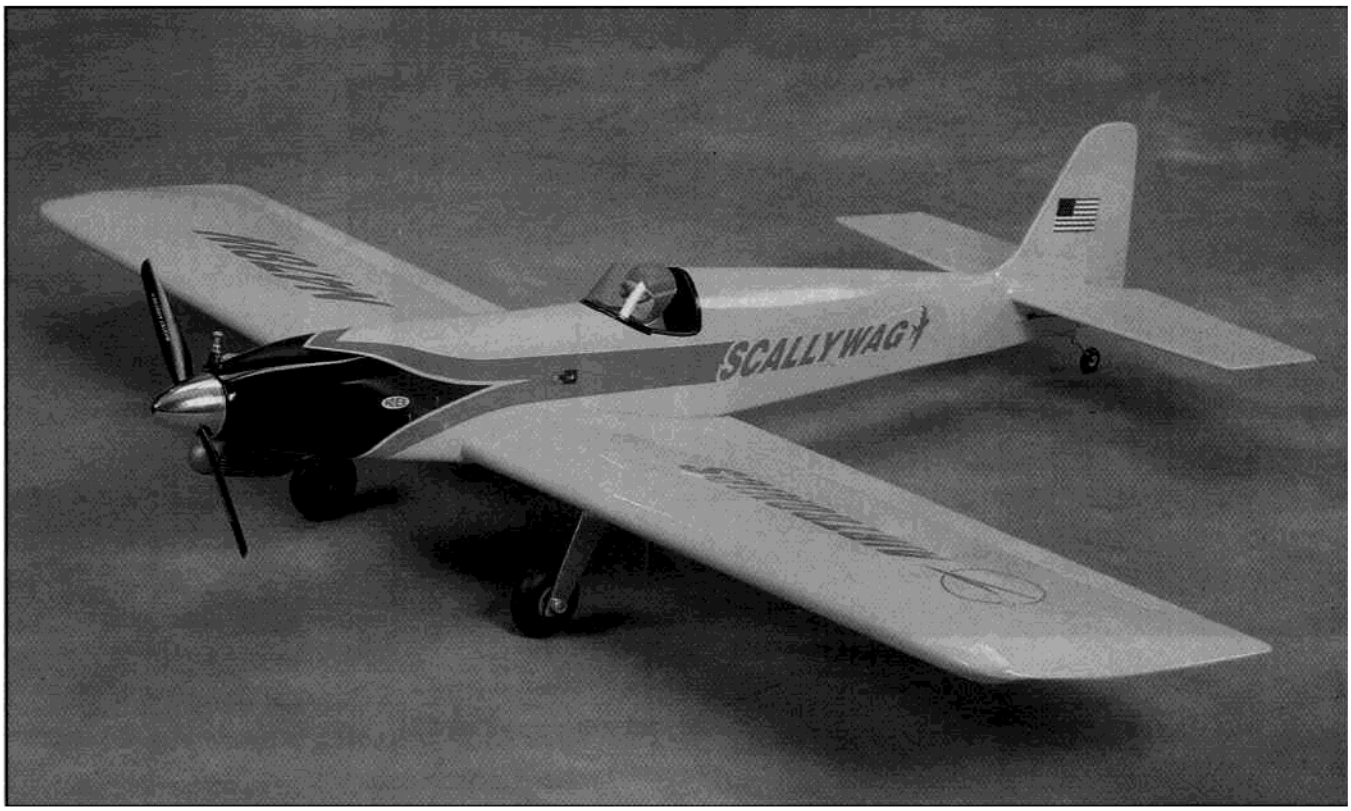
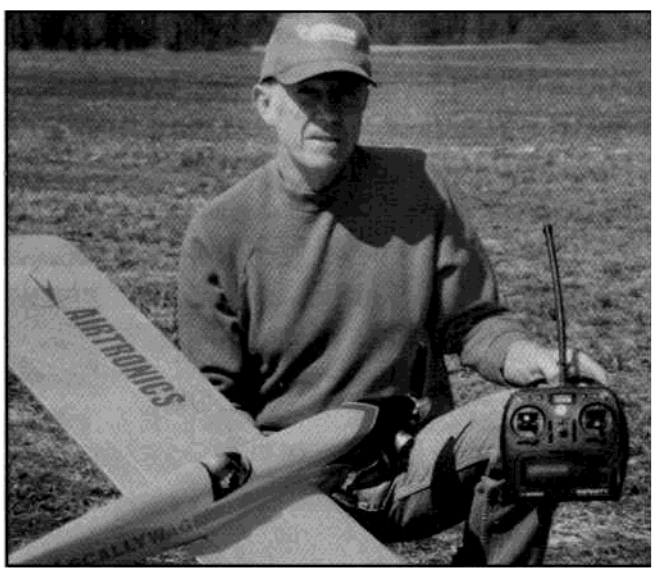
SCALLYWAG

