
**CAP 231EX ARF ASSEMBLY MANUAL**

**INTRODUCTION:**

Congratulations on the purchase of your SIG CAP231EX ARF kit! Properly assembled, powered and flown, this SIG ARF kit will surely become one of your favorite models. Since the general construction, sanding and covering have already been done at the factory, the only remaining tasks are those of assembly and radio and engine installations. Note that due to the large number of useable engines for this model, we simply cannot cover every possible installation. However, the volume provided inside the large cowl should be helpful when mounting any engine within the suggested size range.

The SIG CAP231EX ARF contains some of the lightest, best-engineered construction of any ARF on the market. This is one of the reasons it flies as well as it does, using the recommended engine sizes. You will find that the CAP has superb take-off and landing characteristics combined with remarkable aerobatic capabilities. The airframe has been specifically designed to provide you with a "zeroed out" model. This is to say that the wings and horizontal stabilizer sit at 0° in relationship to the thrustline. In turn, this provides you with a model that is completely "honest" in any attitude. We will cover more set-up information in the course of the following assembly instructions. For those of you who are interested in 3-D work, we have provided the CAP with double beveled rudder and elevator hinge lines. This means that the flying surfaces can be driven to throws in excess of 45° for 3-D maneuvers!

We urge you to follow these assembly instructions closely to produce the model as it is intended to be. Modifications are the very nature of modelers and we're sure that many of you will be tempted. Simply be aware that certain assembly procedures for this airplane must be followed. We will make a point of telling you what these are as we proceed.

**REQUIRED EQUIPMENT, TOOLS AND SUPPLIES FOR ASSEMBLY:**

**RADIO EQUIPMENT**

We highly recommend the use of one of the modern programmable computer radios, such as the excellent Airtronics™ RD-6000 system, used during our development of this design. Such radio systems allow you to easily set and adjust every function and additionally pre-program various flight functions to suit your individual style of flying. Four channels are required to fly your CAP231EX; rudder, elevator, ailerons, and throttle. However, you will require a total of six servos; ailerons-2, elevators-2, rudder-1, and throttle-1.

Since your CAP 231EX is a large, highly aerobatic airplane and because the control surfaces are also large, we urge you to use appropriate servos on all flight surfaces (ailerons, elevator, and rudder). This model should not be flown with “standard” 40 - 50 inch/ounce output servos! The CAP is big enough to impart very large air loads and standard servos will quickly fail, resulting in loss of control. You should use heavy-duty ball-bearing servos with at least 65 inch/ounces of torque or more to drive the ailerons, elevator, and rudder. If available, use a servo with metal gears instead of plastic. Specifically in our prototype models, we used Airtronics™ #94731 servos for the ailerons, elevators, and rudder. This is a dual ball-bearing servo, rated at 80 inch/ounces of torque. Another good choice is the Hitec™ #605MG servo (77 inch/ounces) or Hitec™ #615MG servo (107 inch/ounces). These servos or equivalent from other manufacturers, can be relied upon to work well thoughout the CAP’s flight envelope.

A “standard” servo is adequate for the throttle.

We also suggest that you consider using after-market reinforced plastic servo output arms, such as the Du-Bro "Super Strength" products. These output arms are available to fit any servo. They are very strong and work well with this model. We highly recommend their use with the pull-pull rudder system used in this CAP. Using typical plastic servo output arms with the braided steel cables for rudder control, may cause problems due to the potential of wearing of the plastic by the cables over extended use. The Du-Bro output arms are molded from considerably tougher material and these have held up extremely well in our CAP prototypes.

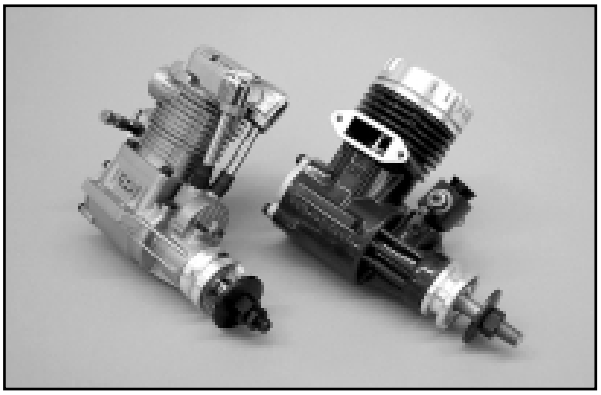
In addition to the servos, switch harness, receiver, etc., used in normal airborne radio installations, you will also need two (2) 12" aileron servo extensions, one (1) aileron Y-harness cable for the two aileron servos, and a Y-harness splitter cable for the two elevator servos. Note that the elevator Y-harness cable is used to electronically connect both elevator servos to a single connector going into the receiver. Normally, this requires reversing one of the elevator servos, making it the "mirror image" of the opposite one, mounted on the opposite fuselage side. However, we found a great product that not only acts as an elevator Y-harness cable/extension, it electronically reverses one of the elevator servos and has a centering adjustment pot. This feature lets you dial in the elevators exactly to a neutral relationship with each other. This product is called the "Miracle Y™", sold by MAXX PRODUCTS, Lake Zurich, Illinois. It can be ordered with any radio manufacturer's connectors you specify. We have thoroughly tested this product and found it to be reliable, easy to use and very reasonably priced. In addition, it is a total of 24" in length - 12" of elevator extension cables and a 12" cable lead to the receiver. Perfect for the CAP! Please refer to the Manufacturer's Index for further contact information.

Finally, since you will be using a total of six servos to fly this airplane, we strongly suggest you use a large capacity battery pack for use in this model. We have used both 1000 Mah and 1200 Mah packs with very good results. Using the light 1000 Mah pack, we have been able to safely fly five or six flights during any given flying session, a reasonable amount of flying time for most modelers. Naturally, a larger pack provides more flight time but

remember that larger can also equate to heavier. We also suggest that you routinely use an Expanded Scale Voltmeter (ESV) at the field to check the charge condition of your batteries. This common piece of field equipment can save your model!

**ENGINE SELECTION**

The SIG CAP 231EX ARF has been flown with a variety of 2 and 4-stroke engines. As everyone knows, there is no substitute for power and the engines recommended for this model all provide good power margins. Naturally, the larger engines in this range make more power and will fly the CAP with more authority than the smaller engines. It is simply a matter of how you want to fly this airplane. We can tell you that our testing with both the Irvine 1.20 and 1.50 2-stroke engines was very good. Both engines make great power and are easy to install and operate. In the case of the 1.50, we use a 16 x 8 APC prop and find the power sufficient to achieve excellent vertical performance, with power to spare. When using a 2-stroke engine, mufflers are always a problem. But not in this case! SIG stocks a special in-cowl muffler for use with the CAP and either the Irvine 1.20 or 1.50 engines. This muffler is very effective, fits perfectly and was expressly designed for use in the CAP. It is SIG part number IRV120150M. In the 4-stroke range, good engine choices might be the YS 1.20 or 1.40 and others such as the Saito 1.20, 1.50, or the newer 1.80.



We have done no testing of gasoline engines for this model and cannot recommend any one particular engine over another. However, should you decide to power your CAP with a gasoline engine, be very sure to use gasoline compatible fuel tubing and a fuel tank meant for gasoline.

**TOOLS AND SUPPLIES**

The CAP ARF requires a variety of typical hobby tools and supplies found in most workshops. For example, you will need a power drill, a selection of drill bits, a Dremel® Tool, screwdrivers (both slotted and phillips), a soldering iron and solder, pliers, a hobby knife with a selection of blades, a ruler, a tape measure, masking tape, wax paper, petroleum jelly, threadlocking compound, such as Loctite®, etc.

You will also need a variety adhesives. We suggest you have both thin and thick SIG CA glues handy, as well as both 5 and 30-minute epoxy glues. For ease of mounting the elevator splitter cables, we found that clear silicon adhesive works great. These assembly instructions will be specific regarding adhesives. While we all have our own preferences, we would urge you to give careful consideration to these suggestions.

**KIT CONTENTS**

The following is a complete list of every part included with your CAP 231EX ARF kit. This kit was packed and inspected at the SIG factory. Each part has been individually inspected and packed by SIG employees. We urge you to be as careful as we have been, using the check-off blocks to inventory your kit before beginning assembly.

- ❑ 1 Fuselage, covered
- ❑ 1 Wing Set, covered
- ❑ 1 Aileron Set, covered
- ❑ 1 Aileron Servo Hatch Cover Set, covered
- ❑ 1 Wing Bolt Plate, covered
- ❑ 1 Vertical Fin, covered
- ❑ 1 Rudder, covered
- ❑ 1 Horizontal Stabilizer, covered
- ❑ 1 Elevator Set, covered
- ❑ 1 Fiberglass Cowl, painted
- ❑ 1 Molded Plastic Canopy Base, painted
- ❑ 1 Molded Plastic Tail Fairing, painted
- ❑ 1 Fiberglass Wheel Pant set, painted
- ❑ 1 Canopy, clear plastic
- ❑ 1 Tailwheel Assembly, complete
- ❑ 1 2-3/4" dia. Spinner Assembly, complete
- ❑ 1 500cc Fuel Tank Set
- ❑ 1 .021x72" Rudder Pull-Pull cable
- ❑ 4 3/32"O.D.x1/2" Alum. Pull-Pull Crimps
- ❑ 2 4-40 Threaded Rigging Couplers
- ❑ 1 1/8"dia.x2" Heat Shrink Tubing
- ❑ 1 Pre-Cut Wood Parts Package:
  - 4 Aileron Servo Mounts - 13/16" sq. x 3/8"
  - 2 Rudder Servo Mounts - 3/8"x 9/16"x1"
  - 1 Throttle Tube Mount - D/C 1/8" plywood
  - 1 Wing Joiner - laminated plywood
  - 1 Front Wing Dowels - 5/16" dia.x1-9/16"
  - 10 Mounting Pads - 1/8"x3/4"sq. plywood
- ❑ 1 2-56 Solder Clevis - Throttle
- ❑ 14 4-40 Blind Mounting Nuts
- ❑ 2 4-40 J-Bolts - Tank Mounting
- ❑ 4 4-40 Solder Clevises - Aileron/Elevators
- ❑ 7 4-40 Threaded R/C Links
- ❑ 2 4-40 x 2/34" Threaded Pushrods - Ailerons
- ❑ 2 4-40 x 2-1/8" Threaded Pushrods - Elevators
- ❑ 4 4-40 x 3/8" Slotted Bolts - Wheel Pants
- ❑ 6 4-40 Hex Nuts - Jam Nuts For Clevises
- ❑ 10 4-40 x1/2" Nylon Bolts - Canopy/Cowl Mounts
- ❑ 4 10-32 x 1" Socket Head Bolts - Motor Mounts
- ❑ 4 10-32 Blind Mounting Nuts - Motor Mounts
- ❑ 2 M5.5x35mm Nylon Wing Bolts
- ❑ 3 M4x25mm Landing Gear Bolts
- ❑ 12 #4x3/8" Sheet Metal Screws - Control Horns
- ❑ 1 Main Landing Gear, .190 hardened aluminum
- ❑ 2 3-3/16" dia. Main Wheels
- ❑ 1 1-1/4" dia. Tailwheel
- ❑ 2 Wheel Axles, hardened steel
- ❑ 2 Lock Nuts for wheel axles
- ❑ 4 Wheel Collars & Set Screws for wheel axles
- ❑ 8 #2 Wood Screws for aileron servo hatches
- ❑ 1 Motor Mount Set, glass-filled nylon
- ❑ 1 Pushrod Connector Assembly - Throttle
- ❑ 17 Nylon Double X Hinges
- ❑ 17 Steel Hinge Pins
- ❑ 3 Nylon Control Horns/RIGHT-Ail., Elev. & Rud.
- ❑ 3 Nylon Control Horns/LEFT - Ail., Elev. & Rud.
- ❑ 1 1/8"O.D.x18" Nylon Throttle P/R Tubing

- ❑ 1 18" Steel Cable Throttle Pushrod
- ❑ 1 #64 Rubber Band - Fuel Tank Retainer
- ❑ 1 Set, Special CAP 231EX Decal Sheets:
  2 #DKM277A
  1 #DKM277B
- ❑ 2 3/4"x18" Yellow Covering Material Strips
- ❑ 1 Assembly Manual

**COVERING MATERIAL**

Your SIG CAP 231EX ARF kit has been expertly covered with #819 Dark Yellow Carl Goldberg Models ULTRACOTE®. Before leaving the factory, all covered parts were inspected and cleaned before being packed. Upon opening your kit you may find that the covering has relaxed in some areas, requiring reshrinking. This is perfectly normal and has nothing to do with the covering material or how it was applied. It has to do with the wood beneath the covering. Wood takes on or loses ambient humidity. Your CAP ARF was manufactured in a relatively humid region of the world. The wood was therefore holding humidity at the time the parts were covered and bagged. Once the parts are removed from their bags and subjected to drier conditions, the wood quickly loses moisture and the covering may appear loose. This also explains why most iron-on coverings stay tight in the summer only to loosen a little in drier winter conditions.

We suggest you use a heat gun and/or a cloth-covered iron to completely go over the various covered parts of your CAP, making sure the covering is drum tight and that every seam is well adhered. Be sure to follow Goldberg's suggested heat settings for ULTRACOTE® to avoid damaging the covering.

**MODELER S TIP**: One of the most common problems associated with shrinking any covering film is controlling the heat around seams. Heat applied close to or directly onto seams re-heats the covering adhesive and the seam will often "crawl". This is easy to control. Just tear a few paper towels into strips and soak them in cool tap water. Lay the wet strips over any covering seam and use your heat gun or iron as you normally would. The wet strips keep the seam cool while the covering immediately next to it shrinks. This tip works great with any iron-on covering.

**INSTALLING HINGES**

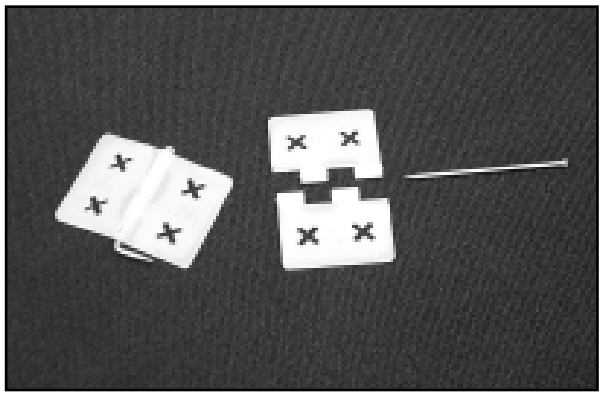
As mentioned, the CAP 231EX is a large airplane with large, powerful flying surfaces. This means that the hinges used to attach these flying surfaces must be up to the task. For this reason, we have included SIG's famous Double X Pinned Nylon Hinges for use with this model. Properly installed, these hinges are extremely smooth in action and very strong. The effort involved in mounting these hinges will be more than compensated by the close fit, smooth action and the peace of mind you have when flying this airplane.

The hinging procedure is the same for all flying surfaces - ailerons, elevators and rudder. This manual will tell you when to hinge the various surfaces - DO NOT hinge surfaces ahead of time, unless instructed to do so. Note that each flying surface and its corresponding installation point have been pre-slotted at the factory for your convenience. Ailerons require four (4) hinges each, elevator halves require three (3) hinges each, and the rudder uses three (3) hinges, for a total of 17 hinges and hinge pins. These are provided in a separate bag in your kit.

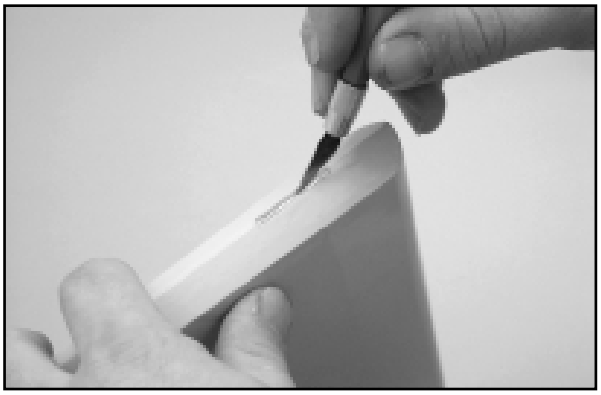
**IMPORTANT NOTE**: There are left and right ailerons. You can easily tell which aileron belongs with the proper wing by the fit and noting the plywood hardpoint plate for the aileron horns on the bottom of each aileron. The outline of this plate is easy to spot through the covering. It lines up with the aileron servo hatch on the bottom of each wing panel. The elevator halves are symmetrical and each has a plywood hardpoint plate on both sides, allowing them to be mounted on either the right or left side of the horizontal stabilizer.

Begin by using a hobby knife to completely open up and clear each pre-slotted hinge openings. These slots need to be 1" wide to accept the width of the hinges and about 5/8" deep on each side. Next use a short length of thin saw blade material (such as a piece of Dremel® saw blade) to open the width of the slots even further to accept the thickness of the nylon hinges.

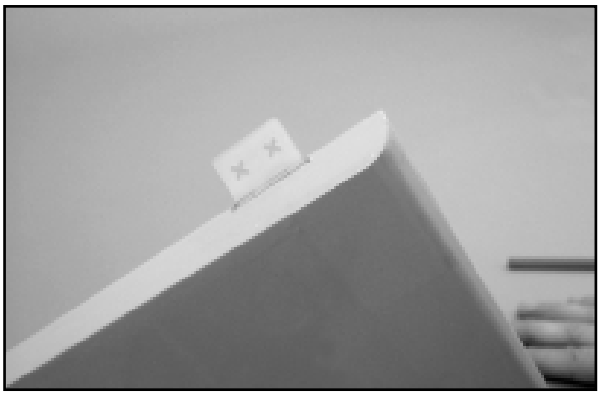
Assemble the hinges by inserting a hinge pin through the center holes of both interlocking halves. Once the hinges are pinned, use a pair of needle nose pliers to bend the sharp end of the pin 90°, as close to the hinge joint as possible, without binding it. Pre-assemble all hinges in this manner.



