to work with a combination of adjustments by also repositioning the pushrod at the servo end. Moving the pushrod towards the center of the servo horn will decrease the control surface throw - outward will increase it.

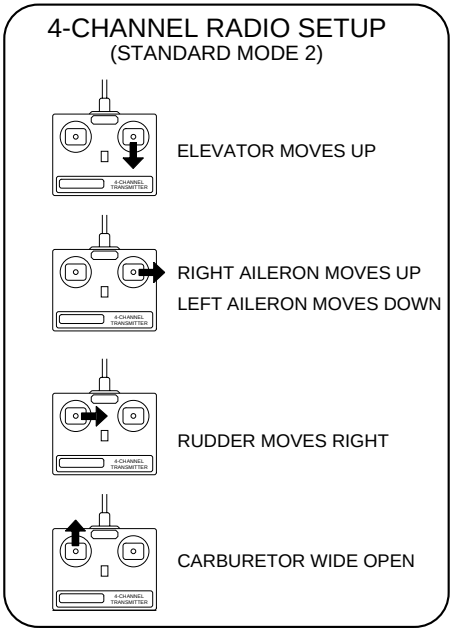
Control Surface Throws

Note: Throws are measured at the widest part of the elevators, rudder and ailerons. If your radio does not have dual rates, set the control throws to halfway between the specified high and low rates. We recommend the following control surface throws as a starting point:

	High Rate	Low Rate
Elevator	5/16" [8mm] Up 5/16" [8mm] Down	3/16" [5mm] Up 3/16" [5mm] Down
Rudder	1" [25mm] Right 1" [25mm] Left	5/8" [16mm] Right 5/8" [16mm] Left
Ailerons	3/8" [9.5mm] Up 3/8" [9.5mm] Down	1/4" [6.5mm] Up 1/4" [6.5mm] Down

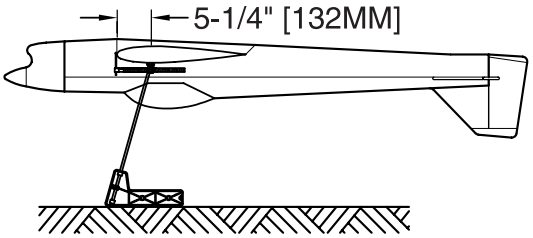
One leading cause of crashes is flying an airplane with its control throws set differently from those recommended in the instructions. The Great Planes AccuThrow™ (**GPMR2405)** lets you quickly and easily measure actual throws first, so you can make necessary corrections before you fly. Large, no-slip rubber feet provide a firm grip on covered surfaces without denting or marring the finish. Spring tension holds AccuThrow's plastic ruler steady by each control surface. Curved to match control motions, the ruler provides exact readings

in both standard or metric measurements.
Make sure the control surfaces move in the proper direction as illustrated in the following sketch:



Balance Your Model

Note: This section is VERY important and must NOT be omitted! A model that is not properly balanced will be unstable and possibly unflyable.



❑ 1. The balance point (C.G.) is located 5-1/4" [132mm] back from the leading edge of the wing. Balance your Spectrum using a Great Planes C.G. Machine™ Airplane Balancer **(GPMR2400)** for the most accurate results. This is the balance point at which your model should balance for your first flights. After initial trim flights and when you become more acquainted with your Spectrum, you may wish to experiment by shifting the balance up to 5/16" [8mm] forward or backward to change its flying characteristics. Moving the balance forward may improve the smoothness and stability, but the model may then require more speed for takeoff and may become more difficult to slow for landing. Moving the balance aft makes the model more agile with a lighter, snappier "feel" and often improves knife-edge capabilities. In any case, please start at the location we recommend. Do not at any time balance your model outside the recommended range.

❑ 2. With the wing attached to the fuselage, all parts of the model installed (ready to fly), and an empty fuel tank, block up the tail as necessary to level the stab. Lift the model at the desired balance point, and observe the tail of the aircraft. If the tail drops, the model is "tail heavy" and you must add weight* to the nose to balance the model. If the nose drops, it is "nose heavy" and you must add weight* to the tail to balance the model.

Note: Nose weight may be easily installed by using a "spinner weight." Tail weight may be added by using Great Planes **(GPMQ4485)** "stick-on" lead weights.

* If possible, first attempt to balance the model by changing the position of the receiver battery. If you are unable to obtain good balance by doing so, then it will be necessary to add weight to the nose or tail to achieve the proper balance point. Remember to secure the receiver and battery after your model has been balanced.

Balance Your Model Laterally

IMPORTANT: Do not confuse this procedure with "checking the C.G." or "balancing the airplane fore and aft."

