

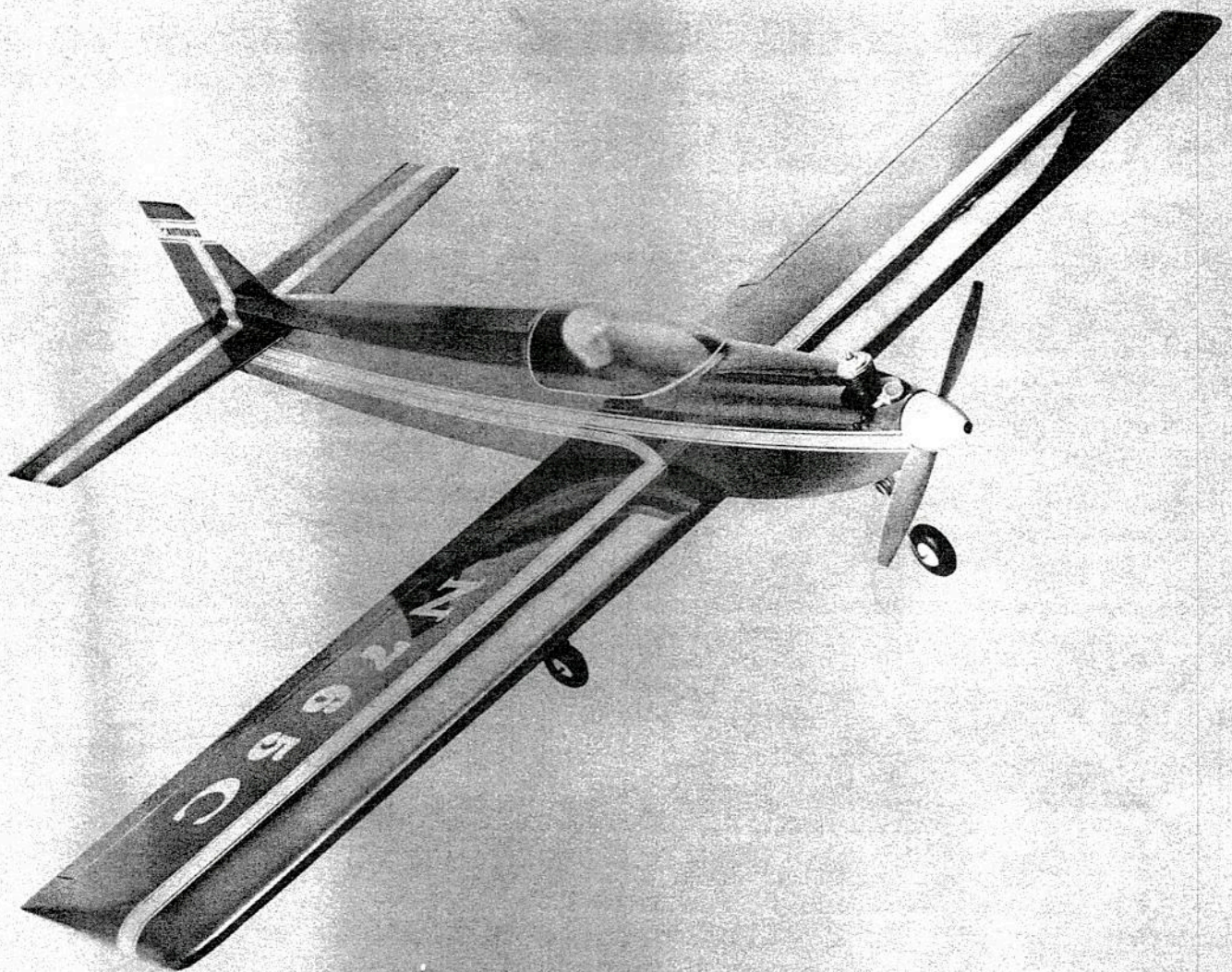
**BUILDING INSTRUCTIONS FOR**



**AIRTRONICS**

# **Warlock 05**

**1/2A SPORT PATTERN/PYLON RACER**



## INTRODUCTION

Every modeler has his or her opinion of what constitutes a truly good looking R/C aircraft. It is also true that good looks do not necessarily go hand-in-hand with performance. Usually something is compromised to achieve either looks or performance. This becomes especially true with R/C aircraft in the 1/2A category. A beautifully finished scale or pattern airplane that flies at 26 to 30 ounces realistically delivers most of its enjoyment in the pit area, where it can be admired for the thing of beauty that it is. However, that same airplane might have been a star performer in the air if the designer had compromised in the design of the construction and if the builder had compromised his building and finishing habits and maybe left the landing gear off and maybe used more nitro in his fuel.

The Warlock 05 was expressly conceived and designed as a straightforward approach to uncompromised performance in a 1/2A sized aircraft. When built to the plans and instructions, powered by a stock Tee Dee .049 or .051, swinging a stock prop and with landing gear in place, the Warlock 05 will deliver the kind of crisp, smooth flight characteristics that are generally associated with larger, more high-powered R/C aircraft.

In terms of construction, we feel the Warlock 05 is relatively simple and rugged and that it offers a maximum of flying pleasure for the minimum amount of work involved in its assembly.

Finally, we are confident that the handsome and distinctive lines of the Warlock 05 will enhance your enjoyment of this aircraft

even more. Wherever our prototypes have been flown, they have literally been show-stoppers. Pilots have stopped whatever they were doing and watched the Warlock do its thing. In the pit area, the airplane never failed to gather a group of admirers who were there to comment on the unusually nice lines of an airplane of this size. With a small amount of attention paid to detailing the cockpit, the "believable" look of this design becomes even more so.

We suggest that you take some time to look over the plans, familiarize yourself with the various parts of the kit and read through the instructions at least once before starting the actual assembly. The instructions have been laid out in a definite sequence that will enable you to quickly and accurately construct your Warlock. However, since this model is definitely not for the beginner and most of you who will build this model have well established building habits, deviation from our assembly approach is to be expected. If this is the case, try to read the instructions at least once anyway, for they could clear up questions that might arise later.

Our prototypes were built with Titebond, 5-minute epoxy, contact cement and a little Hot-Stuff. Use any or all of these adhesives as you prefer. A good, straight building board at least 36" long by 8" wide is a must. A Moto-Tool and a jigsaw, while not a must, would be handy. Grab the pins, masking tape, plastic wrap or waxed paper, clear the debris from your last project off your bench, and let's get this bird built!