Next, use a sharp #11 blade in your hobby knife to countersink the round "knuckles" of one of the hinges into the beveled edge of the flight surface (ailerons, elevators and rudder). Simply insert a hinge into the flight surface until it bottoms out on the edge of the bevel. Use your hobby knife to then cut a slot on each side of the hinge knuckle to a depth equal to the knuckle (about 1/8"). Remove the hinge half and use your knife to cut the rest of the balsa and covering away from the hinge slot, allowing the hinge knuckle to recess into the flying surface. Repeat this process for each hinge slot location on each flying surface.

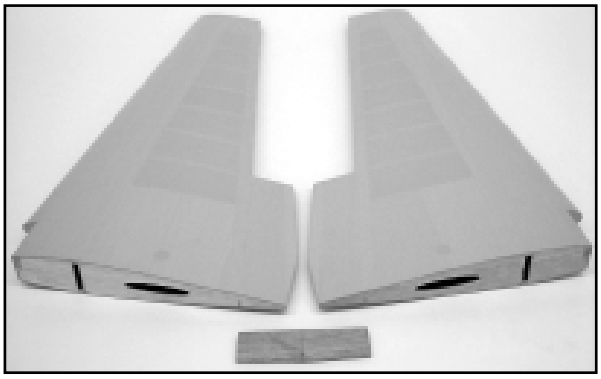


The flight surface can now be hinged in place. Begin by using a scrap wood stick to apply a coat of petroleum jelly, such as Vaseline®, to both sides of the hinge knuckle, as well as each end of the knuckle. Do not get this material on the hinge ends to be glued! Petroleum jelly keeps epoxy from sticking to the hinge joints. Hinges should be installed, starting with the flying surface side first. We also suggest using slow cure 30-minute type epoxy for hinging because of the longer working time and strength. Apply epoxy glue to one side of the hinge, liberally coating each side and filling the "double X" cutouts. Insert the hinge into its slot, along with the sharp end of the pin. Slide the hinge in place into the previously cut recess. The free, unglued side of the hinge half should be even with the front, beveled edge of the flying surface when flexed 90°. Use a clean cloth and alcohol to carefully remove any excess glue and move to the next hinge. Once the hinges are in place in the flying surface, apply epoxy to each side of the remaining hinge halves and insert them into the corresponding slots in the wing, stab or fin. You want the beveled leading edge of the flying surface to be as close to the mating part as possible while still having <u>full</u> left and right or up and down movement ability. Again use alcohol and a cloth to carefully remove all excess glue. Flex the flying surface to be sure it moves freely. Tape the part in place and move to the next surface to be hinged.

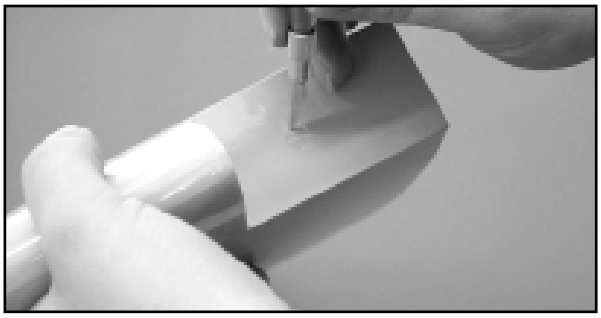


**WING ASSEMBLY**

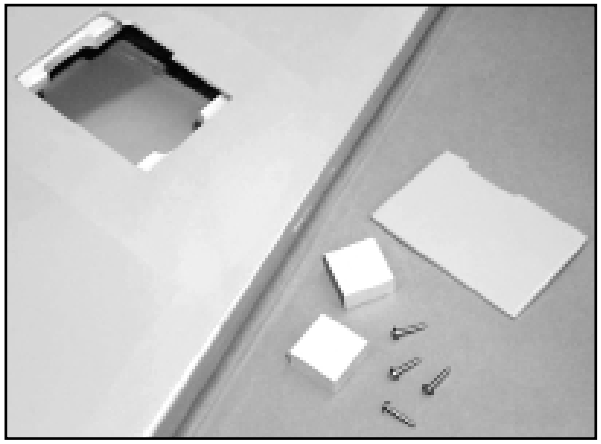
The wing panels have been carefully built, sanded and covered at the factory. The dihedral angle has been already built into the root ribs of these two panels and should require no further adjustment. However, before assembly, install the plywood laminate wing joiner into one of the panels and slip the opposite panel in place. Check the fit for alignment and that both root ribs come into firm, straight contact with each other. If the wing joiner requires a little trimming to achieve this fit, do so now. These instructions assume a good fit.

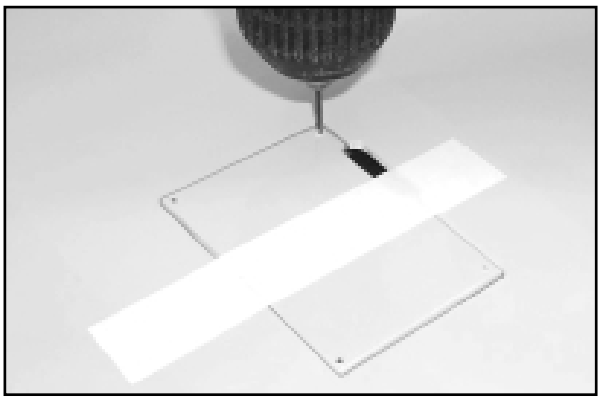


❑ 1) Prepare the two wing panels for assembly by first using your hobby knife to remove the covering from the forward wing dowel mounting holes, the top round holes for the servo cable exits and the rear wing bolt mounting holes.

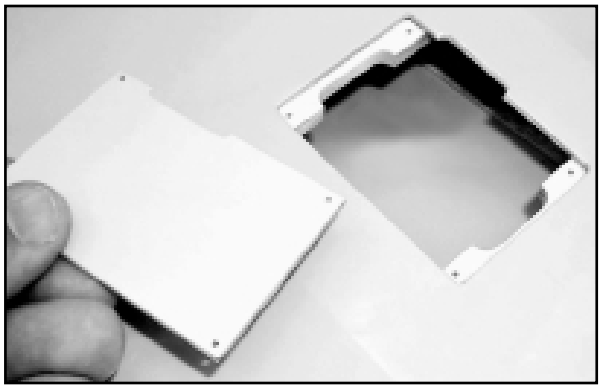


❑ 2) From the kit contents, locate the two (2) pre-covered aileron hatch covers and eight (8) #2 x 3/8" screws. Trial fit the hatch covers into the aileron servo openings to determine which cover goes in the right wing and which goes in the left wing. Position and tape the hatch covers in place, aligning their servo arm cutouts with the ones in the wing opening.

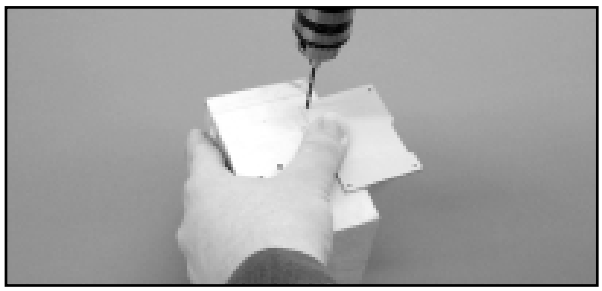




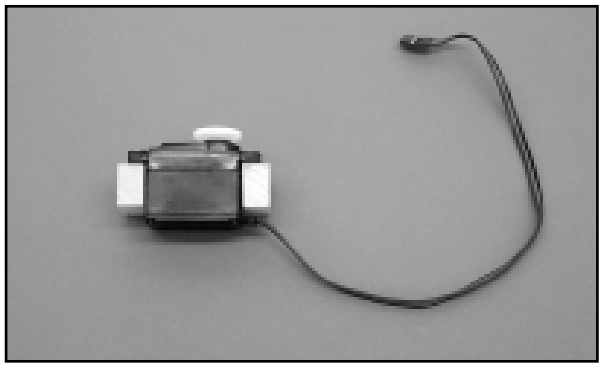
Drill a 1/16" dia. hole near each corner of the hatch covers. Drill completely thru the hatch cover and into the hardwood mounting beams that are in the wing.



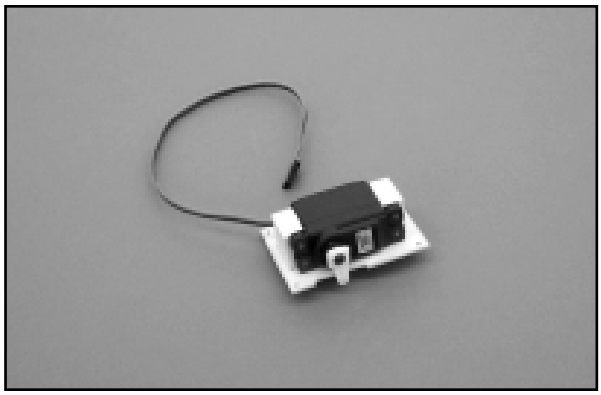
❑ 3) Remove the hatch covers. Redrill the holes in each corner of the covers with a 1/8" dia. drill bit to allow clearance for the screws.



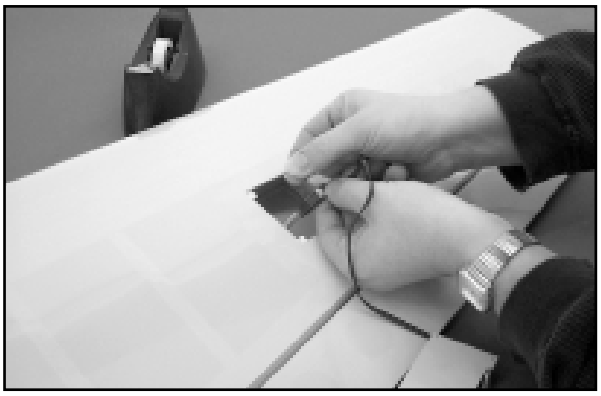
❑ 4) The aileron servos are mounted to the back, uncovered sides of the servo hatch covers. From the kit contents, locate the four (4) 13/16" sq. x 3/8" aileron servo mounts. You will also need the servo mounting grommets, screws, etc., supplied by the radio manufacturer for this step. Remove the servo output arm/wheel and lay the servo flat on its side. Position two of the mounting blocks beneath the servo's mounting arms, also flat on the same surface as the servo. Use a bit to drill the servo mounting holes into the wood mounting blocks. Use the screws that came with your radio system to now mount the servos to the two mounting blocks.



❑ 5) Attach the output arm back onto the aileron servo. Place the servo/mounting block assembly onto the back side of the servo hatch, aligning the output arm with the half slot opening. The servo output arm must be able to move freely back and forth without touching the slot's edge - about 1/32" clearance is adequate. With the servo now in this position, use a sharp pencil to mark the hatch with the locations of the servo mounting blocks. Remove the servo from the hatch and apply thick CA or 5-minute epoxy the to bottoms of the servo blocks and glue them in place to the hatch, again checking for output arm clearance. Place a weight onto this assembly and allow it to dry. Repeat this step with the opposite servo hatch cover.

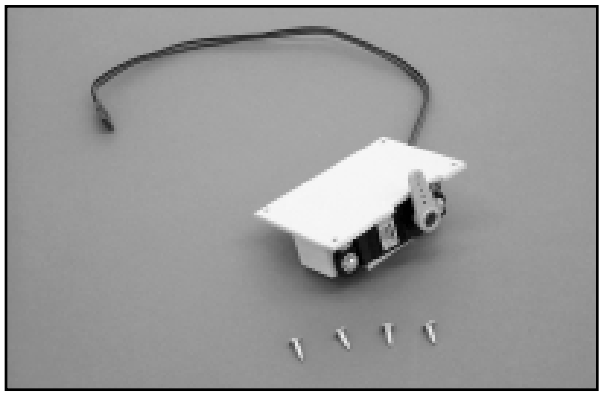


❑ 6) Before installing the aileron servos and hatch covers into the wing panels, use your radio system to 1) center both servos and 2) to check travel. Install the correct servo output arms onto each servo, being sure they are upright at

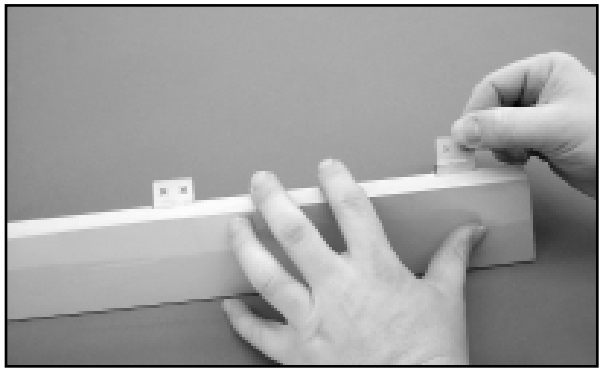


90¡ to the servo and that they are long enough to clear the wing's surface during extremes of travel. Once this has been checked, attach the 12" servo cable extensions to

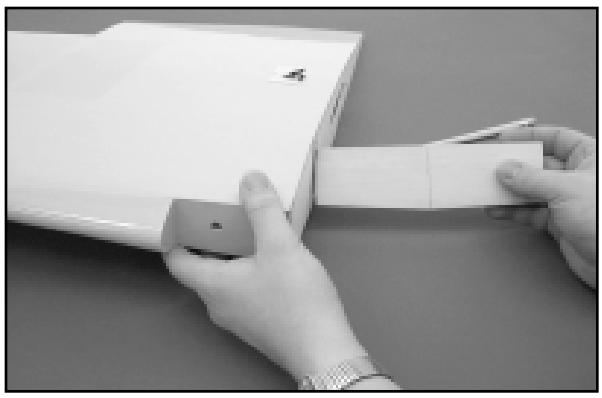
both aileron servos. We would suggest that you also use tape to secure these connections. Feed the servo extension cable into the wing servo hatch opening, through the holes in the ribs and finally out through the round holes provided at the center of each wing panel. Tape the connector to the wing's top surface. Install the aileron servo/servo hatch in place into the wing and use the #2 x 3/8" washer head screws to secure the hatch. Did you remember to install the output arm screws in each servo?



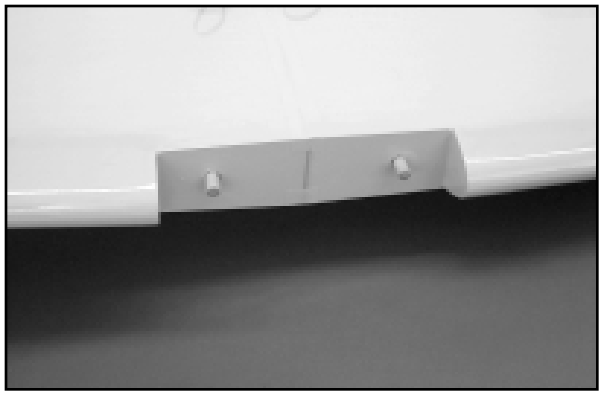
❑ 7) Using the hinging instructions provided, install and glue the four required hinges into each aileron. Hinge each aileron to it's appropriate wing panel - remember that the inset ply aileron horn mounting pad is located on the bottom side of each aileron. Carefully clean any excess epoxy with a clean cloth and alcohol.



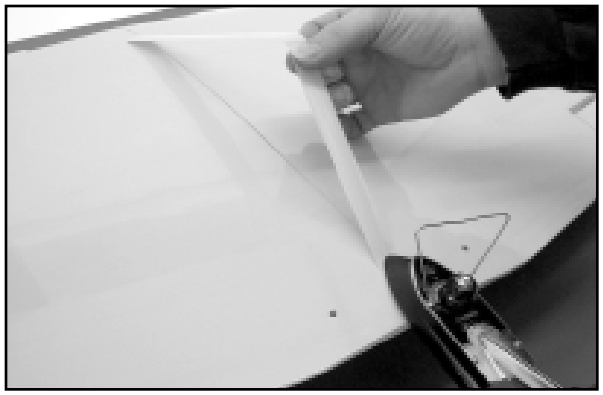
❑ 8) Use 30-minute epoxy to liberally coat the inside of each wing joiner pocket in both wing panel roots. Liberally apply epoxy glue to the exposed wood center ribs of each wing panel and apply glue to the laminated plywood wing joiner itself. Insert the wing joiner into one wing panel pocket and slide the other panel in place over the exposed joiner end, joining the two panels at the center. Press the panels together and use alcohol and a cloth to remove all excess glue. Firmly tape the front and trailing edge joints to align and secure them. Place a clean rag on the floor next to a wall. Stand the wing upright, with one wingtip on the cloth, as vertical as possible, leaning against the wall. Place a weight on the upper wing tip and allow this assembly to fully cure.



❑ 9) Use slow cure 30-minute epoxy to install the two front locating dowels into the front wing plate, leave 1/2" of dowel exposed to engage the corresponding fuselage mounting holes. Use plenty of glue and a stick to get it into the two holes before inserting the dowels. Visually be sure these dowels are straight in the wings and not at angles. With the dowels in place, stand the wing up on its leading edge and allow the glue to cure.

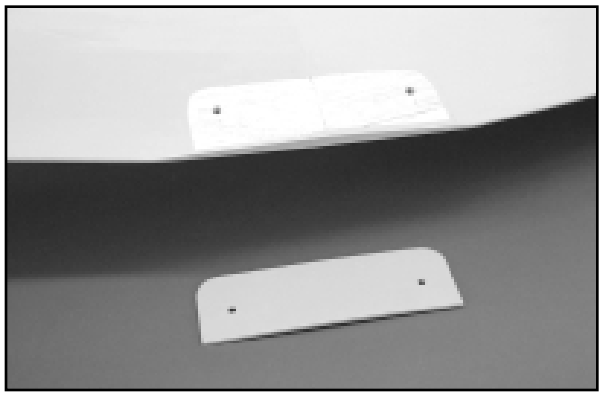


❑10) Use the 3/4" x 18" lengths of ULTRACOTE® supplied with your kit and a heat iron to carefully cover the center wing glue joint. Cover the bottom seam first, followed by the top seam.