BY BOB WALLACE





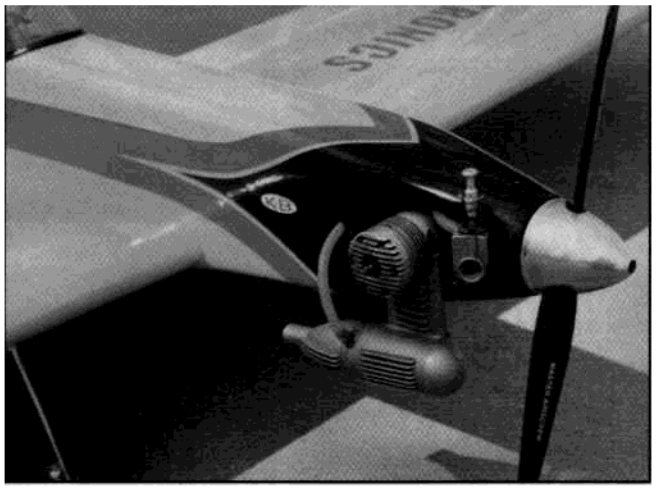
This Slick .40-.46 Powered Sport Flier Builds Quickly And Is Loaded With Performance

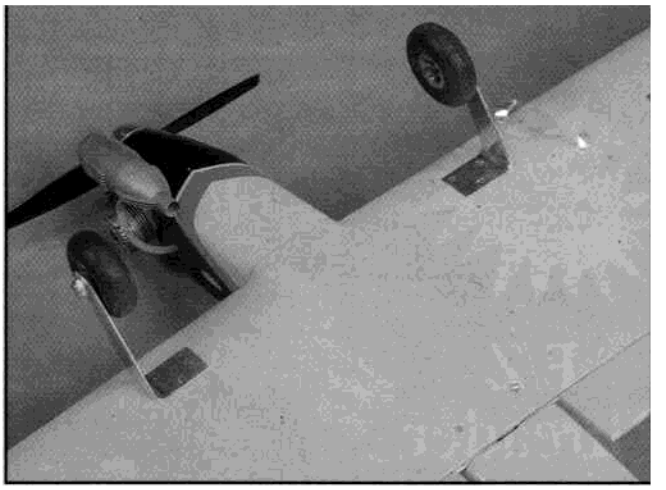
The Scallywag was designed in an effort to produce a highly aerobatic, fun-to-fly, sport aircraft with a sleek or racy appearance.

It had to be relatively easy and inexpensive to build, possess nimble and responsive in-flight qualities and still be docile enough to be well within the piloting capabilities of any "Sunday" or sport flier.

Construction of a Scallywag is very basic and via conventional building methods. It is designed to be adequately powered by any sport type .40-.46 (2-stroke) R/C engine. While a higher-powered ABC Schnuerle ported engine, even equipped with a tuned pipe, could be used, it really isn't necessary.