Now that you have the basic airplane nearly completed, this is a good time to balance the airplane laterally (side-to-side). Here is how to do it:

❑ 1. Assemble the model in as in preparation for flight. (No fuel is required for this procedure.)
❑ 2. With the wing level, lift the model by the engine propeller shaft and the fin post (this may require two people). Do this several times.

❑ 3. If one wing always drops when you lift the model, it means that side is heavy. Balance the airplane by adding weight to the opposite, lighter wing tip.

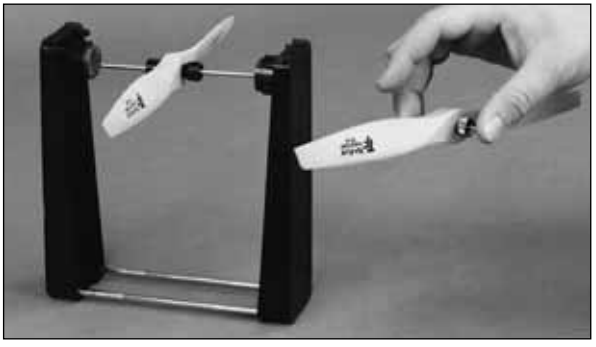
Note: An airplane that has been laterally balanced will track better in loops and other maneuvers.

Preflight

At this time check all connections including servo horn screws, clevises, servo cords and extensions.

Charge the Batteries
Follow the battery charging procedures in your radio instruction manual. You should always charge your transmitter and receiver batteries the night before you go flying and at other times as recommended by the radio manufacturer.

Balance the Propeller
Carefully balance your propellers before flying. An unbalanced prop is the single most significant cause of vibration. Not only may engine mounting screws vibrate out, possibly with disastrous effect, but vibration may also damage your radio receiver and battery. Vibration may cause your fuel to foam, which will, in turn, cause your engine to run lean or quit.



We use a Top Flite Precision Magnetic Prop Balancer™ **(TOPQ5700)** in the workshop and keep a Great Planes Fingertip Balancer **(GPMQ5000)** in our flight box.

Find A Safe Place to Fly
Since you have chosen the Spectrum ARF, we assume that you are an experienced modeler. Therefore, you should already know about AMA chartered flying fields and other safe places to fly. If for some reason you are a relatively inexperienced modeler and have not been informed, we strongly suggest that the best place to fly is an AMA chartered club field. Ask the AMA or your local hobby shop dealer if there is a club in your area and join. Club fields are set up for R/C flying and that makes your outing safer and more enjoyable. The AMA address and telephone number are in the front of this manual. If a club and flying site are not available, find a large, grassy area at least 6 miles away from houses, buildings and streets and any other R/C radio operation like R/C boats and R/C cars. A schoolyard may look inviting but is too close to people, power lines and possible radio interference.

Ground Check the Model
Inspect your radio installation and confirm that all the control surfaces respond correctly to the transmitter inputs. The engine operation must also be checked by confirming that the engine idles reliably, transitions smoothly and rapidly to full power and maintains full power, indefinitely. The engine must be “broken-in” on the ground by running it for at least two tanks of fuel. Follow the engine manufacturer’s recommendations for break-in. Make sure that all screws remain tight, that the hinges are secure and that the prop is on tight.

Range Check Your Radio
Whenever you go to the flying field, check the operational range of the radio before the first flight of the day. First, make sure no one else is on your frequency (channel). With your transmitter on, you should be able to walk at least 100 feet away from the model and still have control. While you work the controls, have a helper stand by your model and tell you what the control surfaces are doing. Repeat this test with the engine running at various speeds with a helper holding the model. If the control surfaces are not always responding correctly, do not fly! Find and correct the problem first. Look for loose servo connections or corrosion,

loose bolts that may cause vibration, a defective on/off switch, low battery voltage or a defective receiver battery, a damaged receiver antenna, or a receiver crystal that may have been damaged from a previous crash.

Engine Safety Precautions
Note: Failure to follow these safety precautions may result in severe injury to yourself and others.

Keep all engine fuel in a safe place, away from high heat, sparks or flames, as fuel is very flammable. Do not smoke near the engine or fuel; and remember that the engine exhaust gives off a great deal of deadly carbon monoxide. Do not run the engine in a closed room or garage.

Get help from an experienced pilot when learning to operate engines.

Use safety glasses when starting or running engines. Do not run the engine in an area of loose gravel or sand; the propeller may throw such material in your face or eyes.

Keep your face and body as well as all spectators away from the plane of rotation of the propeller as you start and run the engine.

Keep these items away from the prop: loose clothing, shirt sleeves, ties, scarfs, long hair or loose objects such as pencils or screwdrivers that may fall out of shirt or jacket pockets into the prop.