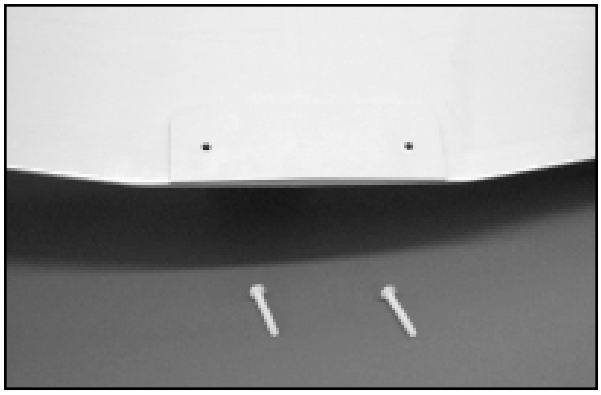
❑11) The wing is now fitted to the fuselage. First engage the two forward dowel ends in the wing into the two dowel holes in the forward, bottom fuselage former. Because of slight differences in the manufacturing process, it may be necessary to adjust one of these holes slightly to receive the wing dowels. If this is the case, only adjust one of the holes. This is easiest to do with a #11 blade in your hobby knife, opening the hole to either the right or left, allowing the wing dowel to pass. Once the wing engages into the front of the fuselage, press it in place into the wing saddle.

❑12) From the kit contents, locate the covered plywood wing bolt plate. The bolt plate has two holes that will line up with the



wing bolt holes already drilled in the rear center section of each wing panel. Use your hobby knife to remove the covering over the two wing bolt holes in the wing panels and the bolt plate. Place the plate in position over the trailing edge of the wing, aligning its rear edge with the fuselage bottom and its two bolt holes with the bolt holes in the wing panels. In this position, press the bolt plate to the wing and use a pencil to draw the outline of the bolt plate onto the wing. Remove the wing from the fuselage. Use a hobby knife to remove the covering material on the wing, about 1/8" inside the bolt plate outline. Glue the bolt plate to the wing - aligning its bolt holes with those in the wing - with thick CA glue. Hold or clamp the plate firmly to the wing, allowing the glue to set.

❑13) From the kit contents, locate the two M5.5 x 35mm nylon wing bolts. Mount the wing in place to the fuselage and insert the two nylon wing bolts into the two holes. Thread the bolts into the blind mounting nuts and use a screwdriver to tighten them and the wing in place onto the fuselage. Do not over tighten the bolts. Remove the bolts and the wing from the fuselage.

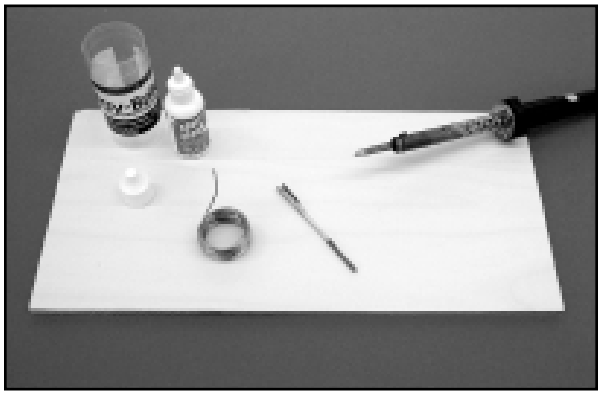


❑14) Connect aileron servo Y-harness to your receiver and servo leads to the Y-harness. Turn on your transmitter and plug your airborne batteries into your receiver. You should now be able to operate your aileron servos.

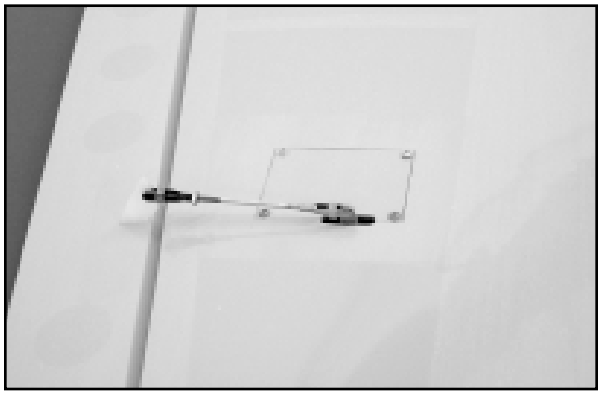
- Center servos with trims and/or through the radio's computer.
- Carefully center servo output arms to exactly 90° upright when at neutral.
- Test the action of the servos, making sure the output arms move freely and that they move in the correct directions for left and right aileron action.
- Turn off the radio system, disconnect the servos from the Y-harness.

❑15) From the kit hardware provided, locate one left and one right nylon control horn and four #4 x 3/8" sheet metal screws. Tape the ailerons in neutral and lay the wing upside down on your bench. Position one of the ailerons horns in place on the bottom, leading edge of the aileron, lined up with the servo output arm. Mark the horns hole locations onto the aileron with a pointed marker pen. Drill two 3/32" dia. guide holes into the aileron at the marks just made. Mount the horn in place, using two #4 x 3/8 sheet metal screws. Repeat this process on the opposite aileron.

❑16) Make the aileron pushrods by first soldering a 4-40 solder clevis to the unthreaded ends of the two 4-40 x 2-3/4" steel pushrods. Thread a 4-40 hex nut onto the threaded end of the pushrod, followed by a threaded clevis. Connect the solder clevis end of the pushrod to the aileron servo output arm. Holding the pushrod in place to the aileron horn, adjust threaded clevis as needed to match its connecting



pin to the middle hole in the horn - snap the threaded clevis in place to the horn. Repeat this process on the opposite wing panel. Remove the tape holding the ailerons in neutral to the wing panels.



❑17) Check the aileron servo action with your transmitter by connecting the servos to your receiver. Final adjustments of all flying surfaces will be done after assembly is complete. This completes the wing assembly.

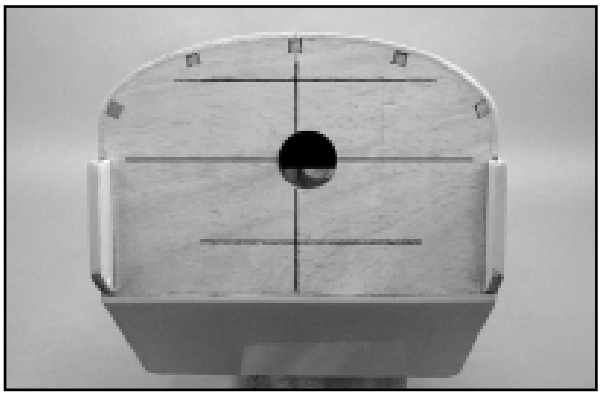
**ENGINE MOUNTING**

It is assumed that most modelers will side mount their engines, with the head in the right cowl cheek. The CAP has a relatively large amount of area for this type of engine mounting and it is highly recommended. Realistically, the engine could be mounted in any position, including upright or inverted, as long as it is understood that the cowl must be cut to clear it. These instructions assume that your engine will be mounted on its side with the head in the right cowl cheek. Accurate horizontal and vertical engine centerline marks are on the firewall. These marks must be used in order to position your engine accurately to the intended thrustline and to accurately mount the cowling. The round hole in the firewall accepts the front of the fuel tank and is purposely offset to allow fuel line clearance when installing most engine types. The supplied motor mounts are generic. They will accept many engines but not all. Check your engine for fit to these mounts before using them. Other after-market mounts are available and will work on this airplane if you choose.

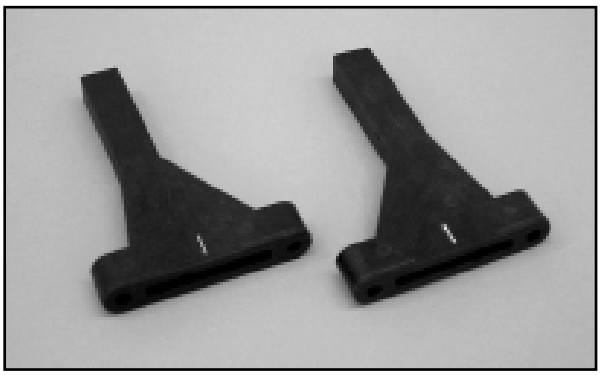
❑ 1) Use a straightedge and pencil to highlight the horizontal and vertical centerline marks on the firewall.

❑ 2) Measure the width of your engine's case, at the mounting lugs. (example: an Irvine 1.50 2-stroke has a case width of 2.03" (2-1/32") between the mounting lugs and a Saito 1.50 measures almost exactly 1.80" between the mounting lugs.). Divide the case width measurement by 2 and place a mark on each side of the vertical centerline on the firewall.

These marks become the inside locator marks for the two motor mounts.

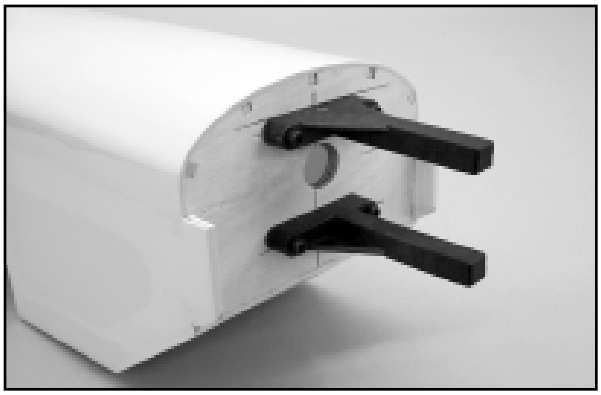


❑ 3) The motor mounts have a centerline "tick" mark at their mounting ends. Line this mark up with the vertical centerline, with the inside edge aligned with the case width marks just made. This is the position the mount needs to be, in order to fit your engine. Mark the mount's bolt hole locations onto the firewall with a pencil or a little shot of paint from a spray can - remove the mount. Repeat this procedure for the opposite mount arm.



❑ 4) Use a 3/16" dia. bit to drill the four required holes in the firewall for the two motor mount arms, being careful to center them as exactly as possible. Once all four holes are drilled, change drill bits to a 1/4" dia. and redrill the four holes to allow clearance for the 10-32 blind nuts.

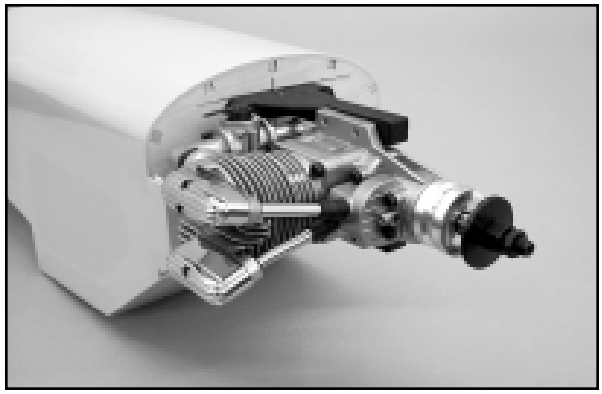
❑ 5) Apply epoxy glue to the four 10-32 blind nuts, keeping glue away from the threads. Install the nuts from the inside of the fuselage, pressing them firmly in place. Use a motor mount arm and a 10-32 x 1" socket head bolt to pull the blind nuts firmly into place in the back of the firewall. Remove the bolt after each nut is secured. When all four nuts are in place, use a cloth and a little alcohol to remove excess glue from the inside back face of the firewall.



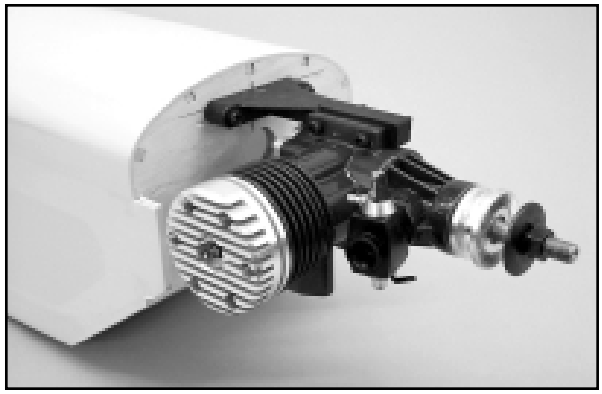
❑ 6) Bolt the two motor mounts to the firewall. Place your engine on the mounts. Move the engine on the mounts until it measures exactly 6" from the front face of the prop drive flange, back to the firewall. This is the distance your engine needs to be from the firewall for cowl mounting and prop clearance purposes. Mark your engine's mounting lug bolt hole locations onto the motor mount arms and remove the engine.

❑ 7) Note that we have supplied you with most of the hardware needed to assemble this kit, with the exception of engine mounting bolts. These you will need to obtain yourself. We have used and strongly recommend, steel hex head bolts at least 1-1/4" - 1-1/2" long, with washers and lock nuts. For example, 8-32 bolts will fit and work with both the Saito and Irvine 1.50 engines -

**DO NOT USE SELF-TAPPING OR WOOD SCREWS FOR MOUNTING YOUR ENGINE ON THE SUPPLIED MOTOR MOUNTS!**



Drill the four required mounting holes in the motor mount arms, being very careful to drill them perpendicular to the mount arm at 90° angles, using the hole locations just made. These must be clearance holes, which allow the



bolts to slip through. In the case of 8-32 bolts, an 11/64" dia. drill bit will provide clearance holes. With the engine's muffler and needle valve removed, mount the engine in place to the motor mount arms.

❑ 8) You will of course need to mount a muffler to your engine and in turn, the muffler must be considered when mounting the cowl in the next assembly step. If you are using either the Irvine 1.20 or 1.50 2-stroke engines to power your CAP, SIG has a muffler available for these engines that is not only light in weight but fits perfectly within the cowl. This muffler is SIG part number IRV120150M and is available separately.

**MOUNTING THE COWL**

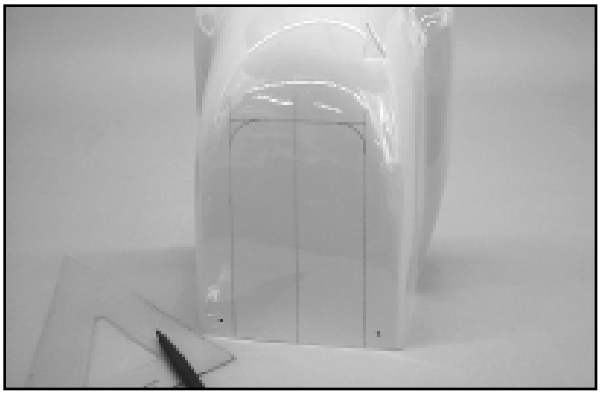
Before mounting the cowl, carefully inspect its inside rear edges. Use sandpaper to smooth the inside rear surface of the cowl, making it free of any bumps or ragged edges that may scratch or dent the fuselage when pressed in place. Also, make sure the four mounting holes are open and free of any debris.

- ❑ 1) Carefully fit the fiberglass cowl in place over the engine and back onto the fuselage. The head of your engine will likely fit inside the cowl. If it does not, you will now need to open the cowl cheek, allowing clearance of the head, rocker arm cover or whatever else may be contacting the inside of the cowl. This is largely a matter of carefully observing where the engine part is contacting the cowl and then marking that location on the cowl with a felt marker. Remove the cowl, and use a Dremel® Tool to make a small hole in the cowl at the point of contact. Refit the cowl, checking the hole location and size, adjust as needed and again use the Dremel® Tool to work on the opening. This method is referred to as "sneaking up" on the opening, making a perfect clearance hole. A handy tool for this job is a small penlight. The penlight can be used from the inside or outside of the cowl to highlight and spot required hole locations. We suggest using a clearance distance rule of thumb of at least 3/16" from the cowl to any engine part.
- ❑ 2) Once the cowl is in place without any part of the engine contacting it, push the cowl back onto the fuselage until the engine prop mounting flange emerges from the front spinner ring. This flange must clear the front of the cowl by at least 1/16".
- ❑ 3) Slip the spinner backplate in place over the engine prop shaft, pushing it all the way back to the prop mounting flange. Mount a prop or prop stub "dummy" in place on the drive shaft, followed by the thrust washer and retaining nut. Tighten this assembly sufficiently to bring the spinner backplate firmly in place against the prop mounting flange.
- ❑ 4) We suggest mounting the cowl with a 1/16" space between the back of the spinner and the cowl. This allows for small thrust adjustments, if desired. Use scrap pieces of 1/16" plywood to space the cowl behind the back surface of the spinner backplate. Center the spinner backplate to the cowl and use masking tape to hold it securely in this position. Use masking tape to secure the back of the cowl to the fuselage, leaving the four pre-drilled mounting holes uncovered. With the cowl securely in place, it is in position for mounting to the fuselage.
- ❑ 5) Use a 7/64" dia. drill bit to drill holes through the fuselage, centered in each of the four holes in the cowl (1 hole on each upper right and left sides of the cowl and 1 hole on each bottom right and left sides of the cowl). From your parts bag, locate two (2) 1/8" x 3/4" sq. plywood plates, four (4) 4-40 x 1/2" nylon bolts and four (4) 4-40 blind mounting nuts. The two 1/8" x 3/4" sq. ply plates will be glued to the inside of the fuselage at the upper right and left hole locations, directly over the holes just drilled. Hold one of the ply plates in place, flat against one of the upper inside cowl mounting holes and use a sharp pencil, from the outside, to make a mark on the plate. Remove the plate and use a 5/32" dia. bit to drill a hole through the plate at the mark just made. Apply epoxy glue to one of the 4-40 blind nuts and insert it into the plate, pressing it firmly in place - wipe off any excess glue. Apply glue to the face of the ply plate and hold it in place inside the fuselage. Before pressing the plate in place, run one of the 4-40 nylon bolts through the cowl and into the fuselage. Engage the bolt into the threads of the blind nut, mounted in the ply plate. Thread the bolt in place, tightening it until the plate is firmly in place against the inside of the fuselage. Repeat this procedure to secure the opposite side of the cowl with a nylon bolt, plate and blind nut.