I elected to use a K&B (No. 4011) .40 engine with its standard muffler in my Scallywag and it proved to be an ideally suited engine. Master Airscrew and APC 10 x 6 propellers were used and both per-

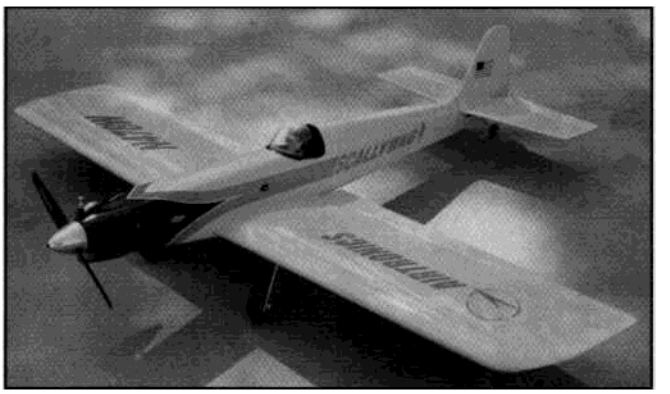


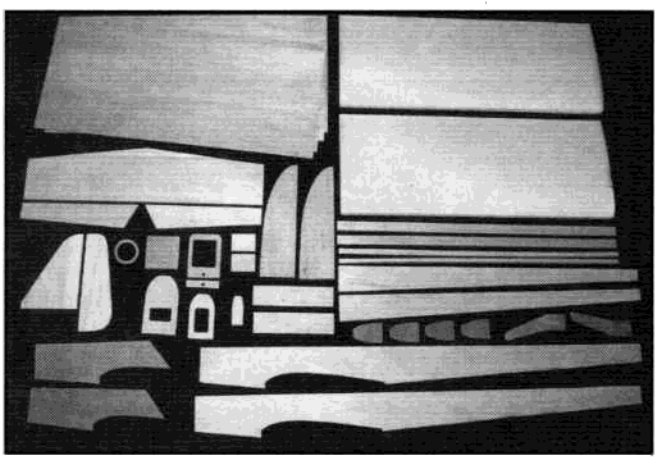


formed equally well.

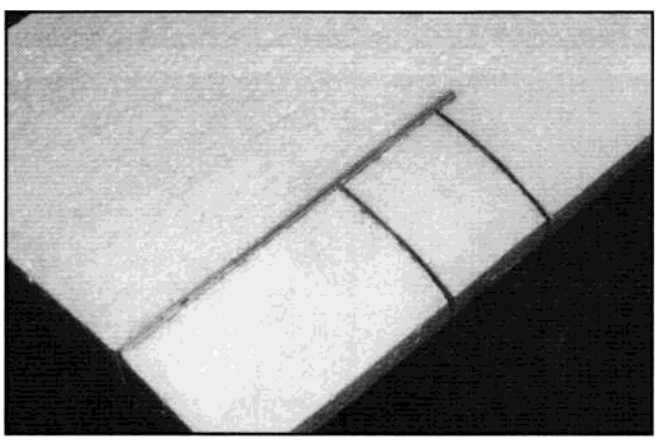
The Scallywag wing is a fully symmetrical type that has a fairly thick section, similar to the types that are used on the ultra lightweight competition fun-fly designs or the "profile" types that perform so well in the air, yet are (in my opinion) so ugly in appearance.

The decision to mount the landing gear in the wing instead of the fuselage was done for two reasons, the first being that the wider stance of the gear legs produces better tracking during the take-off run and superior ground handling characteristics, and the second being that I believe it just looks nicer and hopefully gives the aircraft a bit of that sleek, World War II fighter look. RC'ers who have been reluctant to try a "taildragger" (and those who have experienced ground handling problems with a past design, especially one with a short-coupled fuselage, or one where the landing gear is a fuselage