## SECTION I

### WING ASSEMBLY

1. Pin the 1/8" x 1/4" bottom wing spar in place directly over the plans. Position all of the ribs in place over the bottom spar and the plans but do not glue in place yet.
2. Pin the bottom 1/8" square trailing edge rib cap in place over the plans, making sure that it is in firm contact with the bottom rear of each rib. A long straightedge is helpful with this step.
3. Remove each rib, apply glue to the bottom spar notch and the bottom rear, and reposition in place. Be sure that each rib is truly upright by using a small triangle. As shown on the plans, leave a 3/32" gap between the two W-1 ribs.
4. Apply glue to the leading edge of each rib and glue the 1/4" x 1/2" leading edge in place. Use scrap supports as shown on the plans to obtain a butt-fit with each rib.
5. Cut two pieces of 1/8" square balsa to make the two upper trailing edge rib caps — these are 9-1/2" long. Glue these two pieces in place, outboard of the aileron torque rods, as shown on the plans. When dry, sand the upper edges of these rib caps until they are flush with the top contour of the ribs.
6. Glue the 1/8" x 1/4" top spar in place making sure that it fits flush with the top of each rib.
7. The top 1/16" balsa leading edge sheet may now be glued in place. This sheet butt-glues to the leading edge and extends aft to the top spar. Contact cement may be used for this step.
8. The trailing edge sheet, the center section sheet and the 1/16" x 1/4" rib cap strips may now be glued in place, in that order. Be careful to cut this sheet to insure snug, gap-free joints.
9. While the wing is still on your building board, trial-fit the aileron torque rods. Note that the right rod is longer than the left. This longer rod fits into the right wing panel. Carefully slot the trailing edge sheet as shown on the plans to accommodate the upright torque rod ends that will be inside of the fuselage. Remove the torque rods from the wing.
10. Remove the wing from your work surface. The two W-2 wing ribs in each panel that hold the main landing gear trunnion blocks may now be slotted as shown on the plans. Note that these blocks, when in place, protrude 1/16" below the bottom surface of the ribs. Once these ribs have been cut to accept the trunnion

blocks, they can be epoxied in place. Use epoxy liberally around those internal areas where the blocks are in contact with the ribs and the bottom spar.

11. Establish a "cutting line" between the two W-1 center ribs where the 3/32" gap was left. Either score the wood deeply or use pinholes. This line will be used later when cutting the wing in two.

12. Turn the wing upside down and pin it securely in place to your building board, using shims at the leading edge with the trailing edge pinned flat to the board. Make sure that the wing is in place flat. When the bottom sheet is glued in place any twists or warps will become permanent. Glue the leading edge, trailing edge and center section sheeting in place, in that order. Note that the center section sheet must be trimmed to fit around the landing gear trunnion blocks. Add the 1/16" x 1/4" rib cap strips and allow the wing to dry completely before removing it from the board.

13. Sand the wing tip ribs flat with a sanding block. Carefully sand the trailing edge of the wing flat for a good fit with the 3/8" x 1" trailing edge/aileron stock. The leading edge may now be shaped. This is quickly done by using a razor plane to obtain the general shape followed by sanding to obtain the final shape. Care should be taken to check uniformity of shape as you progress.

At this point it is suggested that you set aside the wing and begin the fuselage construction. This will permit precise installation of the forward wing hold down dowel, when the time comes.

## SECTION II

### FUSELAGE ASSEMBLY

1. First decide whether your engine is to be upright or side-mounted, then layout and drill the holes necessary to install your motor mount on the 1/8" plywood firewall, F-1. Our prototypes use 2-56 x 1/2" bolts and 2-56 blind mounting nuts. Install and epoxy the blind mounting nuts in place at this time.
2. With the motor mount in place, drill the two fuel line holes in the firewall, as shown on the plans.
3. Former F-2, 1/8" air-ply, can now be cleared out as shown on the plans. This allows tank and battery pack installation and removal. Trimming out this former is easily done with either a jigsaw

or a Moto-Tool. Drill former F-5, 1/8" air-ply, with one 3/16" diameter hole for the outer elevator Nyrod. Location of this hole is dependent on your elevator servo type and location.

4. The two 3/32" fuselage sides can now be completely framed with all longerons, uprights and supports. This is best accomplished by first marking the locations of each fuselage former and stringer former with a soft pencil on each fuselage side. Be sure to make a **right** and **left** fuselage side! Care should be taken to insure that the 3/16" x 3/4" trailing edge firewall supports are in place perfectly straight so as not to create any up or down thrust when the firewall is in place. The 3/16" x 3/4" tailpost is glued to only **one** of the fuselage sides at this time.

5. The 3/32" balsa doublers that fit **between** F-2 and F-5 may now be glued in place. Note that these doublers do not have the airfoil cut into them, you can do this in Step 6.

6. Remove the framed fuselage sides from the building board. Carefully cut the airfoil shape out of each of the doublers with a No. 11 X-Acto blade. Pin or hold the two fuselage sides together with the framing to the outside and "match" them with light strokes of your sanding block.

7. Mark center lines on F-2 and F-5. Trial-fit these formers in place checking fit. Using 5-minute epoxy, glue the formers in place. Block or jig the fuselage upside down on your building board making sure the structure is square and allow to dry.

8. Bevel the aft inside fuselage sides, framing and tailpost to fit together as shown in the top fuselage view of the plans. The total width of the end of the two fuselage sides when squeezed together should be 3/16". Glue the aft fuselage sides together, making sure that the fuselage has the same curvature on each side.

9. With a triangle and pencil, draw the center lines on each of the aft stringer formers, F-3, F-4, F-6, F-7 and F-8. Glue former F-4 directly to the back of F-3, matching the center lines — this gives you a gluing "shelf" for the stringers.

10. Glue the F-3/F-4 formers in place, centering carefully. Use a triangle or wood block to insure that it sits 90° upright.

11. Glue former F-8 in place, again making sure that it is centered and upright. There should be a 3/32" stringer gap on each side of this former to the outside of each fuselage side. This leaves a small gluing surface for this former which is all that is needed to hold it in place. Note that the distance from the aft side of F-8 to the end of the fuselage should be exactly that of the center line width of the stabilizer.

12. As shown on the plans, glue a 1/16" x 1/4" balsa spacer between the fuselage sides at the F-7 location. Now glue stringer formers F-6 and F-7 in place. Again, these formers should be carefully centered and upright and there should be a 3/32" gap on each side of them to the fuselage sides.

13. All five 1/8" square balsa stringers can now be glued in place as shown on the plans.

14. The outer elevator Nyrod tube is now installed. Determine the exit point at the rear of the right fuselage side (see plans). A sharpened length of 3/16" O.D. brass tubing can be used to cut a neat angled slot in the fuselage side for the outer Nyrod. Rough-up the tubing with sandpaper, slide it into position in the fuselage and epoxy in place. After the epoxy has cured, trim and sand the tubing flush with the fuselage side. The aft fuselage bottom can now be sheeted with cross-grained 1/16" balsa. Start at F-5 and work aft. Do not install the forward 1/16" ply bottom yet.