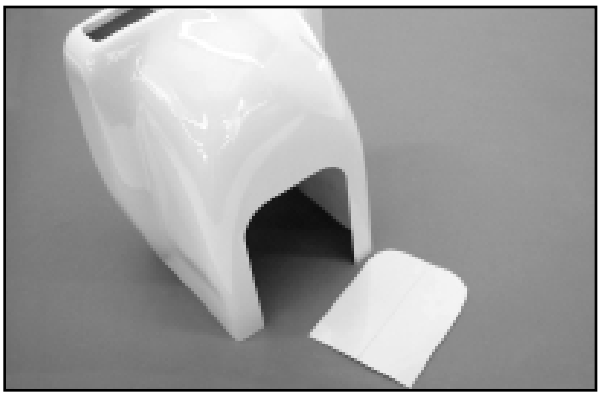
- ❑ 6) The two bottom cowl holes are handled in a similar manner but without using plywood plates. Apply epoxy glue to one of the 4-40 blind nuts and insert it into one of the bottom inside cowl hole locations. With the fuselage flat against your workbench, use pressure to seat the nut firmly into the plywood. Wipe off any excess glue and repeat the process with the remaining blind nut and cowl mounting hole.
- ❑ 7) Use the four nylon 4-40 x 1/2" bolts supplied in your kit to secure the cowl to the fuselage from the outside. Remove all masking tape, the 1/16" plywood spinner/cowl spacer, the retaining nut, prop and spinner backplate. Check your work and remove the cowl from the fuselage.
- ❑ 8) An opening must now be made in the bottom of the cowl. This opening is absolutely necessary to allow incoming air to properly flow through and exit the cowl. Without this opening, your engine will overheat and quit. If you are using a 2-stroke engine, such as the Irvine 1.20 or 1.50 or a 4-stroke, such as the Saito 1.20, 1.50 or the 1.80, we suggest using an opening, which measures 4-1/8" wide by 7" deep. This size opening allows the exhaust pipes on the recommended SIG muffler for the Irvine engines to clear the cowl with plenty of additional air exit area, as well as allowing plenty of air for 4-stroke engines. This opening may certainly be "customized" for your particular engine/muffler set-up, as long as there is sufficient air exit area.

  Stand the cowl upright on its rear edge, nose up, with the bottom side facing you. You will need a ruler, a 90° triangle and a fine point non-permanent felt marker pen to mark the cowl for cutting. The approximate width of the bottom rear edge of the cowl is 6-1/2". Make a mark at the center of the

cowl, approximately 3-1/4" in from the outer edge. Stand the triangle up against the bottom edge of the cowl, aligned with the mark just made. Use the felt marker to draw a vertical line up toward the nose about 8" long. Measuring from this centerline, make a mark at 2-1/16" to the left of the centerline and another at 2-1/16" to the right of the centerline. Again using the triangle and the marks just made, draw a straight vertical lines on the cowl from the bottom edge up towards the nose, again about 8" long. These two outer lines should parallel the centerline. Measure 7" up from the back edge of the cowl, making a mark at one of the outer vertical lines. Repeat this measurement and mark on the other outer vertical line. Use a straightedge and marker pen to connect these two marks. This gives you the area to be cut out from the bottom of the cowl. To avoid sharp corners and for a better look, we suggest using a circle guide to round the two upper corners of this cut out area.



The fiberglass can be cut from the cowl easily, using a Dremel® Tool and a large cut-off wheel. Before cutting out the cowl opening be sure to wear safety glasses and a mask of some kind to avoid inhaling any fiberglass dust. Carefully cut the fiberglass, using the lines previously drawn. If you are careful, you will find that you can get fairly close to the lines with the cut-off wheel. The goal is to remove most of the material within the lines. Once the piece is cut and removed, exchange the cut-off wheel for a sanding drum bit in your Dremel® Tool. Use the drum sander bit to round the upper two corners and to lightly clean up any jagged edges. Use 220 sandpaper to clean up the edges of the cutout, without sanding the paint. Make sure the edges are uniform and free of any loose glass. Remove all fiberglass dust from the cowl with alcohol and a clean cloth.

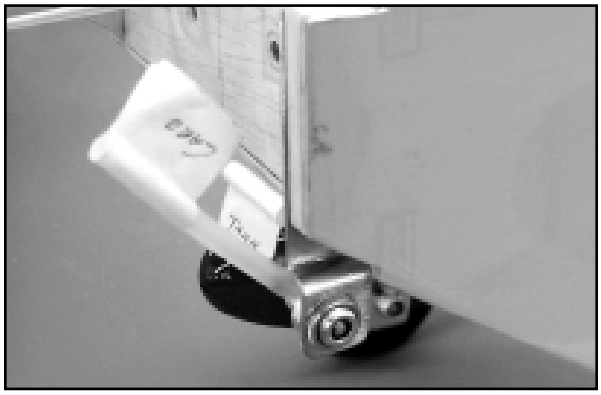


❑ 9) Mount the now trimmed cowl back onto the fuselage, over your engine. In this step you will determine the location for the hole required for your engine's needle valve to exit the cowl. This is easiest done using the penlight mentioned earlier in step #1 and fine line marker pen. First find the approximate location of where the needle valve will exit by looking carefully at your engine's carburetor. Mark that location onto the cowl.

Now look a little closer and use the penlight to adjust the mark just made from the outside of the cowl. Reposition the mark as required to get as close as possible to the actual exit location. Use the Dremel® Tool and a small tipped grinding bit to make a small hole (maybe 1/16" in diameter) in the cowl, at the exit mark just made. Chances are that you were quite close to the actual exit point. Stick a piece of music wire into the hole, down to the needle valve hole in the carburetor. Carefully observe if the hole needs to be repositioned to straighten up the wire, as if it were the needle valve. Make another mark on the cowl and again use the Dremel® Tool to open the hole just a little towards the correct position. In this manner, continue checking and adjusting the exit hole until it aligns perfectly with the carburetor/needle valve position. Use the Dremel® Tool and tapered bit to open the hole enough to insert and install the needle valve in the carb. Be sure the hole has at least 3/32" clearance around the needle valve to avoid contact.

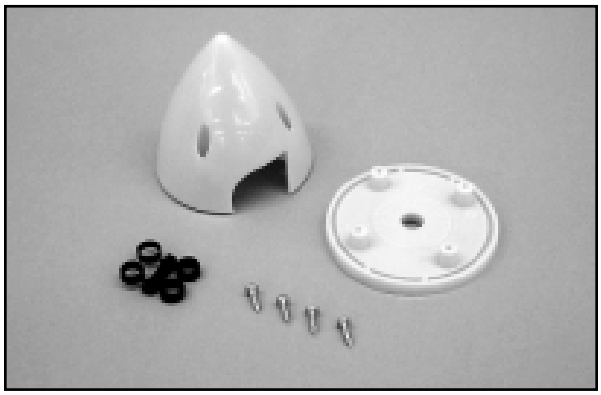
❑10) You must be able to fuel and de-fuel your CAP conveniently. There are several commercially available fueling systems that would work with this model. We have used and highly recommend the Du-Bro #334 Kwik-Fill Fueling Valve for glow engines. In this optional step, we will explain how we mounted our fuel valve. All that's required is to make a simple aluminum bracket, mount it to the firewall area and make a small hole in the cowl to accept the fuel probe. We mounted our filler bracket on the inside face of the left hardwood protrusion on the left edge of the firewall. In order to meet the cowl as closely as possible but

not contact it, we bent the bracket to match the fuselage/cowl side when viewed from the front. Our bracket was made from K&S 1/16“ aluminum sheet. Drill the bottom end of the bracket with a 3/8" dia. hole to accept the fuel valve body and drill two 7/64" dia. holes at the top end, allowing it to be mounted in place with two #4 sheet metal screws (not supplied).



A small hole in the cowl, directly over the fuel valve, must now be made to allow the fuel probe to be inserted into the valve. Place your penlight behind the bracket, at the hole for the filler valve. You can now clearly see exactly where the hole must be on the outside of the cowl. Mark this location with a marker pen, remove the cowl and use the Dremel® Tool and a tapered bit to open up a hole about 5/16" in diameter at the mark made earlier. Put the cowl back on and check your work. Adjust the hole as needed to allow easy insertion and removal of the fuel probe.

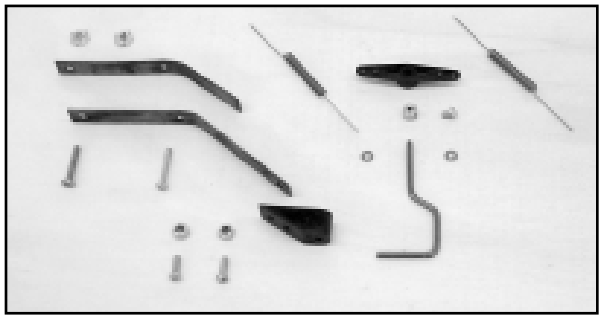
With the engine and cowl mounted in place, the spinner can now be fitted to the engine. This spinner is a high quality SIG unit that has been molded to accept APC propellers up to 16 x 8 in size. The shaft hole in the base of the spinner must be made to fit your particular engine. If required, shaft spacers are included. If your engine shaft is larger than the hole size in the spinner, it can be drilled to fit. This should be done using a drill press. Slip the base plate onto the shaft. Slip the propeller onto the shaft and secure it with



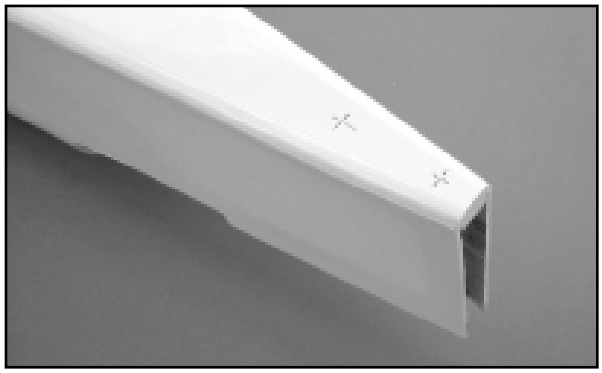
your engine's nut and washer. Snap the spinner nose cone in place into the base plate channels and use the four mounting screws supplied with the spinner to mount it to the base plate. Don't over-tighten the screws but bring them up snug.

**GENERAL FUSELAGE AND TAIL GROUP ASSEMBLY**

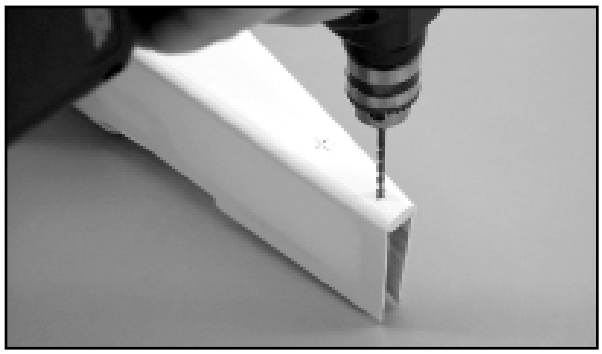
❑ 1) From the kit contents, locate the bag containing the tailwheel assembly. Lay the fuselage upside down on your bench. Note that the tailwheel assembly will be mounted



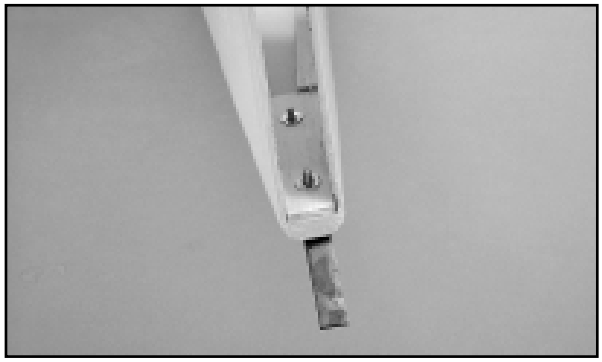
directly to the fuselage at the rearmost location. Hold one of the two tailwheel leaf springs in place on the fuselage, lined up with its centerline. Use a fine tip felt marker to mark



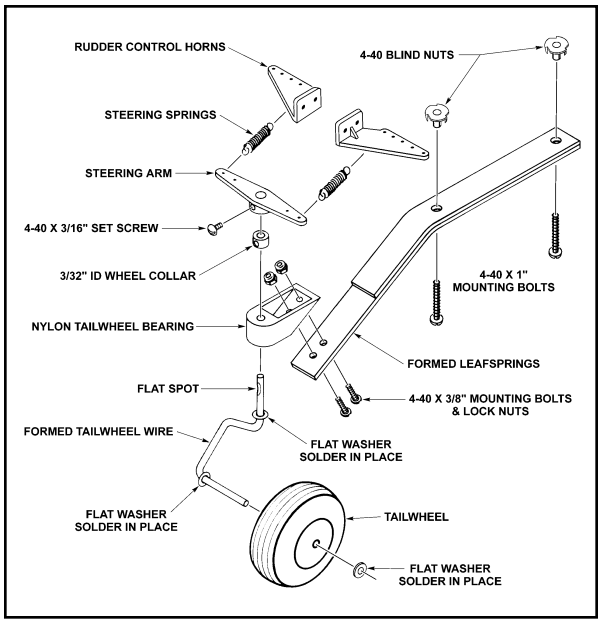
the locations of the two mounting holes in the spring, onto the fuselage. Remove the spring and use a 5/32" dia. drill bit to drill two holes through the fuselage bottom at the hole locations just made.



❑ 2) Turn the fuselage over, exposing the inside rear of the fuselage. Apply epoxy glue to the front surfaces of the two 4-40 blind nuts and insert them into the two holes just drilled. Press them into the wood and wipe off any excess glue, keeping glue out of the threads.

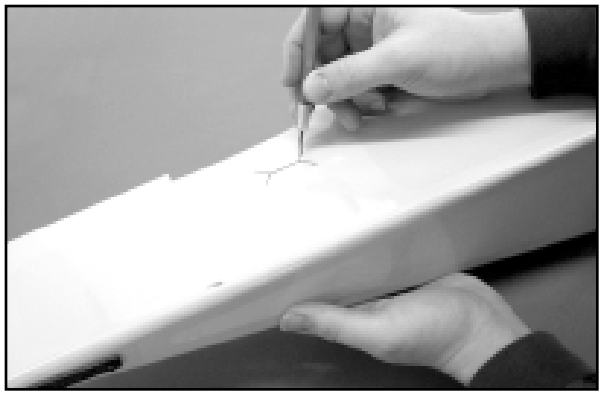


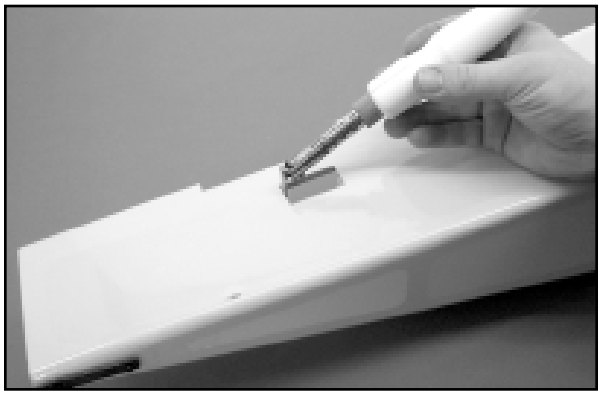
❑ 3) As shown, assemble the nylon bearing bracket to the longer of the two leaf springs with two 4-40 x 3/8" bolts and two 4-40 locknuts. Slip a #2 washer over the top of the tailwheel wire, sliding it down to the top bend in the wire. Solder the washer in place to the wire as shown. Slip another #2 washer over the axle end of the tailwheel wire, sliding it back to the first bend - solder the washer in place. Insert the top end of the tailwheel wire into the plastic bearing bracket, up to the soldered washer. Insert the wheel collar into the bottom of the steering arm, aligning its threaded hole with the arm's clearance hole. Install the 4-40 x 3/16" bolt through the steering arm hole, threading it into the wheel collar. Slip the steering arm in place over the exposed top end of the tailwheel wire, with the set screw facing the rear. Leave clearance for free movement and tighten the set screw in place to the wire.



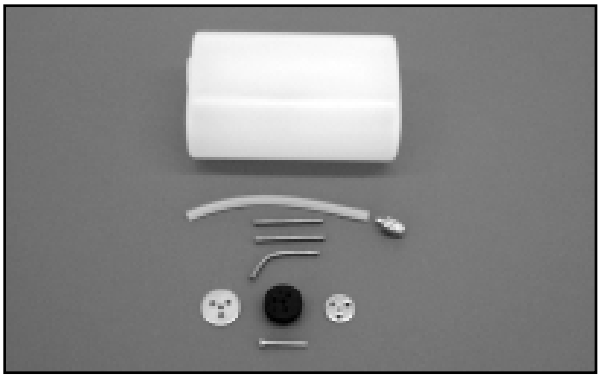

❑ 4) Place the 1-1/4" dia. tailwheel onto the axle end of the wire. If the wheel is a tight fit, use a 7/64" dia. drill bit to open the axle hole a little. The remaining #2 washer will be soldered in place to retain the tailwheel. To protect the plastic wheel hub, use a scrap piece of 1/32" plywood over the axle and against the wheel. Slide the washer in place against the plywood and solder it in place - remove the plywood spacer. The completed tailwheel assembly is now bolted in place to the fuselage, using two 4-40 x 1" bolts. Use non-permanent Loctite® on the bolt threads to prevent them from loosening.

