RASCAL 110 ARF ASSEMBLY MANUAL

INTRODUCTION:

SIG's RASCAL 110 ARF represents one of the largest, best built R/C model aircraft ever offered to modelers. The distinctive and classic lines of the Rascal are reminiscent of the beautiful personal aircraft designs of the thirties and post WWII periods. The elegant good looks of the Rascal design seem to bridge the gap between modern small aircraft and airplanes from the golden age of flight.

Designed specifically for modelers who have always wanted a large, giant-scale airplane *without* all of the large airplane hassles, the Rascal 110 ARF kit offers a perfect balance of size, performance, looks, and versatility. From experience, we can tell you that the Rascal 110 ARF will almost always draw a crowd of admiring onlookers. But when the airplane takes to the air, the smooth flight characteristics and sheer size make it even more impressive.

You will have never flown an easier to handle airplane than the Rascal 110 ARF. Take-offs and landings are spectacular in their smoothness and when it comes to what goes on in the air, the Rascal 110 is positively elegant. Despite it's large size, the Rascal 110 can be easily flown at most typical R/C flying sites, either grass or asphalt fields. Landings can be very slow and predictable and the take-off runs are usually less than many .40-size trainers.

Powered with typical 1.20 4-stroke engines, the Rascal 110 is capable of mild aerobatics, such as loops, lazy rolls, inverted flight, etc. Power the airplane with larger engines and things can get a bit more interesting. Our Rascal 110 models, powered with 1.50 or 1.80 4-stroke engines and 1.50 2-stroke engines, turned into very capable aerobatic airplanes! Of course, the Rascal 110 ARF is not a pure aerobatic machine and was never intended for IMAC competition. None-the-less, with practice, it will deliver an amazingly nice flight routine.

The Rascal 110 ARF is very well built, with attention paid to every detail of its construction and finish. Even the functional aluminum wing struts have been expertly built and factory painted, providing just the right "look" to the model. The fiberglass cowl and wheel pants are equally impressive, giving the airplane that "finished" look, truly setting it apart from anything else available. The airframe has been expertly covered with AeroKote™, employing a trim scheme that is highly visible in flight and very attractive on the ground. The kit includes all of the detailed decals seen on the box art, allowing you to make the model very realistic. SIG has even included a beautiful scale-like tailwheel assembly that fits the look of this airplane almost perfectly!

Because of its size and lifting ability, the Rascal 110 ARF is a great choice for use as a camera ship, either still or video. Properly powered, it would also make a good glider tug and is also certainly capable of towing banners. Properly modified, it could also be used to drop candy or parachutes. Another potential use for this versatile model is night flying. Because the trim scheme employs the use of transparent covering material in the open areas of the structure, lighting systems - such as those made and sold by Ram Products - would be very effective!

Assembly of the Rascal 110 is easy, quick, and straightforward. This assembly manual is fully illustrated and includes all detailed instructions in the correct sequence. This allows you to get the airplane from the box to the flying field in a very short amount of time. We strongly suggest that you read through this manual first to get familiar with the various parts and their assembly sequences. The proper assembly and flying of this aircraft is *your* responsibility. *If you are new to the sport/hobby of radio control model airplanes, we urge you to seek the assistance of a qualified person to help you assemble this R/C model aircraft correctly. If you do not understand a particular assembly step or sequence,* ***DO NOT*** *guess - find qualified help and use it.*

RADIO EQUIPMENT:

The Rascal 110 ARF requires a 4-channel radio system, with five servos. Because of its size and the wide variety of engines that can be used in this airplane, we highly recommend that you use servos with at least 60 in/ounces of torque. Such servos are more appropriate for a model of this size.

We use and can highly recommend either the Airtronics™ RD-6000 Sport system or the Hitec™ Flash 4X system for this airplane. Both of these affordable and reliable computer radio systems offer all the features you'll need for this and the many other R/C aircraft in your future. For reference, this assembly manual shows the installation of Hitec™ #HS-545BB servos for aileron, rudder, and elevator controls. A Hitec™ #HS-300 standard servo is used for throttle control. We used a Hitec™ #23873 RCD 3800 Supreme Shift Select receiver and a Hitec™ #57215 Standard Switch Harness. We also used one Hitec™ #54606 36" servo extension for the elevator servo and two Hitec™ #57346 24" servo extensions for the aileron servos. A Hitec™ #57350 Y-Harness to connect the aileron servo leads to the receiver. All of these items are available separately as after-market equipment at very affordable prices. See your local hobby shop for more information.

We like to use Du-Bro after-market servo output arms. These are exceptionally strong and always seem to be the right shape and geometry for most of our applications. Du-Bro makes their output arms to fit any available servos, just use the right part number for your particular brand of servos. Because our assembly manual model is using Hitec™ servos, we chose the Du-Bro #675 set.

With an R/C model as large as the Rascal 110 - especially when using five servos - we always suggest using airborne battery packs with larger capacity than the typical battery packs supplied with most radio systems. For example, we used an after-market 1400mAh four-cell battery pack in the model shown in this assembly manual. Be sure you have a charger capable of properly charging these larger battery packs.

ENGINE SELECTION:

The Rascal 110 can be powered by a wide range of engine sizes and types - 2-stroke, 4-stroke (both single and twin cylinder types), and even smaller gasoline engines. Keep in mind that the airplane has been designed to be relatively light, producing a good flying model with a very favorable wing loading. In addition, the design is fairly aerodynamically clean for a high-wing model. These two factors result in very good performance when using engines in the suggested range. Over-powering this model is totally unnecessary and not recommended.

What are the considerations for choosing a particular type of engine to use in this model? If you are most comfortable with glow engines, then a 2 or 4-stroke type may be best for you. Just remember that these engines, especially the larger engines used to fly a model of this size, tend to use a lot of fuel in their operation. Glow engines also produce a lot of exhaust residue that must be cleaned off after each flying session. If these are not problems for you, then glow engines, in the recommended sizes, can certainly be used with good results.

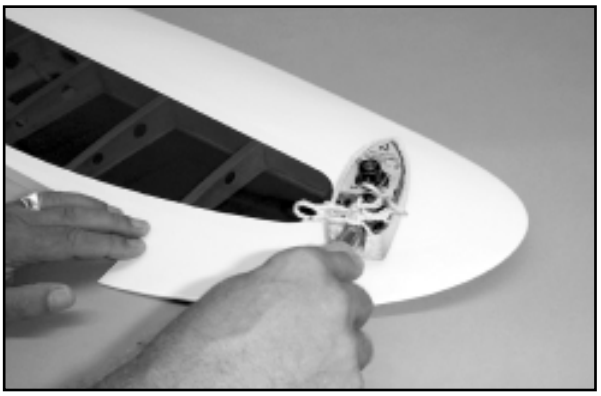
Although, we have not tried it, another interesting engine type to consider would be twin-cylinder 4-strokes in 1.60 to 1.82 sizes. In the installation of a twin cylinder engine, the only real issue would likely be how to install the fiberglass cowl over the two cylinder heads. In the case of a twin cylinder engine, probably the best way to deal with the cowl would be to neatly "split" it, from front to rear, along the centerline of the engine, creating top and bottom cowl halves. The two halves could then be joined along the seam with small bolts. Neatly done, this would create fairly easy engine access and a very realistic look.

Smaller gas engines in the range of 1.3 to 1.6 cubic inches are also good potential powerplants for the Rascal 110. For example, the gas engine depicted in this manual is the new F.P.E. 1.3 motor, with electronic ignition. This engine flies the airplane very nicely, swinging a 16 x 8 prop at about 7400 rpms. With the supplied 450cc (15.2 oz.) fuel tank, flight times are around 23 minutes and can be even longer with throttle management! Of course, side benefits from using gas engines are things like greatly reduced fuel costs, much less field support equipment needed, great reliability, and the almost total lack of clean up required. At the end of the day, clean up usually consists of wiping off a few bug strikes and fingerprints.

COVERING MATERIAL:

Your Rascal 110 ARF has been professionally covered with SIG AeroKote™. This material is well known for its ease of application, light weight and consistency of color. If you live in a drier climate, you may notice that some wrinkles might develop after removing the covered parts from their plastic bags. This is perfectly normal in low humidity climates. Your model was built and covered in a part of the world with relatively high humidity and therefore, the wood was likely carrying a fair amount of moisture. When exposed to relatively drier air, the wood typically loses this moisture, dimensionally "shrinking" in the process. In turn, this may cause some wrinkles. However, these wrinkles are easy to remove by just using a hobby type heat iron.

We suggest covering the iron's shoe with a thin cotton cloth, such as an old T-shirt, to prevent scratching the film. The iron should be set to 220°F - 250°F (104°C - 121°C). Use the heated iron to lightly shrink the material - do not press on it. Then, lightly iron the material back down to the wood. You can also use a hobby-type heat gun to re-shrink the covering but you must be careful around seams or color joints. Re-heating seams may cause them to "creep", making them unsightly. This is especially true with the Rascal 110 inset trim scheme. Also, be careful with the heat gun when working around the windshield and side windows - heat will distort this clear plastic material.



We also suggest that you take a few moments to go over all the seams with your iron, making sure they are all sealed and well adhered. This is especially important when you power your model with a glow engine. Exhaust residue will contaminate a seam that is not sealed, making it almost impossible to re-seal effectively.

Your Rascal 110 ARF is covered with SIG AeroKote™
#SIGSTL100 White
and
#SIGSTL010 Transparent Red or #SIGSTL050 Transparent Blue

REQUIRED TOOLS:

For proper assembly, we suggest you have the following tools and materials available:

A selection of glues - SIG Thin and Thick CA and
SIG Kwik-Set 5-Minute Epoxy
Threadlock Compound, Such as Loctite® Non-Permanent Blue
Silicon Sealer - clear or white tub and shower type
Screwdriver Assortment
Pliers - Needle Nose & Flat Nose
Diagonal Wire Cutters
Small Allen Wrench Assortment
Pin Vise for Small Dia. Drill Bits
Hobby Knife With Sharp #11 Blades
Scissors
Heat Iron and Trim Seal Tool
Masking Tape
Paper Towels
Glass Cleaner, such as SIG Pure Magic Model Cleaner or Windex®
Power Drill With Selection of Bits
Dremel® Tool With Selection of Sanding and Grinding Bits
Soldering Iron and Solder
Large Fuel Tubing

COMPLETE KIT PARTS LIST:

The following is a complete list of all parts contained in this kit. Before beginning assembly, we suggest that you take the time to inventory the parts in your kit, using the provided check-off boxes (❑). Note that the CA type hinges for the ailerons, rudder, and elevators are in place in each of these parts but are not yet glued in place. Also, note that the nuts and bolts required to mount your engine to the motor mounts are not included in this kit and must be purchased separately.

BASIC AIRCRAFT PARTS:

- ❑ 1 each Right Wing Panel With Aileron in Place With 4 CA Hinges - Not Glued Aileron Servo Cable String Installed - Factory Covered
- ❑ 1 each Left Wing Panel With Aileron in Place With 4 CA Hinges - Not Glued Aileron Servo Cable String Installed - Factory Covered
- ❑ 1 each Vertical Fin & Rudder Assembly With 4 Hinges - Not Glued Factory Covered
- ❑ 1 each Horizontal Stabilizer & Elevator Assembly With 6 Hinges - Not Glued Factory Covered
- ❑ 1 each Fuselage With Clear Plastic Windshield Installed With 7 Screws. 4 Landing Gear Blind Mounting Nuts Installed, Installed 1/4-20 Blind Mounting Nuts For Wing Attachment, 2 Wing Strut Attachment Blind Nuts Installed, Pull-Pull Exits Installed - Factory Covered

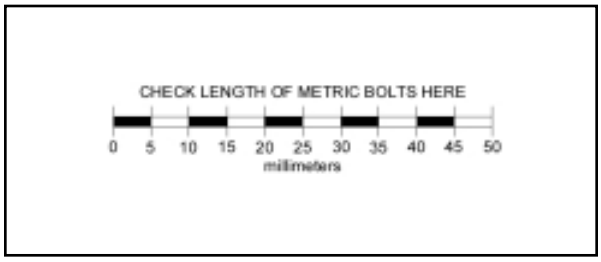
SUB ASSEMBLIES:

- ❑ 1 bag Fiberglass Cowl, White:
  - ❑ 4 each #3 x 10mm PWA Mounting Screws
- ❑ 1 bag Fiberglass Wheel Pants - 1 Right, 1 Left - Factory Painted (Blue/White or Red/White) With Blind Mounting Nuts Installed (2 per pant) for Mounting
- ❑ 1 bag 3" Dia. White SIG Spinner Assembly:
  - ❑ 1 each Spinner Cone
  - ❑ 1 each Spinner Backplate
  - ❑ 1 each Prop Adapter Ring Set
  - ❑ 4 each #2 x 10mm Phillips Head Mounting Screws
- ❑ 1 bag Molded Clear Plastic Side Window Set
- ❑ 1 bag Motor Mount Assembly:
  - ❑ 2 each Fiber-Filled Motor Mount Arms - 1 Right, 1 Left
  - ❑ 4 each M4 x 25mm PWA Mounting Bolts
  - ❑ 4 each M4 Washers
  - ❑ 4 each M4 Split Ring Lock Washers
  - ❑ 4 each M4 Blind Mounting Nuts
- ❑ 1 bag Fuel Tank Assembly:
  - ❑ 1 each 450cc (15.2 oz.) Fuel Tank
  - ❑ 1 each Fuel Pick-Up "Clunk" - Metal
  - ❑ 1 each 4-1/2" Length of Fuel Tubing (for glow engines only)
  - ❑ 1 each Rubber Fuel Tank Stopper (for glow engines only)
  - ❑ 1 each Front Stopper Compression Plate
  - ❑ 1 each Rear Stopper Compression Plate
  - ❑ 1 each M3 x 18mm Phillips Head Compression Bolt
  - ❑ 3 each 3mm Dia. Aluminum Tube Fuel Lines:
  - ❑ 1 @ 40mm Long
  - ❑ 1 @ 50mm Long
  - ❑ 1 @ 60mm Long
- ❑ 1 bag SIG Tailwheel Assembly - Medium:
  - ❑ 1 each Main Tailwheel Spring Arm With Steering Arm & 1-1/4" Dia. Tailwheel Installed
  - ❑ 1 each Secondary Tailwheel Spring Arm
  - ❑ 1 each 2-Arm Rudder Steering Plate - Metal
  - ❑ 2 each #2 X 10mm PWA Steering Plate Mounting Screws
  - ❑ 3 each #3 x 15mm PWA Tailwheel Assembly Mounting Screws
  - ❑ 2 each Centering Springs
- ❑ 1 bag Main Landing Gear Assembly:
  - ❑ 1 each Landing Gear, 4mm Hardened Aluminum – Factory Painted White
  - ❑ 2 each 3-1/2" Dia. Main Wheels - "Lite"-Type
  - ❑ 2 each M5 x 50mm Hardened Steel Allen Head Axle Bolts
  - ❑ 4 each M5 Hex Nuts
  - ❑ 2 each M5 Split Ring Lock Washers
  - ❑ 2 each M5 Brass Spacer Sleeves
  - ❑ 4 each M4 x 20mm PWA Main Landing Gear Mounting Bolts
  - ❑ 4 each M4 Split Ring Lock Washers
  - ❑ 4 each M3 x 12mm Phillips Head Wheel Pant Mounting Bolts
  - ❑ 4 each M3 Split Ring Lock Washers
- ❑ 1 bag Wing Strut Assemblies:
  - ❑ 1 each Right Wing Strut, Aluminum, With Contoured End Caps Installed - Factory Painted White
  - ❑ 1 each Left Wing Strut, Aluminum, With Contoured End Caps Installed - Factory Painted White
  - ❑ 4 each M3 x 20mm Allen Head Mounting Bolts
  - ❑ 4 each M3 Washers
  - ❑ 4 each M3 Split Ring Lock Washers
- ❑ 1 bag Aileron Servo Hatch Assemblies & Wing Bolts:
  - ❑ 1 each Right Aileron Hatch, Plywood - Factory Covered
  - ❑ 1 each Left Aileron Hatch, Plywood - Factory Covered
  - ❑ 4 each 10mm x 20mm sq. (3/8" x 3/4" sq.) Hardwood Aileron Servo Mounting Blocks
  - ❑ 8 each #3 x 10mm PWA Servo Hatch Mounting Screws
  - ❑ 4 each #2 x 8mm PWA Mounting Block Screws
  - ❑ 2 each 1/4-20 x 1-1/2" Nylon Wing Mounting Bolts

- ❑ 1 bag Miscellaneous Wood Parts:
  - ❑ 4 each Channeled Balsa Tail Fairings - Factory Covered
  - ❑ 1 each 5/16” x 3/4” x 5” Balsa Fuel Tank Retainer Block
  - ❑ 1 each 1/8” Lite-Ply Die-Cut Rear Fuel Tank Former
- ❑ 1 bag Main Wing Joiner Parts:
  - ❑ 1 each 5mm x 26.9mm x 318mm Aluminum Main Wing Joiner
  - ❑ 1 each 9.8mm Dia. X 80mm Aluminum Tube - Rear Wing Locator Tube
- ❑ 1 bag Control Surface Hardware Parts:
  - ❑ 2 each .024” x 47-18” Plastic Coated Pull-Pull Steel Cable
  - ❑ 4 each Metal R/C Links, Threaded onto Brass Pull-Pull Fittings
  - ❑ 5 each Nylon Control Horns
  - ❑ 1 each Nylon Control Horn Base
  - ❑ 4 each #3 x 12mm PWA Aileron Control Horn Mounting Screws
  - ❑ 4 each M2 x 20 mm Phillips Head Bolts - For Rudder & Elevator Control Horn Mounting
  - ❑ 4 each M2 Hex Nuts
  - ❑ 4 each 1.9 mm Dia. x 4.2mm Brass Pull-Pull Swaging Tubes
- ❑ 1 bag Pushrod Assemblies:
  - ❑ 3 each #4-40 Metal Pushrods, Threaded One-End:
    - ❑ 2 each @ 4-3/8” - Aileron Pushrods
    - ❑ 1 each @ 4-5/8” - Elevator Pushrod
  - ❑ 3 each #4-40 R/C Links
  - ❑ 3 each #4-40 Solder Links
- ❑ 1 bag Throttle Linkage Package:
  - ❑ 2 each Metal R/C Links With M2 x 22mm Studs Threaded in Place
  - ❑ 1 each 5mm Dia. x 19-3/4" Nylon Tube - Female Throttle Tube
  - ❑ 1 each 3.4mm Dia. x 23-1/2" Nylon Throttle Pushrod Tube
- ❑ 1 bag SIG Fueling Valve Mounting Bracket - #SIGSH759

MISCELLANEOUS:

- ❑ 1 each RASCAL 110 Assembly Manual
- ❑ 1 each RASCAL 110 Printed Instrument Panel
- ❑ 1 each RASCAL 110 Decal Sheet - 9" x 27"



NOTE: In addition to the above parts, you will need the following specific items:

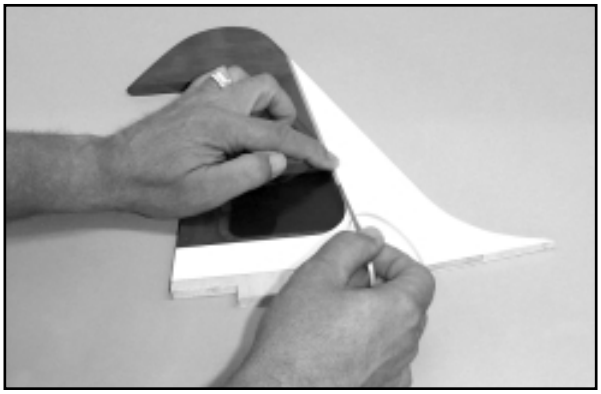
4-Channel Radio System with 5 Servos (4 with 60in/oz torque or better)
Engine
Engine Mounting Bolts for Specific Engine Used
Fuel Tubing (correct size and type for your engine)

OPTIONAL:

Some modelers may want to dress-up their Rascal 110, using striping tape to accent the trim scheme. We like this look and decided to use it on our models. We used a good quality striping tape to frame the color lines, where the transparent color meets the white covering. This was easy to do and gives a very nice finished look to the overall model. Because the Rascal 110 is such a large model, we found that it was much easier to apply the striping tape to the individual parts *before* they were assembled.

For a model of this size, we suggest using either 1/8" or 3/16" wide striping tape. Of course, you can choose your own colors. On our Rascal 110 models, we thought that either blue or black striping tape looked good with the transparent red and white version but other colors may also appeal to you. The transparent blue and white version looks especially classy with aluminum or silver trim striping tape. Whatever color you choose, be sure to use good striping tape, applying it smoothly, avoiding any wrinkles when working the tape around the corners.

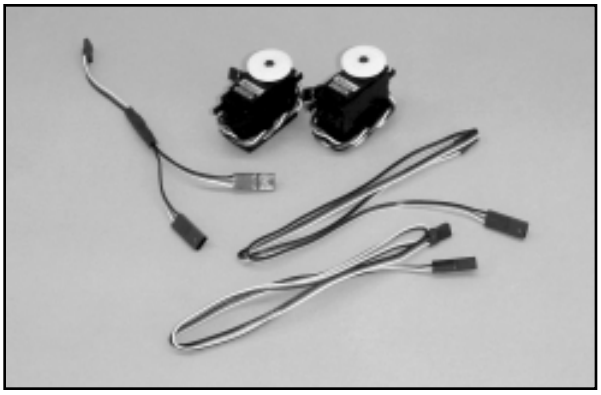
We also used striping tape to create a "frame" around the windshield. This really adds to the overall realistic look of the airplane. Give it a try, the finished look is great!



WINGS:

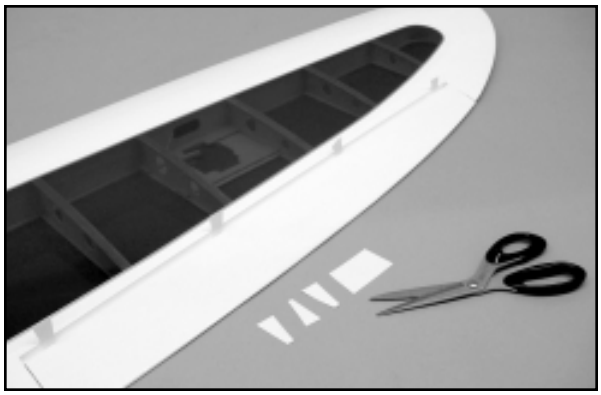
The Rascal 110 wing is designed to be a 2-piece system, joined by the main aluminum joiner blade at the spar box location and the rear locating tube. This joiner system has proven itself to be very tough and easy to use. This wing system is further augmented in strength with the functional wing struts. The obvious benefit, especially with a model of this size, is the fact that the wing panels are much easier to transport and store.