15. Provision for the forward wing hold down dowel can now be made. First hold and/or tape the wing to the fuselage firmly so that the centerlines of F-2 and F-5 match the centerline of the wing. With an electric drill and a 3/16" bit, drill a hole straight through F-2 and the leading edge of the wing. Make sure you at least go **through** the leading edge of the wing. Set the wing aside for now.

16. The firewall, F-1, can now be epoxied in place after first making sure that it fits snugly and that it sits in position squarely — remember that thrust requirements are **not** needed on this model.

17. The 1/16" ply bottom nose sheet is now epoxied in place. Note that this sheet extends from the aft face of F-2 to the forward face of the firewall. A thin bead of 5-minute epoxy around all of the firewall/fuselage joints in the tank area greatly strength-

ens this compartment and you may wish to coat this area with one application of resin or Formula II Hobby-Poxy before the top nose blocks are glued in place. Be sure to avoid getting any resin or glue on the blind mounting nuts.

18. Note that the top forward fuselage covering is comprised of **two** pieces of 3/8" balsa — one that extends from the "instrument panel" forward to the rear face of the firewall and one which extends from the rear face of the firewall, forward to the nose. Bevel the rear piece, if desired, to form a slanted instrument panel and glue it in place. Do not glue the remaining nose block in place yet.

19. Whether your engine is to be side-mounted or upright you will need to have either a spare Tee Dee crankcase assembly or carefully remove the sleeve, piston and carburetor assembly from the engine you plan to use. If you are going to do the latter, place a piece of masking tape over the sleeve and venturi holes of the crankcase to keep out dust. Next you need to determine the location of your engine mounting holes on the motor mount. This can be easily accomplished by bolting the motor mount to the firewall and placing the crankcase on the mount. Next tape the 1/16" ply spinner ring in place followed by mounting the spinner you plan to use on the crankcase. With everything in place, drill your engine mounting guide holes so that there will be a 1/32" to 1/16" gap between the rear of the spinner and the ply spinner ring. Tap the mount per the manufacturer's instructions and re-install the mount and crankcase to the firewall.

20. Trim the bottom 3/8" balsa chin block to fit in place between the firewall and the spinner ring and between the fuselage sides, as shown on the plans. Sand out the half-round nose gear exit and glue this block in place.

21. Now glue the remaining top 3/8" balsa nose block in place. Note that this will completely cover up the engine mount and crankcase assembly. You will be opening up this area later on, after first shaping the fuselage.

22. The 1/16" ply spinner ring can now be epoxied in place making sure that the spinner matches when in position on the crankcase.