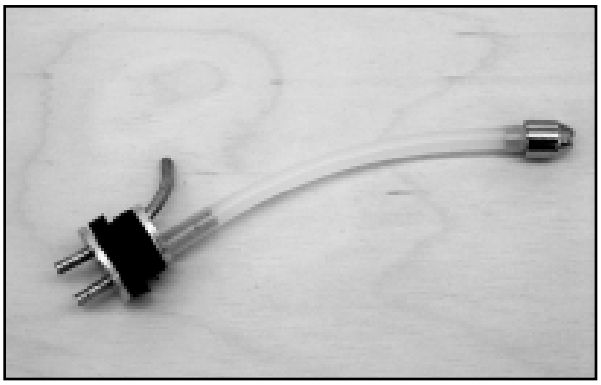
❑ 5) Use a sharp #11 blade to open up the two elevator servo cutouts, beneath the stabilizer saddle at the top rear of the fuselage. Use a trim seal iron to tack the loose covering around into these cutouts. Trim and remove the excess covering material.

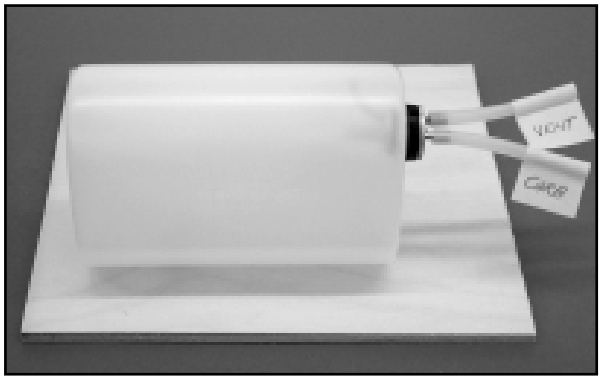




❑ 6) Assemble the fuel tank as shown. Be sure to label the "vent" and "carb" lines for later identification.



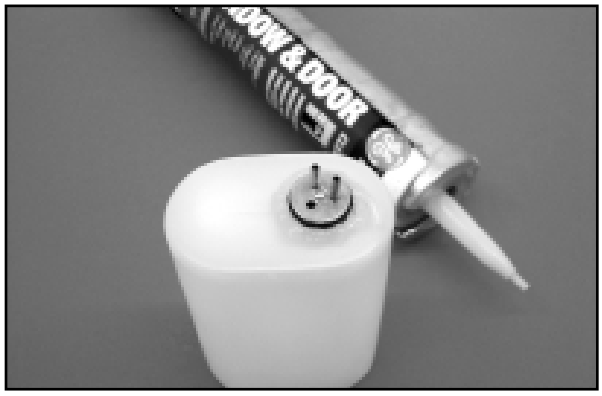




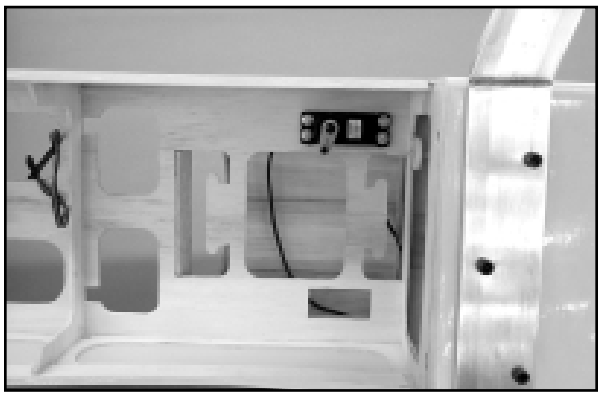

❑ 7) Trial fit the tank in place into the front of the fuselage to familiarize yourself with how it mounts. The front fits into the hole in the firewall and the end of the tank requires support. For this you will need to now install two J-hooks,

one on either side of the tank. With these in place, a #64 rubber band is hooked to one J-hook, pulled around the tank and hooked to the opposite J-hook. With the tank in place, use a pencil to mark the J-hook locations - remove the tank. Glue two 1/8" x 3/4" plywood mounting pads over the hook location marks. Use a twist drill with a 5/64" bit to drill guide holes through the pads and fuselage supports. Thread the hooks in place.

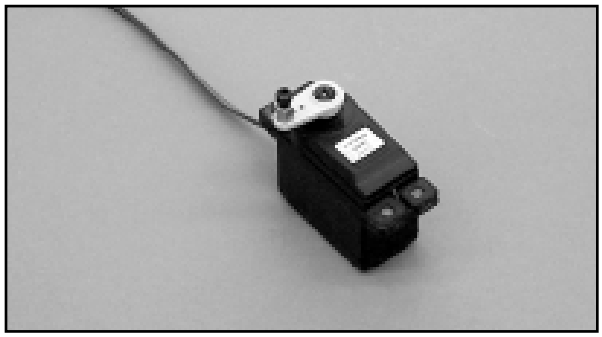
❑ 8) Apply a bead of silicon adhesive around the neck of the tank, where it contacts the inside of the firewall. Fit the tank in place into the fuselage, pressing it firmly against the firewall. Support the rear of the tank to the fuselage with a #64 rubber band, using the J-hooks.



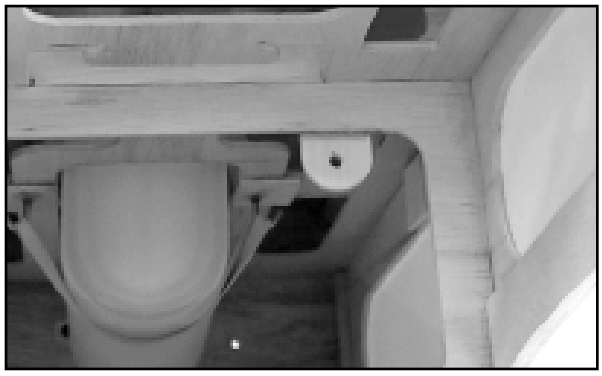
❑ 9) Two throttle servo locations are provided, one on each side of the fuselage. Choose the side that corresponds with the throttle arm on your engine. Attach the grommets supplied with your radio system to the servo mounting lugs and use the mounting screws, also supplied with your system, to mount the throttle servo.



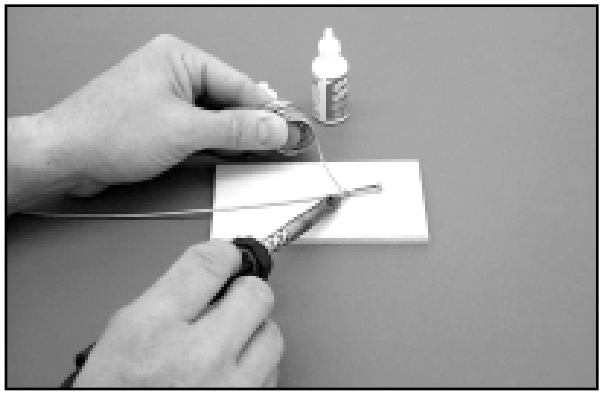
❑10) From your kit, locate the 1/8" OD x 18" nylon throttle tubing, the 18" length of steel throttle cable, the die-cut 1/8" plywood throttle tube support (small part with one rounded end with a hole for the tube), the pushrod connector assembly (3/16" hex brass body, nylon retainer and 4-40 x 1/8" socket head cap screw) and the 2-56 solder clevis. Drill a 1/8" dia. hole through the firewall, aligned with your engine's carburetor throttle arm. From the front, insert the 1/8" nylon tube through the firewall and into the fuselage, leaving 3" exposed in front of the firewall (typical when using a 1.20 or 1.50 2-stroke engine). With the tube in place, turn the fuselage over and note the location of the tube in relationship to the throttle servo. You want to position the tube directly in front of the servo's output arm. Assemble the pushrod connector to the servo output arm.



Slip the die-cut 1/8" plywood throttle tube support part over the end of the tube, back to the forward fuselage former location. Glue the support in place to the inside front of the former, locating the tube directly in front of the throttle servo output arm. Use a razor blade to trim the tube to a length of 1" behind the die-cut tube support. Remove the tube and sand its surface with 220 sandpaper to rough it a little. Reinstall the tube and glue it in place to the firewall and the die-cut tube support with thick CA glue.

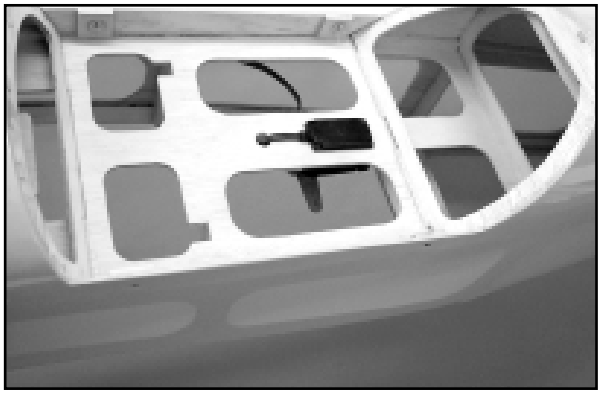


❑11) The steel throttle cable is now prepared for installation. Solder the provided 2-56 solder link to one end of the cable

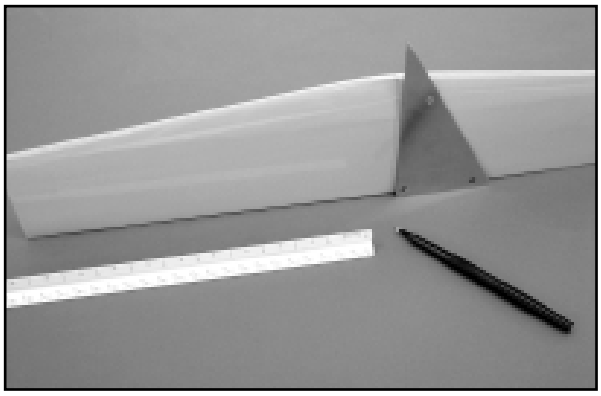


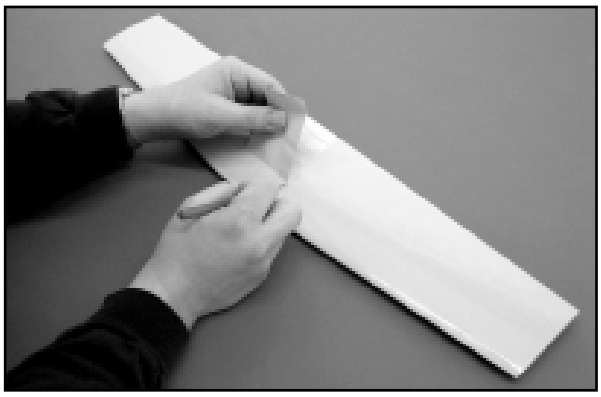
- this is the carburetor end. Install the brass pushrod assembly to the output arm on the throttle servo and press the output arm in place onto the servo. From the firewall, insert the bare end of the cable through the throttle tube, connecting the solder link to your engine's throttle arm. The cable is now cut to length, leaving about 2" of extra length behind the brass pushrod connector. The extra length will be useful when setting up the throttle later on.

❑12) From your kit contents, locate the two 3/8" x 9/16" x 1" hardwood rudder servo mounting blocks. As shown, the rudder servo is mounted in the center servo cutout, directly beneath the canopy base. In order to mount the servo, the two hardwood blocks must be glued in place at the front and rear edges of the cutout. Test-fit the servo first. If the opening needs enlargement, do this now until a good fit is achieved. Epoxy the mounting blocks in place. As shown, we drilled a small diameter hole in front of the servo, redirecting the connector back into the fuselage. Use the grommets and screws provided with your radio system to securely mount the rudder servo in place onto the blocks.

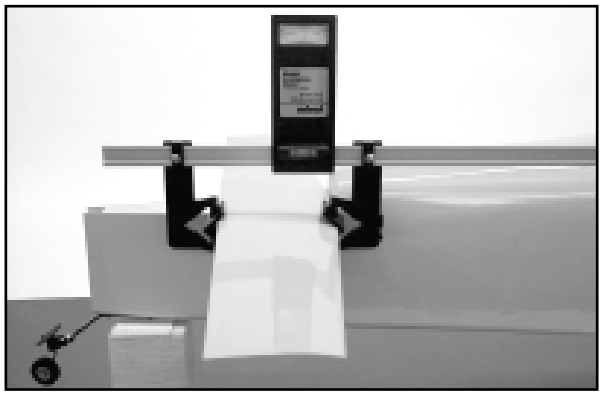


❑13) Use a ruler to find the exact center of the stabilizer, marking the location with a felt pen. Use a triangle to draw a 90° centerline directly onto the stab at this location. Place the stabilizer into the fuselage, centering it visually. Holding the stabilizer in place, use the felt pen to mark the stab bottom, where it meets the fuselage on each side. Remove the stabilizer and use a #11 blade to carefully remove the covering material just inside of these two lines, including where it contacts the fuselage at its leading and trailing edges.

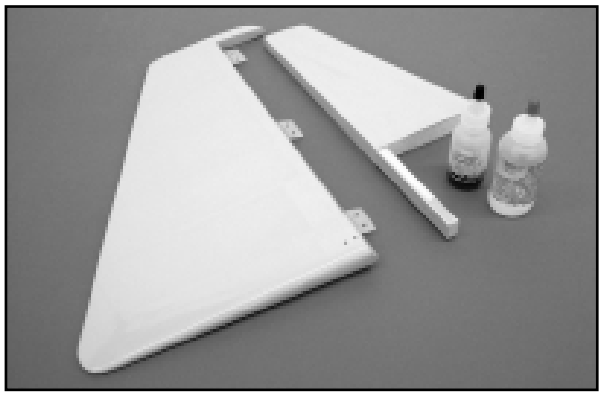




❑14) In this step you will prepare the horizontal stabilizer for mounting by first checking it's alignment with the wing and fuselage. Start by using the three M4 x 25mm bolts provided to mount the landing gear to the fuselage. Bolt the wing in place. Attach a Robart Incidence Meter tool to the inboard leading and trailing edge of the wing and prop the rear of the fuselage up until it is level according to the meter. In this position, the wing incidence should read 0°. Place the stabilizer into its saddle in the fuselage and use weights to secure it. With the stab in this position, remove the Incidence Meter from the wing and attach it to the leading and trailing edge of the stabilizer. Ideally the meter will again read 0°. If it does not, then the saddle in the fuselage must be adjusted to seat the stab at 0°. Use sandpaper or a #11 blade to adjust the stab saddle as needed. Remove the stab from the fuselage.

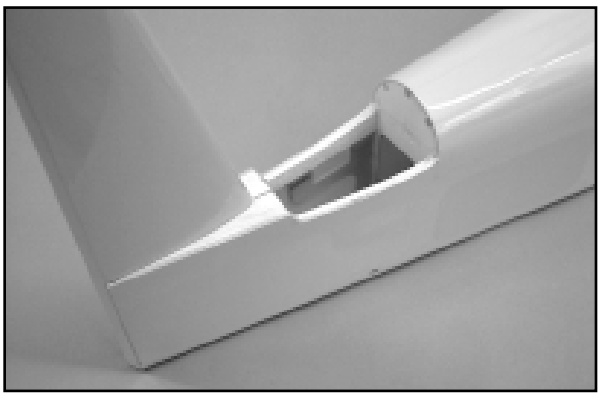


❑15) To prepare the fin for mounting to the fuselage, first, pre-hinge the rudder, gluing the hinges into the rudder, but not into the fin. Remove the covering material from the sides of the fin tailpost that fits into the fuselage. Draw a centerline onto the fuselage fin mounting base, to assist you in aligning the fin. Using slow-cure epoxy, apply glue to the bottom of the fin and to the tailpost sides, where it contacts

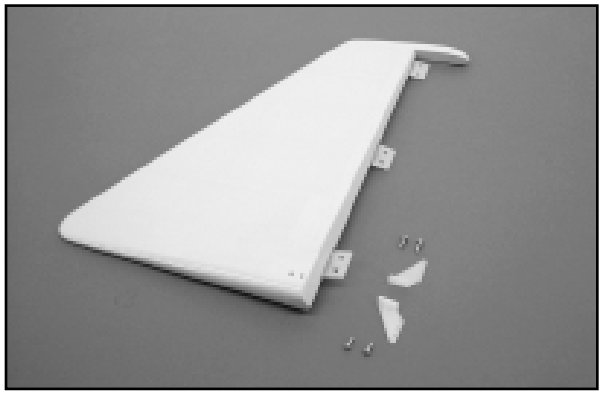


the fuselage. Slide the fin in place into the fuselage and onto the fin mounting base. Align the leading edge of the fin with the centerline and use tape to hold the fin in place. With the fin in this position, view the airplane from the front and rear to be sure that the fin is absolutely 90° upright to

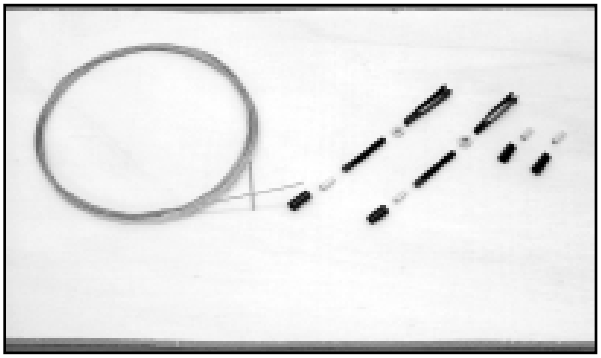
the fuselage and aligned with the centerline of the fuselage. Wipe off any excess glue with alcohol. Adjust as needed and tape securely. Remove the wing and allow the glue to cure completely.



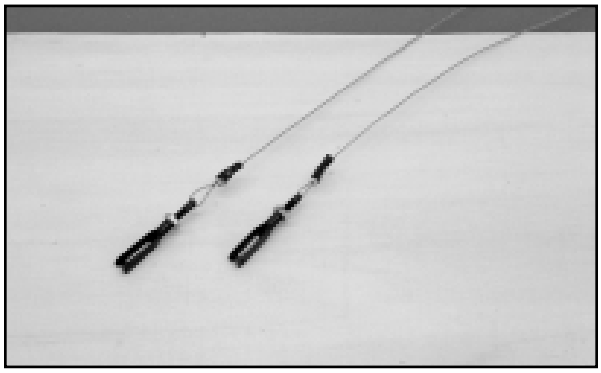
❑16) Install a right and left rudder horn to the bottom of the rudder using #4 x 3/8" sheet metal screws. The rudder has inset plywood mounting pads on each side for this purpose. The two rudder horns directly oppose one another and should be lined up with the pull-pull exits at the bottom rear of the fuselage. The rudder is now hinged to the fin using epoxy glue on the hinges - remember to protect the hinge knuckles with petroleum jelly. Clean off any excess glue and allow to cure.