As received in the kit, the wing panels have the ailerons in place but <u>not</u> yet permanently hinged. Hinging the ailerons will be done

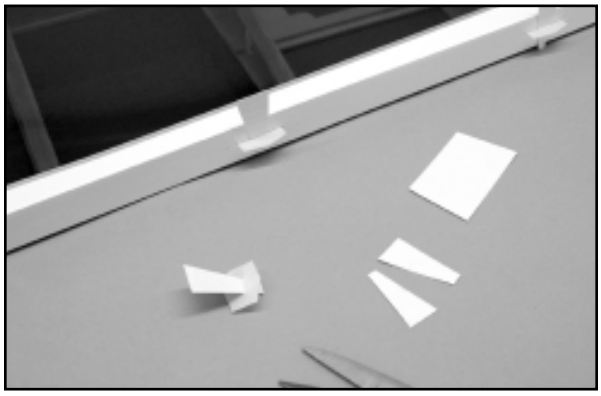


in the very first step. To protect the covered parts of your model from unnecessary damage, we suggest covering your work surface with protective foam or an old blanket. For the following steps, you will need two aileron servos, two servo lead extensions and a Dual Servo Y-Harness for your particular radio system. It will be helpful to have your radio system charged and ready to use.

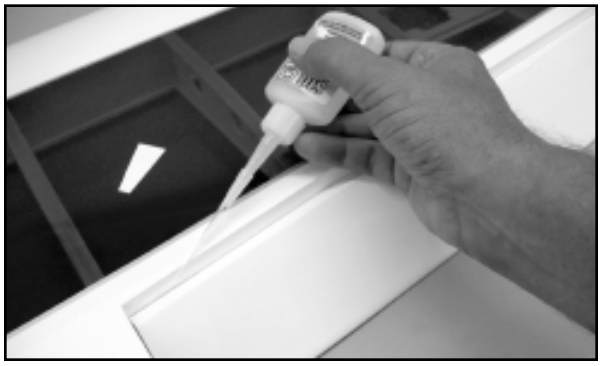
❑ 1) Remove the aileron from the wing panel and pull out the four CA hinges from their slots. Note that the supplied hinges have a die-cut center slot that can be used to accurately place and center the hinge equally into both the wing panel and the aileron. To do this, use an old business card and scissors to cut some "wedges". These should be wide enough at one end so as not to pass through the hinge slot cut-out.



Press the four hinges into the slots in the wing panel, up to the hinge's center slot. Place one of the card wedges into each hinge, then press the aileron in place onto each exposed hinge half, up to the card wedges. Slide the aileron left or right to center it within the wing panel aileron bay. The hinges are now in proper position for permanent mounting.



Flex the aileron downward, exposing the hinges between the wing and aileron. Hold the aileron in this flexed position with a piece of masking tape. For CA hinges, we always recommend using a fine-tip applicator on the glue bottle, to better control the flow. Remove the card wedge from one of the hinges and carefully apply four (4) small drops of thin CA glue to the left and right side of the exposed hinge center.

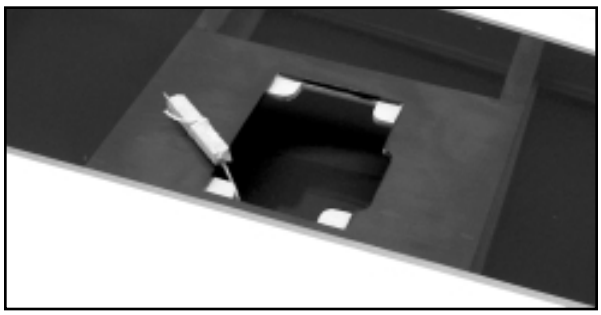


IMPORTANT NOTE: When installing CA type hinges, *more is not better!* Applying excess thin CA glue to this type of hinge does nothing more than stiffen it, potentially causing the hinge to break. If you have followed these instructions, each hinge will have a total of 8 small drops of thin CA glue on each side. This is the correct amount of adhesive.

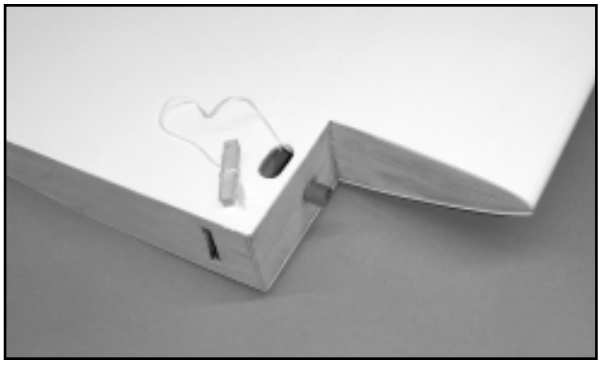
Remove the card wedge from the next hinge and again apply four drops of glue to each exposed hinge edge. Repeat this process for the remaining hinges. Remove the tape holding the flexed aileron to the wing panel and flex the aileron in the opposite direction. Again, use a piece of masking tape to hold the aileron fully flexed to the wing panel. Turn the wing panel over and apply four drops of thin CA glue to each exposed edge of each hinge, exactly as before. Remove the tape holding the aileron, returning the aileron to its centered position. Because it takes a little time for the CA glue to fully wick through the surface of the hinge and surrounding wood, allow at least 10 minutes before flexing the aileron. Clean-up any excess glue drops, runs, or smears on the covering with SIG CA Debonder and a paper towel.

After sufficient time has passed, flex the hinged aileron firmly up and down on the wing panel to create free and easy movement. Also, pull on the aileron at each hinge location to make sure all four hinges are securely in place. Repeat this procedure for the remaining wing panel and aileron.

❑ 2) Inside the servo bay opening, you will find a short length of wood with a string tied to it. The string is used to pull the aileron servo lead through the wing and out of the opening at the bottom, center of each wing panel - leave the piece of wood in place for now.

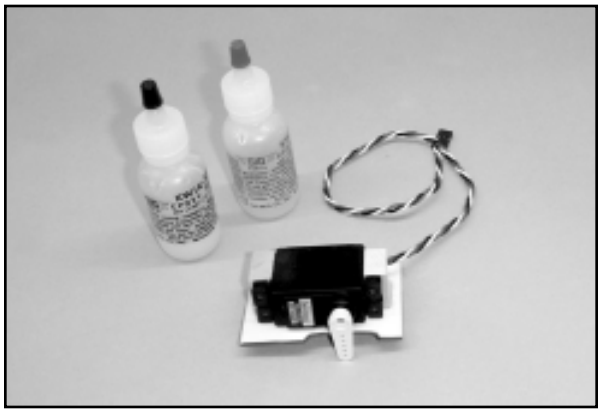


Also, on the bottom of each wing panel, at the center front location, you will see an oblong opening. This is the aileron servo lead exit opening. Inside this opening, you will see a piece of wood with a



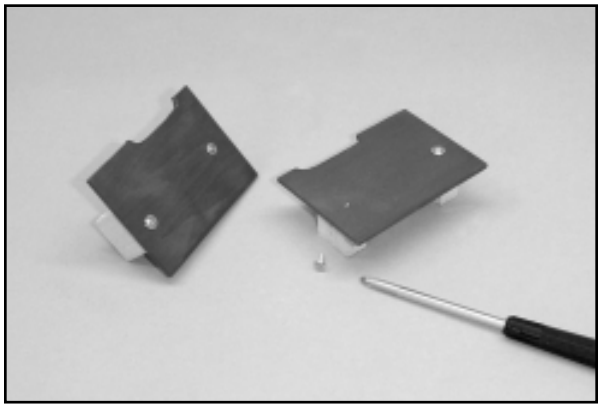
string tied to it - this is the other end of the string in the aileron servo bay. Leave the string in place for now.

❑ 3) From the kit contents, locate the bag containing the two factory covered aileron servo hatches, the aileron servo mounting blocks, and the mounting screw hardware. The aileron servos are now mounted to the factory covered plywood servo hatch covers - note that there is a left and a right hatch cover, made to fit the left and right wing panel hatch openings. Begin by installing the rubber grommets and brass eyelets (supplied with your radio system), into both aileron servos. Use epoxy or slow CA glue to mount the 3/8" x 3/4" sq. hardwood servo mounting blocks to the inside surface of the hatch cover, using the servo itself for spacing.

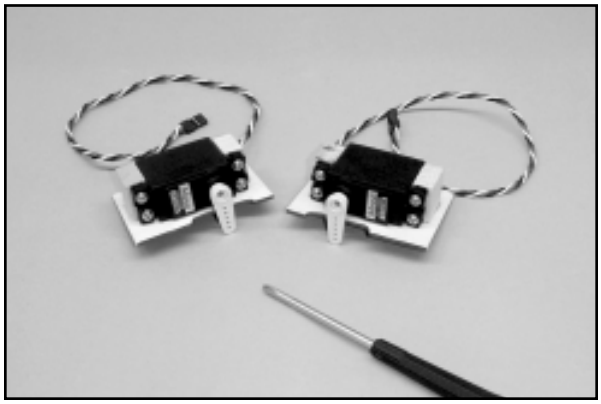


First, position the servo with its output arm directly over the center of the hatch's clearance slot and centered in the middle of the "1/2 slot" cut-out. Allow the glue to set. With the servo mounting blocks now glued in place, remove the servo. Assemble the remaining servo hatch cover and servo mounting blocks in the same manner.

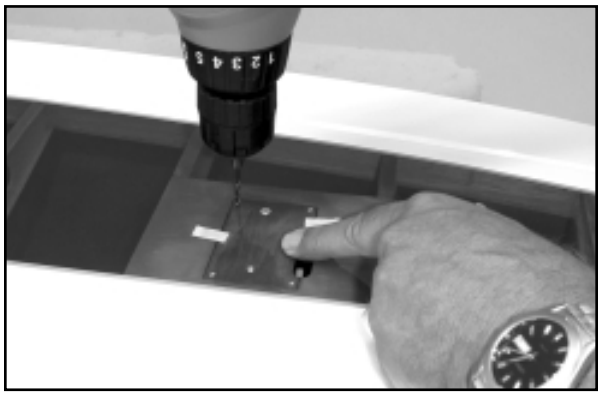
❑ 4) From the screws included in the aileron servo hatch bag, select the four smaller #2 x 8mm PWA mounting block screws. These screws are used to mechanically secure each servo mounting block to the servo hatch cover. Use a ruler to find the approximate center of each block and mark the location onto the covered side of the aileron servo hatch. With a 1/16" dia. bit, drill two holes - about 1/4" deep - through each servo hatch and into the mounting block, at the marks just made. Install and tighten the four screws in place through both servo hatch covers.



Use the servo mounting screws provided with your radio system to secure both aileron servos in place to the mounting blocks on each aileron servo hatch. To avoid possibly splitting the mounting blocks with the screws, first pre-drill the holes with an under-size drill bit.

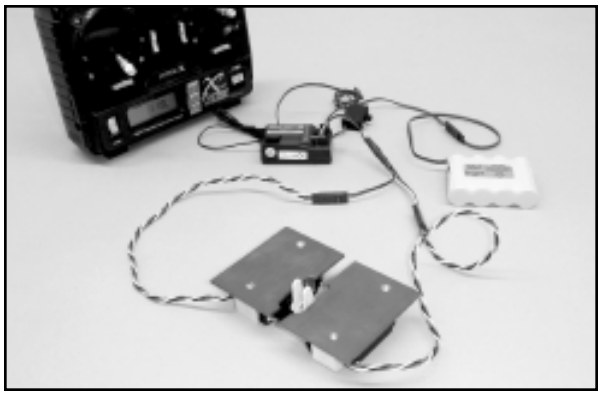


❑ 5) The servo hatch covers, with the servos in place, are now prepared for mounting into each wing panel. Carefully insert the servo cable into the servo bay and position the hatch cover into the recess (if the scrap piece of wood with the retrieval string tied to it is in the way, break the piece of wood away and lay it in the servo bay for now). Use small pieces of tape to hold the hatch in position on the wing panel. Use a 5/64" dia. bit to drill four holes in each corner of the servo hatch, through the hatch and the corner plywood mounting gussets, built into the wing. Be careful when doing this, not to run the drill bit through the top of the wing! Remove the servo hatch from the wing.



Re-drill the four corner holes in the servo hatch, using a 1/8" dia. bit to allow clearance for the #3 screws. The aileron hatch covers are now complete and ready for mounting.

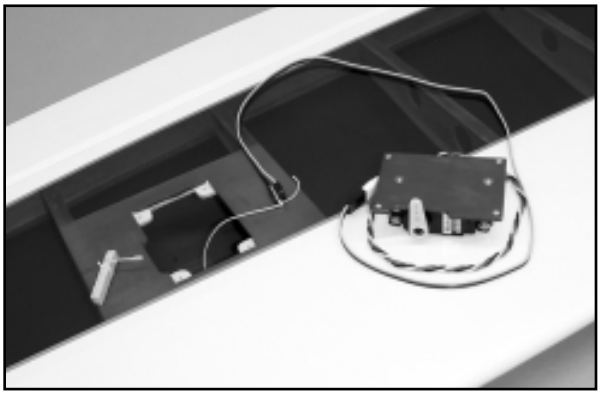
❑ 6) At this point, it is time to connect the two aileron servos to the Y-harness and the receiver, in order to set and adjust their center points. Slip the servo arms onto each servo and place them together on your workbench, with the servo arms facing each other. This gives you a good visual reference. Turn your transmitter on and then the receiver. Re-position the servo arms on the servo splines, getting them both as close to 90° as possible.



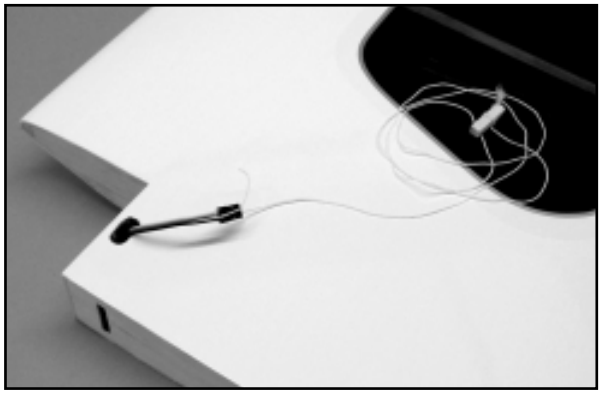
If you are using a computer radio, you can easily center the two servos through the radio's program for that function.

While the radio is still on, determine if the servos are moving the correct direction to provide "left" and "right" aileron movements when installed in the wing panels. For reference, "right" aileron stick movement on the transmitter should move the right aileron upward and the left aileron downward. If the direction of travel is incorrect, reverse the action of the servos through the transmitter. Doing this may re-center your servos a little. If so, re-center the servo arms on the servos to 90°. With the servo arms now centered and the servos moving in the correct direction, install and tighten the output arm retaining screws into both servos.

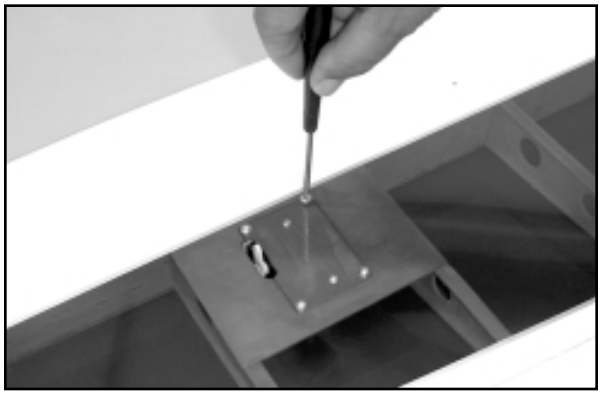
❑ 7) Plug a 24" servo extension lead into each aileron servo plug and secure the connections with plastic tape. Reach into the servo bay in the wing panel and pull the scrap piece of wood with the string tied to it out of the opening. Remove the scrap piece of wood and tie the end of the string securely onto the end of the servo lead extension. Double check to be sure you are mounting the right hatch into the right wing panel.



Reach into the oval hole at the center, front of the wing panel and remove the scrap piece of wood with the opposite end of the retrieval string tied to it (tweezers or needle nose pliers might be handy in doing this). Begin routing the servo extension lead through the wing by lightly pulling on the inboard end of the string while feeding the cable extension end into the hole inside of the servo bay. Continue pulling the lead through the wing until the servo extension plug is fully out of the exit hole, while seating the servo hatch in place. Remove the string from the plug and use a piece of tape to hold the servo lead to the bottom of the wing for now.



Both aileron servo hatches are now secured in place into each wing panel, using the eight #3 x 10mm PWA head screws.

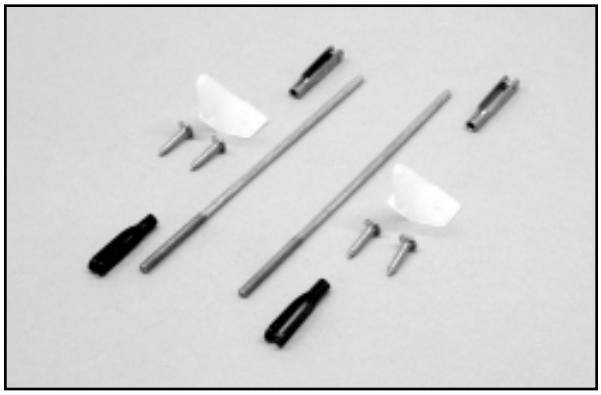


❑ 8) From the kit contents, locate the Control Surface Hardware Parts bag and the Pushrod Assemblies bag. From the Pushrod Assemblies bag, remove the following:

❑ 2 each #4-40 x 4-3/8" Aileron Pushrods, Threaded One-End
❑ 2 each #4-40 R/C Links
❑ 2 each #4-40 Solder Links

From the Control Surface Hardware Parts bag, remove the following:

❑ 2 each Nylon Control Horns
❑ 4 each #3 x 12mm PWA Control Horn Mounting Screws

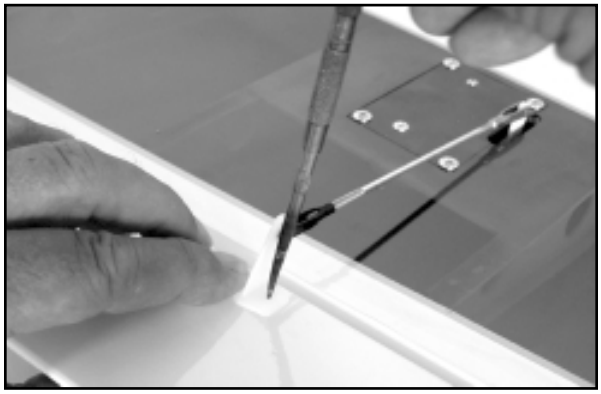


The two #4-40 solder links are now soldered to the unthreaded ends of each #4-40 x 4-3/8" pushrods. To make this easy, quick and strong, we highly recommend using Stay-Brite® Silver Solder and flux - available at most hobby shops. You will also need a good soldering iron (25W or better) or gun. Lightly sand the unthreaded end of both pushrods, where the solder link will be positioned. This tends to make the solder joint even more secure. The secret to

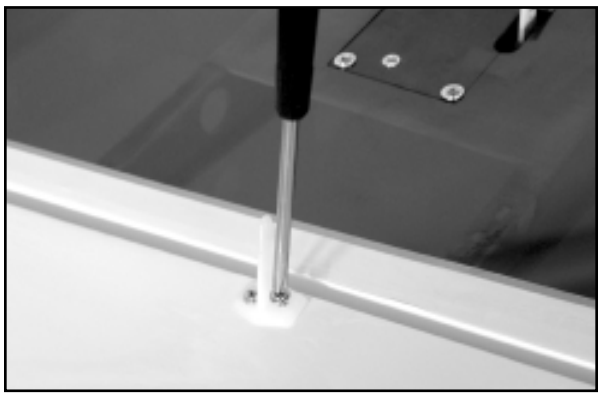
good solder joints is using the soldering iron to completely heat *both* parts before applying the solder. Apply a little flux to the end of the pushrod and insert it into the barrel of the R/C solder link about 3/8" of an inch - no further. Use a weight or a clamp to hold the parts in this position. Apply another drop or two of flux to the front and rear of link's barrel and place the soldering iron onto the solder link, keeping it there until the flux boils. Apply a little solder to the solder link, allowing it to flow into the barrel. When the joint looks neat, remove the soldering iron and allow the assembly to cool. Clean the joint with a rag and fresh water to remove all excess flux. Prepare both aileron pushrods in this manner.

❑ 9) Use two pieces of masking tape to secure each end of the ailerons to the wing panels, holding them in "neutral" position. Prepare the two nylon control horns by first drilling out the two mounting holes in the base with a 3/32" dia. bit. This allows the #3 mounting screws to pass more freely.

Connect the aileron pushrod to the servo output arm, using the solder link. Connect the 4-40 R/C link to the nylon control horn, using the 2nd hole from the end. Thread the R/C link onto the pushrod wire until threads show through the R/C link. Place the base of the nylon control horn onto the front edge of the aileron, with the pushrod wire visually aligned in parallel with the wing ribs. The correct mounting location for the control horn is with the front edge of its base lined up with the edge of the aileron. Thread the R/C link in or out on the pushrod threads until the base of the control horn is in the correct position, sitting flat on the aileron.

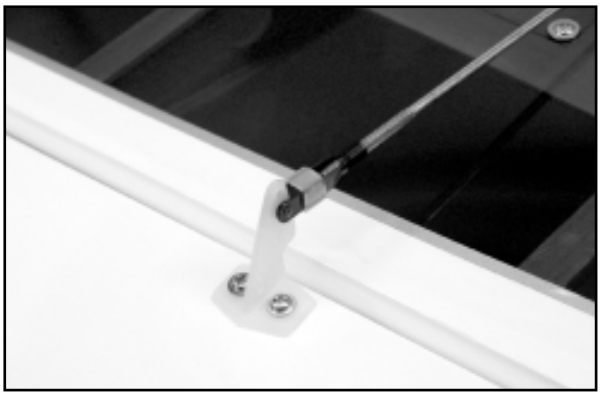


Once in position, use a pointed object to mark the control horn's two mounting hole locations into the aileron. Rotate the pushrod out of the way and use a 1/16" dia. bit to drill two holes - about 1/2" deep - into the aileron at the marks just made. Remove the control horn from the R/C link and use two #3 x 12mm PWA screws to mount the control horn securely to the aileron.