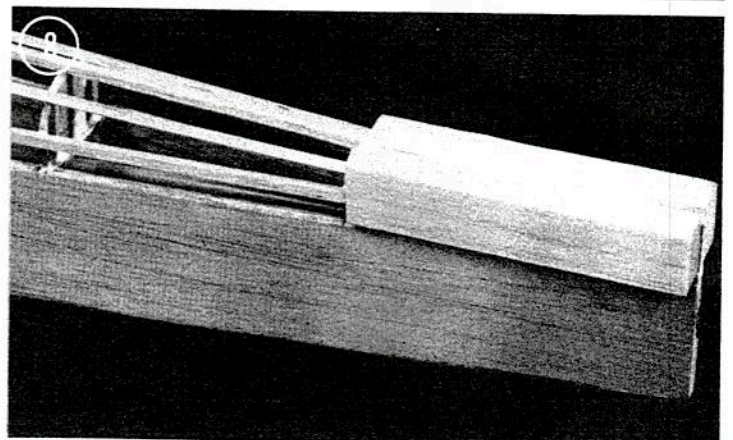
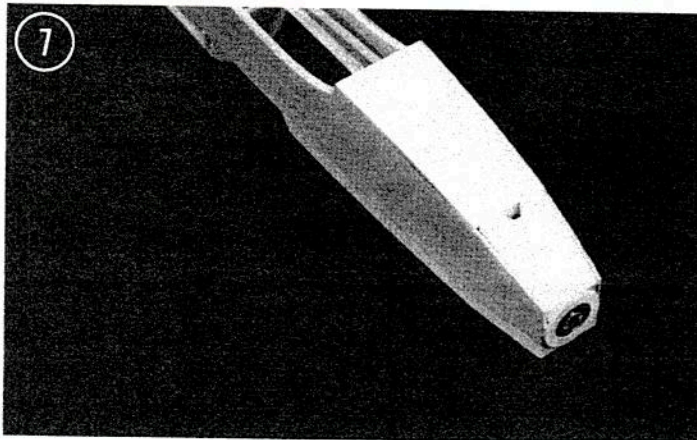
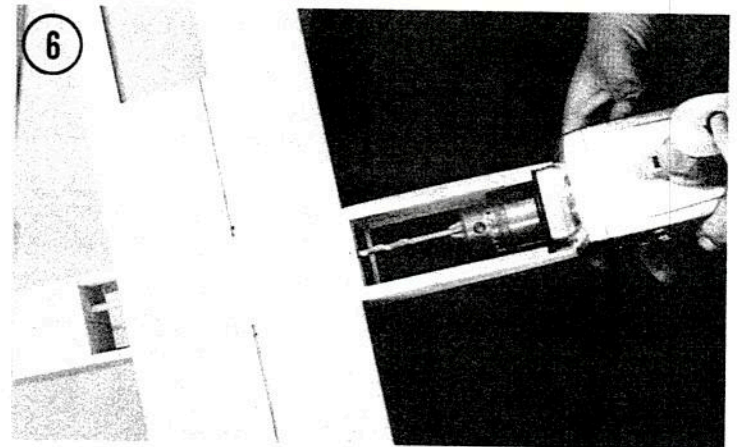
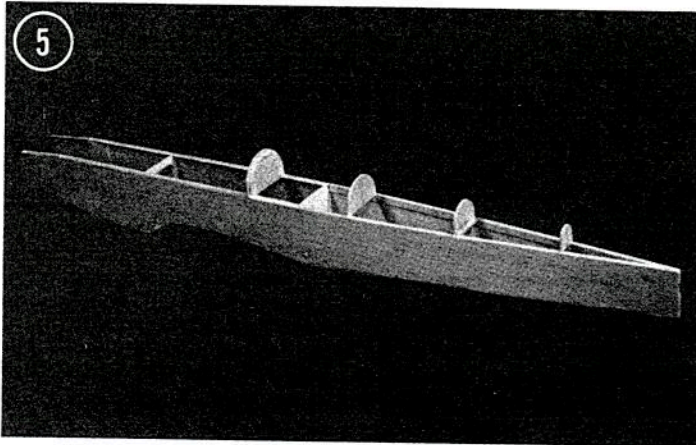
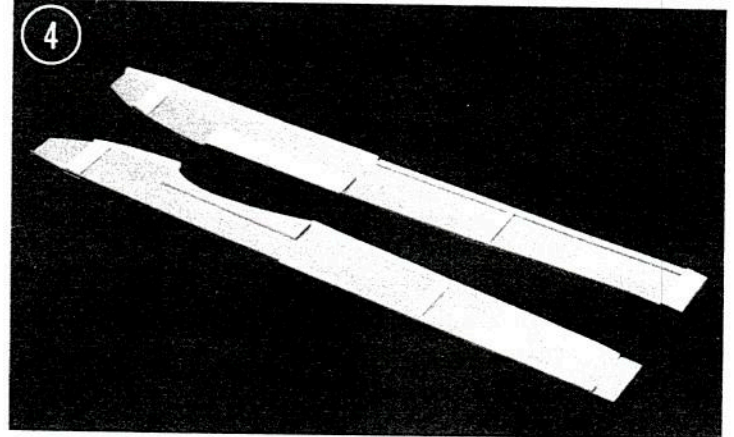
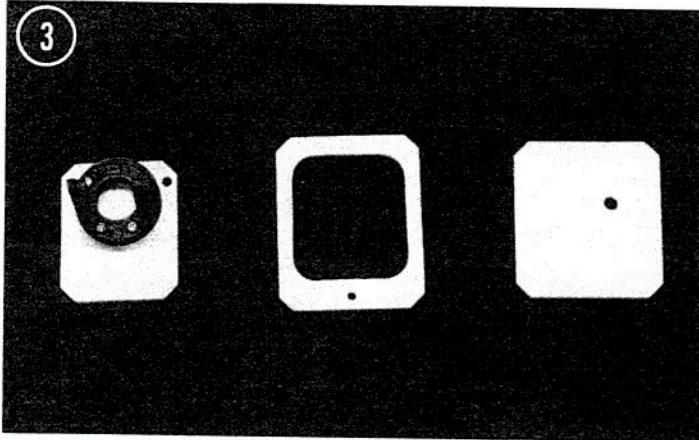
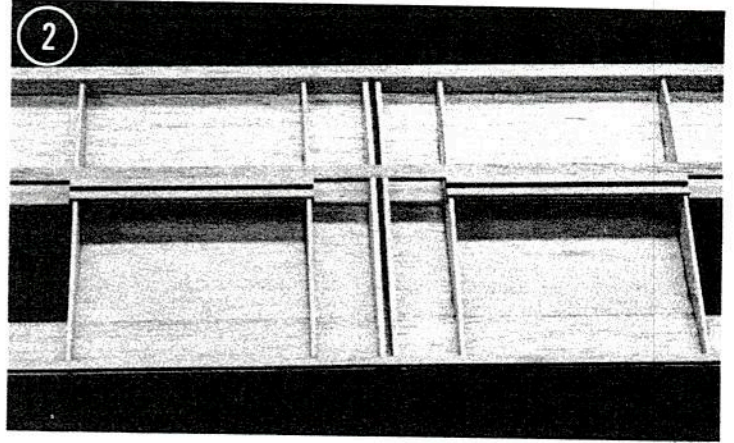
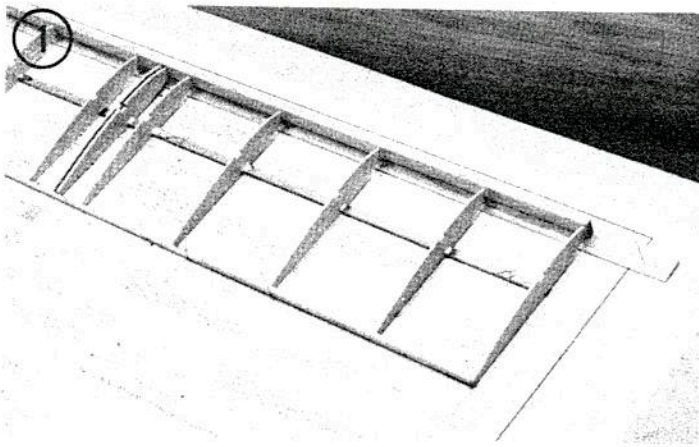
23. The soft balsa block tail fillets can now be temporarily attached to the fuselage for shaping. This is done by first making scrap 1/8" balsa stabilizer and fin spacers. Tack-glue the scrap stabilizer spacer in place on the fuselage, aft of F-8. Tack-glue the two balsa fillet blocks on each side of the scrap fin spacer and tack glue these to the top of the stabilizer spacer. Make sure the fin spacer is aligned correctly fore and aft, on center. Let this assembly dry for later shaping and removal.

24. Glue the 1/16" balsa "cockpit flooring" in place, cross-grained, between F-3 and the 3/8" balsa "instrument panel". Note: Leave a small space between the fuselage sides and the edge of the flooring for mounting the canopy (see the fuselage top view of the plans for this detail).