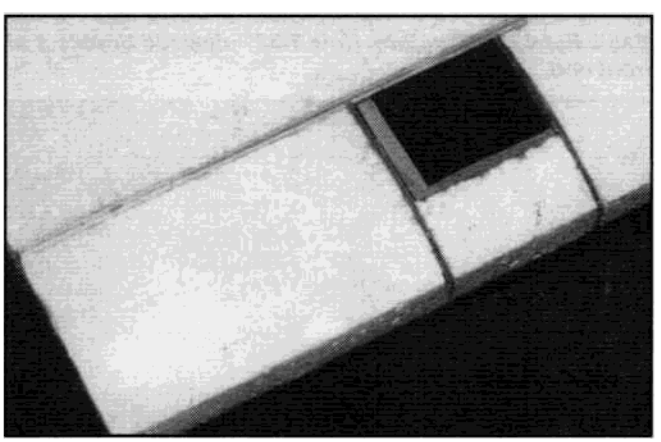




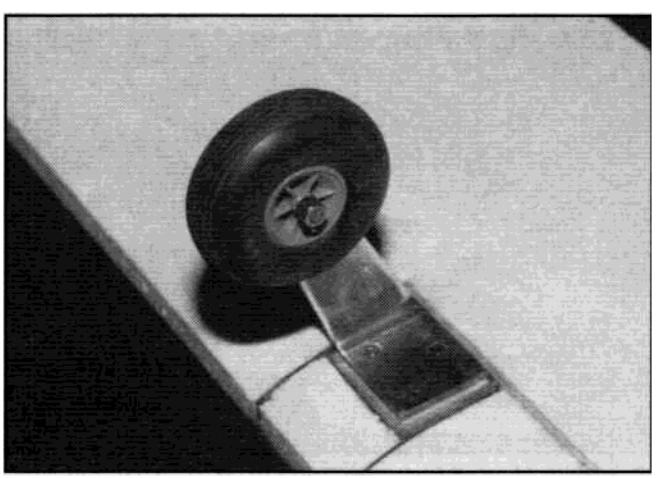
The "kit," all the basic parts required.



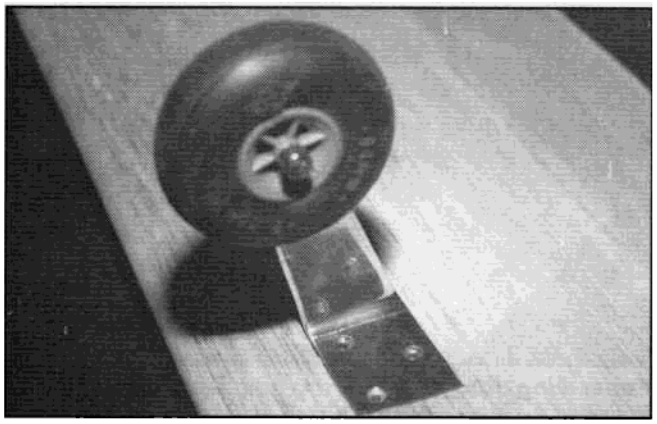
Foam wing core with landing gear spar and half ribs installed.



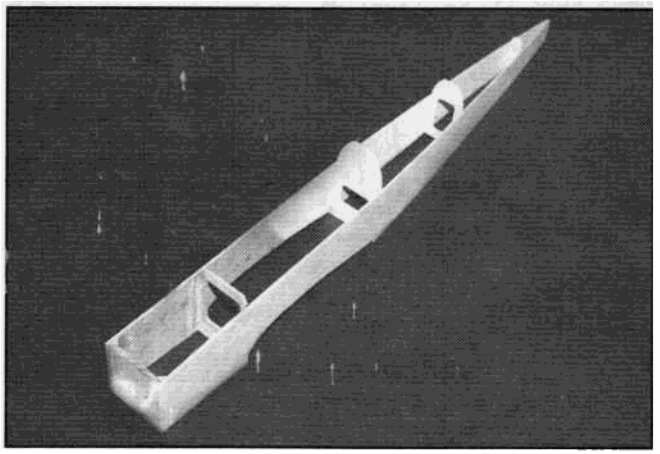
Landing gear plate glued in place. Note plastic tape covering L.G. leg attachment area. This allows easy removal of balsa wing skin after the wing is sheeted.