Re-connect the R/C link to the control horn and remove the two pieces of tape holding the aileron in neutral to the wing panel. Plug the aileron servo into one of the leads in the Y-harness and turn on the radio system. Make sure the aileron trim lever is set at neutral on the transmitter. Now, use the transmitter to check the aileron for neutral. Adjust the R/C link as needed for neutral and test the action of the aileron with the transmitter. The action should be smooth with good centering back to neutral. Also again, check that the aileron is moving in the proper direction for "right" and "left" aileron commands from the transmitter. If necessary, reverse the aileron direction from your transmitter and re-adjust the R/C link to the control horn as required. Repeat this procedure with the remaining wing panel and aileron.

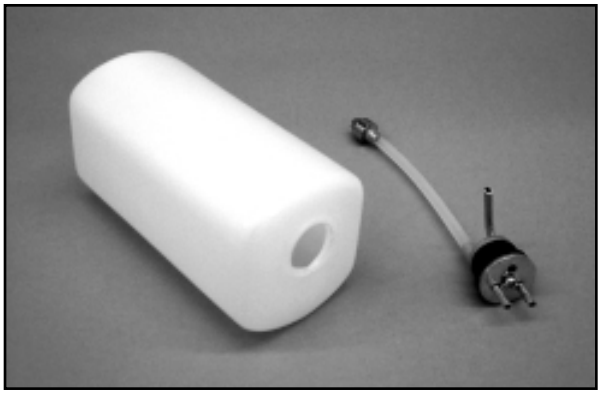
With the aileron servos installed, centered, and all adjustments made to the linkages, it's good practice to secure the R/C links to the control horns and servo output arms. Cut four short lengths - about 1/4" or so - of medium fuel tubing. Slip a piece of tubing over each R/C link, onto the two arms. Re-attach the R/C link to the control horn and output arm and then, slide the tubing forward to the connection. This ensures that the R/C links cannot be easily dislodged from these important linkages.



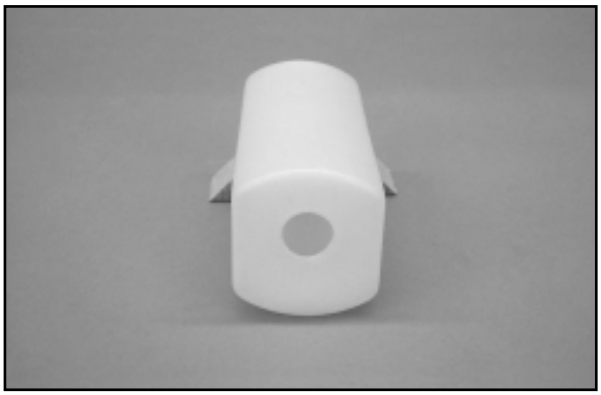
With the exception of the decals, the wings are now complete and ready to use. Set them aside for now.

FUEL TANK ASSEMBLY:

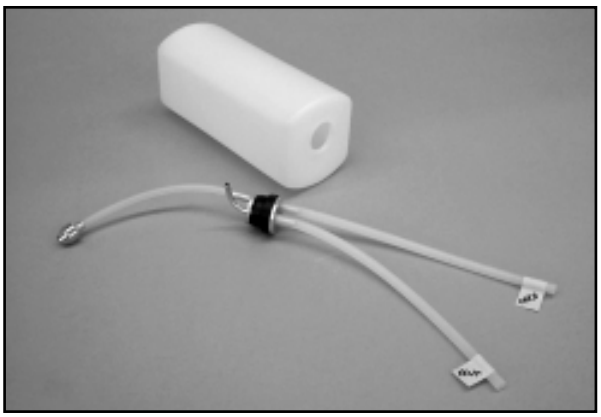
From the kit contents, locate the Fuel Tank Assembly bag. The 450cc (15.2 oz.) fuel tank will now be assembled. We suggest using a simple two-line fuel delivery system in this airplane. One fuel line is connected to the fuel pick-up or "clunk" line and the engine's carburetor. If you are not using a fueling valve, this same line is used to fill the tank. The second fuel line is the overflow line for use when filling the tank. After filling the tank, this same fuel line is then connected to the engine's muffler pressure nipple to provide manifold pressure to the tank. Note that the rubber stopper for the tank has two holes all the way through it. Use these two holes for the two aluminum fuel lines.



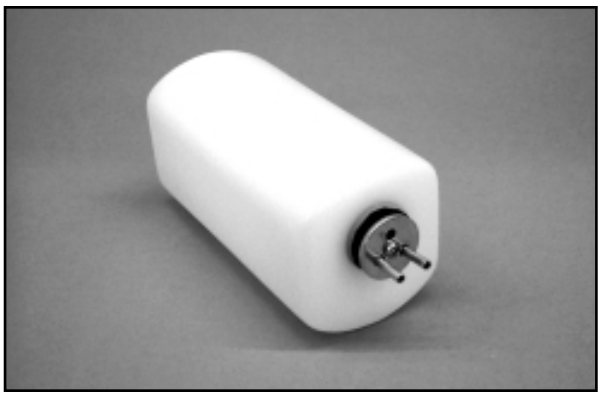
Also, note that the correct position for the fuel tank, mounted inside of the fuselage, is with the off-center stopper hole toward the top.



Gently bend the aluminum overflow tube upward to just reach, (but not touch), the top of the tank on the inside. Adjust the length of the internal silicon tubing to allow free movement of the fuel pick-up weight inside the tank, at its rear. Insert the stopper assembly into the neck of the tank, firmly seating the stopper. Slip short lengths of silicon fuel tubing over the two exposed aluminum fuel lines and identify each of them as "vent" and "carb" with small pieces of tape. This helps later when connecting the fuel lines to the proper locations.



Secure the stopper assembly in the tank by tightening the compression bolt in the center of the stopper assembly. Tighten this bolt firmly, causing the rubber stopper to expand in the tank's hole, creating a secure seal around the neck of the tank.



FUEL TANK FOR GASOLINE ENGINES:

If you plan to use a gasoline engine in your Rascal 110, then you must assemble your fuel tank, using gas compatible parts.

Because gasoline attacks and destroys the typical silicon fuel tubing used for glow engines, as well as the rubber stoppers used in most R/C fuel tanks, these items must be replaced with gasoline-compatible parts. Sullivan Products makes a neat "Gasoline/Diesel" Fuel Tank Conversion Kit (P/N #484) for this very purpose. This little package includes a gas compatible stopper, Tygon fuel pick-up tubing and molded nylon front and rear compression plates. Du-Bro Products, also, makes a replacement tank stopper for gasoline use (P/N #400) and Tygon fuel line (P/N #799). Note that the Rascal 110 fuel tank is usable with either the Sullivan or Du-Bro replacement stoppers. Remember to use only gas-compatible fuel tubing for gasoline engines, such as Tygon - sold by both Du-Bro and Sullivan.

The fuel tank body itself is gas compatible and can be assembled in the same way as described earlier, using a replacement gas stopper and Tygon fuel lines.

ENGINE AND FUEL TANK INSTALLATION:

This assembly phase requires some custom installation work, based on the particular engine size and type that you've chosen for your Rascal 110. Note that the fuselage has been built with the correct right and down thrust adjustments already incorporated into the firewall. These are:

2°	Right Thrust
2.5°	Down Thrust

In addition, true vertical and horizontal centerlines, for placement of the engine motor mounts, are marked on the firewall. Centering your engine, using these locators, allows the cowl to fit almost perfectly at the front. Note that the vertical centerline is off-center to the left, allowing for the built-in right thrust. Of course, some "fudging" with the center lines can be done to fit your engine, as long as it's not excessive.

The following engine installation instructions will cover both 4-stroke and gasoline engines. Installing a 2-stroke glow engine in this model is similar in concept to the installation of 4-strokes, with the only real differences being the location of the throttle pushrod and the many choices for mufflers. Because it's impossible to cover every engine that might fit into these three groups, you will have to decide for yourself if your particular engine is suitable for this model and if it can be made to fit.

Mufflers must also be considered for any engine installation. The different types, sizes, and configurations of commercially available mufflers is huge. In the Rascal 110, the most ideal choice for an engine/muffler set-up would be an inverted engine with a Pitts-style muffler system. This keeps the nose "clean" with only the bottom of the cowl having to be opened for cooling. Some

modelers may disagree and feel that a side mounted, or even an upright engine installation would be preferable. For this reason, the Rascal 110 fuselage comes with a clean firewall, without any pre-drilled motor-mount holes. This allows you to choose the best engine and muffler installation for your airplane.

Obviously, whatever engine you use, it must be able to fit within the cowl and must have a mounting base, (motor mount), "footprint" that will fit onto the firewall. To assist you in planning for your choice of engine and its installation, the following photos and dimensions may be helpful.

Photo #1 shows a cut-away cowl mounted to the fuselage. As you can see, there is a maximum distance of about 6" from the front face of the firewall to the front edge of the cowl. This means that the combined distance from the back surface of the motor mounts to the backplate surface of the spinner can be as far as 5-7/8", still leaving a 1/8" gap between the front of the cowl and the back of the spinner.

Photo #1

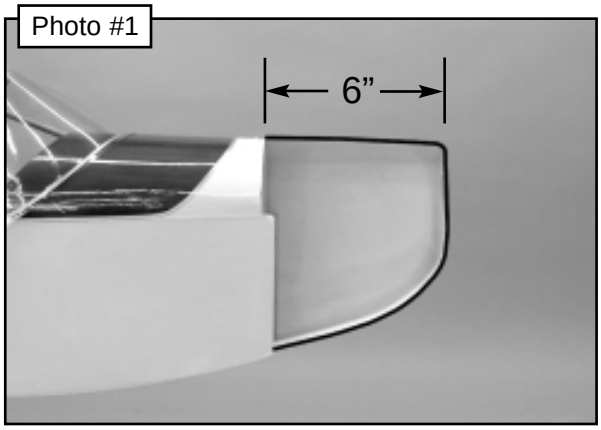


Photo #2 shows a side view of the fuselage with two vertical reference lines drawn on its side, just behind the firewall location. These two lines represent the furthest forward that the cowl can be mounted (the forward line) and the furthest back it can be mounted (the rear line). As you can see, the cowl can be positioned, front to rear, by as much as 1/2".

Photo #2

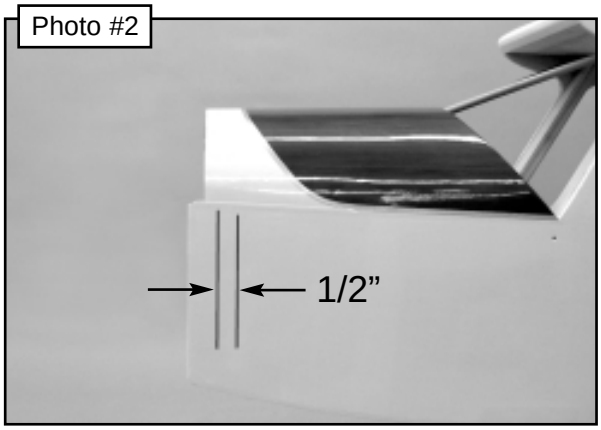
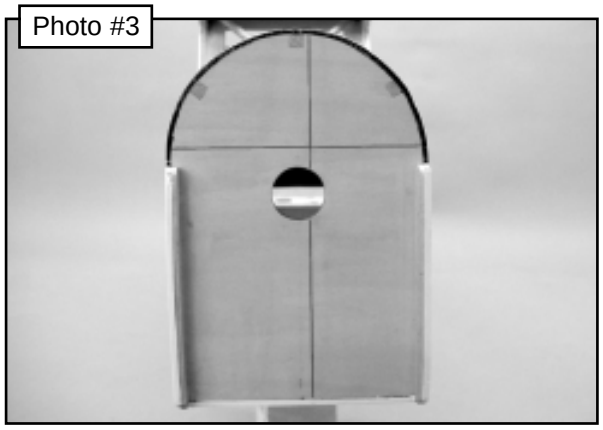


Photo #3 shows the front face of the firewall with the vertical and horizontal centerlines. These two lines represent the correct centered position of your engine when it is mounted to the firewall. These lines are to be used for measurement reference.

Photo #3



IMPORTANT NOTES:

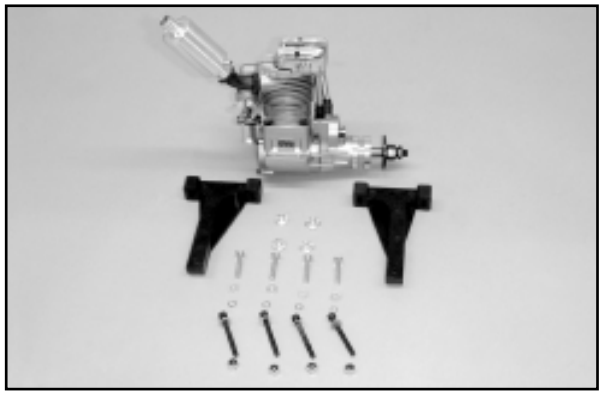
1) The motor mounts provided with the Rascal 110 ARF kit are of excellent quality and designed to work well with 2-stroke engines up to 1.20 displacement and 4-stroke engines up to 1.50 displacement. **DO NOT** use any engine larger than these with these motor mounts. Replace the mounts with engine mounts designed specifically for larger engines.

2) **DO NOT** mount your engine on these motor mounts by drilling and tapping them for bolts or screws! These mounts should be drilled for *clearance* of the engine mounting bolts and the engine secured to the mount arms with bolts, washers, and lock nuts. Tapping threads into these motor mount arms may weaken them, potentially causing them to fail.

4-STROKE ENGINES:

The following steps will show the installation of a Saito 1.50 four-cycle engine. The engine will be mounted in the inverted position. To make the initial fitting of the engine to the mounts more convenient, remove the muffler and header pipe for now. We also suggest that you remove the screws holding the windshield in place to the fuselage and set these parts aside for now.

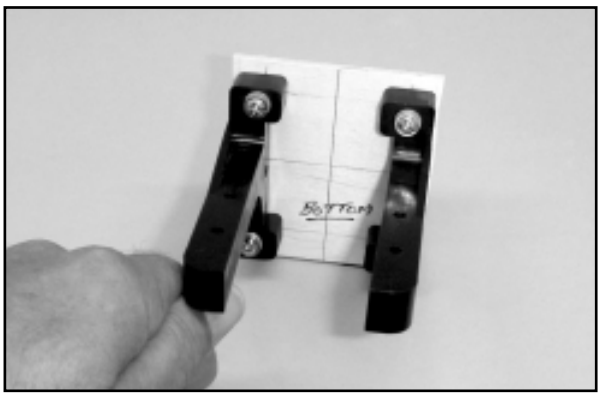
❑ 1) From the kit contents, locate the Motor Mount Assembly bag. In addition, you will need the engine mounting bolts (not included) for your particular engine. In the case of the Saito 1.50, we used 8-32 Allen Head bolts with 8-32 lock nuts for this purpose.



The first step is to properly mount the engine itself to the motor mount arms. A very easy and accurate way to do this is to temporarily mount the two motor mount arms onto a scrap piece of 1/4" plywood, with the correct spacing for your engine. Doing this ensures that the back faces of both mounts are truly flat in

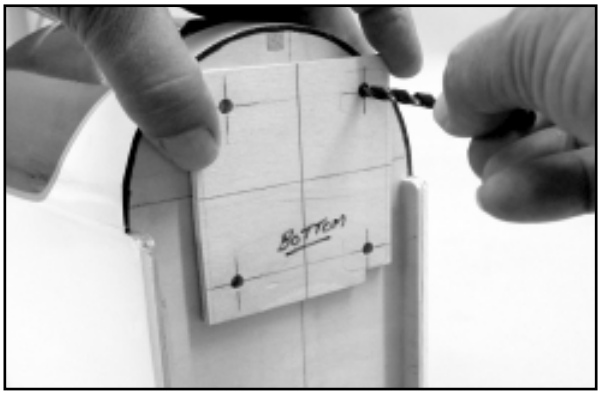
relationship to each other and the engine, when it is eventually mounted in place to the firewall.

Prepare the scrap piece of plywood with accurate horizontal and vertical centerlines, using a pencil and a triangle. Next, measure the width of your engine case and draw those locations onto the scrap piece of wood, using the centerline for the measurements. Note that the two motor mount arms have oblong mounting holes. This allows you to move either one or both of the arms left or right as needed. When drilling the mounting holes, use the center of the oblong holes to allow a little movement in either direction. Drill the four motor mount holes through the plywood, using a 3/16" dia. bit. Install the motor mount arms to the piece of plywood, using the blind nuts, bolts and washers provided. Just hand-tighten the bolts enough to hold the arms in place.

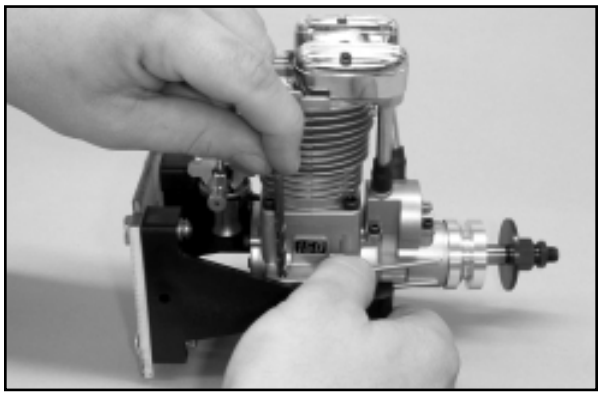


Slide the motor mount arms left or right to align them accurately to each side of the vertical centerline. Once in position, use a screwdriver to temporarily tighten the bolts just enough to lock the arms in place. Place the engine onto the motor mount arms. Using a ruler, adjust the engine on the mounts to locate the face of its prop hub at 5-15/16" from the face of the scrap piece of plywood. Hold the engine in this position and use a drill bit in each of the engine's mounting lug holes, marking their centered positions onto the motor mount arms. Remove the engine and remove the motor mount arms from the piece of plywood.

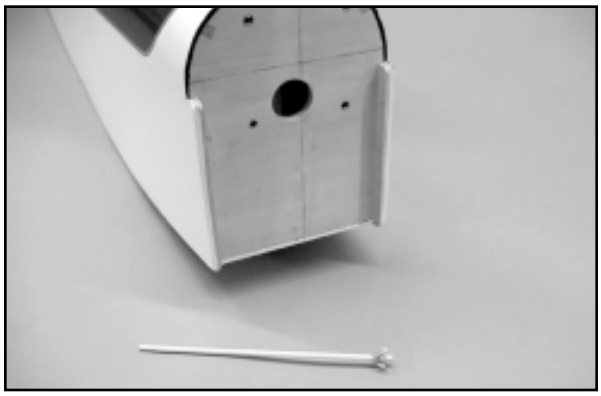
❑ 2) The bolt holes are now drilled through the two motor mount arms. These four holes should be *clearance* holes for the bolts you intend to use. For example, using the Saito 1.50 engine shown here, we used 8-32 x 1-1/2" socket head bolts. For 8-32 bolts, we used a #19 (.166) bit to drill the proper clearance holes. If you are careful, it may be possible to drill these holes by hand. However, we suggest using a drill press to ensure that these holes are correctly placed and drilled truly perpendicular to the motor mount arms.



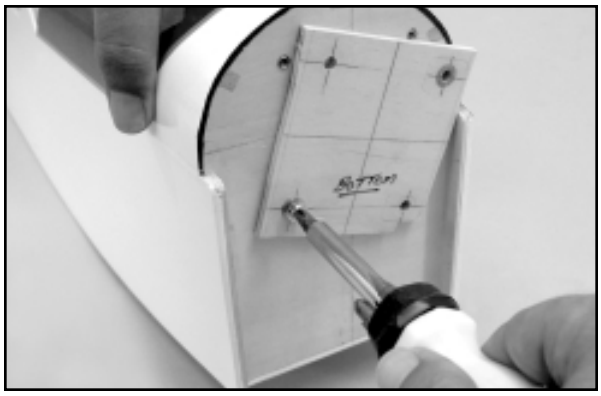
❑ 3) The scrap piece of plywood used to mount the engine has now become a pattern that is used to accurately locate the four required mounting holes onto the firewall. Hold the pattern against the firewall and line-up its horizontal and vertical centerlines with those on the firewall. Hold the pattern in place and use a 3/16" dia. bit, twisting it a few times, marking the four hole locations onto the firewall. Remove the pattern and use the same bit and a power drill to make the four holes through the firewall, at the marks just made.



❑ 4) The four M4 Blind Mounting Nuts are now installed into the backside of the firewall. To do this, you will have to reach into the nose compartment, through the top of the fuselage, using your fingers to feel for the hole. This can be made a lot easier by inserting a length of 1/8" dowel (7" or 8") through the hole from the firewall side. When you can see the end of the dowel in the fuselage, slip one of the blind nuts onto to it and then, pull the dowel back out of the hole while holding the nut on the dowel from the inside. This will locate the blind nut to the back side of the hole every time.



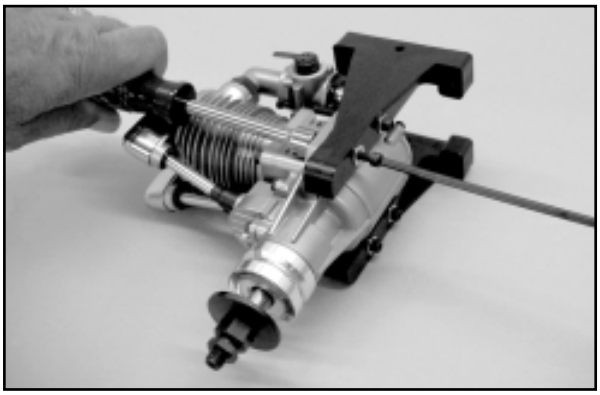
Hold the nut against the firewall with your finger and use one of the M4 bolts to engage its threads from the front of the firewall. Thread the bolt all the way in place. Use a screwdriver to tighten the bolt, "pulling" the barrel of the blind nut fully into the back side of the firewall, (we ran our bolts through the holes in the plywood pattern



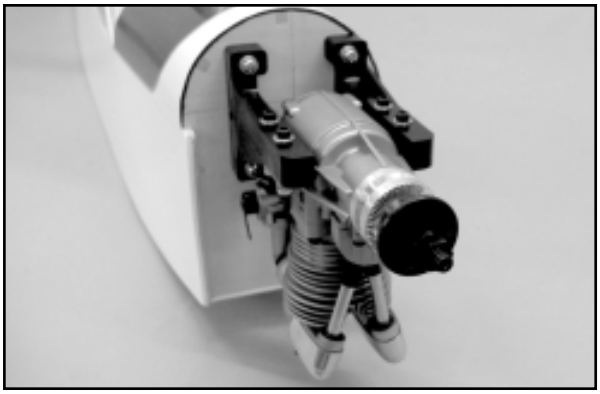
first in order to avoid "dimpling" the face of the firewall with the bolt head).