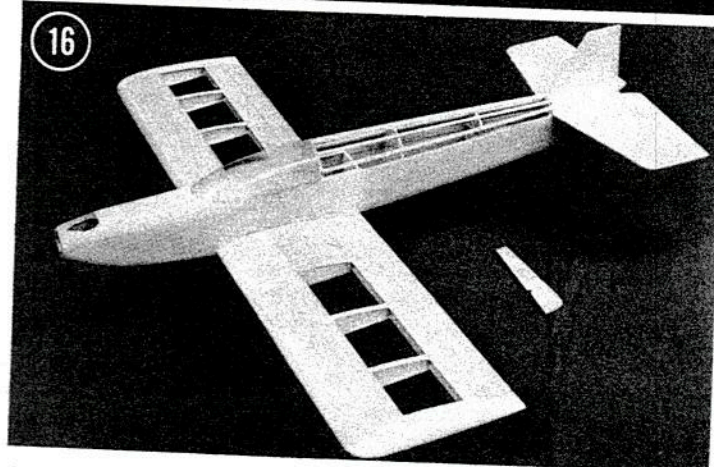
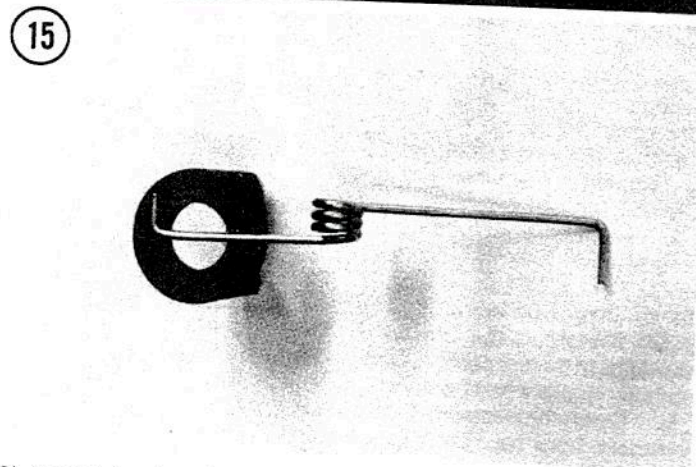
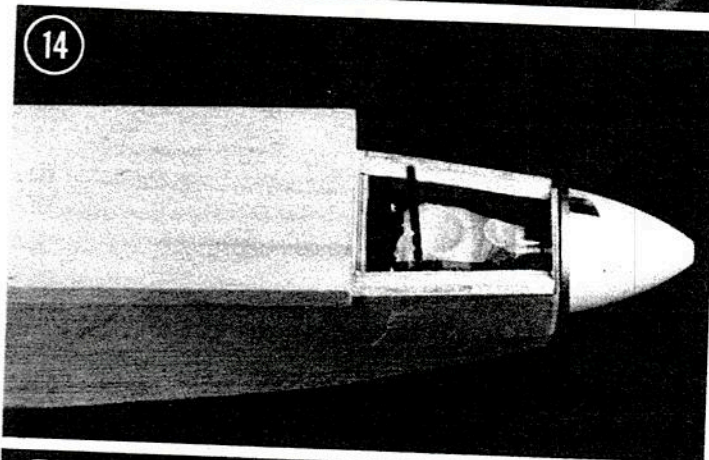
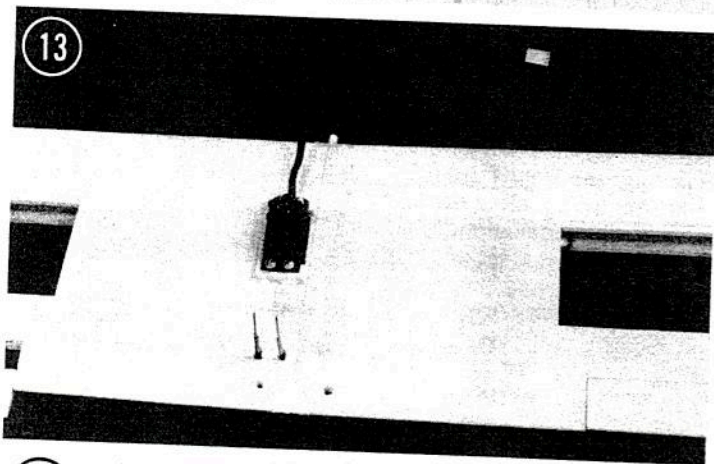
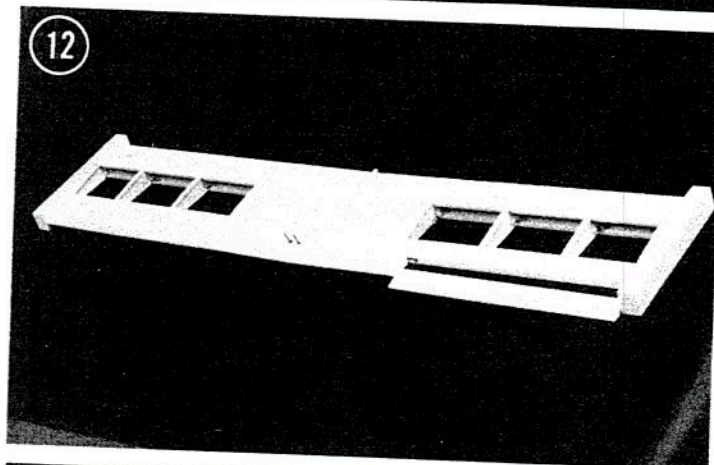
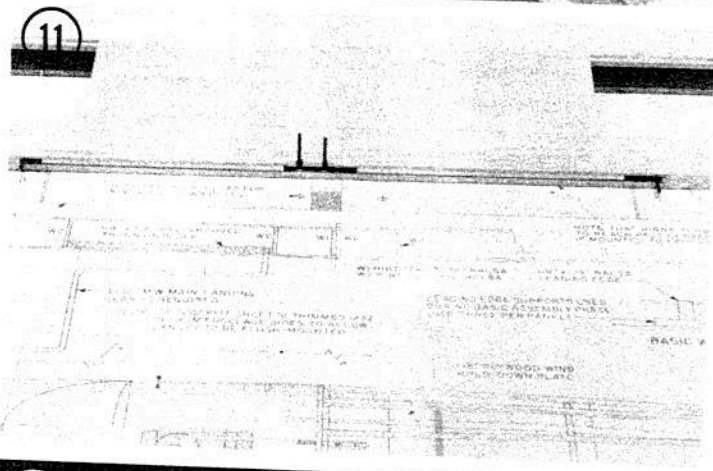
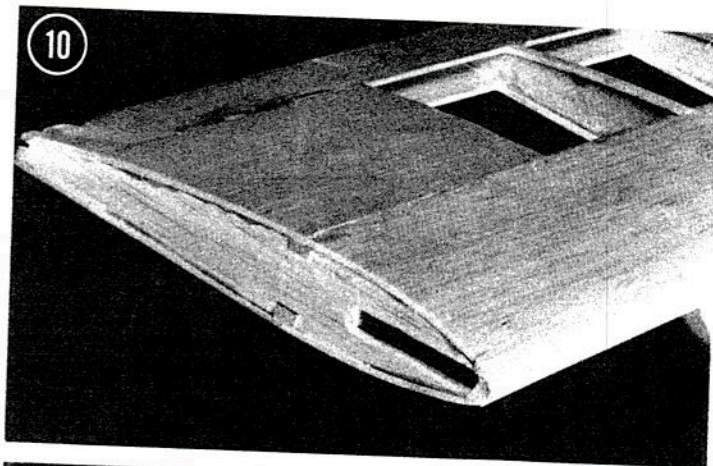
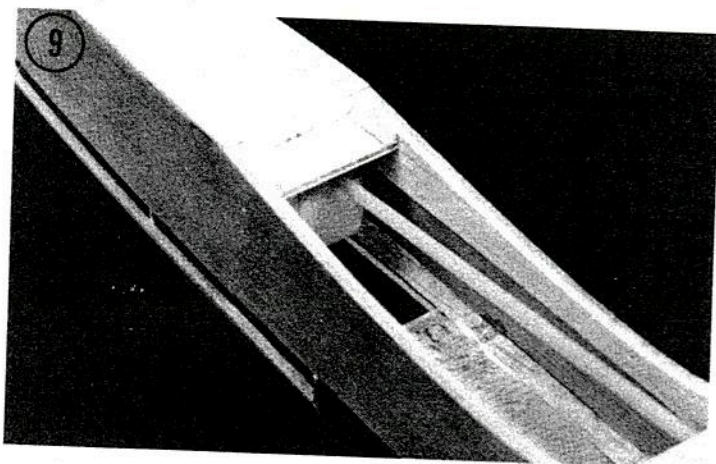
25. Carefully trim the canopy to shape. When trimmed, lightly sand the edges to remove any flash and set aside for later assembly.