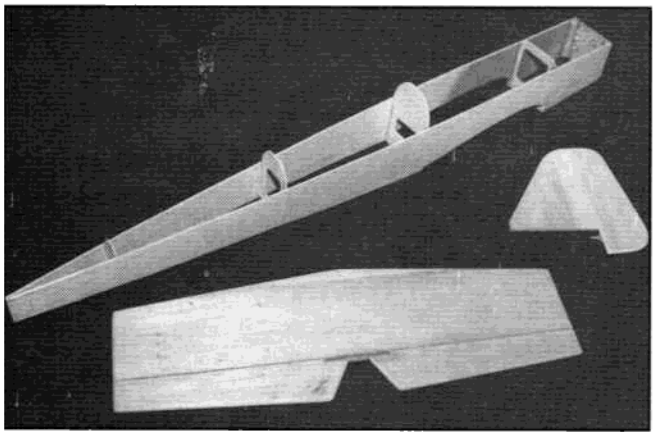
Landing gear installed on mounting plate.



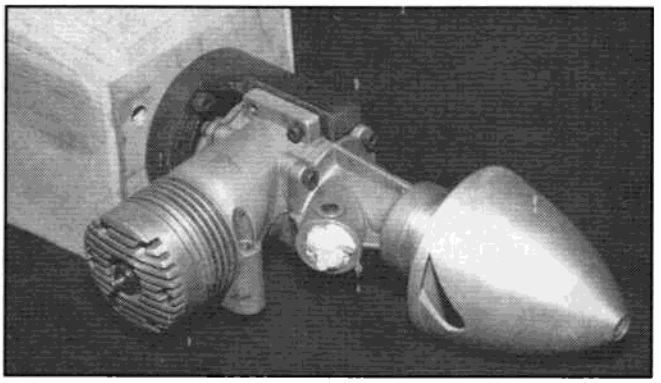
View of landing gear in place on sheeted wing.



Basic fuselage structure. Note 1/32" plywood doublers at front end.



Opposite view of fuselage. Tail surfaces are made from 1/4" sheet balsa.



Nose area, ready to install cowling blocks. K&B .40 used on author's original.

mounted type with the wheel spacing fairly close together), will find the Scallywag to be quite different and surprisingly easy to maneuver on the ground. An effort was made to keep the Scallywag prototype light in weight without sacrificing strength. This was primarily done by carefully selecting all of the balsa that would be used in constructing the aircraft, using only medium and fairly soft grades.

The prototype Scallywag weighed in at 4 lbs. 3 oz. ready to fly less fuel, which is quite good for a .40-.46 size sport airplane with almost 600 sq. in. of wing area. I preferred to finish the fuselage with epoxy enamels, so an additional ounce or two of weight could have been saved in that area also, with the use of film type covering.

Completed aircraft, ready for covering.

The Airtronics radio components utilized were all standard size units, with a 600 mAh battery pack, four standard #94102 servos, and a #92765 (FM) receiver. The transmitter used was an Airtronics Infinity 660. There is ample space within the fuselage to easily accommodate any normal size radio system components.

What else can be said about an R/C design that isn't a scale model and is not intended for use in any type of competitive flying, except to say that it does fly very well.

It is very aerobatic, yet quite smooth with no bad in-flight characteristics. Any RC'er who has progressed beyond the beginner phase and has mastered a full

4-function type of aircraft, will have no trouble in flying a Scallywag. From a construction viewpoint, any modeler who has built a few wood type kits and has only basic scratch-building skills shouldn't have any difficulty in successfully constructing a Scallywag.