If desired, the blind mounting nuts can be permanently adhered to the backside of the firewall by using a little 5-minute epoxy on your finger to spread the glue around the outside edges of each nut. **Do not** get glue into the threaded centers.

❑ 5) Temporarily mount the engine to the two motor mount arms, using your own hardware (again, we suggest socket head hardened steel bolts with lock nuts, as shown). Because the engine will have to be removed in the following steps, don't tighten the bolts yet - just enough to get the engine sitting firmly in place on the motor mount arms.



Apply a little threadlock compound to each of the M4 x 25mm mounting bolts. Slip a split ring washer and a M4 washer onto each bolt. Hold the engine/motor mount assembly in place to the firewall and install each bolt in place to hold the assembly to the firewall. Allow enough play in the bolts to be able to slide the motor mount arms left or right, as needed, to center the motor mount bases to the firewall. When everything looks about right, firmly tighten the bolts.

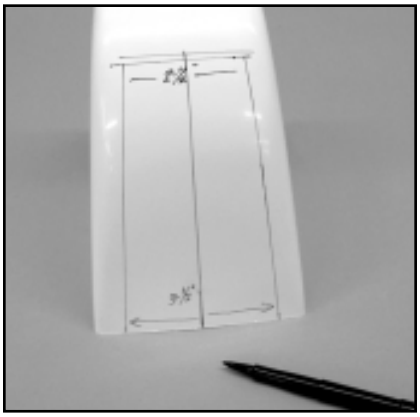


TOOLS 101:
We've all heard stories about "inferior foreign metric hardware". Unfortunately, much of this bias tends to come from individuals who use the wrong tools to do the job! For example, there are many types of Phillips screwdriver bits. Use too small of a screwdriver bit in a Phillips head bolt and you will almost always roach out the head. When working with Phillips head hardware, choose a screwdriver that completely fits and fills the Phillips head openings. Likewise, oversized screwdriver bits will also ruin the bolt head. Choose your tools with care, and use them the way they were intended.

❑ 6) From the kit contents, locate the bag containing the Fiberglass Cowl and mounting screws. The cowl is now prepared to fit in place over the engine and onto the cowl. In the case of our inverted engine, this requires that the bottom of the cowl be opened to clear the engine head and to provide adequate cooling. Always remember to wear a face mask and eye protection when working with and cutting fiberglass parts.

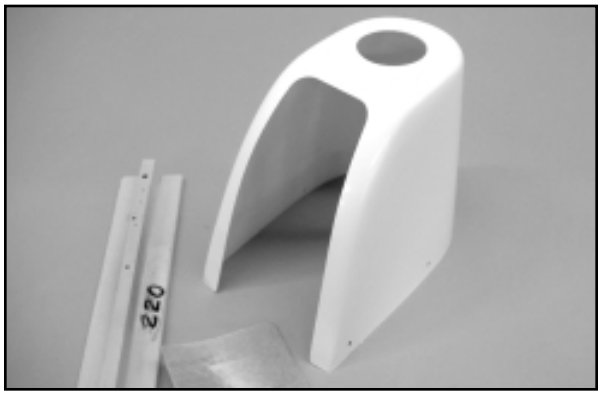
Begin by placing the cowl on a flat surface, with the nose up. Use a ruler and a pencil or non-permanent marker pen to place a mark at the bottom center. Use a 90° triangle to then make a vertical line straight up the middle of the cowl bottom. This line becomes the reference line for the required opening.

Since the overall width of the Saito 1.50, at the head, is about 2-1/4", we know that the opening must be at least that wide. When creating this opening, the idea is to neatly expose as much cooling air to the cylinder head as possible. As shown, we used a width of 3-1/2" at the back of the cowl, tapering up to 2-1/2" wide at the top of the opening. After making the measurements, connect the marks with a non-permanent pen and a flexible straight edge, such as a strip of balsa. At the top of the opening there are two corners. Use a circle guide to draw radiuses at these two corners.



With the outline of the opening now drawn onto the cowl, the actual opening is now made. To do this neatly and quickly, we suggest using a Dremel® Tool. Start with a carbide cut-off wheel to first remove the major piece of fiberglass within the outline.

Follow this by using a drum-sanding bit to smooth the edges and contour the corner radiuses. Be careful to keep the edges as smooth and uniform as possible, using the lines as a guide. Use a sanding block with 220-grit paper to sand the straight edges smooth. Finally, use a piece of 220 sandpaper to lightly sand all of the edges, making them completely smooth. Clean the cowl, removing all dust and wipe off any remaining ink lines with alcohol.



The cowl should now be able to fit over the engine and onto the front of the fuselage.

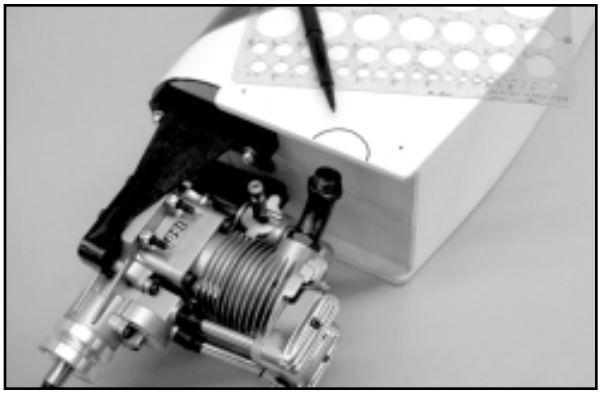
❑ 7) The cowl can now be mounted to the fuselage. To do this as accurately as possible, it is helpful to have the spinner backplate in position on the engine. From the kit contents, locate the bag containing the Spinner Assembly. Remove the spinner backplate and the four, molded shaft adapter rings from the package. The center hole in backplate can be shimmed to fit many engine prop shafts. However, our Saito 1.50 has a very large shaft diameter - even larger than the hole in the backplate. This requires that the hole be opened up with a drill to fit on the shaft. To do this accurately, we used a drill press. Once the backplate fits onto the engine, the cowl can be mounted.

Slide the cowl in place over the fuselage and then, place the backplate onto the engine prop shaft. This gives you good visual reference for centering the cowl to the spinner. We suggest leaving a gap of anywhere from 1/8" - 1/4" between the front of the cowl and the backplate. Hold the cowl tightly in position and use a non-permanent marker pen or pointed punch to mark the four mounting hole locations on the fuselage sides, through the pre-drilled holes in the cowl. Remove the cowl.

Use a 1/16" dia. bit to drill guide holes into the fuselage, about 1/4" deep. Use the four #3 x 10mm PWA screws to mount the cowl to the fuselage. Do not over-tighten these screws at this time. Remove the screws and the cowl, for now.

❑ 8) The cowl is now prepared to clear the engine muffler. As mentioned earlier, R/C engine muffler shapes and types are all different and therefore, each engine/muffler installation tends to be one of a kind. For example, our Saito 1.50 has a muffler manifold shape and location that does not allow the muffler to exit the cowl without interfering with the front of the fuselage. This fact means that a small part of the front of the fuselage must be relieved to allow muffler clearance. A flexible manifold tube and a Pitts-style muffler may work to eliminate this issue but we chose to work with the stock engine set-up. Here's how we did it.

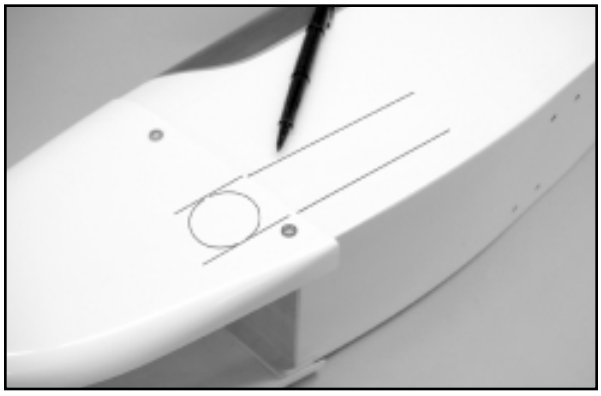
With the engine in place on the mounts, lay the fuselage on its side, manifold side up. Rotate the manifold on the engine head to find the location on the fuselage that will require the least amount of relief to allow the muffler to be mounted. In our case, this was the lower, left side. Use a circle guide to determine the diameter of the muffler (our Saito muffler measured just about 1-1/8" in diameter). We used a non-permanent marker pen to mark the fuselage with the approximate exit location for the muffler body, using the next size up circle guide diameter - 1-1/4". This partial circle mark becomes the guide for the initial relief of the fuselage for muffler clearance.



Remove the engine from the motor mounts. Use a hobby knife and #11 blade to cut away the covering material within the area to be sanded. We used a scrap length of 1-1/4" dowel (aluminum tubing or a scrap piece of pipe would also work just as well) and wrapped it with 80 grit sandpaper. We, then, sanded the required channel, at the same approximate angle that the muffler would sit on the engine. Believe it or not, we sanded this relief channel perfectly the first time! The channel was approximately 1/8" larger in diameter than the muffler body, which is just about perfect for clearance. Place the engine, with the manifold and muffler loosely in place, back on the mounts to check your work. Make any adjustments needed to improve the channel. When it looks right, remove the engine and lightly sand the finished channel with 220 sandpaper.

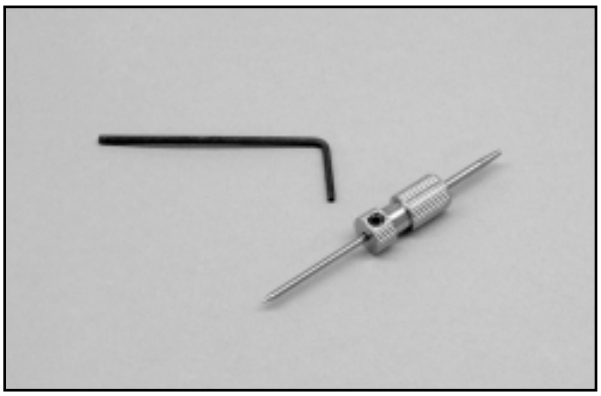
The open wood in the channel needs to be filled and fuel proofed. Use a little 5-minute epoxy to do this, smoothing it with your finger. When the glue sets, sand it smooth with 220 sandpaper.

❑ 9) The fiberglass cowl must now be relieved to match the muffler exit channel in the fuselage. To do this accurately, draw two parallel "witness" lines onto the fuselage side with a non-permanent marker pen. The top line is the top of the channel and the bottom line is the bottom of the channel. Mount the cowl to the fuselage and use a straight edge to transfer the witness lines onto the cowl. With the cowl still in place, use a flashlight illuminate the inside of the cowl at the sanded groove area. This will show the outline of the channel on the cowl. Use the marker pen to lightly outline the edge of the channel. Use a circle guide to complete the circle onto the cowl and remove it from the fuselage.



Use a Dremel® Tool with a drum-sanding bit to clear out the cowl, within the marks just made. Continue to trial fit the cowl in place to the fuselage, refining the cowl opening until it fits in place with a uniform 1/8" of clearance all the way around the muffler. With the openings made, use a wrench to tighten the manifold nut, securing the manifold in final position to the engine head. Likewise, tighten the muffler nut, locking it in place to the manifold.

❑ 10) A music wire needle valve extension is now made to allow adjustment of the high-end needle from outside the cowl. Most engines come with needle valves that have set screws, used for this purpose. The Saito has such a setscrew, with a center hole diameter for the extension that's just about 1/16". We put a short length of 1/16" dia. music wire into the needle valve hole and tightened the setscrew. The needle valve is then threaded back in place onto the carburetor, all the way. Place a straight edge against the fuselage side at the nose, intersecting the piece of wire. Mark this point on the wire with a marker pen. Remove the needle valve and wire from the engine and remove the wire from the needle valve. Cut the wire to length at the mark just made. Sharpen one end of this wire to a point, using a Dremel® Tool and a carbide cut-off wheel. Insert the unsharpened end of the wire back into the needle valve and tighten the setscrew.



Thread the needle valve back onto the carburetor, all the way. Mount the cowl to the fuselage. Turn the fuselage upside down on your work surface. Use a pair of needle nose pliers or a hemostat to begin unthreading the needle valve. As the needle turns, the sharpened point on the wire will contact the inside of the cowl. Hold a scrap piece of plywood against the outside of the cowl, over the pointed wire, and continue unthreading the needle valve. Within a few turns, the wire point will begin to show on the outside of the cowl, as a dimple. When you can see this mark, stop turning the needle and remove the cowl. Use a 3/32" dia. bit to drill a hole through the cowl at the dimple mark. Remove and discard the pointed piece of music wire from the needle valve. Make sure the needle valve set screw is aligned to allow access to it when the cowl is in place.

Cut a new length of 1/16" music wire, about 4" long. Put the cowl back on the fuselage and insert one end of the wire through the cowl and into the hole in the needle valve. Tighten the setscrew enough to hold the wire. Use a marker pen to mark the wire, outside of the cowl, about 1/8" away from its surface. Remove the wire from the needle valve and cowl. Use pliers to make a 90° bend at the mark just made. Trim the excess wire from the bent

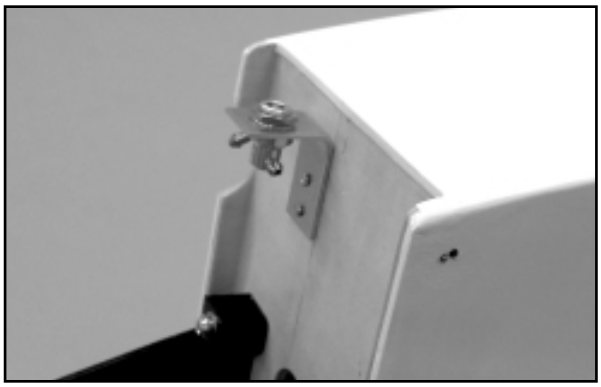
end, leaving about 3/8". Insert the wire back into the cowl and needle valve and tighten the setscrew. You should now have a neat looking, perfectly aligned needle valve extension.

OPTIONAL:

❑ 11) Because of the inverted position of the engine in our Rascal 110, we wanted to make the fueling and de-fueling process as simple as possible. The installation and use of a fueling valve completely solves all these issues. To do this on our Rascal 110 models, we installed a Du-Bro #334 Kwik-Fill Fueling Valve (the #334 valve is for use with glow fuel) onto the firewall in the engine compartment. **DO NOT** mount the fueling valve directly to the fiberglass cowl. Doing so will ultimately cause damage to the fiberglass.

To make the mounting and positioning of the fueling valve easy, we have included a SIG Fueling Valve Mounting Bracket part (#SIGSH759) in your kit. This bracket allows the Du-Bro valve to be mounted anywhere on the firewall that is most convenient for your particular engine installation. This fueling system has proven to be convenient and simple and only requires the two basic tank fuel lines to function.

We mounted our fueling valve on the firewall, pointed straight down through the bottom cowl opening. ***Be sure to locate the bracket far enough off center on the firewall to allow your glow driver to fit onto the glowplug.*** Mounting the bracket in this position eliminates the need for another hole in the cowl and hides it from view.

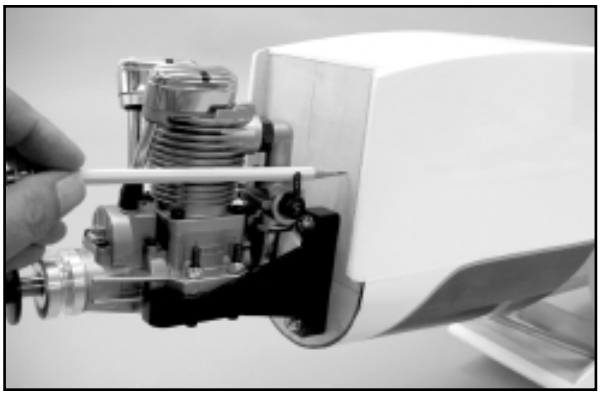


DETAILS, DETAILS.....

We wanted to provide our cowl with a few simple surface details to make it more believable. We decided to add a few "panel" lines and some rivets to add the detail we were looking for. To do this we first carefully wet-sanded the entire cowl with #600 wet/dry sandpaper. After drying the cowl completely, we used 1/16" striping tape to create the panel lines and 1/4" wide striping tape to fashion the four "latches". We mixed some 5-minute epoxy and used the sharpened end of a dowel to add the rivets. To do this, lightly dip the dowel into the epoxy and place a single "dot" of glue in the desired location, repeating the process for the rest of the rivets.

After these details were added, we painted the cowl and even the mounting screws, using a good quality, fuel proof white paint. The paint makes the surface details stand out nicely and after drying, the cowl is ready to mount.

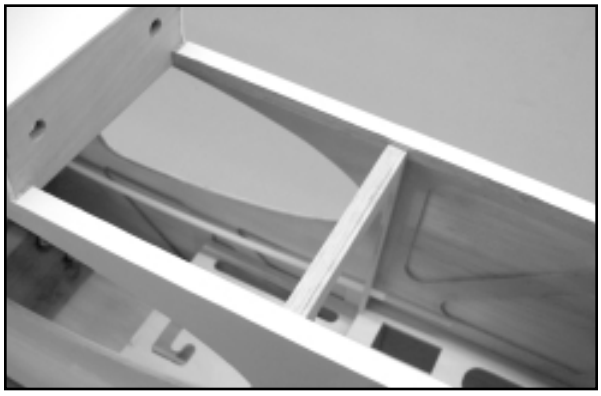
❑ 12) With the engine temporarily back on the mounts, the required hole for the throttle tube is marked onto the face of the



firewall. Visually line-up the throttle arm, at the point where it will be driven by the throttle pushrod, straight back to the firewall. Use a pencil to mark this location on the firewall.

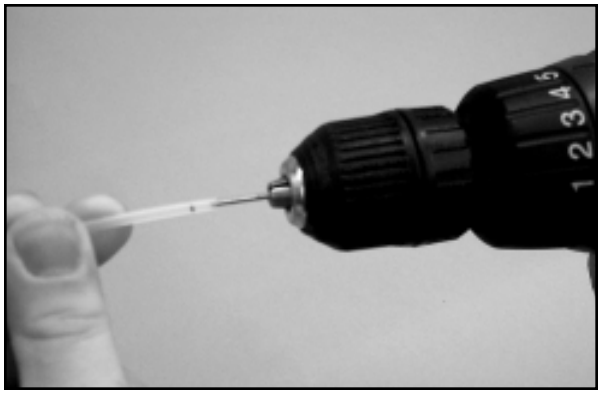
The throttle tube hole is easier to drill with the engine out of the way, so remove it from the mounts. Use a power drill with a 13/64" dia. bit to drill the hole through the firewall. From the kit contents, locate the Throttle Linkage bag. Remove the 5mm x 19-3/4" female throttle tube and the 3.4mm x 23-1/2" inner nylon throttle pushrod. The outer tube must now be inserted into the fuselage, through the hole in the firewall. It is then fed through the second pre-drilled hole in the first former, through the pre-drilled hole in the second tilted cabin former and finally, through the pre-drilled hole in the third cabin former and into the servo bay. These holes have been pre-drilled on *both* sides of the fuselage formers to accommodate different engines and carburetors.

To make this fairly easy, first feed the inner nylon throttle pushrod through these same holes, beginning in the servo bay. Feed the pushrod through each hole, reaching into the fuselage with your hand, guiding the pushrod through each hole. When the pushrod emerges from the firewall, slide the outer pushrod tube over it and begin feeding the tube back through the same holes. As you proceed, twist the tube with your fingers, helping it to center itself and pass through. When the end of the tube is into the servo bay, it's in place. Remove the inner pushrod tube.

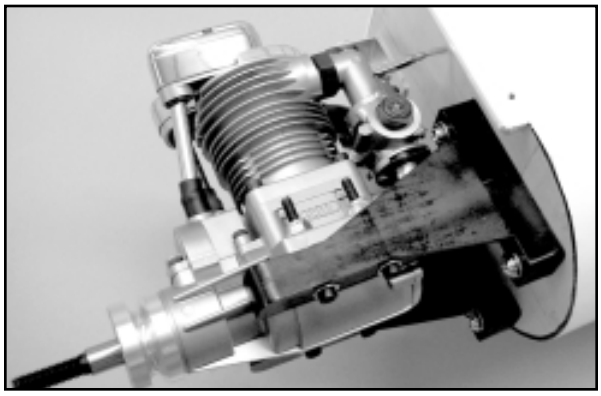


❑ 13) Four-stroke engines all have crankcase breather fittings. Our Saito has this nipple fitting in the rear of the crankcase. Attach a 7" or so length of fuel tubing to this fitting. Using your mounting hardware, mount the engine - with the muffler and manifold firmly in place - permanently to the motor mount arms.

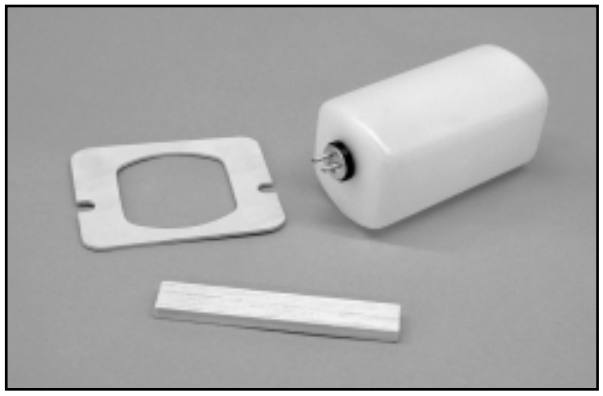
The inner throttle pushrod is now prepared for connection to the engine throttle arm. From the Throttle Linkage bag, locate one of the R/C links with an M2 x 22m stud threaded in place. Unthread the stud from the R/C link. The stud is now threaded into one end of the inner nylon throttle pushrod. A neat way to do this is to use an electric drill. Lightly chuck the stud about halfway into the drill and holding the nylon pushrod firmly, thread the stud in place with the drill - simple, neat, and quick!