❑17) The rudder pull-pull system is now installed. Begin by using your radio system to accurately center the rudder servo. Install the output arm onto the rudder servo. From your kit contents, locate the package containing the coil of .021 braided steel cable, rigging couplers, heat shrink tubing and aluminum crimps. You will also need two 4-40 threaded R/C links and two 4-40 hex nuts. Cut the braided cable into two equal 36" lengths (a carbide cut-off wheel works great) and cut the heat shrink tubing into four 1/2" lengths.



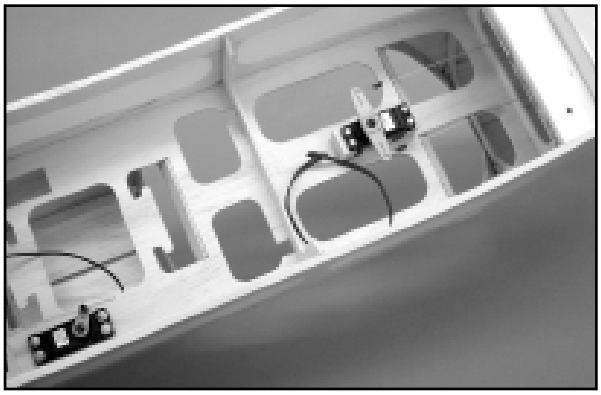
Place one 1/2" length of heat shrink tubing onto one end of the cable, followed by one of the 1/2" aluminum tubes. Thread the end of the cable through the small hole in the end of the threaded rigging coupler, giving yourself about 4" - 5" to work with. Make a half loop around the rigging coupler hole and run the short end of the cable through the aluminum tube. Pull the tube up to the rigging coupler, about 1/2" away from it. Take the short end of the cable and loop it back around and through the aluminum tubing, pulling it tight. Use a pliers or a crimping tool to squeeze the aluminum tube tightly over the cable in two places, locking it in place. Cut off the excess short end of the cable. Press the heat shrink tubing in place over the aluminum tube and use heat to shrink it in place. Thread a 4-40 hex nut completely onto the rigging coupler, followed by a 4-40 R/C link. Center the link approximately onto the rigging coupler threads. Repeat this process on the remaining length of cable. These two prepared ends will be located at the rudder.



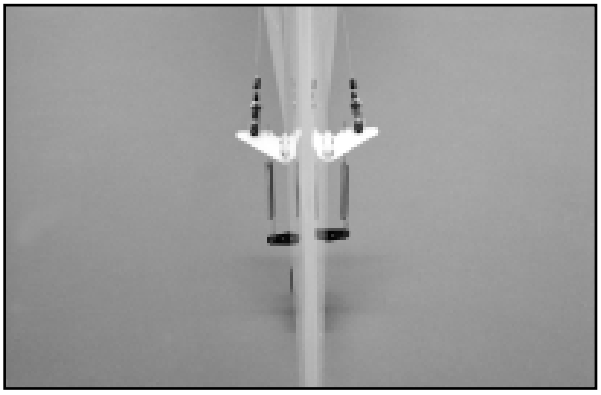
**PULL-PULL GEOMETRY:** In order to make this or any pull-pull system work correctly, without binding or placing undue stress on the servo, the connections must have the proper geometry. This is simply a matter of making the spacing of the two required connections at the rudder horns and those at the servo output arm, the same distance apart. Using the after-market DuBro Super Strength output arms, we used the two outer holes, which have a spacing of 2". Therefore, at the rudder horns, we made our connections at the center holes on each horn, providing 2" of spacing. Doing this assures smooth, non-binding rudder action.

Feed the bare end of the cables into the pull-pull exits at the bottom rear of the fuselage and up to the rudder servo location. Use masking tape to hold the rudder in neutral with the fin. Connect the R/C links to the rudder horns using the same hole locations on each horn. Turn the fuselage upside down on your bench and make the cable connections to your servo output arm. Start by placing a 1/2" length of heat shrink tubing onto the cable, followed by a 1/2" aluminum tube. Thread the bare cable end through a hole in your output arm with a half loop back into and through the aluminum tubing. Pull the cable to remove any slack - not tight - and slide the aluminum tube up to the output arm, about 1/2" away. Re-loop the bare cable end through the aluminum tubing and pull it tight. Crimp the tubing in two places and cut off the excess cable. Press the heat shrink tubing in place over the aluminum tube and use heat to shrink it tight. Repeat this process with the remaining cable on the opposite side of the output arm. With the rudder still taped in neutral, adjust the R/C links at

the rudder horns to approximately the same mild tension - do not pull the cable tight. Remove the tape holding the rudder in place, plug the rudder servo into your airborne system, turn on the transmitter and test the movement and centering of the rudder. Adjust as needed. Thread the hex nuts back to the R/C links and tighten them to lock the clevises in place. Be certain the output arm screw is in place!



❑18) The two tailwheel centering springs are now attached to the tailwheel tiller arm and the two rudder horns. Use needle nose pliers to make a small "Z" bend at one end of each spring. Install the "Z" bend ends to rudder horns. Apply a small amount of tension to the spring and use the pliers to make a 90° bend at the tailwheel tiller arm hole. Insert the wire into the tiller arm and make another 90° bend, creating a "Z" bend. Do not over stretch the springs when doing this. The springs should center the tailwheel to the rudder when it is at neutral.

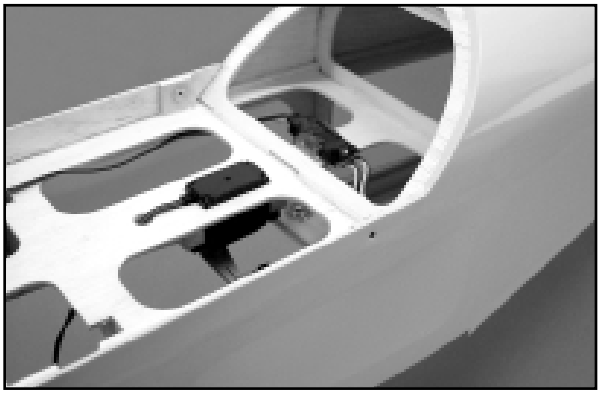


❑19) The elevator servos are now installed. As mentioned earlier, you will either need to electronically reverse one of these servos and use a standard Y-harness with 12" extensions or use the "Miracle Y™" elevator splitter to


obtain "mirror image" elevator action. Install the splitter cables through the back of the canopy hatch opening, back to the two elevator servo cutouts. To avoid a clutter of

cables and to keep them away from the pull-pull cables, route the extensions through the upper rear fuselage. Connect the servos to the extension cables, securing the connectors with tape. Mount the servo grommets supplied with your radio system to both servos. Insert one of the servos in place and mark it's mounting hole locations onto the fuselage side with a felt pen. Pre-drill guide holes

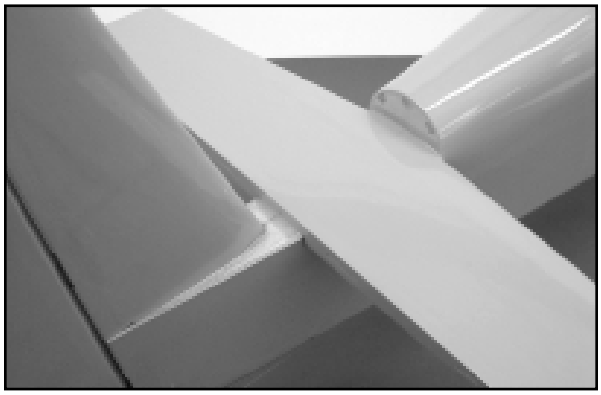
(typically 1/16" dia.) for the mounting screws and repeat this procedure on the other side of the fuselage for the opposing servo. Install the elevator servos, securing them with mounting screws. Use your radio system to check the action of these servos. Make any corrections required. We used silicon adhesive to spot glue the extension cables in place to the upper rear of the fuselage and to mount the "Miracle Y™" control pot, just behind the canopy base.



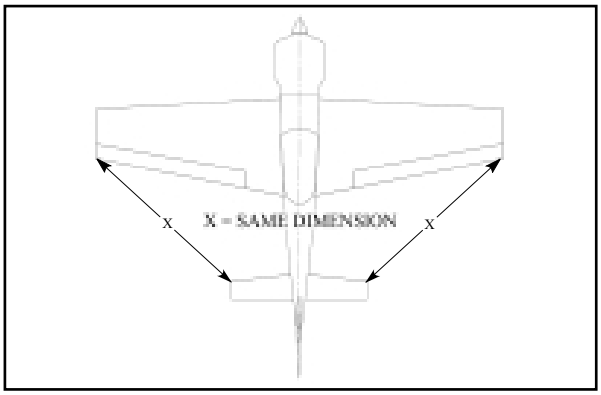
❑20) Pre-hinge the elevator halves by gluing their hinges in place and preparing the horizontal stabilizer to receive the opposite hinge ends - do not hinge elevators to the

stabilizer yet.

❑21) Bolt the wing back in place to the fuselage. The horizontal stabilizer is now glued in place. Use only slow-cure epoxy for this step. First set the airplane on your flat work surface and prop the tail up to about level. Apply glue to the



fuselage stab saddle and position the stab squarely in place - use a weight to secure it. View the airplane from the top, front and rear, making sure the stab is square, without leaning one way or the other. Use a ruler to measure from the outer trailing edge wingtip back to the stab's leading edge tip and note the measurement and repeat this process on the opposite side. The two measurements should be the

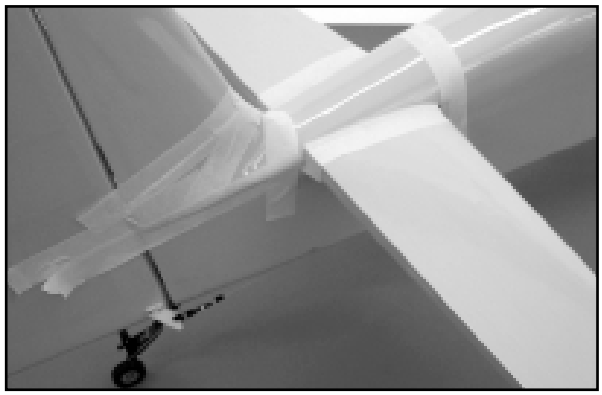



same. Make adjustments as needed. Tape and/or weight the stab firmly in place to the fuselage, wipe off any excess glue with alcohol and allow the glue to set. Remove the wing from the fuselage.

❑22) Locate the molded plastic fuselage/fin fairing. Fit the fairing in place onto the fuselage, over the stabilizer and around the fin to check the fit. Trim as need to seat the fairing

squarely in place, in contact with the fuselage, top of the stabilizer and the fin. Once satisfied with the fit, mark the location of this fairing onto the fuselage, stab and fin with a pencil - remove the fairing. Use a sharp #11 blade to cut

away the covering just inside of the outlines just made, exposing the wood. Apply a coat of epoxy glue to the inside of the fairing where it will contact these areas. Fit the fairing, pressing it firmly in place to make sure it contacts all gluing areas. Clean up any excess glue with alcohol and use tape to secure the faring in place. Allow the glue to cure.



❑23) Apply petroleum jelly to the elevator hinge knuckles and apply epoxy to the exposed hinge halves. Attach the left and right elevator halves to the stabilizer, wiping off any excess glue from the hinge line. Tape the elevator halves to the stabilizer in the neutral position and allow the glue to cure.

❑24) From the kit contents, locate the two 4-40 x 2-1/8" elevator control rods, two 4-40 solder clevises, two 4-40 threaded R/C links and two 4-40 hex nuts. Make two elevator pushrod assemblies by soldering a solder clevis onto the unthreaded ends of the pushrods. Thread a hex nut onto the threaded ends, followed by an R/C link.

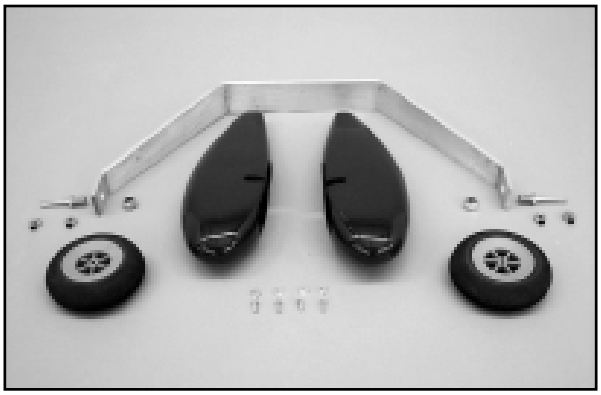
❑25) From the kit contents, locate a right and left nylon elevator horn and four #4 x 3/8" sheet metal screws. Remove the wing from the airplane and turn the fuselage upside down on your bench. The elevator horns are now installed onto the bottoms of the elevator halves. As mentioned, there are plywood mounting pads in the elevator halves, inset in their forward, inboard leading edges. Hold the horn in place on the elevator, lined up with the elevator servo output arm, with the holes in the horn directly over the elevator/stab hinge line. Mark the horn mounting holes with a felt pen. Pre-drill the hole locations with a 3/32" dia. bit. Mount the horn in place with two #4 x 3/8" screws. Repeat this procedure on the opposite elevator half.

Use your radio to center the elevator servos and then mount

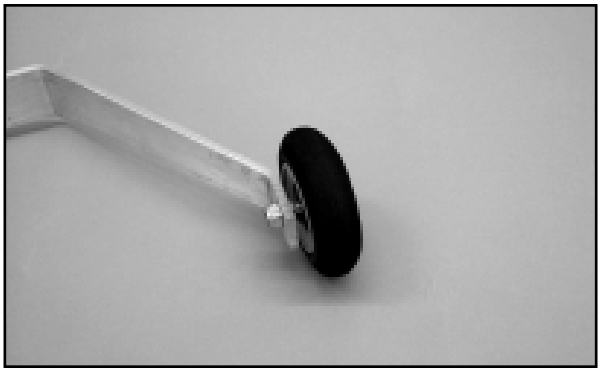
the servo output arms in place at 90° upright. Attach the solder clevis ends of the elevator pushrods to the servo output arms. Adjust the threaded clevis ends to fit into the middle hole in each elevator horn. Remove the tape holding the elevators in neutral and test the movement of the elevators with your radio. Adjust as required get both elevators exactly at neutral - if you are using the "Miracle Y™" splitter cable, you can turn the pot adjustment to achieve neutral very easily. Final surface throw adjustments and locking the R/C links in place with the hex nuts will be made later.

**LANDING GEAR AND WHEEL PANT ASSEMBLY**

From the kit contents, locate the two 3-3/16" dia. main wheels, two main wheel axles, two axle lock nuts, four wheel collars with lock screws, four 4-40 x 3/8" bolts, four 4-40 blind nuts and two fiberglass wheel pants. You will also need the aluminum landing gear and the three M4 x 25mm mounting bolts. We also suggest that you use Loctite® threadlocking compound on all bolts used in the assembly of the landing gear.



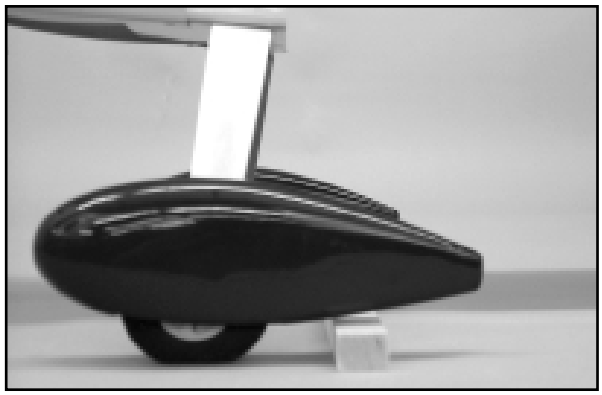
❑ 1) Install the axles into the large holes at the bottom of each



landing gear leg. Thread the large lock nuts onto the threaded ends of the axles and tighten these securely in place to the landing gear. Slide a wheel collar onto the axle shaft, all the way to axle's hex nut. With the wheel collar set screw pointing straight down, tighten the set screw to the axle. Slide a main wheel onto the axle, followed by another wheel collar. With the set screw pointing straight down, tighten the set screw enough to temporarily retain the wheel.

❑ 2) With the wheel pant slots facing inward, fit the pant in place over the wheel - if necessary, loosen the wheel collars to reposition the wheel to fit into the pant. The pant slot should accept the axle hex nut. If not, rotate the hex nut with a wrench until the pant slides in place. This is how the pants fit to the landing gear.

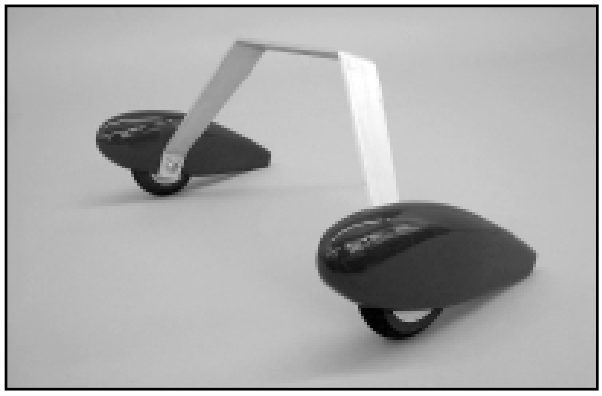
❑ 3) Remove the loose wheel pants from the landing gear. Bolt the landing gear in place to the bottom of the fuselage. Set the fuselage on your flat workbench, with the tail supported to approximately level. Place both wheel pants onto the landing gear. Use a length of balsa stock (1" sq. shown) to equally raise the rear of both wheel pants. Move the balsa spacer to adjust the angle of the wheel pants until their centerlines look parallel with fuselage. Hold the pant in this position, against the landing gear. Use a 7/64" dia. drill bit, through the two pant mounting holes, to mark the wheel pant with the hole locations. Remove the wheel pants.