CONSTRUCTION

It is suggested that before construction is started, the builder first cut out all of the shaped parts as shown in the construction photo. These parts include the fuselage sides and doublers, bulkheads, formers, landing gear plates, spars, half ribs, sheet tail surfaces, ailerons, and wingtips.

A product that works slick for creating formers, ribs, bulkheads, etc., is See Temp instant template material, available from See Temp, P.O. Box 105, Sussex, WI 53089. See Temp is a frosted translucent surface plastic material on to which you simply trace the outline that you want, score the outline with a sharp blade, bend it on the scored lines, and you have a perfect template that is even reusable, should you ever wish to build another identical model. While fabricating all of the shaped parts first does not actually speed up the assembly process, it does create sort of a "kit" effect whereby the construction phases seem to progress in a less interrupted fashion.

As mentioned, selecting your balsa wood stock carefully, and using only medium to medium/soft grades, can save several ounces of unnecessary aircraft weight.

Wing:

Start by first cutting out the necessary foam core cutting templates. These templates can be made from 1/16" to 3/32" plastic laminate, aluminum, or even plywood.

Cut your foam wing cores from 1 lb. density expanded polystyrene (EPS) foam board.

If you do not have a foam cutter or an aeromodeling friend who does, Scallywag wing foam cores are available from Wallace R/C, 91 Sylvan Street, Avon, CT 06001. The cost is $18.00, plus $4.00 for handling and first-class shipping. The next step is to cut the slots in the wing cores to accept the 1/8" lite ply landing gear spars. The easy way to make these cuts is with a band or jig saw. Mark the correct position and length of the spar cuts on the foam cores and lay the cores back into one of the scrap foam cradle pieces, and make the cuts. Try to achieve a good snug fit between the lite ply spars and the foam. These cuts can also be made by hand, using a sharp X-Acto knife or a Zona saw blade, and a straightedge. If you are making these cuts manually, I suggest that you mark the cut positions on both sides of the foam core, in order to be sure that the cuts are being made vertically. Glue the lite ply spars in place with 5-minute epoxy.

Next, mark the correct position for the (W1) 1/32" plywood landing gear plate half ribs and make these cuts in the foam cores in the same fashion. Epoxy the (W1) half ribs in place. The landing gear legs should now be cut from 3/32" (.093) dural aluminum and bent to the indicated angle. Drill the holes for the wheel axles and mounting screws in the gear legs. Position the landing gear mounting flanges on the 1/8" plywood mounting plates and mark the positions for the 4-40 mounting screws. Drill these holes in the plates to accept the 4-40 blind nuts. Install the blind nuts and mount the gear legs to the plates with flat head 4-40 machine screws. Glue the 1/4" triangle stock pieces onto the 1/8" plywood plates. Position each plywood landing gear plate assembly above the foam, between the two (W1) half ribs where they are to be recessed into the foam and mark the forward edge of the plate onto the foam.

Stop for a moment and check to be sure that you are making a "right" and a "left" hand wing panel! Carefully remove the foam in these areas to accept the plate assemblies. The landing gear plate assemblies should fit snugly between the (W1) half ribs and the 1/8" lite ply spar, with the outer face of the plate flush with the surface of the foam core. Epoxy the landing gear plates in place. Carefully block sand and vacuum clean the foam cores and set them aside. Prepare the 3/32" sheet wing skins, and sand and vacuum them. Be sure that the wing skins are slightly oversize to allow for the airfoil curvature and for trimming. Before sheeting the foam cores, position the aluminum landing gear legs in place on their respective mounting plates and mark the edges of the gear leg mounting flanges on the plywood plates. Next, cover these flange areas on the plywood plates with plastic tape (electrical tape is fine). The reason for doing this is to allow for the easy removal of the balsa wing sheeting after the cores have been sheeted; this allows the aluminum gear legs to fit flush with wing skin. The plastic tape also keeps the wing sheeting adhesive out of the blind nut threads. Epoxy, contact type adhesive, or even aliphatic resin may be used for applying the wing sheeting. I prefer to use slow cure epoxy for this step and will outline the steps for this process, using the simple "weighting of the sheeted cores" method while the epoxy cures. Experienced modelers may prefer to use the vacuum bagging method for this phase of construction.