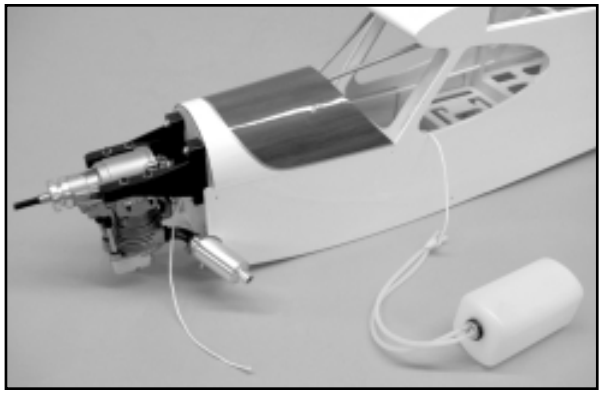
Thread the R/C link onto the end of the stud and insert the other end of the pushrod into the tube in the firewall. The connection can now be made to the throttle arm. The throttle arm location on our Saito was fairly close to the firewall which caused our linkage to be slightly too long. We solved this by cutting off a little (3/32" or so) of the threaded barrel at the rear of the R/C link, using a carbide cut off wheel. Leave the pushrod connected to the engine for now.



❑ 14) The assembled fuel tank is now installed. From the kit contents locate the Miscellaneous Wood Parts bag. For this step you will need the die-cut 1/8" lite-ply Rear Fuel Tank Former and the 5/16" x 3/4" x 5" balsa fuel tank retainer, as well as the fuel tank. In addition, have your fuel tubing ready and some silicon sealer.



Cut two 8" or so lengths of fuel tubing and place one length onto each of the two fuel tank lines. Fish a length of string through the round fuel tank hole in the firewall, through the tank compartment and into the cabin area. The string will be used to direct the tank and fuel tubing into the tank compartment. Tie the end of the

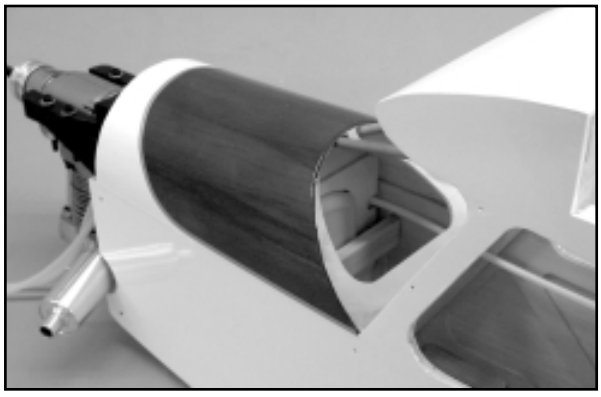


string at the cabin area firmly to the ends of the two fuel lines.

Apply a generous bead of silicon sealer around the neck of the fuel tank. Remember that the correct orientation of the fuel tank within the fuselage is with the neck of the tank "up" when viewed from the front. Insert the tank into the fuselage from the cabin area, lightly pulling the string from the front and guiding the tank into place from the rear. Pull the fuel lines through the hole in the firewall and press the tank firmly into the round hole. We used a scrap piece of sponge rubber to temporarily hold the tank in this position.

Apply a bead of glue (thick CA glue works well here) to each side of the 1/8" lite-ply fuel tank former, where it will contact the sides of the second fuselage former. Fit the former in place through the cabin and onto the rear of the fuel tank. Press it firmly against the fuselage former.

The 5/16" x 3/4" x 5" balsa tank retainer is now installed against the back of the tank, between the fuselage sides. Position the retainer piece squarely and apply a few drops of CA glue to hold it in place. If the tank should ever need to be removed, the retainer can be easily broken free allowing the tank to be slid back out. Remove the scrap piece of foam rubber supporting the tank and connect the fuel lines to the fueling valve and engine.



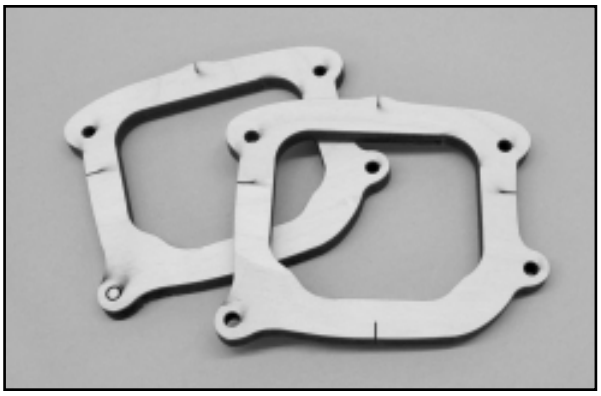
❑ 15) We made a simple thin sheet metal bracket to attach and direct the fuel tubing coming from the engine drain fitting, to the firewall. We left about 1/2" or so of this tubing hanging below the firewall. The four cowl mounting screw holes in the fuselage sides, at the nose, should now be "hardened". Place a couple of drops of thin CA glue into each screw hole. This hardens the threads and also, serves to make these holes fuel-resistant. The cowl will be final-mounted to the fuselage in the Spinner Assembly section.

This completes the installation of your 4-stroke engine. Skip the GASOLINE ENGINES section, moving to the FUSELAGE PREPARATION & SERVO INSTALLATION instructions.

GASOLINE ENGINES:

The Rascal 110 is a good subject for smaller gasoline engine power. There are several such engines on the market, including the RCS 1.40 and other similar sized motors. Keep in mind that there are some considerations when choosing a gas engine for this model. One of these is the required width of the mounting bolt pattern on the firewall and the firewall spacer needed to move the engine forward from the face of the firewall, toward the front of the cowl. Since it is likely a given that gasoline engines used in this model will be installed inverted, then another consideration is the engine's muffler. The ideal gas engine set-up would be an inverted installation with a Pitts-style muffler contained within the cowl.

The gas engine we used for our Rascal 110 is the new F.P.E. 1.3 with electronic ignition. This engine fulfilled all of our installation and mounting criteria, as well as having a nice Pitts-style muffler. This engine produces very good power, turning a 16 x 8 prop at 7400 rpm. This airplane/power combination has produced a consistently "fun" airplane to operate and fly. Making the use of this engine even easier is the fact that SIG produces laser-cut engine spacer/mounts that are ready to use. These are cut from rock-hard 1/4" plywood and the package contains two spacers. For our F.P.E. 1.3 installation, we needed 1" of spacing and therefore used four of these spacers. For reference, the part number for these spacers is SIGSH806.



Another important consideration, when setting up this or any gas engine powered model, is the adequate separation of the radio system components from the engine's ignition system components. The general rule of thumb states that there should be at least 12" of separation between these two systems. This means everything; switches, battery packs, all wiring, etc. The reason for this separation is that the engine's ignition system may "talk" to the radio system via RF (radio frequency) emissions, thus causing interference.

In the real world, 12" of separation may not always be possible. In our gas powered Rascal 110 models, we had no problem separating the two systems by 11-1/2" - the two closest components being the two switches (one for the ignition system and one for the radio system). This component separation, coupled with a good radio system and the engine's RF-suppression sparkplug, has made our Rascal 110's "glitch" free. For reference, we have always flown our gas powered Rascal 110 models with FM radio systems, with no problems. PCM radio systems are said to be more selective and therefore more resistant to RF emissions.

❑ 1) If you've chosen a different make of gas engine for your airplane, you'll first have to create a firewall spacer/mount from hardwood or 1/4" plywood. The engine needs to be mounted with

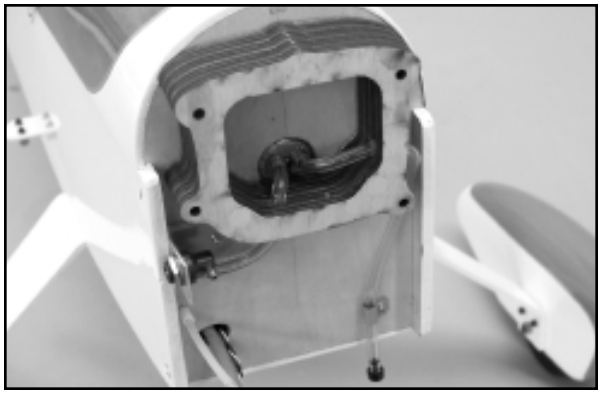
its propeller backplate at a distance of 5-15/16" from the front face of the firewall. This distance is required to mount the cowl and still have about 1/8" - 1/4" clearance between the back of the spinner and the front of the cowl. Most gas engines in the size range used on this airplane are shorter in overall length (including the muffler) than this figure. Therefore, you will need to carefully measure the length of your engine, from the face of its prop support, back to the rearmost part. The overall engine length is subtracted from the required 5-15/16" figure. The resulting number represents the distance that the engine must be spaced and mounted from the face of the firewall.

The simplest way to create a good spacer is to trace the outline of the engine's mounting backplate (including the mounting bolt locations) directly onto a piece of hardwood that is of the correct thickness. Using a jigsaw, this outline is cut out. Next, the spacer is drilled for clearance holes for the engine mounting bolts (for 8-32 bolts this would be an 11/64" drill bit). Since this spacer will cover the fuel tank neck at the firewall, a hole must be cut from the center of the spacer, taking out as much material as possible to clear the tank lines. The finished spacer is then epoxied to the firewall in the centered position, using the horizontal and vertical centerlines on the firewall for reference.

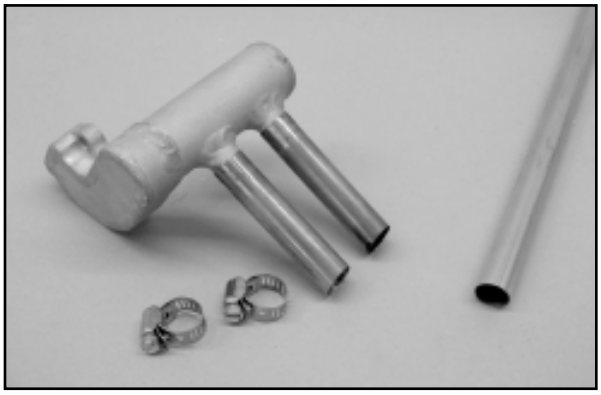
With the spacer now in place on the firewall, clearance holes for the engine mounting bolts are drilled through the firewall. The appropriate size blind mounting nuts are then installed into the back face of the firewall - in the case of our F.P.E. 1.3 engine, we used 8-32 hardware. These are installed using the same method as described earlier in Step #4, in the 4-STROKE ENGINE installation section.

❑ 2) The fuel tank, assembled using gas-compatible Tygon tubing for the fuel pick-up and a gas-compatible stopper, is now installed into the fuselage. The installation of the tank is covered in Step #14, in the 4-STROKE ENGINE section and is exactly the same for the gas version.

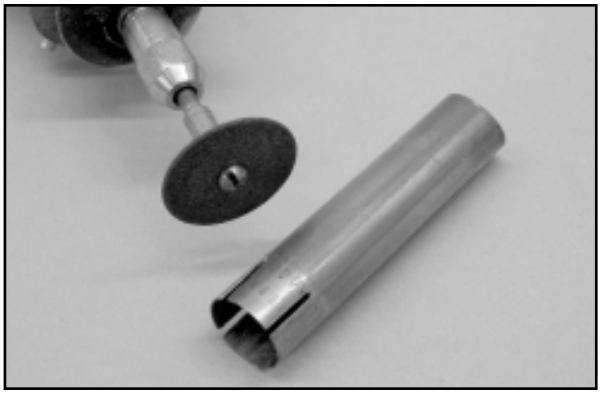
❑ 3) In order to route the two required fuel lines from the tank to the engine and fuel filling valve, two appropriate sized holes must be drilled through the sides of the wood engine spacer, at the correct locations. The fuel lines are then fitted onto the tank fuel tubes and routed out of the two holes. The "vent" or overflow line will hang straight down. We made a simple sheet metal bracket to anchor this line to the firewall, keeping it away from the muffler. The fuel pick-up line goes directly to the fuel valve.



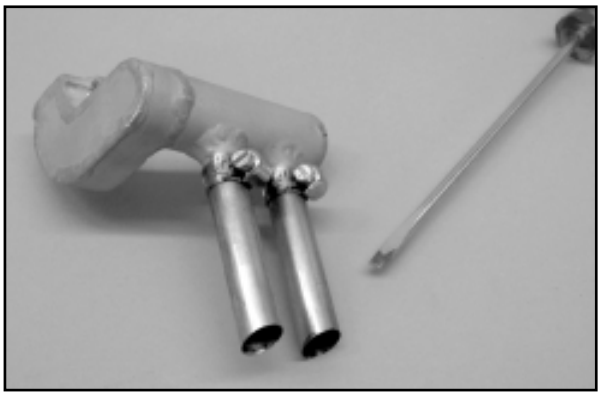
❑ 4) If your engine has a Pitt's style muffler, it will probably require exhaust extensions to clear the firewall at the bottom of the fuselage. In the case of our F.P.E. 1.3, we used two 2-1/2" lengths of K&S brass tubing, 17/32" in diameter (K&S #140). This tubing had the perfect inside diameter to slip over the F.P.E. Pitts muffler. We cut the exhaust end of each piece of tubing a slight angle to vector the exhaust towards the rear of the fuselage. To hold these two exhaust extensions in place, we used two small automotive type metal hose clamps.



In order to allow the exhaust extensions to be clamped in place, it is necessary to first "slice" them at one end, in four places. These slices are made with a Dremel® Tool and a carbide cut-off wheel. Make each slice about 3/8" deep.



Remove any burrs that may be in the way and slide the tubes - sliced ends first - onto the muffler's exhaust tubes. Position the tubes at the same length with each other and use the hose clamps to secure them firmly in place.



❑ 5) Our F.P.E. engine operates with an electronic ignition. This feature eliminates a great deal of bulk (weight) from its construction and makes for a much easier starting and smoother running engine. The ignition module is a small separate unit that must be installed in the nose of the fuselage, behind the firewall. It must be close enough to the engine to allow the wiring to reach. The module wiring consists of the spark plug lead, the ground wire, the electronic ignition module connection to the prop hub sensor, and the battery pack lead. The battery pack lead stays in

the fuselage and will be connected to a separate battery pack, used to power the system.

The most convenient location for this module in our Rascal 110 installation was at the lower right corner of the fuselage, just behind the firewall. We opened an oblong hole in the firewall at this location to route the wiring through to the engine. The ignition module is wrapped tightly in foam and wedged in place against the firewall, inside the nose.

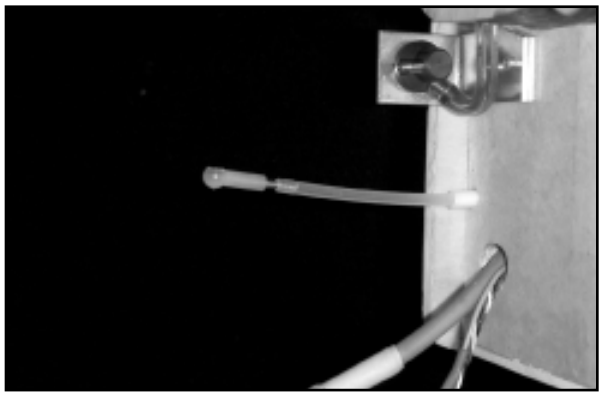
❑ 6) The engine, with the muffler in place, should now be ready to mount, using your own hardware. We suggest using hardened steel socket head bolts of the correct length with lock washers. In the case of our F.P.E. 1.3 engine, we used four 8-32 x 1-11/16" bolts. The bolts must be long enough to go through the blind mounting nuts, but no further. The bolt ends must not contact the fuel tank body. If your bolts are too long, use a carbide cut-off wheel to shorten them to the correct length. Mount the engine to the firewall, but do not tighten the bolts yet.

❑ 7) The throttle linkage is now assembled and installed. With gas engines, it is especially important to avoid any metal-to-metal connections. This is because such connections may cause unwanted RF (radio frequency) "noise". Such RF noise can interfere with the radio system. It is, therefore, important to use the provided nylon pushrod, with a nylon fitting at the engine's throttle arm. For this throttle arm connection, we recommend using a Du-Bro #181 2-56 Threaded Ball Link. This package contains everything needed to make the proper throttle pushrod connection to the engine. Most gas engines used for R/C model aircraft, are equipped with Walbro carburetors and most of these engines have the carburetor mounted to the side of the cylinder head, at non-linear angles. The ball-link throttle arm connection solves this problem.

If the throttle arm on your engine is spring loaded, either remove the spring or cut it from the throttle arm with wire cutters. Choose a location on the throttle arm that will best provide fore and aft linear movement from the servo. This is the location to mount the ball link fitting. Drill the throttle arm to accept the ball link and mount it in place. Note that some throttle arm locations and shapes may require an extension that must first be attached to the primary carburetor throttle arm. If this is the case with your engine, make and attach the extension with the ball link fitting in place.

Use a pencil to mark the firewall at the point where the throttle pushrod will be placed. Remove the engine from the firewall and use a 13/64" dia. drill bit to make a hole through the firewall at the mark just made. The nylon throttle pushrod housing tube is now installed. To do this, follow the instructions provided in Step 12 in the 4-Stroke Engine section to install this tube. After the outer pushrod housing tube is in place, remount the engine permanently in place to the firewall. Be sure to use thread lock compound on the bolt threads. Attach the wiring leads to the engine.

❑ 8) The inner nylon throttle pushrod is now prepared. Use a carbide cut-off wheel to remove the 2-56 x 3/8" threaded section of the Du-Bro brass coupler fitting. Chuck this threaded section into your power drill, leaving half of its length exposed, and thread it into one end of the nylon throttle tube. Thread the nylon ball link fitting onto the remainder of the exposed threads.

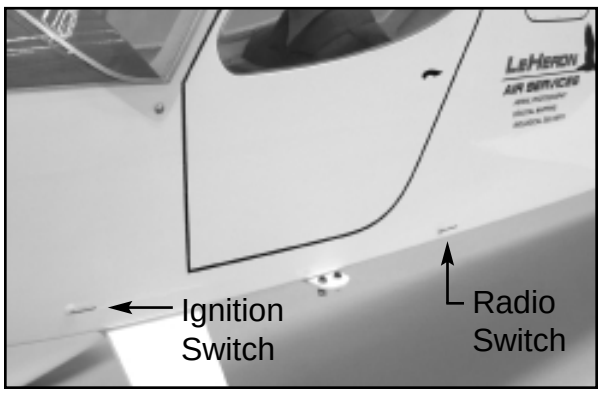


Insert the opposite end of the nylon pushrod into the female tube at the firewall and push it in place all the way back to the servo bay. Press the nylon ball link fitting onto the ball link on the carburetor throttle arm. The servo end of the pushrod will be prepared after the throttle servo is installed in the coming steps.

❑ 9) As mentioned earlier in the Fuel Tank Assembly steps, it is very convenient to install a fueling valve in this airplane. For gasoline engines, Du-Bro makes a very good fueling valve, Du-Bro P/N 335. This valve is easy to use and we have provided an aluminum bracket in your kit that will allow you to mount the valve directly to the firewall. In our gas powered Rascals, we mounted this valve on the right side of the firewall. Connect the Tygon fuel lines to the appropriate nipple fittings on the engine and it is ready to use.

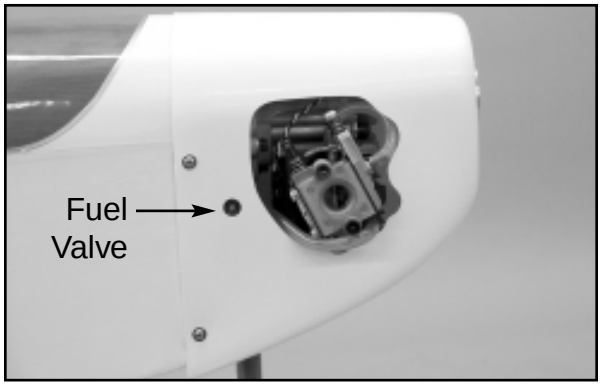
❑ 10) Gas engines with ignition systems require a separate battery pack to power the ignition module. In the case of our F.P.E. 1.3, we used the standard 4-cell 600maH battery pack that came with our radio system for this purpose. This battery pack provides about 1-1/2 hours of running time before needing recharging. We mounted our ignition battery pack in the nose of fuselage, beneath the fuel tank. We wrapped it in foam and wedged it firmly in place.

The ignition system must be able to be turned on and off as needed and this means that there must be a separate switch for this purpose. We used a standard radio system switch assembly, with a charging receptacle, for this purpose. We mounted this

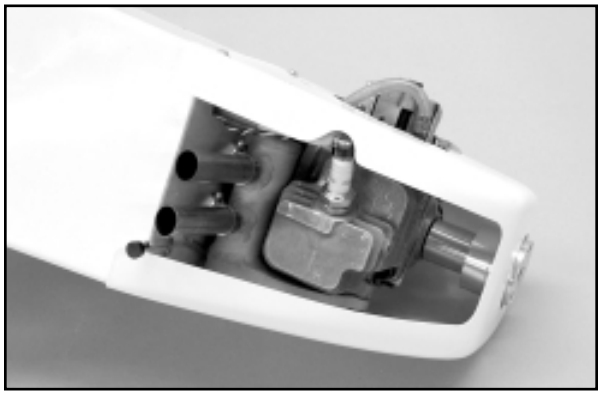


switch inside the fuselage, on the floor, just ahead of the landing gear block placing it far forward, away from the radio system. To activate the switch, we used a piece of music wire with an "L" bend, on the fuselage side. To do this like we did, refer to the Radio Installation section, Step #1.

❑ 11) The fiberglass cowl is prepared for mounting using the same methods described in Steps 7, 8, and 9 in the 4-Stroke Engines section of this manual. With most gas engines and their side-mounted carburetors, the cowl will have to be opened to clear this assembly. We, also, opened a small hole directly over the fuel valve to allow access with the fuel probe.



In the case of our F.P.E. 1.3 engine installation, we also had to relieve the bottom right edge of the cowl opening to clear the sparkplug wire.