26. Epoxy the 1/8" x 3/4" ply rear wing bolt plate in place as shown on the plans. Glue scrap 3/16" triangle stock on each side of the bottom of this plate for support. Note that some of the triangular stock will need to be trimmed flush with the wing saddle.

27. At this point the major fuselage construction is completed and it can be shaped and sanded. This is most easily accomplished by using a razor plane or knife to work down the blocks to rough shape followed by sandpaper to develop the final contours, insuring uniformity of shape from side to side and that too much material is not removed. In the nose area, it is a help to mount your spinner on the crankcase and shape to that contour. At the rear of the fuselage the tail fillet blocks are shaped as shown on the plans and when done correctly, they carry the shape of the fuselage back to the rudder. Although not shown on the plans, you may wish to glue small 1/16" or 3/32" balsa sheet "stringer fillets" between each stringer and the F-4 location directly behind the canopy. These give a nice finished look to your airplane and are helpful when it comes time to cover this area.



(1) First phase of wing construction — Section I, Steps 1-4. (2) Sheeting upper surface and adding landing gear trunnion blocks — Section I, Steps 5-10. (3) Motor mount and firewall assembly — Section II, Steps 1-3. (4) Fuselage sides — Section II, Steps 4-7. (5) Fuselage assembly — Section II, Steps 8-10. (6) Drilling hole for wing hold down dowel — Section II, Step 15. (7) Adding chin block — Section II, Step 20. (8) Aligning tail fillet blocks — Section II, Step 23.



(9) Assembly of cockpit flooring and wing bolt plate — Section II, Steps 24-26. (10) Slotting wing rib W-1 — Section III, Steps 1-2. (11) Trial fitting aileron torque rods — Section I, Step 9. (12) Installing wing tips and ailerons before shaping — Section III, Steps 7-9. (13) Mounting aileron servo — Section III, Step 15. (14) Drilling motor mount — Section II, Step 19. (15) Routing groove in motor mount to accept nose gear wire — Section V, Step 3. (16) Final fit-check and assembly — Section V, Steps 6-7.

## SECTION III

### COMPLETING THE WING

1. Remember the cutting line that you put on the wing? Using that line as a guide, carefully cut the wing in two. Block-up each panel at the wing tip 1/4" and sand each W-1 root rib flat. When this is done correctly your wing should have a total of 1/2" dihedral when the two panels are held together.

2. Using the 3/16" entry hole that you drilled in the leading edge as a guide, slot each of the W-1 root ribs, as shown on the plans, to accept the leading edge wing hold down dowel. Once this is done, lightly sand out the half round hole in each panel to accept the 3/16" diameter dowel when the two panels are held together.

3. You can cut your right and left ailerons and your right and left trailing edge pieces from the 3/8" x 1" trailing edge stock. This operation should be done carefully to avoid overly large surface gaps.

4. Lightly rough up the plastic bearing tubes on each torque rod with sandpaper and epoxy the right and left torque rods into their respective wing panels. Note: The right torque rod extends out past the W-1 root rib in order to fit into the left wing panel.

5. Epoxy the wing panels together with one panel flat and the other blocked up 1/2". Align carefully and allow to cure completely.

6. Glue the inboard trailing edge pieces in place. Avoid getting any glue on the torque rods as this will bind their operation.

7. Glue the wing tip blocks in place.

8. Locate and drill each aileron so that they slip into place over the exposed torque rod end in each panel.

9. For wing shaping purposes, tack-glue the ailerons in place. The entire wing, including the tips can now be sanded to final shape. Again, do this step carefully, insuring uniformity of shape from side to side.

10. Remove the ailerons from the wing and bevel the leading edges of each, as shown on the plans. The hinge slots can now be cut into both the wing and the ailerons, using the plans for location reference. The fitted ailerons and hinges can be set aside for now.

11. Wrap the center section of the wing with the nylon tape supplied, using glue or epoxy. **This is essential** since no dihedral braces are used or needed.

12. Clear out the 3/16" leading edge dowel hole and epoxy this dowel into the wing, leaving 1/4" of it protruding from the leading edge.

13. Mount the wing into place on the fuselage and check the fit on the wing saddle. Make sure that, when in place, the wing is accurately aligned to the fuselage in all planes. Mark the location of the two wing bolt holes on the wing. With the wing accurately mounted on the fuselage, drill through the wing and the 1/8" plywood hold down plate in the fuselage using a 7/64" bit in the two marked bolt hole locations. Remove the wing and tap the hold down plate with the 6-32 x 3/4" self-tapping screw supplied. Redrill the two holes in the wing with a 9/64" drill. Reinstall the wing and bolt it in place with the two nylon bolts supplied and check for proper seating and alignment.

14. While the wing is bolted in place to the fuselage you may wish to add the optional fuselage/wing fairing that carries through the fuselage lines onto the wing (see the plans). This simple addition to your airframe adds greatly to the "finished look" we all strive so hard for. Scrap 1/4" sheet balsa or built up layers of 3/32" balsa can be used. Once glued in place, sand the fairing smooth and round the front edges to match the fuselage. Remove the wing from the fuselage.

15. The cut out for your aileron servo can now be made. As shown on the plans, the aileron servo sits upright in the left wing panel, just behind the top spar. The spruce screw bases supplied are epoxied fore and aft of the servo cut out to facilitate attachment of the servo with wood screws. The aileron servo, when in place, should be lined up with the two protruding aileron torque rod ends.

16. The torque rod actuator arms can be made very simply with the 1/16" I.D. brass tubing supplied. Flatten about two-thirds of the length of each of the two pieces in a vise and drill three or four adjustment holes in the flattened portion of each. The remaining one-third of the tubing is slipped over the exposed torque rod ends in the center section of the wing and soldered in place. An alternate method is to solder the lengths of tubing in place over the torque rod ends and use commercially available aileron links, such as Rocket City's No. 05 or Du-Bro's No. 103. These allow set screw adjustment and work equally as well.

## SECTION IV

### TAIL SURFACES

1. Epoxy the 1/8" diameter dowel joiner to the elevators using the trailing edge of the stabilizer for alignment. Round the leading edge of the elevators. Cut the hinge slots in both the stabilizer and elevators but do not glue the hinges in place at this time.

2. Using a sanding block, sand the leading edge, trailing edge and tip tapers on both the stabilizer and elevators. The fin and rudder can be sanded to shape the same way by taping the rudder to the fin on one side and sanding the other side then reversing the tape and sanding the opposite side.

3. Sand a 1/4" half round clearance hole out of the rudder, as shown on the plans, to allow clearance for the elevator joiner. Set aside the tail surfaces for later assembly.