❑ 4) Use a 5/32" dia. drill bit to drill two mounting holes in the wheel pant at the marks just made. Apply epoxy glue to the face of two 4-40 blind mounting nuts and insert them in place into the holes, from the inside of the wheel pant. Wipe off any excess glue, keeping it out of the blind nut threads.

❑ 5) Install the wheel pants to the landing gear and secure them with the 4-40 x 3/8" bolts. Turn the landing gear assembly upside down and use the two wheel collars to center and space the main wheels to the pant openings. The wheels should turn freely without obstruction. Mount the

completed landing gear to the fuselage.

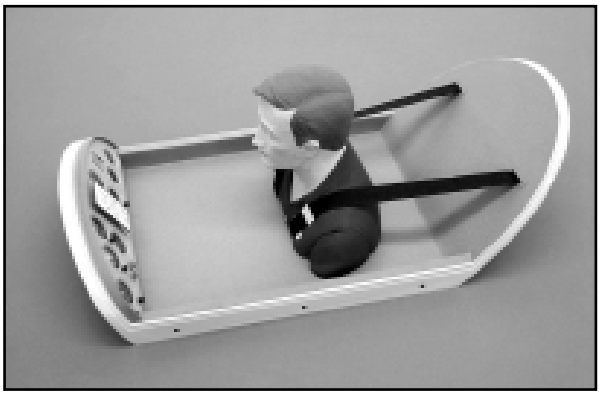


**CANOPY AND CANOPY BASE ATTACHMENT**

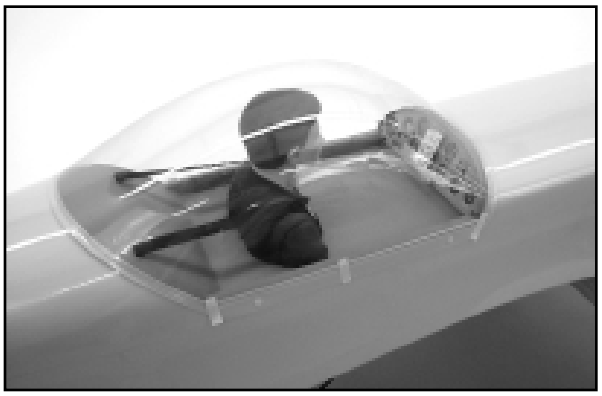
The molded plastic canopy base has three (3) factory drilled holes on each side. These accept the 4-40 x 1/2" nylon mounting bolts, used to hold it in place. Begin by using masking tape to accurately position and secure the base in place to the top of the fuselage. Make sure the base is firmly in place and that its front and rear mounting lips are over the fuselage. Use a fine point felt marker pen to mark the position of each mounting hole on both sides of the fuselage - remove the canopy base.

From your kit contents, locate six 1/8" x 3/4" sq. plywood mounting pads, six 4-40 x 1/2" nylon slotted bolts and six 4-40 blind mounting nuts. Center one of the plywood mounting pads directly behind one of the hole marks just made, holding the pad firmly to the inside of the fuselage side. Use a 7/64" dia. drill bit to drill through the fuselage side and the plywood pad - remove the pad. Use a 5/32" dia. bit to enlarge the hole in the pad. Apply glue to the face of a 4-40 blind nut and press it in place into the pad. Apply glue to the face of the pad and press it in place to the inside of the fuselage side, with the blind nut aligned with the drilled hole. From the outside, thread a nylon bolt in place through the hole and into the blind nut. Screw the bolt in place, bringing the ply pad firmly in contact with the fuselage side. Wipe off any excess glue. Repeat this procedure for the remaining five holes. With all holes drilled and all pads and blind nuts in place, the nylon bolts must now be trimmed in length to clear the inside surface of the canopy base. Use a sharp, single-edge razor blade to cut 1/4" off of the length of each bolt.

If desired, the canopy base can now be detailed. On our prototypes, we used light gray art paper to line the bottom and back of the canopy base, giving it depth and color. We measured and cut the paper to fit and applied it to the base with a heavy coat of spray cement. We used a commercially available instrument panel - the Hanger 9™ CAP 232 panel - mounting it with epoxy glue. Last, we used a Hanger 9™ 1/4 -Scale Civilian pilot figure to finish the cockpit. No matter what pilot figure you decide to use, be sure to reinforce the bottom surface of the canopy base with a piece of 1/32" plywood, epoxied in place. This stiffens the canopy base and allows you to drill through the bottom of the base for mounting screws to secure the pilot figure. We finished off the overall look of our CAP cockpit using black twill tape to simulate the shoulder harness restraint belts and a few pieces of light aluminum sheet to simulate buckles and harnesses. Overall, it looks believable and does not add much weight.



To mount the canopy, first wash it in warm sudsy water to remove any hand oils, mold release agents, etc. Rinse and dry it completely with a soft cloth and avoid handling the inside surface. Use 220 sandpaper to lightly scuff the canopy base edge, where it contacts the canopy itself. Wipe off excess dust with alcohol. Mount the canopy base to the fuselage with the nylon bolts. Use slow cure epoxy to mount the canopy. Mix a small amount of glue and use a small stick to apply the glue only to the sanded edge of the canopy base - apply a reasonable amount but not so much that it oozes. Carefully place the canopy onto the canopy base,



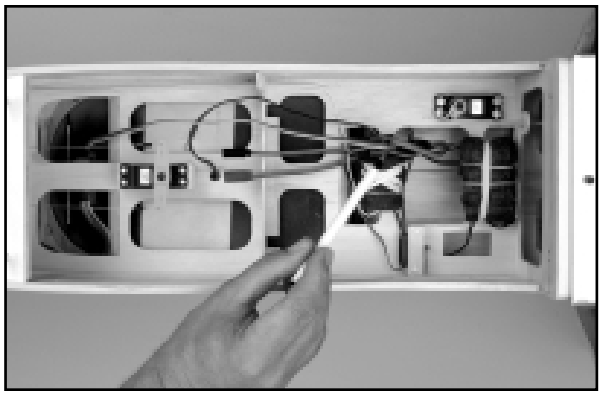
easing it into position. Use alcohol and a paper towel to wipe off

any excess glue, while lightly pressing the canopy in place to the base. Secure the canopy to the base with pieces of masking tape and allow the glue to cure.

When the glue has cured, remove the masking tape. The canopy/canopy base joint can now be covered using ULTRACOTE® matching trim tape, available from Carl Goldberg Models. This tape is called ULTRASTRIPE™ and is available in a variety of widths. We suggest using the wider tape, such as the 3/16" or 1/4".

**RADIO INSTALLATION**

With the servos now installed with the correct extensions in place and secured, all that remains is the installation of the receiver, battery pack and switch. Remember that the single heaviest unit in this system is the battery pack. This means that you can, if needed, locate the batteries wherever they are required to achieve the correct CG. When mounting the receiver and battery pack, first wrap them in foam and use rubber bands and/or tie-wraps to secure them in the fuselage. This allows these units to be easily accessed and repositioned if necessary. The switch can be mounted onto the fuselage side or internally. We prefer an internally mounted switch. We mounted ours onto the radio tray, using a length of music wire to activate the switch from the outside. This is simple to do. Just drill a small diameter hole in the switch lever to fit a piece of .045 music wire. Drill an exit hole in the side of the fuselage, lined up with the switch/wire location. Make a 90° bend in one end of the wire and insert the short end into the hole in the switch. Apply silicon glue to one side of the switch and insert the wire through the hole in the fuselage, pressing the switch firmly to the radio tray. Make another 90° bend in the wire outside of the fuselage, giving you a small "handle" to pull and push when activating the on/off switch. Besides looking neat, this method provides protection to the switch from dirt, debris and exhaust.



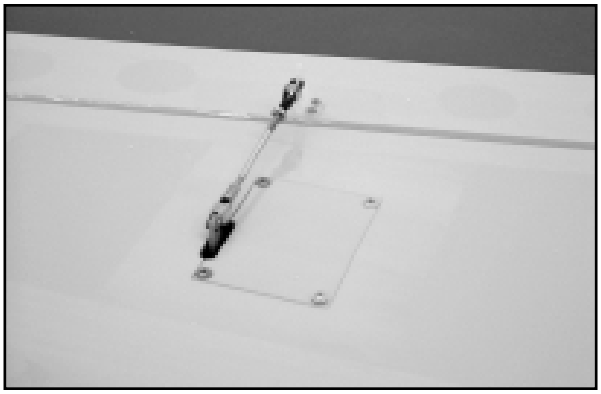
When mounting the receiver, note that we have provided the CAP with an internal antenna exit tube. When viewed from the wing saddle (fuselage upside down) this tube is located on the right side of the fuselage, extending from the radio tray back through the fuselage, exiting just ahead of the tailwheel assembly on the bottom. Thread your antenna through this tube when installing your receiver.

All servo, switch, and battery connections to the receiver are now made. The aileron Y-harness stays plugged into the receiver aileron channel receptacle, with the two connecting ends hanging loose for wing attachment. Turn the radio system on and check the functions of the throttle, elevator and rudder servos. These should all now be centered and working perfectly, without any binding. Correct any such problems now. Plug your aileron servo leads into the Y-harness connectors and mount the wing to the fuselage. Test the action of the aileron servos, adjusting the linkages as needed to center them. Make sure the ailerons are traveling in the proper direction to provide left and right roll. With everything checked and working, now is the time to set the initial control movements.

**CONTROL MOVEMENTS**

This is an important section of this manual. After flying your CAP231EX for awhile, getting used to its characteristics, you will likely change the control throws to suit your style of flying. But you have to start somewhere and this is where you begin. These movements provide the CAP with very smooth control inputs without the immediate need for expotential. We suggest starting out with these movements as your low and high rates. Note that we do not suggest full rudder throw initially. This is because the rudder is very large and aerodynamically powerful. So powerful that it can fly the airplane in knife-edge flight even at fairly low throttle settings. At full throw, the rudder can also toss the CAP very deeply into snap maneuvers, literally slowing it down. Rudder throw is something you can easily play with after you are more comfortable with the airplane, especially for 3-D type flying.

Last, after setting the controls for these surface movements, make sure each clevis has a length of fuel tubing in place to prevent it from coming disconnected from either the control horns or the servo output arms. Also be sure you have tightened each of the 4-40 hex nuts tightly against all threaded R/C links, locking them in place.



| SURFACE | SUGGESTED THROWS |
|---|---|
| AILERONS: | LOW RATE: 3/4" UP - 3/4" DOWN<br>HIGH RATE: 7/8" UP - 7/8" DOWN |
| ELEVATORS: | LOW RATE: 1-3/8" UP - 1-3/8" DOWN<br>HIGH RATE: 1-3/4" UP - 1-3/4" DOWN<br>(MEASURED AT INBOARD TRAILING EDGE) |
| RUDDER: | 3" RIGHT - 3" LEFT<br>(MEASURED AT WIDEST,<br>LOWER TRAILING EDGE) |
| THROTTLE: | FULL MOVEMENT |

**DECAL APPLICATION**

The decal set provided with your CAP is truly a work of art. These decals are adhesive-backed Mylar, NOT water activated transfers. These decals are not die-cut and require that you cut them from

their sheets with a sharp #11 blade or good pair of scissors. Note that every decal on all three sheets is numbered. These numbers correspond to the CAP 231EX 3-view line drawing on the last page of this manual, providing you with their placement locations - Note: The 3-view drawing provided is NOT scale and should not be used for documentation. Use this drawing, as well as the box art, to locate your decals accurately.

Since these decals are large and because the adhesive is very aggressive, it is important that you use the proper technique in applying them to your model. DO NOT deviate from this procedure. Doing so may ruin the decals. Following this procedure will allow you to easily place the decals in their proper locations and permanently adhere them to the model. Once in place, these decals stand up well to day-to-day flying use and are resistant to fuel exhaust. With reasonable care, they will look good for a very long time.

You will need a good glass cleaner, such as Windex®, a supple squeegee (the SIG 4" Epoxy Spreader, #SIGSH678 is perfect for this job), clean, soft cloths (old tee shirts are great), a good straight edge, a ruler and a hobby knife with sharp #11 blades. For application of the larger decals, such as the wing, fuselage, stab, etc., we suggest that you also have some trim tape handy for temporary guidelines - 1/8" width or so is perfect.

Begin with the wings. Use a flat, clean work surface to cut out the two wing decals, #1. Cut the decals as closely to the graphic as possible, using a straight edge for the long cuts. With the decals ready, use a long length of striping tape to locate the top edge of the decals on the wing. Do this by stretching the tape from one wingtip to the other. With the tape aligned and lightly pressed in place, the decals can now be applied. Carefully peel and remove the decal from its sheet, suspending it in the air with your fingers. Spray Windex® on the adhesive side of the decal and then onto the wing, where the decal will be applied. Apply enough Windex® to create a true film on the wing surface. Place the decal carefully onto the wing - do not press. Slide the decal accurately in place, lightly smoothing any wrinkles with your fingertips. Once the decal is in position, use the squeegee to begin lightly pressing the decal in place, while holding it to the wing with your fingers. Take your time and use progressively heavier pressure to remove the Windex® from beneath the decal. As the Windex® is forced out from beneath the decal, the adhesive will take hold and make the decal difficult to move. Carefully continue using the squeegee, removing any bubbles and making sure the decal edges are firmly in place. Remove the guideline striping tape from this half of the wing. Use a soft clean cloth to gently wipe away any remaining liquid from the wing panel - always wipe away from decal edges, never into them. Repeat this process with the remaining wing decal. This is the basic procedure for applying all of the remaining decals to the model.

The fuselage sides, including the cowl, also require the use of striping tape to align the top edges of the decals accurately, as well as to align them correctly from one side to the other. To do this, take a careful look at the 3-view drawing and the photographs of the actual model. These will help you understand where the decals are to be placed. When placing the striping tape guide on the fuselage, have the cowl in place and the rudder taped to neutral. Once the striping tape is placed along the entire length of the fuselage, rudder and cowl, carefully cut the tape at the rear edge of the cowl and remove the cowl. The checkers will be applied to the cowl, off the fuselage but you will already have the guideline accurately in place. We also found it easiest to apply the rear checkers (#6 and #18) to both the fuselage and rudder in one piece, using the squeegee to set them in place. Then use a #11 blade to cut and trim them at the hinge line.

Applying the decals to the cowl is not difficult. Start with the top run of checkers - #22 (left side) and #15 (right side). These are placed on the cowl to match the fuselage checker, along the tape guide to the front. Use the squeegee to rub them in place, wrapping the rear edge around and into the inside of the cowl. Next, apply the bottom cowl checkers, #23 (left side) and #16 (right side) in the same manner, aligning their rear edges with the corresponding checker on the fuselage. Note that when viewed from the side, this bottom course of checkers is parallel with the top course. Use the squeegee to rub the checkers in place. Next use the #11 blade to carefully cut out the clear portion of these cowl checkers, using the knife to lift an edge, peeling them away from the cowl. This leaves only the dark checks accurately in place. Finally, apply the center checkers, #CL-1, 2, 3, and 4 (left side) and #CR-1, 2, 3, and 4 (right side). These are applied individually, with their corners aligned with the top and bottom checkers. Despite the small compound curves, these center checkers will lay flat nicely when applied with the squeegee.

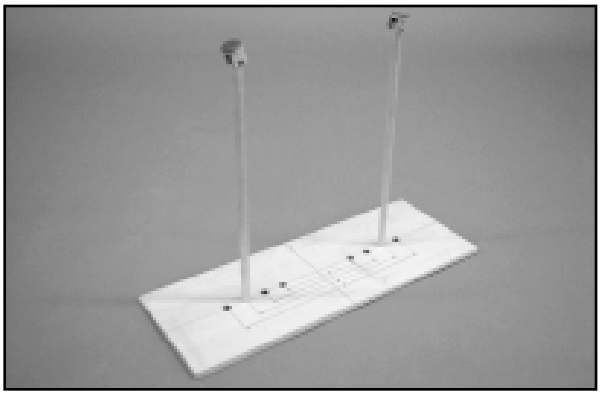
When all decals are in place, use a soft cloth to carefully wipe them dry, as well as the rest of the model. Carefully check all decal edges and corners, using the squeegee to burnish them firmly in place. Leave the model alone and avoid handling for a few hours. This allows the decal adhesive to set and any residual liquid to evaporate. Although usually not necessary, decal edges can be further protected by applying clear epoxy paint with a small brush, to seal them. For perspective, our prototypes have been flown extensively and used at tradeshows and the decals still look great!

**ESTABLISHING BALANCE**

In terms of success, this is probably the single most important step in preparing your CAP for flight. The final placement of the longitudinal Center of Gravity for this model is extremely important and should be approached with patience and care.

Completely assemble the model, including propeller, spinner, etc. DO NOT fill the fuel tank for balancing purposes. Once the model is assembled, as it would be for flight, you need to find where it balances in this unadjusted condition. This is easiest to do by turning the fully assembled model upside down and using a balancing fixture. We make our own balancing fixtures with a couple of 1/4" dia. dowels glued into a fairly substantial wood base, at perpendicular 90° angles. The dowels need to be the same length and tall enough to accommodate the height of the assembled CAP, as well as the width of the fuselage, plus about 1/4" to 1/2" additional width. The tops of the dowels need to be padded to avoid damage to the wing. We used 1/8" thick rubber sheet, cut to 1/4" diameter, glued in place, for the padding. There

are commercial units available for balancing but be sure they are large enough to support the weight and size of the CAP.



For initial test-flying and familiarization purposes, we suggest a starting balance point of 4" behind the inboard leading edge of the wing. 4" equals 27% of MAC (Mean Average Chord). For reference, a balance point of 4-1/2" behind the wing's inboard L.E. equals 30% of MAC and 4-15/16" behind the L.E. equals 33.3% of MAC.