Use a “chicken stick” or electric starter to start the engine. Do not use your fingers to flip the propeller. Make certain the glow plug clip or connector is secure so that it will not pop off or otherwise get into the running propeller.

Make all engine adjustments from behind the rotating propeller.

The engine gets hot! Do not touch it during or right after operation. Make sure fuel lines are in good condition so fuel will not leak onto a hot engine, causing a fire.

To stop a glow engine, cut off the fuel supply by closing off the fuel line or following the engine manufacturer’s recommendations. Do not use hands, fingers or any other body part to try to stop the engine. Do not throw anything into the propeller of a running engine.

AMA Safety Code (excerpt)

Read and abide by the following Academy of Model Aeronautics Official Safety Code:

General
1. I will not fly my model aircraft in sanctioned events, air shows, or model flying demonstrations until it has been proven to be airworthy by having been previously successfully flight tested.

2. I will not fly my model aircraft higher than approximately 400 feet within 3 miles of an airport without notifying the airport operator. I will give right of way to and avoid flying in the proximity of full-scale aircraft. Where necessary an observer shall be used to supervise flying to avoid having models fly in the proximity of full-scale aircraft.

3. Where established, I will abide by the safely rules for the flying site I use and I will not willfully and deliberately fly my models in a careless, reckless and/or dangerous manner.

7. I will not fly my model unless it is identified with my name and address or AMA number, on or in the model.

9. I will not operate models with pyrotechnics (any device that explodes, burns, or propels a projectile or any kind).

Radio Control
1. I will have completed a successful radio equipment ground check before the first flight of a new or repaired model airplane.

2. I will not fly my model aircraft in the presence of spectators until I become a qualified flier, unless assisted by an experienced helper.

3. I will perform my initial turn after takeoff away from the pit or spectator areas and I will not

thereafter fly over pit or spectator areas, unless beyond my control.
4. I will operate my model using only radio control frequencies currently allowed by the Federal Communications Commission.

Flying

The Spectrum is a great flying sport airplane that flies smoothly and predictably, yet is highly maneuverable. It does **not** have the self-recovery characteristics of a primary trainer, and therefore you must either have mastered the basics of R/C flying or seek the assistance of a competent R/C pilot to help you with your first flights.

Takeoff
If you have dual rates on your transmitter, set the switches to "high rate" for takeoff, especially when taking off in a crosswind. Although the Spectrum has great low speed characteristics, you should always build up as much speed as your runway will permit before lifting off, as this will give you a safety margin in case of a "flame-out."

Flying
We recommend that you take it easy with your Spectrum for the first several flights and gradually "get acquainted" with this fantastic ship as your engine gets fully broken-in. Add and practice one maneuver at a time, learning how she behaves in each one. For ultra-smooth flying and normal maneuvers, we recommend using the "low rate" settings as listed on page 24. "High rate" elevator and rudder may be required for crisp snap rolls and spins. **Speed** is the key to good knife-edge performance.

Landing
When it's time to land, make your approach low and shallow, as this ship wants to just keep on flying. If you find that it lands a little fast, you might try dialing in a few clicks of up elevator when you cut the throttle on the downwind leg of the landing approach. This will automatically help to bleed off some of the speed. If your Spectrum is assembled straight and true, you'll find that you can really flare it out for slow, nose-high, full-stall landings without fear of tip stalling.

Have a ball! But always stay in control and fly in a safe manner.

Other Kits Available from Hobbico

Hobbico® Extra 300S AWARF-Plus™ HCAA2080

Hobbico's true-scale, 58.25" span, all-wood Extra 300S AWARF-Plus features control linkages engineered for demanding aerobatics, with two aileron servos, pull/pull rudder cables and dual elevator pushrods. Its turtledeck and rounded fuselage bottom are made of split-resistant, laminated balsa, and the preapplied covering looks nearly seamless. Includes hardware, formed aluminum gear and photo-illustrated instructions.

Hobbico TwinStar™ AWARF® HCAA2075

Experience the increased realism—in sight and sound—of flying a twin! Flight-ready in only 14-20 hours, the Hobbico TwinStar AWARF (All-Wood, Almost Ready-to-Fly) offers the easiest twin-engine action available. Even if it's only your third or fourth model, you'll make the transition easily. Smart engineering gives you maximum piloting protection: Both engines are positioned near the plane's centerline, so it handles very much like a single-engine model. Each engine has its own fuel supply, so you'll still have power if one engine quits or a fuel line problem occurs. And because it's almost ready-to-fly, assembly is fast and familiar—with durable, all-