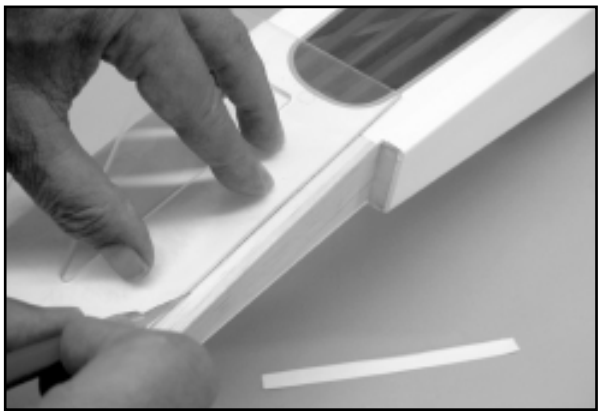
FUSELAGE PREPARATION & SERVO INSTALLATION:

In this section, the fuselage is prepared for mounting the tail group. The elevator, rudder, and throttle servos will also be installed. Because of the size of the airplane, it is much easier to take care of these steps now. From the kit contents, locate the bag containing the four factory covered Channeled Balsa Tail Fairings - you will need two of these for this section. Also, locate the bag containing the Control Surface Hardware Parts. From this bag remove the following:

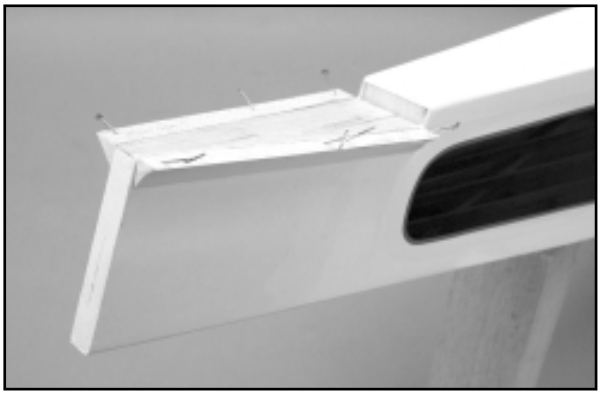
2 each	. 024" x 47-1/8" Plastic Coated Pull-Pull Steel Cables
2 each	Metal R/C Links, threaded onto brass pull-pull fittings
2 each	1.9mm dia. x 4.2mm Brass Pull-Pull Swaging Tube Fittings

In addition, the elevator, rudder, and throttle servos and the elevator servo extension cable will be used. You will also need the remaining R/C link and threaded metal stud.

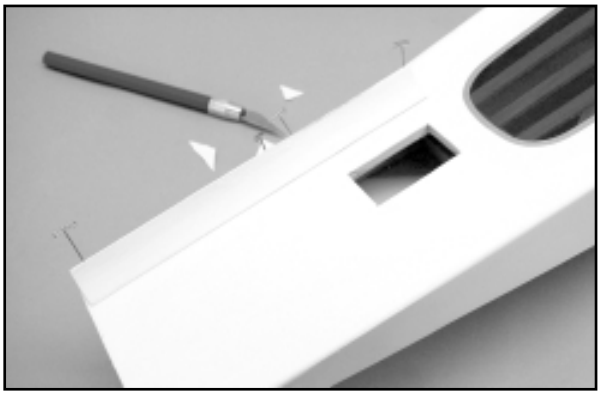
❑ 1) Two of the Channeled Balsa Tail Fairings are now glued in place at the fuselage stabilizer saddle, one on each side. These fairings add additional gluing area and support to the stabilizer saddle. To glue the fairings in place, prepare the fuselage sides by removing the covering material directly beneath the saddle area. This will be a strip that is 5/16" deep by the length of the fairing. Prepare both sides of the fuselage in this way.



Use 5-minute epoxy to glue the two fairings in place onto each fuselage side, flush with the top surface of the stabilizer saddle, as shown. Pin the fairings in place and allow the glue to cure.

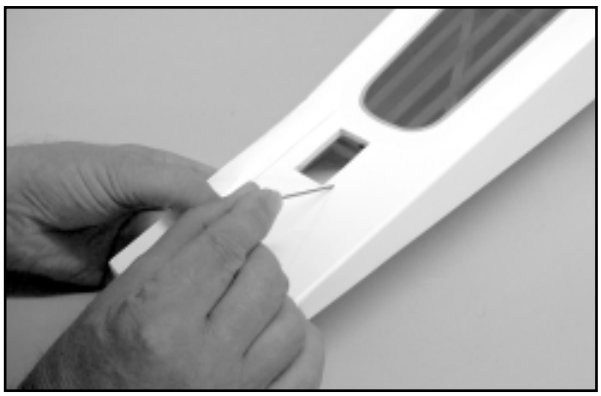


❑ 2) On the <u>right</u> fuselage side, directly beneath the stabilizer saddle, there is an opening for the elevator servo. The opening has been covered over at the factory and must now be opened. Use a hobby knife with a sharp #11 blade to do this now. Find each corner of the rectangular opening and cut the covering toward the center, leaving four covering "flaps". Use a small covering iron to seal the four sides of the opening and trim the excess material away.

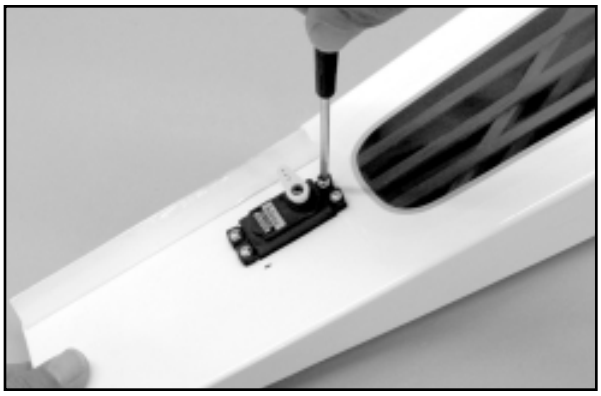


❑ 3) Looking inside the elevator servo opening, you will see the factory installed pull-pull exit tubes. These two exits are now opened on each side of the fuselage, as shown. After finding

these small openings on each side of the fuselage, puncture them with a pin. These two openings can be cleared using a hobby knife or a sharply pointed tool. We used a sharpened piece of 1/16" dia. music wire to complete the hole.



❑ 4) The elevator servo, with the extension cable attached, is now mounted into the rear of the fuselage. Install the rubber grommets and brass eyelets (supplied with your radio system) into the servo. Wrap the servo extension cable connection with tape before placing it in the fuselage. Insert the end of the cable into the elevator servo opening and fish it through the fuselage up to the servo compartment while placing the servo into its opening in the fuselage. The correct orientation for the servo is with its output arm toward the front of the fuselage, as shown. Mount the servo in place, using the four servo mounting screws that came with your radio system.

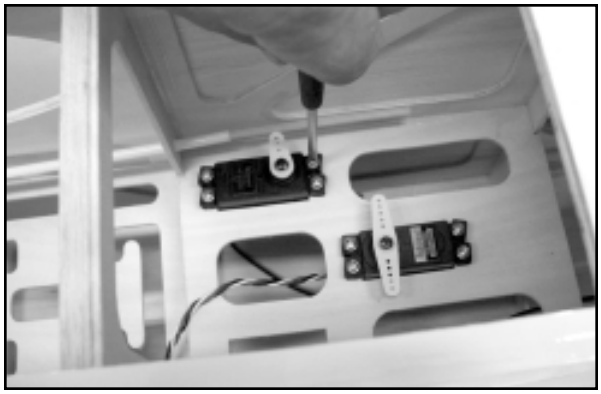


We did not want the elevator extension cable flopping around in the rear of the fuselage and decided to anchor it at a couple of points. We reached into the back end of the fuselage, through the servo compartment, and glued a couple of balsa retainers over the cable to hold it in place.

❑ 5) The rudder servo is now installed. As shown, the servo fits in the center of the servo compartment, with its output arm toward the front. You will need an output arm that is long enough on each side to properly operate the pull-pull linkage to the rudder. As mentioned earlier, we used the Du-Bro "Super Strength Servo Arms" for all of our servo output arms. We used the 1-3/4" two-arm output for the pull-pull set-up on our rudder servo.

Install the rubber grommets and eyelets onto the rudder servo. Use your radio system to determine that the servo is moving in the correct direction for "left" and "right" rudder action and center the servo output arm to the servo. Install the servo into the fuselage servo tray, using the screws provided with your radio system.

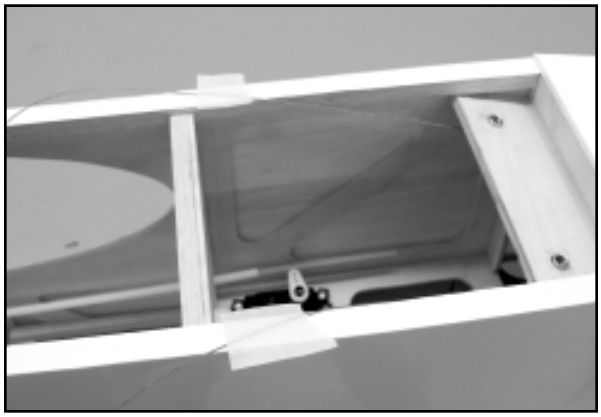
❑ 6) The throttle servo is now installed. This servo is positioned into the fuselage servo tray, next to the throttle pushrod. To allow for full movement of the pushrod, position the servo with its output arm toward the rear of the fuselage, as shown. Install the grommets and eyelets onto the servo and use the screws provided with your radio system to secure it in place onto the tray.



❑ 7) In this step, the pull-pull cables are attached to the rudder servo output arm. The connection of these cables to the rudder will take place in the Tail Group Assembly section. Uncoil one of the pull-pull cables. Thread one end into one of the pull-pull exits at the rear of the fuselage side. Carefully feed the cable toward the

servo compartment, avoiding the stringers or the rudder cable extension. These cables must be unobstructed, with a straight run to the servo. Reach into the fuselage and pull the cable into the servo compartment. Use a piece of tape at the rear of the fuselage, to hold the cable end in place.

Likewise, use a piece of tape to hold the opposite end of this cable to the top of the fuselage side, in the servo compartment. Insert the second cable into the opposite side of the fuselage, at the pull-pull exit. As before, feed this cable into the servo compartment, being careful to not cross or tangle it with anything inside of the fuselage. Use tape to secure both ends of the cable.



At the servo compartment, both cable ends are each prepared with a pull-pull R/C link fitting. Slip a brass swage tube onto the cable end and then, thread the end of the cable through the hole in the end of the threaded brass pull-pull fitting. Thread the loose end of the cable back through the brass swage fitting, pulling it out about 1/2". Close the loop of cable to within about 1/2" or so to the end of the pull-pull fitting and use needle nose pliers to firmly crimp the swage in the middle, securing the cable loop. Repeat this process with the other cable end in the servo compartment.

Thread the round, knurled locking "nut" all the way onto the threaded end of the pull-pull fitting and thread the R/C link in place. Leave equal an amount of threads exposed to make final adjustments later, when the opposite ends of the cable are rigged for the rudder horns.

Connect the R/C links to each end of the servo output arm and place the arm squarely back onto the rudder servo. Thread the servo arm retaining screw back in place into the servo. At the rear of the fuselage, pull each cable out of its exit, taking up the slack and temporarily tape the loose ends of the cable to the fuselage sides for now.

❑ 8) The throttle pushrod is now connected to the throttle servo. Plug the throttle servo into the receiver and turn the radio system on. Use the transmitter to check the throttle servo for the correct direction of travel for "high" and "low" throttle - reverse the servo travel, if needed. Place an output arm onto the servo, positioning it to provide equal travel in both directions. Turn the radio system off, for a moment.

If the outer throttle tube extends too far into the servo compartment, it may restrict the movement of the inner throttle pushrod with the R/C link attached. If this is the case, remove the R/C link at the engine and pull the pushrod out 4" or 5". In the servo compartment, trim the end of the outer pushrod tube to within 1/8" of the back side of the former. Slide the inner pushrod back in place and reconnect it to the engine throttle arm.

The throttle pushrod is now cut to the correct length. Thread the 22mm stud into the R/C link, leaving enough threads on each side for adjustments. Fit the R/C link to the outer hole in the servo output arm and place the arm onto the servo, with the threaded end of the stud facing toward the engine, parallel with the throttle pushrod. Turn the radio system on and move the throttle stick to position the servo output arm to the rear, with the throttle trim in neutral on the transmitter. Pull the pushrod back as far as the engine throttle arm allows. Use a marker pen to mark the throttle pushrod where it should be cut and still accept 1/4" of the threaded stud.

Remove the R/C link and stud from the servo arm and remove the stud from the R/C link. Disconnect the R/C link from the engine throttle arm and pull the throttle pushrod completely out of the fuselage. Use a razor blade to cut the tubing at the mark just made. Install the 22mm stud into the pushrod tube, about 1/4", using an electric drill. Reinstall pushrod back into its housing tube at the firewall, inserting the threaded stud end. In the servo compartment, thread the R/C link onto the stud. Reconnect the forward R/C link to the engine throttle arm.

With the radio system still on, adjust the R/C link at the throttle servo until it easily fits onto the output arm when the servo is positioned at the full rear (usually "low throttle") position. Continue adjusting the R/C link until smooth full-throttle to low-throttle transition is established.

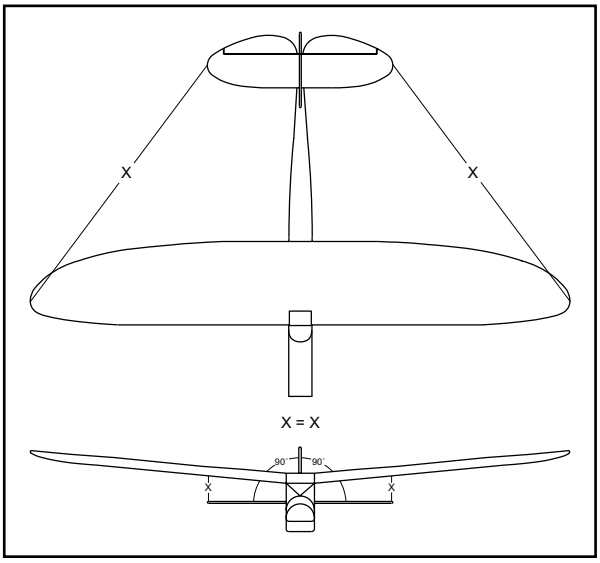
NOTE: If your radio system includes an EPA (End Point Adjustment) feature, you will be able to very accurately dial-in the exact amount of servo travel. If your system does not include EPA, then, you'll have to adjust the total movement of the throttle pushrod mechanically. This means that you may have to reposition the R/C links on either one or both of the connections. For instance, moving the R/C link in closer to the servo will result in a little less total movement. To prevent unnecessary battery drain, it's important to adjust this linkage to eliminate any binding. Also, understand that final throttle set-up is always done when the engine is broken-in and running.

TAIL GROUP MOUNTING & FINAL ASSEMBLY:

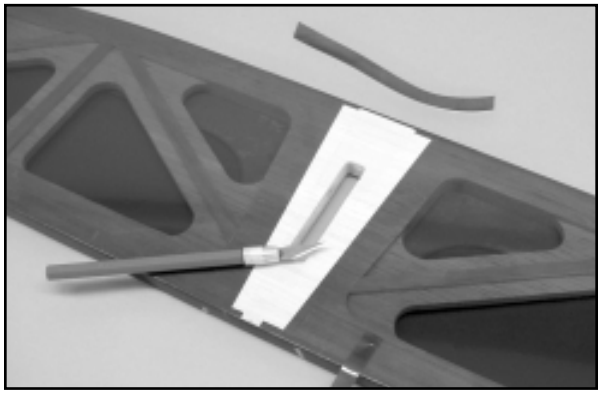
From the kit contents, locate the two bags containing the horizontal stabilizer and elevators and the vertical fin and rudder. You will also need the two remaining factory covered Channeled Balsa Tail Fairings. For alignment purposes, you will also need the wing assembly and the two 1/4-20 nylon wing bolts. Remove the elevator assembly and the hinges from the horizontal stabilizer. Remove the rudder and its hinges from the vertical fin. Set the rudder, elevators, and hinges aside for now.

❑ 1) Join the wing panels together, using the aluminum main joiner and the rear aluminum alignment tube. Carefully press the two panels together at the center. Mount the wing onto the fuselage and use the two 1/4-20 nylon wing bolts to secure it in place (be sure that the two aileron servo leads on the bottom center of the wing panels are inside the fuselage). Set the airplane on a flat surface with enough space around it to easily view it from both the front and rear. Place the horizontal stabilizer (stab) onto the fuselage at the rear, aligning it with the centerline of the fuselage. Hold it in this position with a weight, to be sure it is sitting flat on the fuselage.

Step back, and view the fuselage from the front. The stabilizer must be uniformly aligned to the wing and fuselage, without tilting one way or the other. Carefully square the stabilizer to the fuselage and wing in top view. This is easiest to do by taking measurements from the same point on each side of the airplane.

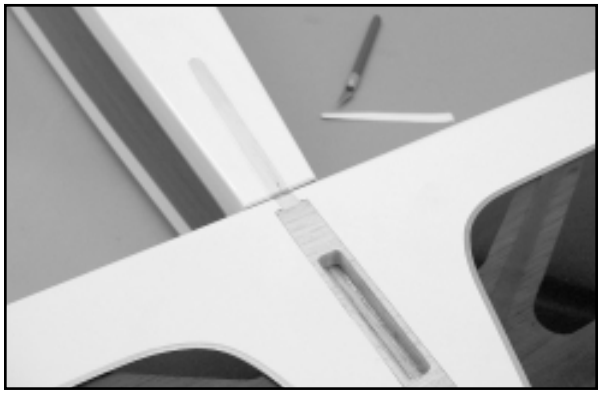


With the stab firmly and correctly in position on the fuselage, use a pencil to draw light lines on each side of its bottom surface, along the straight edges of the channeled balsa fairings. Remove the stab from the fuselage and use a straight edge and sharp hobby knife to *lightly* cut away the excess covering from just inside the pencil marks - **do not** cut the wood beneath the covering!



Use 5-minute epoxy to glue the stab in place to the fuselage. Apply glue evenly to the stab saddle at the top rear of the fuselage. Also, apply glue to the exposed wood on the bottom center of the stab. Place the stab onto the fuselage, making sure it is centered in top view as well as in front view. Use weights or pins to hold the stab in this aligned position until the epoxy cures. Clean off any excess glue on the bottom of the fuselage/stab joints with alcohol.

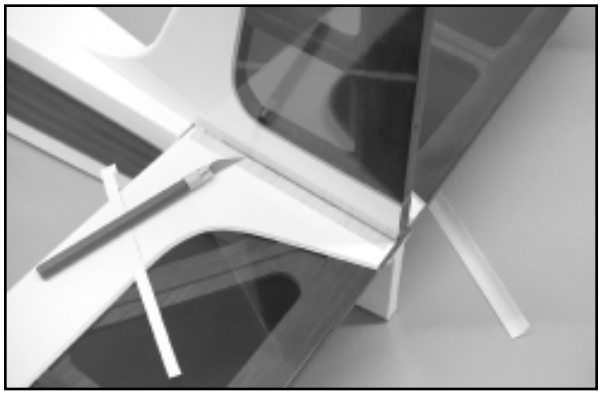
❑ 2) The vertical fin is now glued in place onto the top of the stab and fuselage. First, trial-fit the fin in place. Check the fit of its bottom surface, where it contacts the stab and fuselage. It should contact these surfaces from front to rear. If necessary, trim or sand the bottom of the fin for the best fit. Also, make sure that the rear edge of the fin is in alignment with the rear bottom edge of the fuselage. When you're satisfied, hold the fin in place to the stab and use a sharp pencil to trace around its forward bottom fairing, where it extends forward onto the top rear fuselage. Remove the fin and use a sharp hobby knife to remove the covering from just inside of the pencil outline.



Using 5-minute epoxy, apply glue to the bottom of the vertical fin, including the tab that fits into the top of the stab. Press the fin in place into the stab slot and firmly onto the stab and fuselage. Wipe off any excess glue with alcohol. Use strips of tape and/or pins to align the fin at 90° to the stabilizer. View the airplane from the front, making sure the fin is perfectly upright and square with the stab, wing, and fuselage, without tilting one way or the other. With the fin securely in this position, allow the glue to cure. When the epoxy has set, remove the wing from the fuselage.

❑ 3) The two remaining pre-covered balsa tail fairings are now

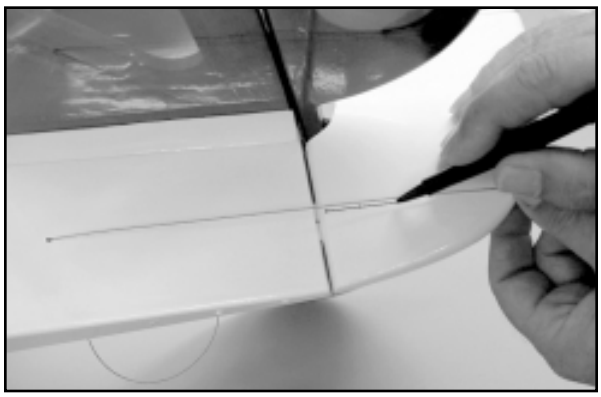
installed onto each side of the fin and stab joints. Lay the fairing in place on the joint and use a pencil to lightly mark its edges onto the fin and stab. Use a straight edge and a sharp hobby knife to clear away the covering material from inside the marks just made, exposing wood. These two fairings are now glued in place with either thick CA glue or 5-minute epoxy.



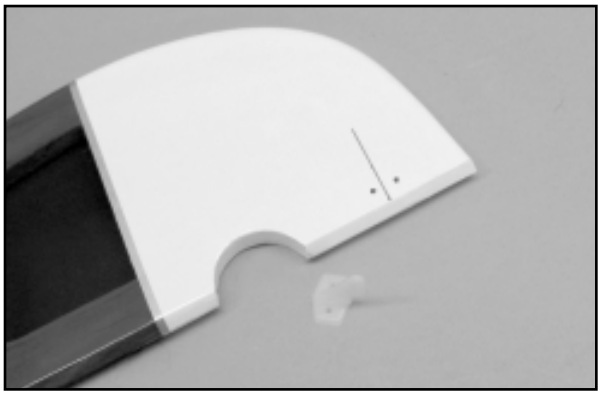
❑ 4) The elevators are now hinged to the horizontal stabilizer. The hinging method is exactly the same used with the aileron hinges. After installing and gluing the hinges, use a little SIG CA Debonder to clean up any excess glue. After hinging the elevators, wait for about 10 minutes to allow the glue to fully wick its way through the hinges and surrounding wood. Flex the elevators up and down firmly, making the movement free and easy.

❑ 5) Before actually hinging the rudder to the fin, it is first prepared to receive the two rudder control horns and the tailwheel steering plate is attached. From the kit contents, locate one of the nylon control horns. Also, locate the Tailwheel Assembly bag and remove the aluminum two-arm steering plate and its two #2 x 10mm PWA mounting screws.