## SECTION V

### COMPLETING THE FUSELAGE

**Note:** The first two steps of this section are concerned with opening up the nose to allow engine mounting. If your Warlock is set-up for an upright engine, these steps will pertain to the **top** of the fuselage at the nose. If your engine is side mounted, these same steps will apply except you will be working on the **right** side of the fuselage at the nose.

1. Determine approximately where the cylinder sleeve will exit the fuselage and cut a small 1/2" hole directly over the top of this location. You should now be able to see the top of the crankcase that was left in the nose. Using the plans as a guide, carefully clear out the engine area. Do not clear out too much area but only enough to allow adequate screw driver clearance for engine removal and installation. Once this hole has been finished, smooth and contour the sides of the hole with light sandpaper. Unscrew the crankcase from the mount and reassemble your engine, complete with needle valve.

2. A slot will have to be sanded into the fuselage to allow the needle valve to clear when the engine is in place. This is easily done with sandpaper wrapped around a 1/4" diameter length of dowel. Again trail fit your engine to the mount being sure that you are satisfied with all clearances. Remove the engine and unbolt and remove the motor mount from the fuselage.

3. The final step in the engine area is to groove the back of your motor mount to "nest" the nosegear in place. This is quickly accomplished with a Moto-Tool and a small router bit. Note that the nosegear should not be totally countersunk into the mount back, a little of it can be protruding when in place. This will cause a clamping action when the mount is bolted firmly in place to the firewall and will keep the nosegear from wobbling.

4. Hand fit your canopy in place, checking that it fits all the way around. Any final sanding to insure a good fit should now be done. It is at this point that any cockpit detailing you may want to do should be done. A Williams Brothers 1-1/2" scale racing pilot, cut off at the "collar" fits this design well. Once you are through with the cockpit detailing, the canopy can be carefully epoxied in place and held with tape until dry.

5. Carefully remove the tack-glued stabilizer, fin and tail fillet assembly from the rear of the fuselage. Again carefully separate these parts. All you are after are the two sanded tail fillet blocks.

6. Bolt the wing to the fuselage. Draw a centerline on the top of the stabilizer for reference and glue the stabilizer onto the fuselage, directly behind F-8. Align the stabilizer to the fuselage centerline and with the wing - pin securely and allow to dry.

7. Glue the tail fillet blocks to each side of the fin at the bottom then glue this assembly directly to the top of the stabilizer and up against F-8. Once again align the fin carefully with the fuselage centerline making sure that it is 90° upright to the stabilizer. Pin securely and allow to dry.

## SECTION VI

### SANDING

Sanding is intended to smooth the surfaces of the wood so that the finished model will look better. Any defect will not be hidden by the final finish but will show up more visibly. The care and patience spent now will reward you with pride when you show your model to your friends and provide you with the self-satisfaction of doing an outstanding job. The difference between a good looking or poor model is usually sandpaper and there are no substitutes. One hour with a sanding block at this stage will provide satisfaction for the life of the model.

Several different sanding blocks, covered with different grades of paper will give true flat surfaces. Emery boards are also helpful for tight corners or stubborn spots.

Use the better grades of sandpaper such as Aluminum Oxide or Silicon Carbide open coat. Garnet paper is also satisfactory but the more common grades of flint paper wear out so quickly that their low cost is offset by the inconvenience and wasted time. Check the shelves of your local hardware store or automotive supply outlet, if you can't find these materials elsewhere. We recommend that you use No. 120 for rough sanding, switching to No. 220, then to No. 320 or No. 400 for final sanding. One sheet of each grade is more than enough to complete this model. Use long strokes and blend the surfaces smoothly. A little water or saliva on dents may raise the wood fibers enough to eliminate the need for filler in most cases. Bad dents or cracks should be filled. We have found that DAP White Vinyl Spackling compound works great for this purpose.

Resand all surfaces with worn No. 320 or No. 400 paper by hand and you are ready to cover and finish your model.

## SECTION VII

### REVIEW NOTES

A quick review of where you should be at this stage of construction is in order:

1. Your fuselage is completely finished and sanded to final shape with the stabilizer, fin and tail fillet blocks all in place.
2. Your engine, mount and nose gear all fit in place and are easily removable (at this point they are out of the fuselage).
3. Your battery pack and fuel tank fit neatly through former F-2 and are also removable.
4. Your fuel line and vent line holes in the firewall have been cleared out.
5. Your wing is completely finished including the aileron servo cutout and the spruce servo screw bases epoxied in place.
6. Your main landing gear wires fit snugly into the trunnion blocks but are not mounted yet.
7. Your aileron torque rods move freely and the brass tubing actuator arms have been soldered in place.
8. Lastly, your ailerons, elevators and rudder have been sanded to shape, fit perfectly in the respective locations but are not yet attached to the airframe.

If you are satisfied that all of the above construction criteria have been met, you can then commence with the covering and final assembly phases.

## SECTION VIII

### COVERING AND FINAL ASSEMBLY

It has been said a thousand times and will be repeated a thousand more — "everybody has his own favorite method of finishing a model". It is important to point out however, that there is one

fact concerning anything that flies that will forever remain constant: LIGHT IS GOOD, HEAVY IS BAD. Weight has a direct bearing on performance. This is true of any aircraft but rapidly becomes even more true as we go down the scale to Warlock-size airplanes. Your target weight for this design should be 20 ounces. Variations, of course, will occur and one or two ounces over the target weight will not appreciably effect performance. Variations of anywhere from three to eight ounces over the target weight will tell in flight. The airplane will still fly at 28 ounces but at that weight vertical maneuvers will almost be non-existent from horizontal flight and the stall speed starts to get fairly high.

To combat weight and therefore poor vertical performance, we have carefully engineered the Warlock 05 with a great deal of emphasis on simplicity of the basic construction and the resulting basic airframe weight. Nothing was compromised however, since the aircraft is as strong as it needs to be. Prototypes have been built and are being flown at under 20 ounces in the two-channel configuration, complete with well done Monokote finishes, landing gear in place and two ounce fuel tanks. All of this serves to point out that genuine ½A performance is now a reality with your Warlock 05.

With the weight considerations outlined above we would strongly recommend that you use one of the plastic film covering materials for your Warlock. We know of no other way to achieve a more superior finish without paying some kind of weight penalty. Of course you can use silkspan and dope if you prefer, just be careful of using too much and of warpage.

Assuming that you are going to finish your model with Monokote or an equivalent plastic film, start the process by coating the interior of the engine area with resin, such as Super-Poxy or with a light coat of Hobby-Poxy Formula II. The idea is to coat the wood and joints to eliminate damage from fuel. Be careful not to get any of this material into the motor mount blind nut holes or the fuel and vent line holes.