Mix about 2-1/2 oz. of slow cure epoxy such as Hobby Poxy's Formula 2 or Great Planes' Pro 45-minute cure epoxy. You may wish to thin the epoxy slightly with isopropyl alcohol to allow for easier spreading. Apply epoxy to the balsa wing skins and squeegee off all excess epoxy. If you don't have a plastic squeegee, an old plastic playing or credit card works equally well for this step. The epoxy-coated skins should appear to be dull and not have a "wet" glossy appearance as this indicates that too much epoxy has been applied. Squeegee the remaining epoxy onto the foam cores at the leading and trailing edges, and in the landing gear plate/spar areas. Apply the epoxy-coated wing skins to the foam cores and place them back into the excess foam core cradle pieces. Align both sheeted wing cores and the scrap foam cradle pieces on a flat building surface and place a piece of flat plywood, plate glass, etc., on top, and then place heavy weights on the entire stacked assembly. Allow the epoxied wing panels to cure overnight.

Remove the sheeted wing cores from the foam cradle pieces and trim and block sand off the excess balsa sheeting, flush with the foam core edges. Glue the 1/4" x 3/4" leading edge and 1/4" x 3/8" subtrailing edge

SCALLYWAG

Designed by:
Bob Wallace
TYPE AIRCRAFT
Sport Aerobatic
WINGSPAN
53 Inches
WING CHORD
11 Inches (Avg.)
TOTAL WING AREA
574 Sq. In.
WING LOCATION
Low Wing
AIRFOIL
Symmetrical
WING PLANFORM
Double Taper
DIHEDRAL, EACH TIP
3/4 Inches
OVERALL FUSELAGE LENGTH
44 Inches (spinner tip to rudder end)
RADIO COMPARTMENT SIZE
(L) 9-3/4" (W) 2-11/16" (H) 2-3/8" Avg.
STABILIZER SPAN
20 Inches
STABILIZER CHORD (inc. elev.)
5-3/4 Inches (Avg.)
STABILIZER AREA
108 Sq. In.
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Upper Middle of Fuselage
VERTICAL FIN HEIGHT
6 Inches
VERTICAL FIN WIDTH (inc. rud.)
5-1/2 Inches (Avg.)
REC. ENGINE SIZE
.40-.46 2-Stroke, or .61 4-Stroke
FUEL TANK SIZE
8 Ounce
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
4
CONTROL FUNCTIONS
Rud., Ail., Throt., Elev.
C.G. (from L.E.)
3 Inches
ELEVATOR THROWS
3/8" Up & Down
AILERON THROWS
7/16" Up — 5/16" Down
RUDDER THROWS
1-1/4" Left & Right
SIDETHRUST
0
DOWNTHRUST/UPTHRUST
0

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa & Ply
Wing	Foam, Balsa & Ply
Empennage	Balsa
Wt. Ready To Fly	67 Oz. (4 Lbs., 3 Oz.)
Wing Loading	16.80 Oz./Sq. Ft.

pieces in place. Block sand these edges flush with the wing sheeting and trim the ends. Install the 3/32" sheet core tip caps, sand them flush with the wing sheeting, and then glue the 1/4" sheet wingtips in place along with the 1/2" tip L.E. blocks and the 1/8" tip braces. Remove the lower wing sheeting where the landing gear leg flanges will recess into the wing. The easiest method of doing this is to cut a small piece of sheeting away so that the piece of protective plastic tape can be seen. Carefully remove enough of the tape so that the 4-40 mounting blind nuts are visible.