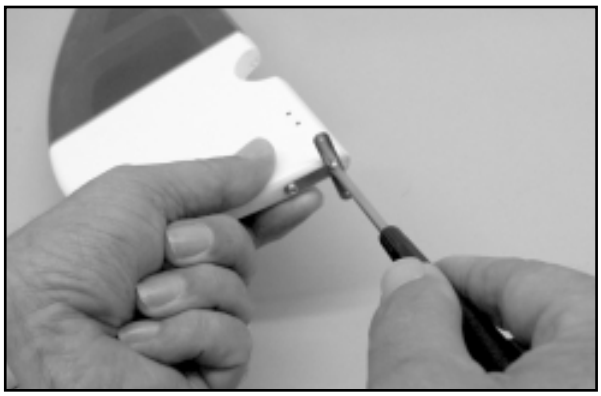
Use two of the rudder hinges (one at the top and one at the bottom) to temporarily fit the rudder in place to the fin. Use a piece of tape to hold the rudder in neutral to the fin and lay the fuselage on its side. Remove the tape holding the pull-pull cable to the fuselage and pull it back in a straight line against the rudder - note the cable exits the fuselage at a very slight downward angle. Hold the cable in this position and mark its location onto the side of the rudder, at its leading edge, with a non-permanent marker pen. This line represents the mounting location for the nylon control horns (one on each side of the rudder). Re-tape the pull-pull cable back onto the fuselage side for now.



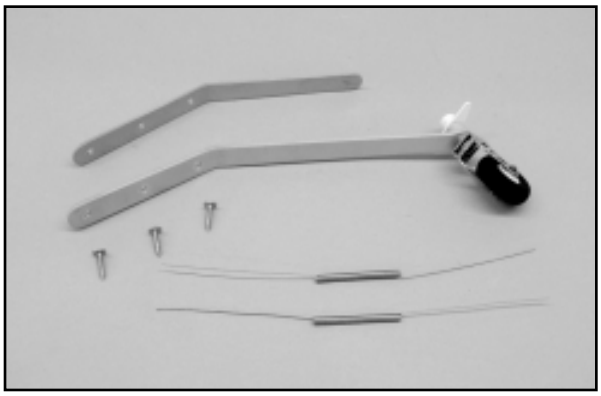
Place the control horn onto the line just made, centering its base on each side of the line. In top view, line up its four linkage holes with the hinge line of the rudder. Hold the horn in this position and use a marking pen to mark the two base mounting hole locations onto the rudder. Remove the rudder from the fin and remove the two hinges from the rudder. Two 5/64" dia. holes are now drilled through the rudder at the two marks just made. This can be done with a hand drill if you are careful to keep the two holes parallel. However, it is easier and much more accurate to use a drill press. The two rudder control horns will be mounted *after* the rudder is hinged.



❑ 6) The two-arm rudder steering plate is now attached to the bottom leading edge of the rudder, as shown, using two #2 x 10mm PWA screws. Note that the bottom leading edge of the rudder has hardwood beneath the covering as a mounting base for these screws. Position the front edge of the horn 1/8" behind the leading edge of the rudder and use the horn's mounting holes as a pattern. Drill two 1/16" dia. guide holes for the screws. Secure the horn in place with the screws.

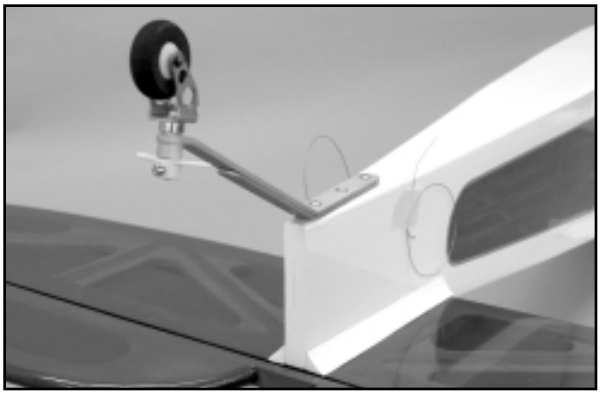


❑ 7) The tailwheel assembly is now mounted to the fuselage. Note that the bottom rear of the fuselage has a plywood hardpoint beneath the covering for mounting this assembly.

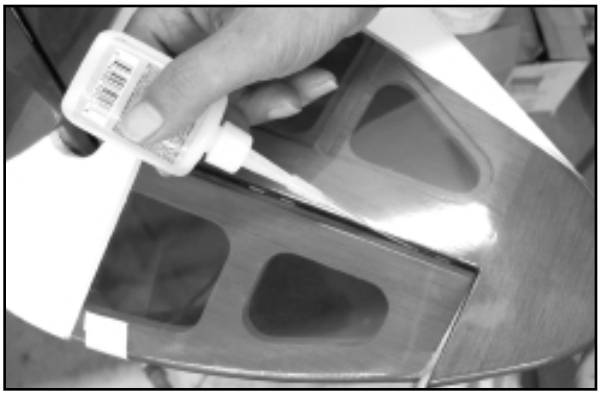


The main tailwheel strut and its secondary spring strut are mounted to the bottom rear of the fuselage. The alignment of this assembly should be directly in line with the center of the fuselage,

from front to rear. Use the three mounting holes in the bracket as a pattern. Drill three 1/16" dia. guide holes for each mounting screw. Mount the secondary spring strut (first) and the main strut arm to the bottom of the fuselage, using the three #3 x 15mm PWA screws provided. Firmly tighten these screws. The two tailwheel centering springs will be installed shortly.

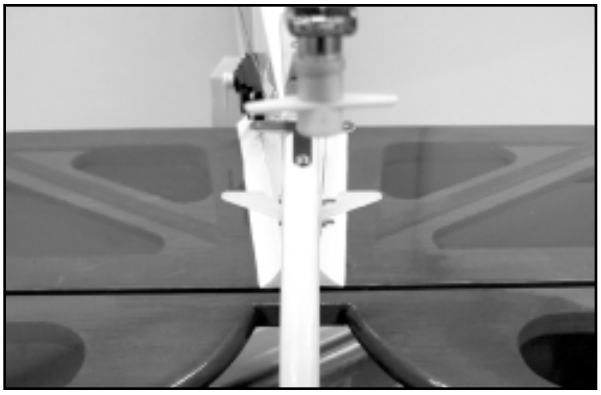


❑ 8) The rudder is now hinged to the vertical fin. The method for doing this is exactly the same as it was for the ailerons and elevators, hinged earlier in this manual. After letting the CA glue wick fully through the hinges and surrounding wood (about 10 minutes), flex the rudder firmly in each direction to create free and easy movement.



The two nylon rudder control horns are now mounted in place, one on each side of the rudder. In case the bottom rudder hinge interferes with the two horn mounting holes, use a 5/64" drill bit to clear the holes. From the kit contents, locate two nylon control horns, two M2 x 20mm Phillips head bolts and two M2 hex nuts.

Insert the two bolts through the mounting holes in one of the control horns. Insert the two bolt ends through the two holes in the rudder. Fit the opposite control horn in place onto the bolts and secure the bolts firmly with the M2 hex nuts.



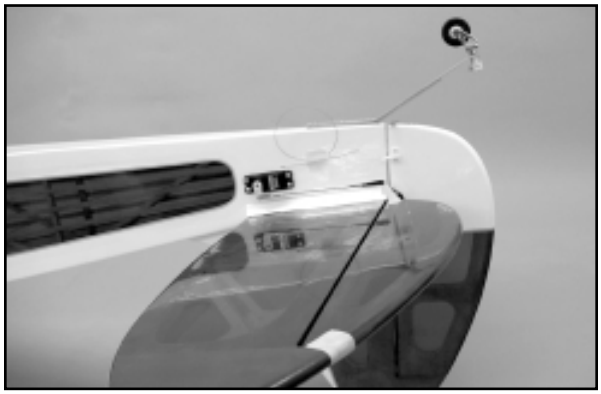
ELEVATOR PUSHROD AND RUDDER INSTALLATION:

From the kit contents, locate the following hardware:

- ❑ 2 R/C Links, Threaded on Brass Pull-Pull Fittings
- ❑ 2 Brass Pull-Pull Swaging Tube
- ❑ 1 Nylon Control Horn
- ❑ 1 Nylon Control Horn Base
- ❑ 2 M2 x 20mm Phillips Head Bolts
- ❑ 2 M2 Hex Nuts
- ❑ 1 4-40 x 4-5/8" Metal Pushrod
- ❑ 1 4-40 R/C Link
- ❑ 1 4-40 Solder Link
- ❑ 2 Tailwheel Centering Springs

❑ 1) The 4-40 elevator pushrod is now made. Solder the 4-40 Solder Link to the unthreaded end of the pushrod. Insert the pushrod into the barrel of the solder link a total of 3/8" and make a good solder connection.

Use two pieces of masking tape to secure both elevators tips in neutral to the stabilizer. With the elevator servo extension cable plugged into the receiver, turn the radio system on. Make sure the elevator trim is also in neutral. Thread the 4-40 R/C link onto the pushrod and attach the nylon control horn to the R/C link, using the second hole from the tip. Attach the elevator servo output arm to the solder link end of the pushrod, in its outermost hole. Press the output arm onto the servo, facing up toward the stabilizer bottom, at 90° to the servo, and rest the base of the control horn onto the leading edge of the elevators.



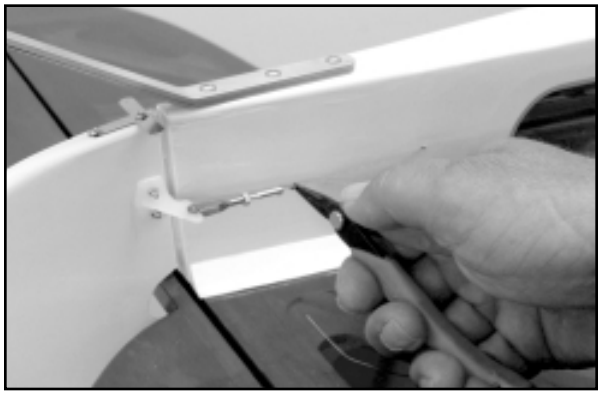
Adjust the R/C link in or out on the pushrod, until the base of the control horn sits exactly at the edge of the bevel line on the elevators. With the base of the horn in this position, mark the location of its two mounting holes onto the elevators, using a sharp pencil or pointed object. Turn the radio system off and remove the output arm from the servo, with the pushrod still in place. Remove

the control horn from the R/C link. Drill two 5/64" dia. holes through the elevators, at the two marks just made - take care to make these two holes at 90° to the elevator surface and parallel with each other.

Insert two M2 x 20mm bolts into the control horn base and insert the two bolt ends into the two holes just made. The flat nylon mounting base part is designed to be tapped by the mounting screws. However, on a model of this size, we prefer to use nuts to secure the horn bolts, so we drilled out the two holes in the base part with a 5/64" bit. Place the nylon base onto the exposed bolt ends, on top of the elevators, and thread the two M2 hex nuts in place. Firmly tighten the bolts and nuts. Remove the tape holding the elevators in neutral and turn the radio system on to test the action of the elevators. The correct amount of surface movement will be set shortly. Re-install the servo output arm retaining screw.

❑ 2) Use a piece of masking tape at the top of the rudder to hold it in neutral to the fin. Make sure the rudder servo output arm is centered on the servo. Turn the radio system on and turn the fuselage over, upside down on your work surface.

Center the R/C links on both threaded pull-pull fittings, leaving equal amounts of adjustment in either direction. Slide a brass swage tube onto one of the pull-pull cable ends. Thread the cable end through the hole in the pull-pull fitting. Thread the end of the cable back through the swage fitting. Connect the R/C link to the rudder control horn, using the second hole from its tip. Pull the loose end of the cable taut and slide the swage tube up toward the end of the pull-pull fitting, to within about 3/8" or so. Test the cable with finger pressure. The idea is to set the cable straight, without being too tight. Use needle nose pliers to firmly crimp the swage fitting in the center. Repeat this procedure on the opposite pull-pull cable.



Remove the piece of tape holding the rudder to the fin. Check the rudder's position with the fin - it should be in neutral. If not, adjust the R/C links as needed to set the rudder at neutral. Test the action of the rudder with your transmitter. It should move smoothly and travel fully left and right to each elevator *without* touching. With the fittings now adjusted and set, tighten the knurled nuts on the pull-pull fittings firmly to the rear of each R/C link. Bend the loose cable ends firmly to 90° against the swage tubes and trim the excess cable with wire cutters.

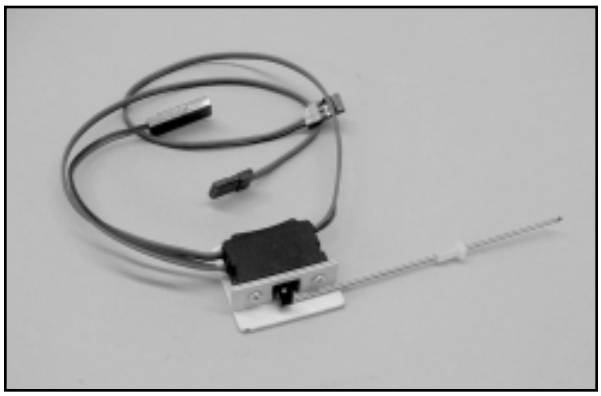
❑ 3) The tailwheel centering springs are now attached to the tailwheel steering arms (just above the tailwheel itself) and the aluminum rudder steering arms, previously mounted to the bottom of the rudder. These springs are installed and bent to impart just a little tension on the tailwheel bracket, centering the tailwheel itself to the rudder. Install the two springs as shown making sure the tailwheel is centered with the rudder when it is in the neutral position. Bending the spring ends precisely and neatly is a lot easier using small needle nose or round nose pliers.

RADIO INSTALLATION:

At this point, the radio installation is all but complete. The only remaining tasks are mounting the on/off switch, packing the receiver in foam and placing it in the fuselage, routing the antenna and final placement of the battery pack (the battery pack will not be secured until the final C.G. is established).

❑ 1) The on/off switch can be mounted on either the outside of the fuselage, using the switch mounting hardware that came with your system or it can be mounted internally. If the switch is to be mounted on the side of the fuselage, a rectangular hole must be cut through the fuselage side to allow the switch lever to fit. The best place to mount a switch is to place it in a convenient location, protected from engine exhaust.

We have always preferred internally mounted switches for several reasons; the installation tends to be visually neat and the switch itself is protected from exhaust, dirt, and debris. In this design, an internally mounted switch is easy to do. We first made a simple switch mount using scrap 1/16" plywood. We drilled the switch lever to accept a piece of .046 music wire. The wire extends out of the fuselage side with a simple "L" bend. The mount is positioned on the floor of the fuselage, behind the main landing gear mounting block. However you mount your switch, make sure it is firmly in place with no pressure on the wiring leads.

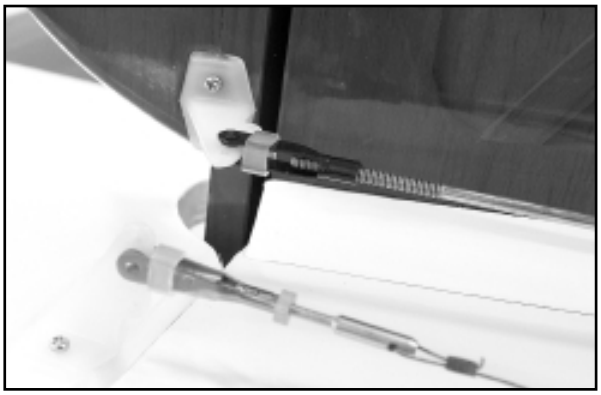


❑ 2) The receiver is now placed in the fuselage. Connect the servo leads to the appropriate channels in the receiver, including the aileron "Y" harness and the switch connector. Test the radio system first, making sure everything works. The receiver is wrapped in protective foam, held in place with tape or rubber bands. The two aileron cable ends of the "Y" harness should be both free and accessible from the top of the cabin. We placed our

receiver directly beneath the battery-mounting stand, just in front of the servo compartment.

The fuselage has a built-in antenna tube that runs from the cabin, along the bottom of the fuselage, to its exit in front of the tailwheel assembly. To pull your antenna easily through this tube, first open the rear end of the tube, on the bottom of the fuselage with a sharp hobby knife. Use your fingers to pull a little on the end of the receiver's antenna, sliding a little insulation away from the wire inside - about 1/8". Insert one end of a 36" length of thin .020 music wire into the antenna insulation and secure it with just a touch of CA glue. Insert the other end of the wire into the tube in the fuselage cabin and push it all the way through until it emerges at the bottom rear of the fuselage. Pull the music wire out of the tube, along with the antenna. Remove the wire from the antenna.

❑ 3) **IMPORTANT:** We urge you to take a few minutes to cut and fit short lengths (about 3/16" or so) of medium fuel tubing onto all of the R/C links on the airplane. This simple safety precaution keeps these connections secure and safe.



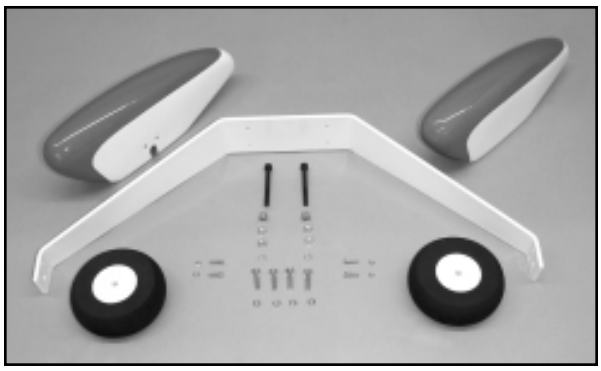
DECAL APPLICATION:

With the main landing gear not yet mounted to the fuselage, applying the decals is a little easier. The decals supplied with your RASCAL 110 ARF kit are high quality Mylar™ with an extremely aggressive adhesive. These are <u>not</u> die-cut decals and must be removed from the sheet with a hobby knife and a sharp #11 blade or sharp scissors. In the case of the large doorframe outline, you can apply it in several ways. We prefer to cut this decal out on both sides of the frame outline, and apply it in one piece. If you are careful, this isn't as difficult as it sounds. It can also be applied without cutting out the inside. Cut out the outline, apply the decal and then, cut out the window frame portion. Application of this and the other decals is easy if you follow the method described below.

We suggest the following procedure to accurately apply the larger decals in this kit. Carefully cut out the decal and lift it off the sheet with tweezers. Use a product like SIG Pure Magic Model Airplane Cleaner, Fantastic®, or Windex® to spray the general area of the model that will receive the decal. Then, spray the <u>adhesive</u> side of the decal as well. Lightly position the decal in place on the model. The liquid cleaner allows the decal to slide easily into the desired position as long as you don't press down on it. Once the decal is in position, hold it lightly in place with your fingertips and use a paper towel to gently dab the excess liquid away. Use a small squeegee to now set the decal in place, removing all excess liquid and any trapped air bubbles from beneath the decal. The SIG 4" Epoxy Spreader - #SIGSH678 - is perfect for this job. Remove any excess fluid with a dry paper towel and allow the decals to set overnight. They will be solidly adhered to the model without any air bubbles.

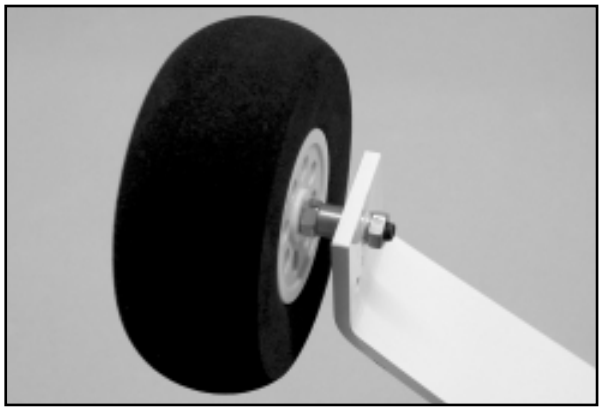
LANDING GEAR AND WHEEL PANT ASSEMBLY:

From the kit contents locate the Fiberglass Wheel Pants bag and the Main Landing Gear Assembly bag. In these assembly steps, we suggest using Loctite® Non-Permanent (blue) Thread-Locking



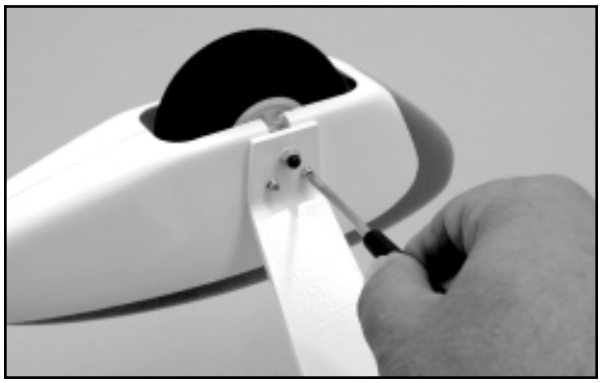
compound for the four wheel pant bolts.

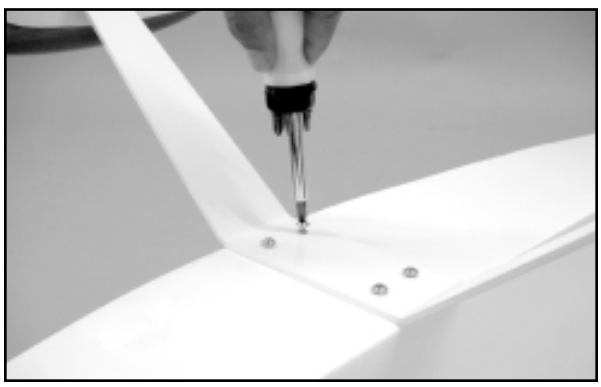
a) Slide one of the M5 x 50mm Allen Head steel axle bolts through one of the wheels. Thread one of the M5 hex nuts onto the axle bolt up to the wheel hub. Slip one of the M5 brass spacer sleeves onto the axle bolt and fit the end of the bolt through the bottom hole in the main landing gear. Place one M5 split ring washer onto the exposed end of the bolt and thread another M5 hex nut onto the bolt end. Firmly tighten the hex nuts, locking the axle bolt in place. Repeat this procedure with the remaining wheel on the opposite landing gear leg.



b) Note that there is a *front* and *rear* edge to the aluminum landing gear. In side view, the leading edge (or front) of the landing gear is straight. The trailing edge (or rear) is slightly angled. Be sure to mount the landing gear and the self-aligning wheel pants in the correct direction!

Slip the wheel pant over the top of the wheel and slide it down in place onto the brass axle spacer, lining up the two mounting holes in the aluminum landing gear with the two holes in the wheel pant. Use two M3 x 12mm bolts and two M3 split ring lock washers to secure the wheel pant firmly in place to the landing gear. Repeat this procedure to mount the remaining wheel pant.