As we all know, as the CG is moved aft, the airplane will become more proactive in pitch. We have flown the CAP at the 30% location and found it to be manageable, with excellent aerobatic capabilities. However, we did notice an increase in pitch sensitivity and decreased the elevator throw to compensate (from 3/4" each way on low rates to 5/8" each way). "Softening" elevator response with a reasonable expotential percentage also works. As stated, the CAP has very powerful flying surfaces and the elevators are no exception. We therefore suggest that you begin with the 27% CG location.

The best means of shifting the CG fore or aft is to locate the battery pack where it is needed to achieve balance. If doing this does not work and more weight is needed, consider using a larger (and therefore heavier) battery pack. Try to avoid adding useless weight. If you need more weight in the nose, try a heavier spinner or replace the light wheels with heavier after-market wheels. If your model is nose heavy and battery shifting does not work, you can make significant changes in balance with lead stick-on weights. These are unsightly but should be considered until such time as you have flown the model and are happy with the CG. Once that's done, the weights can be placed inside the fuselage by simply removing the elevator servos and placing the weights inside and securing them. With the elevator servos back in place, the weights are hidden. For reference, our CAPs, using either the Irvine 1.20 or 1.50 and also, the Saito 1.50 4-strokes, required no additional weight to achieve balance.

Finally, the flight performance of your CAP will benefit greatly by dynamically balancing it. Dynamic balancing requires that the model be suspended upside down, using substantial chord or fishing line. Loop the line over the engine propeller shaft and the other end over the tailwheel bracket. Hang the model from the ceiling or a rafter, leveling it in side view. With the model secured in this way, observe the wings. Ideally they should be level, without one wing lower than the other. If one panel is lower, it means that it is somewhat heavier than the other. When flying the model, this uncorrected imbalance may cause the model to "pull" to the heavy side, especially in up line maneuvers. To make the airplane track true, the light panel needs weight to balance it level with the other panel. Again, this can be done with stick on weights, which could later be hidden. Always secure weights firmly in place.

**FLYING**

If you have carefully followed this assembly manual, you should have no real problems in test flying your CAP 231EX. Make yourself a simple checklist to assure your attention to the following important pre-flight issues:

- **¥ Radio system is fully charged - both transmitter and airborne pack**
- **¥ Each link on all flying surfaces has been checked and has jam nuts and safety tubes in place**
- **¥ All metal bolts have had an application of Loctite¤ to secure them**
- **¥ Nylon bolts holding cowl and canopy hatch are securely in place**
- **¥ All three wheels roll freely and the airplane rolls straight when in neutral**
- **¥ All servos checked for output arm screws**
- **¥ All servos securely in place - no loose mounting screws, bolts, etc.**
- **¥ All servo extension connectors securely taped**
- **¥ All controls work smoothly with no binding, rubbing, etc.**
- **¥ Battery pack secured in fuselage**
- **¥ Receiver wrapped in foam and secured in fuselage**
- **¥ Switch securely in place**
- **¥ Fuel system checked and working**
- **¥ Engine well broken in and reliable**
- **¥ Spinner and propeller are securely in place**
- **¥ Propeller in good condition and properly balanced with no nicks, cracks, etc.**
- **¥ CG is at location recommend in these instructions**
- **¥ Flying surfaces set at prescribed movements per the information provided in this manual**
- **¥ Per AMA, your name, address and telephone number is taped to inside of model**
- **¥ Radio range check to be performed at the flying field**

Try to choose a calm day for the first flight. Good conditions will help in correctly evaluating the flight performance of this model. Begin your test flight by making sure the engine needle valves are properly set, providing a reliable idle, a strong top end and smooth transition performance. We always set our engines to run a little on the rich side and suggest you do the same.

Holding up elevator, taxi the model to get a feel for how it handles on the ground. Make sure you have positive left and right turning ability. If not, make any adjustments needed to achieve positive ground control. Once you are satisfied with the taxi tests, line the model up with the centerline of the runway, nose into the wind. Hold a little up elevator and advance the throttle smoothly - do not run the throttle up all at once! The airplane should roll forward smoothly, tailwheel on the ground. As speed builds, slowly back off the elevators and use just a little rudder, only as needed, to maintain a straight takeoff run. The tail will come up as flying speed is reached and a little up elevator will lift the CAP off the ground.

Maintain a straight outbound flight path, climbing at a shallow angle until a safe maneuvering altitude is reached. If the model requires trim, fly it to a reasonable altitude first before trimming. Initially, make your control inputs smooth and avoid jerking the sticks.

At altitude, make any trim changes needed to achieve hands off, straight and level flight. From our experience, this will take very little trim input, if the model was assembled and balanced according to this manual. Once you're comfortable, make a few circuits around the field to get the feel of the controls. The airplane should demonstrate smooth flight characteristics without jumpiness or over-sensitivity. At altitude, try a roll. Then try another roll to the opposite side. Properly trimmed, the CAP will roll smoothly and very axially in either direction. Now try a loop. The CAP should pull cleanly through loops, without wandering to either side. Once you're comfortable, try knife-edge flight. You will quickly find that the CAP has little or no pitch/roll coupling and that it easily maintains altitude with just a little rudder input! You will also discover that your CAP has outstanding inverted flight characteristics. Our prototypes require only the smallest amount of down elevator to maintain level inverted flight!

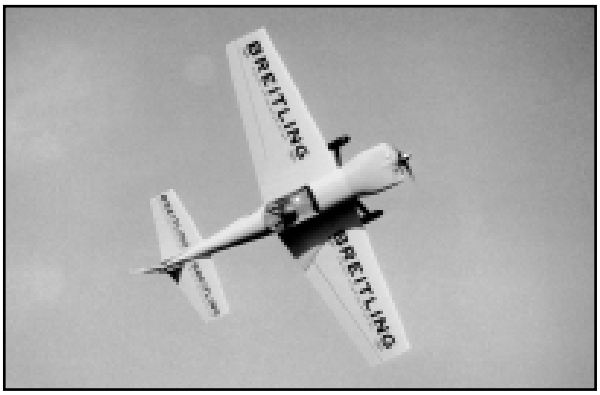
Assuming you're comfortable and getting used to the airplane, take it to a safe altitude and throttle back to get a feel for the slow flight and stall characteristics. Properly balanced and trimmed, your CAP should demonstrate fairly sedate, no fuss stall characteristics. Once flying speed and up elevator input is bled off, the CAP should just drop its nose and resume flying as speed picks up. All of this is great information to have when you are setting up the first landing.

Landing the CAP is a pleasure. We like to keep a little power on the engine during final approach, down to a few feet off the ground. We typically back completely off the throttle once the

airplane is low to the ground with a good rate of descent established. Flair the airplane as the ground approaches for a smooth 3-point landing and rollout. Hard landings are not necessary, sound piloting skills are.

The second flight should be even more fun because you have by now inputted any required trims learned from the first flight. Before flying again, check the airplane for anything that may have come loose, become disconnected, etc. This is good practice and tends to insure a long life for the model.

As you become more familiar with your CAP, you are going to discover its ability to perform aerobatics. The CAP 231EX is an elegant aerobatic machine with seemingly endless capabilities. As mentioned earlier, you will quickly discover that your CAP has a powerful rudder. If you want to, you'll find it fairly easy to make climbing knife-edge passes at fairly low throttle settings. In fact, if your radio has expotential capability on the rudder channel, you may want to tone the rudder action down a little around center, to suit your style of flying. For those of you interested in using your CAP for 3-D aerobatics, set up your radio to take advantage of the huge control movements available from this model. However, we would urge you to "sneak up" on such control throws, making very sure you have them available to you only on your high rate switches!




We are sure that you will enjoy your CAP 231EX for a long time to come. Please fly the model safely with constant regard to other fliers, spectators, and property. Good luck and good flying!

*FINIS*

# MANUFACTURER'S INDEX:

| PRODUCT | SOURCE |
|---|---|
| RD-6000 COMPUTER RADIO SYSTEM<br>and<br>HEAVY DUTY SERVOS | AIRTRONICS, INC.<br>1185 Stanford Court<br>Anaheim, CA 92805 |
| ULTRACOTE¤ and ULTRASTRIPE“ | CARL GOLDBERG MODELS, INC.<br>4734 West Chicago Avenue<br>Chicago, IL 60651 |
| KWIK-FILL FUELING VALVE - #334<br>and<br>SUPER STRENGTH SERVO ARMS | DU-BRO PRODUCTS, INC.<br>480 Bonner Road<br>P.O. Box 815<br>Wauconda, IL 60084 |
| SAITO ENGINES<br>and<br>1/4 SCALE CIVILIAN PILOT<br>HANGER 9“ #HAN8275<br>and<br>INSTRUMENT PANEL<br>HANGER 9“ #HAN177 | HORIZON HOBBY DISTRIBUTORS<br>4105 Fieldstone Road<br>Champaign, IL 61822 |
| "MIRACLE Y“" ELEVATOR SPLITTER<br>and<br>LARGE CAPACITY BATTERY PACKS<br>and<br>AFTER MARKET Y-HARNESSES | MAXX PRODUCTS<br>815 Oakwood Road Unit D<br>Lake Zurich, IL 60047<br>Tel: (847) 438-2233<br>Fax: (847) 438-2898 |
| INCIDENCE METER | ROBART MFG., INC.<br>P.O. Box 1247<br>St. Charles, IL 60174 |
| CAP 231EX DOCUMENTATION<br>FOTO-PAAK #5444 | SCALE MODEL RESEARCH<br>3114 Yukon Avenue<br>Costa Mesa, CA 92626<br>Tel: (714) 979-8058<br>Fax: (714) 979-7279 |
| IRVINE ENGINES<br>and<br>CAP CUSTOM IN-COWL MUFFLER<br>(P/N IRV120150M)<br>and<br>EPOXY SPREADER/SQUEEGEE<br>(P/N SIGSH678) | SIG MANUFACTURING COMPANY, INC.<br>401-7 South Front Street<br>Montezuma, IA 50171-0520<br>Order Line: (800) 247-5008 |

## *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**
**5151 East Memorial Drive**
**Muncie, IN 47302**
**Telephone: (765) 287-1256**

## CUSTOMER SERVICE

SIG MANUFACTURING CO. is totally committed to your success in both assembling and flying the CAP 231EX 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.

**SIG MANUFACTURING COMPANY, INC.**
**401-7 South Front Street**
**Montezuma, IA 50171-0520**

**SIG MODELER S ORDERLINE: 1-800-247-5008**
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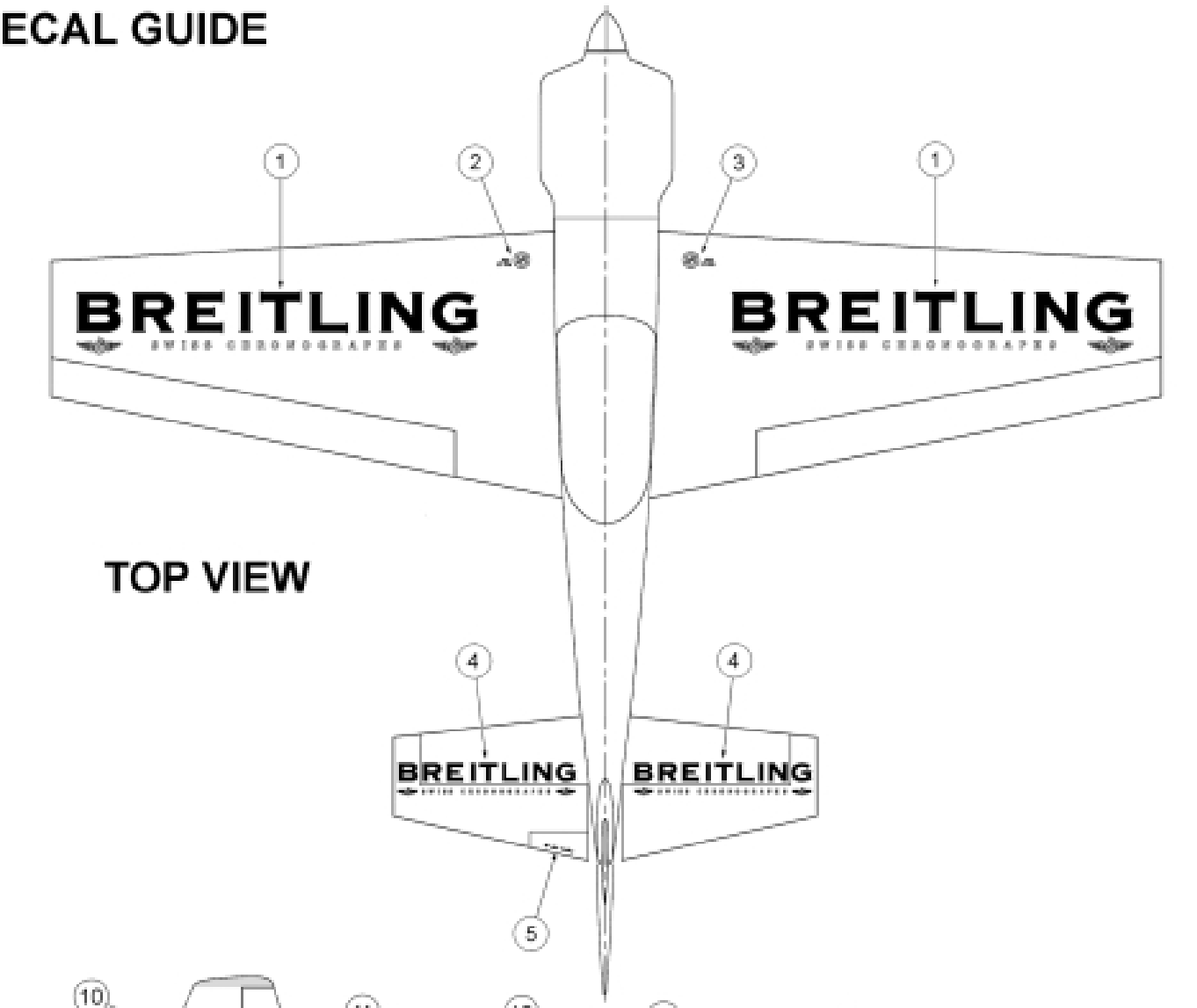
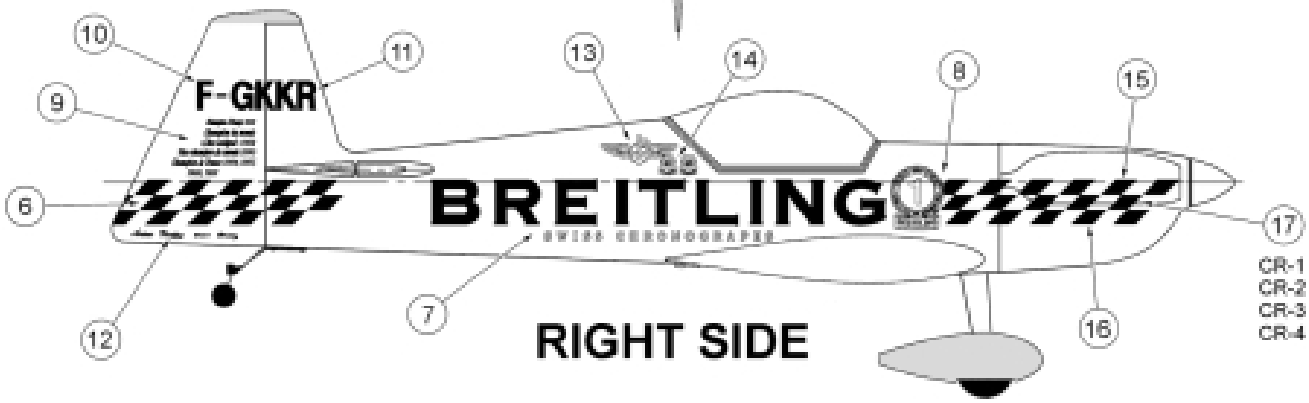
The craftsmanship, attention to detail, and actions of the builder/flyer of this model airplane kit will ultimately determine the airworthiness, flight performance, and safety of the finished model. SIG MFG. CO. s obligation shall be to replace those parts of the kit proven to be defective or missing. 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.

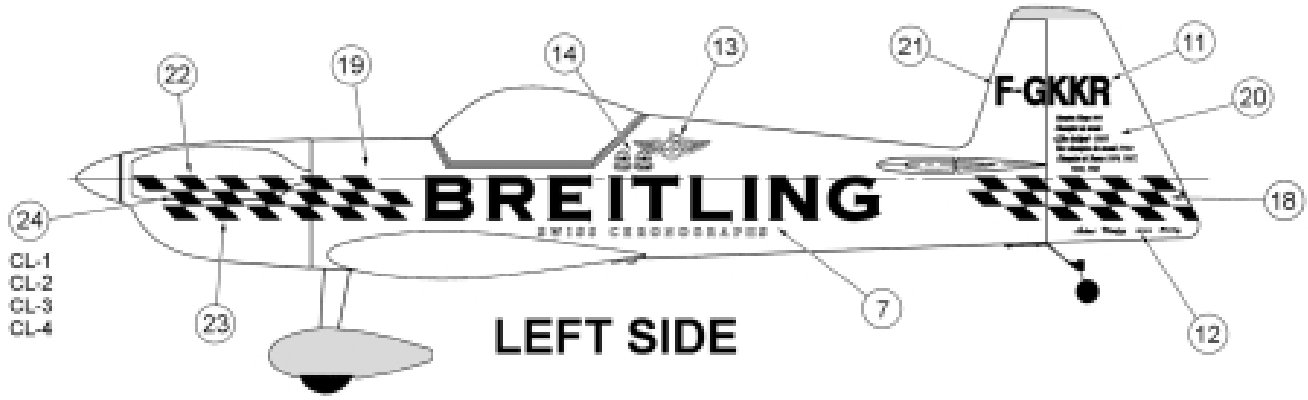
# DECAL GUIDE




TOP VIEW




RIGHT SIDE




LEFT SIDE