Cover the elevators first. The exposed section of 1/8" elevator dowel can be painted to match or it can be covered as well. After covering, re-cut the hinge slots. Next cover both of the ailerons and again, re-cut the hinge slots and open up the torque rod holes in each. The horizontal stabilizer is covered next — first the bottom then the top. As on the elevators, clear out the hinge slots.

The stringer area from the canopy all the way back through the tail fillets to the end of the fuselage is covered next. Although our prototypes were covered in one piece in this area, you may prefer to do it in two pieces. Cover the fuselage bottom next, from the wing saddle aft to the end of the fuselage and from the leading edge of the wing saddle, forward to the spinner ring.

Epoxy the hinges into the stabilizer and wipe off any excess adhesive with acetone. Test fit the elevators to the stabilizer to insure that the hinges slip correctly into place. Apply epoxy carefully to each side of each hinge and press the elevators into place. Again, wipe off any excess adhesive with acetone. After curing, move the elevators up and down, checking for smooth, light action.

The rudder may now be glued to the fin and the end of the fuselage. Wipe off any excess glue and allow to dry. Lightly sand the fin/rudder joint until smooth. Remove any dust and cover the fin and rudder.

The top of the fuselage, from the canopy forward to the spinner ring is now covered in one piece. Lastly, each side of the fuselage is covered. Cut the covering material away from around the engine cutout and reapply your iron around this area to insure good adhesion. If you have used Monokote, a good technique is to mix up a small amount of Hobby-Poxy paint in the matching color of your finish and brush it on inside of the engine compartment and out to where the Monokote was cut. This effectively seals off the covering and at the same time looks very attractive and "finished". Clear out the covering material from the push rod exit and from the nose gear cut out on the bottom of the nose.

The wing is covered last and this is done in four pieces. Cover the bottom panels first, slightly overlapping each piece at the centerline. Cover the top panels last. Pretrim the left wing panel piece to

fit around the servo cutout and screw bases.

Trim away the covering material over the main landing gear slots on the bottom of the wing and reapply heat around this area for good adhesion. Clear out the covering material from the rear wing bolt holes and again reheat this area. Re-cut the hinge slots in the aileron bays.

The ailerons can now be mounted. Epoxy the hinges into the wing and wipe away the excess glue with acetone. As with the elevators, check-fit each aileron prior to mounting permanently. Carefully apply epoxy to each side of each hinge and to the torque rod end and slide the aileron in place. Wipe away the excess epoxy and move the aileron up and down — just a little — to check clearance. Repeat this process with the other aileron. With the exception of trim, your model should be completely covered with all parts in place and working.

After the paint on the inside of the engine compartment has cured, you can set up your motor mount, nose gear and engine. The main gear in our prototypes were mounted in place by first running a bead of RTV silicon in each trunnion slot, pressing the gear into place and allowing the RTV to set. This method works quite well and does away with the usual landing gear clips and screws. Attach the elevator horn to the right elevator side, as shown on the plans and you should be ready to start the radio installation.

## SECTION IX

### RADIO INSTALLATION

The radio installation in this model is very straightforward. The diagrams shown on the plans illustrate exactly what was done on our prototypes for two-channel operation. If you plan to use a third channel for throttle, locate the elevator servo further aft and mount the throttle servo between the elevator servo and the receiver. We used a Cox/Sanwa Micro Servo Aileron Tray (Cat. No. 801610) to mount the elevator servo. This was mounted to the right fuselage side with servo mounting tape. Note that the elevator servo (and throttle servo, if you are using one) is inverted in the fuselage. The receiver is wrapped with sheet foam and sits in place as shown on the plans.

The fuel tank sits in place above the battery pack. We have found that the tank is easier to install by running separate lengths of fuel tubing into each hole in the firewall and pulling it through the fuselage and out through the wing saddle opening. Attach the tubing to the appropriate tank lines and carefully push the tank into position while gently pulling the fuel lines back out of the firewall until the tank is in place. Wrap the battery pack in a little plastic wrap and foam rubber and press it into position beneath the tank. Check the tank at this point to make sure it is correctly in position and secure. If it moves around easily, pack in more foam to secure it.

While the switch may be mounted externally, we like to mount it to the inside of the fuselage (there is plenty of room) and use a length of small diameter music wire out the fuselage side to activate it. The antenna can exit the fuselage through a small hole and be attached to either the fin or the end of the fuselage.

Make up your elevator push rod using the No. 2-56 x 1" studs at each end. Be sure that the studs are screwed into the push rod at least 3/16". Install the clevises so that they offer adjustment either way from center.

The threaded aileron control links are first trimmed to length followed by bending them at the unthreaded end to fit into each side of the servo arm (see plans). Thread a clevis onto each link and make the connection to the aileron actuator arms. Your ailerons should be adjusted for absolute neutral. Make doubly sure that they are connected correctly. With the radio on, move the stick to the right and the right aileron should move up and the left aileron should move down.

The next adjustment that needs to be made is that of surface movement. As shown on the plans, adjust the elevators and ailerons to move 3/16" in each direction from neutral. If this is your first experience with a "hot" airplane, you will quickly see why these surface movements are recommended for the initial flights.

You should now check the balance point of your completed model **without** fuel. The plans show two points of balance: the forward point is for first flights and the aft point is for pilots who have had some experience with pattern-type airplanes. Find the point of balance and mark this point with slivers of masking tape on each wing tip. If the model does not balance where you want it to you can shift the radio gear or add small amounts of lead weight where required. Concerning this point, we have a final word of caution: It is far better to add lead to the nose than to try and fly this airplane in a tail-heavy condition.

## SECTION X

### PREFLIGHT

A few minutes spent now will save you a lot of time later and maybe your airplane.

1. Inspect your model completely. Make sure that the surfaces are firmly attached and move smoothly with your radio commands.
2. Make sure that you have no warps. If you do, correct them before you fly. Make sure that when your transmitter trims are in neutral so are your ailerons and elevators. Adjust the clevises if required.
3. Run your engine. Be sure that the tank feeds properly in all attitudes. Make sure the radio works when the engine is running.
4. Roll your model on the ground. Adjust the nose gear to achieve a straight roll.
5. Be sure that your batteries are fully charged and head for the flying field.

## SECTION XI

### FLYING

Simply put, if you have followed our instructions you should encounter no problems flying your Warlock. The airplane will R.O.G. beautifully with little or no "torque turn" tendencies, due to the wide-spaced landing gear. Lift off speed is quickly reached in 20 to 30 feet or less. Due to the cleanliness of the design and a good power-to-weight ratio, acceleration is extremely rapid.

Once you have "felt-out" the airplane and made any trim adjustments necessary, go for it! We are confident that you will find the abilities of this design as exciting as anything you have flown before.

Good luck and good flying . . .

Scott Christensen

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