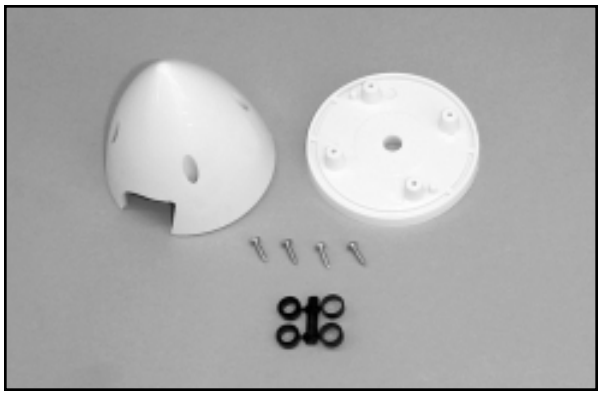
c) The completed landing gear assembly is now mounted to the fuselage using four M4 x 20mm PWA mounting bolts and the four M4 split ring lock washers. Tighten these four mounting bolts firmly in place.

SPINNER ASSEMBLY:

Mount the cowl in place to the fuselage. From the kit contents, locate the bag containing the white SIG 3" spinner assembly. This spinner is easy to install, lends a great look to your finished Rascal 110 ARF and is ready to use with typical propellers in the size range for this model.

IMPORTANT NOTE: From experience, we can assure you that large bore four-stroke engines should *always* be started using a heavy-duty electric starter. It is dangerous to attempt to hand-start these large engines. Therefore, if you have powered your Rascal 110 with such an engine, it would be wise to replace the included plastic spinner with a metal spinner of the same 3" diameter. Metal spinners will hold up better against larger electric starters.

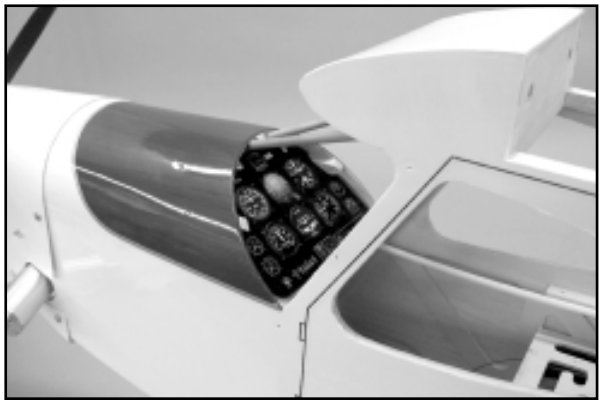
Because the spinner backplate was already fitted to your engine earlier in the cowl mounting instructions, all that's left is to place the backplate onto the prop shaft, followed by the propeller. Firmly secure the propeller using the engine's washer and nut. The spinner cone is now installed over the prop and into the molded recess in the backplate. Attach the spinner cone using the four provided screws. Tighten these screws firmly to seat the spinner cone, but not so tight that you strip them.



INSTALLING THE INSTRUMENT PANEL:

The included, printed 4-color instrument panel adds a lot to the overall look of your model and it's easy to install. Use scissors to cut out the panel from the cardstock sheet. Use a hobby knife and sharp #11 blade to cut the three relief areas in the panel, allowing it to fit around the nose stringers and aluminum tube supports. With the windshield removed, fit the panel in place onto the tilted half-former, at the front of the cockpit. Test the fit and trim if needed. Remove the panel.

We mounted our panel onto a piece of thin plastic sheet, using 3-M™ Super 77 Spray Cement. We lightly sanded the back surface and used a few widely spaced drops of thick CA glue to mount the panel to the former. If it is ever required, the panel can be easily removed.



OPTIONAL:

Whenever possible, we like to install pilot figures in our R/C model aircraft. They add a lot to the overall look of the model. The Rascal 110 is no exception and looks even more believable with a nice looking pilot figure installed in the cockpit!

The "scale" of the Rascal 110 lends itself to the use of 1/4 scale pilot figures. Our preference was for the really nice looking 1/4 scale civilian pilot figure made by Cajun R/C Specialties. This figure comes pre-painted, complete with a nice looking flying cap! He looks very much at home in the Rascal 110's "office".

With the Cajun R/C Specialties 25% scale figure, we found that we had to cut a little material from each of his shoulders in order to fit him into the fuselage. This is was done with a razor saw, followed by a little light sanding with a sanding block and 220 grit sandpaper. After trimming and test fitting the figure for clearance in the cockpit, we made a simple 1/8" lite-ply base to glue him to. The base was cut to fit the exact width of the inside of the fuselage, just beneath the side windows. It was cut wide enough to accept the base of the pilot figure. We, then, sanded the base smooth and painted it flat gray. Next, we installed 1/4" sq. spruce "rails", one on each side of the fuselage, where the base would rest. The base is placed onto the rails and drilled in each corner to accept 4 Du-Bro #2 x 3/8" Allen Head sheet metal screws. This installation allows the pilot figure to be easily removed, if necessary. Finally, the pilot figure is permanently glued to the lite-ply base with epoxy and allowed to dry. The base, with the pilot in place, is secured into the fuselage with the four screws. Remove the pilot figure for installing the side windows.

SIDE WINDOW INSTALLATION:

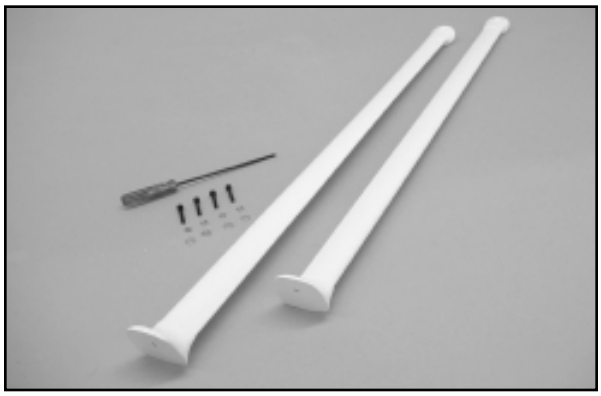
From the kit contents, locate the Molded Clear Plastic Side Window bag. These windows have been molded to fit in place into the side window cut outs, from the inside of the fuselage. Note that there is a left and a right window. Use scissors to cut out each window, leaving about 1/8" of plastic around the edges for a gluing surface.

We suggest using 5-minute epoxy or RC-56 glue to mount these windows. **Do not** use thin CA glue for this purpose! Apply a thin bead of glue around the edges of the plastic window and press it in place from the inside of the fuselage. If necessary, use a few small pieces of tape to hold the window in place until the glue sets. A little alcohol on a soft cloth or paper towel will safely clean any excess glue from the windows.

The windshield - removed earlier - is now re-installed back onto the fuselage, using the seven mounting screws. Likewise, the pilot figure is now re-installed into the fuselage.

WING AND WING STRUT ATTACHMENT:

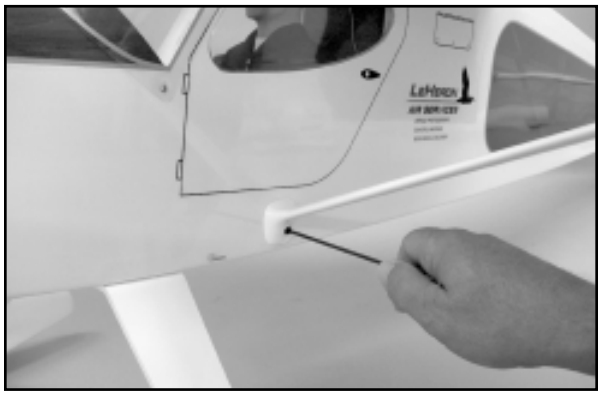
The wing strut system used on the Rascal 110 is functional. The airplane should *never* be flown without the struts in place and secured. The included mounting hardware, specifically the M3 x 20mm (3/4") socket head bolts, requires a 2.5mm ball driver for installation and removal. Do not be tempted to use an S.A.E. 3/32" hex driver. This tool will eventually roach out the bolt heads. Du-Bro Products makes a 2.5mm (for 3mm bolts) ball driver - Du-Bro #450. We highly recommend that you purchase one of these tools for your flight box.



From the kit contents, locate the bag containing the Wing Strut Assemblies. These struts are factory painted and already set-up to mate with the appropriate blind mounting nuts, pre-installed in the fuselage sides and the bottom surfaces of both wing panels. There is a left and a right wing strut - note the airfoil shape of each strut.

The wing is installed onto the fuselage first, secured in place with the nylon wing bolts. Prepare the strut mounting hardware by

slipping a M3 lock washer and then, an M3 washer onto the M3 bolts. Hold the strut in place against the fuselage side and bottom of the wing panel and install the bolts, starting the threads with your fingers. Tighten the bolts in place firmly with a hex driver.



An easy way to store and transport your wing struts is to use thin foam to wrap each end of both struts. This separates them and protects the end fittings from damage. Between flying sessions, leave the strut bolts installed in the wing panels and fuselage sides to keep them from becoming lost.

CENTER OF GRAVITY:

Establishing the correct Center of Gravity on this or any R/C model airplane is critical to its ultimate success in the air. The recommended starting balance point for the Rascal 110 ARF, is located 4-1/2" behind the leading edge of the wing, immediately next to the fuselage side. This is the location of the main wing spars. We've flown this airplane with the C.G. location as far back as 5" without any trouble. However, moving the C.G. further back tends to make the elevators more sensitive and will also accelerate the stall. Remember that the C.G. location is always determined with the airplane fully assembled (including the wing struts) and the fuel tank empty.

For reference, our finished Saito 1.50 powered Rascal 110 shown in this manual, weighs exactly 12 pounds, 2 ounces and required no lead to balance. The 4-cell, 1400mAh battery pack was placed beneath the fuel tank, wrapped securely in foam.

Because of its large size, balancing the Rascal 110 using a typical balancing fixture may not be practical. However, you can get acceptably accurate results by first placing a piece of tape, temporarily, on each side of the fuselage, just beneath the wing, at the 4-1/2" location. Then, simply use your fingers beneath each wing panel to pick the model up at the C.G. location. Another method is for you and a friend to pick the model up at the wingtips, at the main spar location.

The goal is to get the airplane to balance perfectly level at the desired C.G. point. Level means level - not nose down or tail down - level! If the nose hangs down, the model is nose heavy. Likewise, if the airplane hangs tail down, it is tail heavy. If either of these conditions exist with your model, they must be corrected.

If the model is just a "little" nose heavy - nose down a few degrees - it can be safely flown without problem. If the model is very nose heavy, then, it should be corrected. This condition is most easily corrected by shifting the battery pack further back in the radio compartment. If the model is still too nose heavy, then, small stick-on lead weights - available from your hobby shop - can be used to temporarily correct the problem. Later, after flight trimming the airplane, these weights can be placed inside the very rear of the fuselage, through the elevator servo mount hole.

If the model is tail heavy, move the battery pack as far forward as possible to correct the problem. If the airplane still needs more weight to balance, several things can be done:

- Heavier, after-market wheels
- Heavier, after-market spinner
- A larger, thus heavier, battery pack
- A brass Heavy Hub propeller nut - available from Harry Higley Products

In the unlikely event that you cannot achieve the correct Center of Gravity using the above methods, then, stick-on lead weights should be used. When the correct C.G. location has been established, locate the battery pack in the correct location. Wrap the pack in foam rubber and place it securely in the fuselage.

CONTROL SURFACE TRAVEL:

The following Low Rate control surface movements will provide your RASCAL 110 ARF with smooth, predictable flight characteristics. We suggest that you start with these Low Rate movements and adjust them later to suit your style of flying. Note that the rudder and elevator measurements are taken from the widest part of the surface at the trailing edge. The aileron measurements are taken at the inboard trailing edge. We have also provided the High Rate settings that we use with our Rascal 110 models. Again, these can be adjusted to suit your style of flying.

	LOW RATE TRAVEL	**HIGH RATE TRAVEL**
AILERONS:	**1-1/16" UP - 1-1/16" DOWN**	**1-3/8" UP - 1-3/8" DOWN**
ELEVATORS:	**1-3/16" UP - 1-3/16" DOWN**	**1-5/8" UP - 1-5/8" DOWN**
RUDDER:	**1-3/4" LEFT - 1-3/4" RIGHT**	**SAME**

FLYING:

If you've carefully followed these assembly instructions, test flying your new Rascal 110 should be a lot of fun! We repeat this in all of our assembly manuals and we'll do it again now; when it comes to test flying any new airplane, try to choose a day that is calm, with little or no wind. These conditions allow you to better evaluate and more accurately adjust the trim requirements for the model. Take any necessary steps to eliminate all potential problems at the field, especially in the set-up of the engine. A good running, reliable engine is a must in the ultimate success of this or any airplane. Take the time to solve any engine-related problems *before* trying to fly.

Make it a routine part of your pre-flight procedures to check each control on the airplane, making sure each flight surface moves in the correct direction. Also, check each control linkage to be sure they are secure and that nothing is loose. Next, make a routine range check with your radio system to be sure that it is working perfectly. We always suggest that this same range check be made when the engine is running. This is especially true if your airplane is powered with a gasoline engine. Gas engines can often produce extraneous RF (radio frequency) "noise" while running. RF noise can interfere with the radio system, causing servos to "glitch". If this occurs with your model, take steps to eliminate the problem *before* trying to fly the airplane.

When you're satisfied that the airplane is ready for flight, start the engine and allow it to warm-up to operating temperature. Holding up elevator, taxi the Rascal out to the take-off position on the flying field. For take-off, the airplane should be lined-up with the center of the runway, with the nose pointed directly into the wind. Hold a little up elevator and smoothly advance the throttle - **do not** slam the throttle full open all at once. As the airplane begins moving forward, gradually back off of the up elevator input, using the rudder, only sparingly, to correct any engine torque and/or wind induced deviations from a straight take-off run. Allow the tail to come up and the airplane to gather speed on the main wheels. Lift-off will happen shortly. Keep the wings level with the ailerons and climb out at a shallow angle to a reasonable trim altitude. At altitude, make any necessary trim adjustments to achieve straight and level flight.

You will find that the Rascal 110 is a very smooth flying airplane. The surface movements given in this manual should provide the airplane with smooth, positive control in pitch, roll, and yaw. We found this to be true at virtually any speed that we flew the airplane. The controls will remain effective down to virtually zero airspeed. We have found that coordinated turns - using both ailerons and rudder - wasn't necessary with this airplane. The ailerons are effective and get the airplane around just fine. However, using a little rudder in the turns is also very effective and tends to get the airplane around even quicker.

First, try a simple loop from level flight. You should see the airplane track cleanly through the loop with no tendency to "twist out" at the top. A clean tracking loop usually indicates that the C.G. is about right for the airplane. While still at altitude, fly the airplane into the wind and throttle the engine back to idle. Keep the airplane level with the ailerons and hold the nose up with elevator input. Watch carefully to observe the stall characteristics of the model. On our Rascal 110 models, the stall has been consistently gentle, with the wings barely rocking in pre-stall, followed by the nose dropping just a little before the airplane almost immediately resumed controlled flight. With a little rudder input, you'll find that the Rascal 110 can be flown to a virtual standstill before stalling. This exercise tells you a lot about how slow you can fly the airplane during a landing approach.

The Rascal 110 was never intended to be an IMAC capable model but it can perform a surprising number of maneuvers. With the controls set at the recommended starting point, rolls will be slow, especially so with engines at the lower end of the recommended range. However, with a little practice rolls can become axial, smooth, and almost elegant. Inverted flight is easy and we've found that it takes very little down elevator input to hold it in level flight. We've learned to snap roll the Rascal 110 very effectively by entering the snap at quarter-throttle or more. It's amazing to see 9+ feet of wing move that quickly! Likewise, we've learned to enter a spin, again using a quarter-throttle or better entry. The airplane enters a spin very nicely and will instantly stop rotating when the controls are released. We make both the snap roll and spin entries using hard rudder, up elevator, and hard-over ailerons.

Like all of the SIG Rascal models, the rudder is exceptionally powerful on the Rascal 110. You'll find that cross control maneuvers such as side slips, knife-edge flight, flat turns, etc. - are a lot of fun with this airplane. If you're flying from a short field or a field with trees and need to get the airplane down at a higher angle than the normal approach sink rate, try side slipping it into the field. The Rascal 110 can be side slipped (cross-controlled ailerons and rudder) at very high angles of decent, at surprisingly low speeds.

In all of this, we're willing to bet that you'll never tire of those long, slow, low altitude fly-bys and touch and go landings. What a super looking airplane!

Landing the Rascal 110 is a pleasure. No matter what your level of R/C expertise is, understand that the Rascal 110 wing is 1522 square inches in area and this amount of square footage is going to want to stay flying! Therefore, your landing approach should take into account the airplane's impressive glide ratio. We typically start the downwind approach at an altitude of about 50' or so, at about one third throttle. We continually decrease the throttle, maintaining a constant rate of descent. The base turn should be made smoothly to maintain airspeed and the turn to final should wind-up at about 25' - 30'. Line-up the nose with the center of the runway and bring the throttle down to a "high" idle. Keep the wings level and literally fly the airplane down to the runway, closing the throttle to full idle. Flare a little, allowing the main wheels to meet the runway smoothly and let the model roll out to a full stop.

With practice and becoming accustomed to the glide of this airplane, you'll be landing at very low speeds, putting the airplane wherever you want it on the runway. The real secret here is to realize that the Rascal 110 will not easily stall out on you, allowing you to land at very low speeds.

We sincerely hope that your Rascal 110 ARF will provide you with many, many enjoyable flights for many flying seasons to come. We, also, hope that this has been an enjoyable kit for you to assemble and fly. Please *always* operate your airplane in a safe, responsible manner with constant regard to other flyers, spectators, and property.

MAINTAINING YOUR MODEL:

Getting into the habit of routinely performing simple maintenance and inspection of your RASCAL 110 ARF will keep it looking good and flying good for a long time. Full-scale airplanes receive this kind of routine treatment and fly safely for years. Your R/C model

airplane should receive at least the same consideration.

While still at the flying field, and after you've finished flying for the day, empty the fuel tank completely with your fuel pump. After draining the tank, start the engine and let it run the fuel lines totally dry. This is the best way to take your airplane home.

After each flying session, take the time to completely clean your model, removing all spent fuel, dirt, and debris from the finish. We use and suggest fresh, good quality paper towels and a silicon-free cleaner for degreasing and polishing. SIG makes one of the best cleaners for this purpose - Pure Magic Model Airplane Cleaner. This product is great for cleaning, degreasing, and polishing virtually any model aircraft covering material. Clean the model thoroughly, paying special attention to any and all areas that were sprayed by engine exhaust. Clean the airplane until it shines, including the engine, prop, and spinner.

At home, take a little time to completely inspect the airplane, looking for any loose bolts, screws, covering seams, etc. Anything that you find wrong - immediately fix! Inspect the fuselage radio compartment carefully. Check each servo, looking for any loose linkages. Make sure that each R/C link is secured to the servo output arms with short lengths of medium fuel tubing. Then, check each nylon control horn on the flying surfaces for the same thing. Tighten and secure anything that is not supposed be loose. Inspect the engine, looking for any loose bolts or nuts and get them securely back in place right away. Loose engine bolts can almost be totally remedied by removing them, cleaning them with alcohol and using non-permanent thread lock compound, such as Loctite® blue. After applying a little thread lock liquid to the threads, re-install the bolt or nut and tighten it firmly. Also, inspect the propeller. Immediately replace any propeller that is cracked or nicked in any way!

Finally, if you plan to fly the airplane again on the following day, place the radio system - transmitter and airborne batteries - on charge. If you're finished for the week, leave the batteries uncharged. Place them on charge the night before you intend to fly again.

It will surprise you how easy it becomes to perform these few routine maintenance and inspection procedures. It should not surprise you how doing this prolongs the life of your model!

Good luck and good flying!

PRODUCT REFERENCE:

Airtronics Radio Systems	Available At All Good Hobby Shops
Cajun R/C Specialties Scale Pilot Figures & Instrument Panels	312 Martin Oaks Lafayette, LA 70501 (337) 269-5177
Du-Bro Products, Inc. #334 & #335Kwik-Fill Fueling Valves & Hardware	Available At All Good Hobby Shops
Hitec™ Radio Systems, After-Market Receivers, Servos, Servo Extensions & Switches	Available At All Good Hobby Shops
Saito Engines	Distributed Exclusively in the U.S. by Horizon Hobby, Inc., Champaign, Il.
SIG Products Quality Kits, Balsawood, Fuel, Adhesives, Hardware, Accessories, F.P.E. Gas Engines, Irvine Engines	Available At All Good Hobby Shops
Sullivan #484 Gasoline/Diesel Fuel Tank Conversion Kits	Available At All Good Hobby Shops

WARNING! THIS IS NOT A TOY!

Flying machines of any form, either model-size or full-size, are not toys! Because of the speeds that airplanes must achieve in order to fly, they are capable of causing serious bodily harm and property damage if they crash. **IT IS YOUR RESPONSIBILITY AND YOURS ALONE** to assemble this model airplane correctly according to the plans and instructions, to ground test the finished model before each flight to make sure it is completely airworthy, and to always fly your model in a safe location and in a safe manner. The first test flights should only be made by an experienced R/C flyer, familiar with high performance R/C aircraft.

The governing body for radio-control model airplanes in the United States is the **ACADEMY OF MODEL AERONAUTICS,** commonly called the **AMA**. The **AMA SAFETY CODE** provides guidelines for the safe operation of R/C model airplanes. While AMA membership is not necessarily mandatory, it is required by most R/C flying clubs in the U.S. and provides you with important liability insurance in case your R/C model should ever cause serious property damage or personal injury to someone else. For more information, contact:

ACADEMY OF MODEL AERONAUTICS
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Muncie, IN 47302
Telephone: (765) 287-1256

AMA WEB SITE: www.modelaircraft.org

CUSTOMER SERVICE

SIG MANUFACTURING COMPANY, INC. is totally committed to your success in both assembling and flying the RASCAL 110 ARF kit. Should you encounter any problem building this kit or discover any missing or damaged parts, please feel free to contact us by mail or telephone.

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LIMIT OF LIABILITY

The craftsmanship, attention to detail, and actions of the builder/flyer of this model airplane kit will ultimately determine the airworthiness, flight performance, and safety of the finished model. SIG MFG. CO.'s obligation shall be to replace those parts of the kit proven to be defective or missing. The user shall determine the suitability of the product for his or her intended use and shall assume all risk and liability in connection therewith.