Loosely bolt the aluminum gear leg in place and then lightly trace the flange outline onto the balsa wing skin. Remove the landing gear leg and trim away the remaining balsa sheeting, remove the remainder of the plastic protective tape, and the landing gear leg flange should then fit neatly and perfectly flush into wing. Block sand both wing panels and radius the leading edge to the indicated contour. Block sand the root ends of each wing panel to produce the proper dihedral angle, and epoxy them together. Be sure that the dihedral angle is correct and that there is no built-in twist when the wing is joined together.

The 1/4" sheet ailerons and trailing edge tip pieces are now installed, along with strip aileron linkage assemblies. While the 1/4" sheet trailing edge tip pieces should be glued permanently in place, the ailerons and connecting linkages should be hinged and fitted, but not installed permanently yet. Install the 4" wide strip of 4 to 6 oz. fiberglass cloth to the wing center section (top and bottom) with epoxy. When the epoxy has fully cured, lightly block sand this reinforcement "bandage" and feather-in the edges to the wing skins with lightweight spackling. Finish sand the entire wing assembly and set it aside.

Tail Surfaces:

All of the tail surfaces are cut from 1/4" balsa sheet. The elevators are coupled with a short section of 1/4" hardwood dowel.

Fuselage:

Assuming that you have already cut out the various component pieces, the first step is to glue the 1/32" plywood doublers to the balsa fuselage sides. Be certain that you are making a "left" and a "right" hand side! Using the plan sheet as a guide, mark the positions of the various bulkheads and formers onto the fuselage sides. Glue formers F2, F3, F3A, and F4 in place on one fuselage side, making sure that each is perpendicular to the side, then glue the opposite fuselage side in place. Install formers F5 and F6 and draw the tail end of the fuselage sides together and glue. If you have a fuselage building jig, use it for this step in order to ensure that the fuselage curvature is symmetrical. Otherwise, use the plan sheet top view as a guide.

Glue the 1/4" triangle stock reinforcing strips in place behind F2 and in front of F3A. Install the 3/32" sheet instrument panel, the cockpit floor, and the forward 1/2" top block. Next, glue the 3/16" sheeting, between F3 and F4, in place. Drill the necessary holes in bulkhead F2 to accept the engine mount and install the mount with 6-32 machine screws and blind nuts. Now is an ideal time to also drill the holes in F2 for the fuel line and throttle control cable. Glue the hardwood wing bolt blocks in place. Install the 1/8" turtledeck sheeting from bulkhead F4 to F6. It helps to moisten the outer surfaces of these sheeting pieces to allow them to more easily conform to the curvature of the formers. When dry, block sand the top edges of these pieces flush with the tops of formers F4, F5, and F6, and glue the 1/4" sheet turtledeck top piece in place.

Place the wing into the fuselage wing saddle and, when it is properly aligned, mark the position on the leading edge of the wing for the 1/4" hardwood dowel. A good way to do this is to use a short piece of 1/4" brass tubing that has been bevel edged and sharpened on one end. Simply pass the sharpened end of the tubing through the dowel retainer hole in F3 and F3A and rotate it against the leading edge of the wing to mark the exact location for the dowel. Remove the wing and drill the 1/4" hole in the leading edge to accept the hardwood dowel. The dowel should extend into the wing to the 1/8" lite ply L.G. spar, with 3/8" protruding from the leading edge. Epoxy the hardwood dowel in place, allowing the epoxy to cure with the wing repositioned back into the fuselage wing saddle.

Next, drill the holes for the wing mounting bolts. The plans show pieces of 1/2" hardwood dowel mounted into the wing to accept the mounting bolts. This is because I prefer to use 10-24 flat head aluminum bolts to mount the wing. This method results in a nice smooth flush appearance. However, it really isn't necessary, and conventional 1/4-20 nylon mounting bolts with fender washers may be used instead, eliminating the need for the hardwood dowel inserts. If you intend to use 10-24 wing mounting bolts, the holes in the hardwood blocks should be made with a No. 25 drill. For 1/4-20 mounting bolts, use a No. 8 drill. The holes in the hardwood blocks should now be tapped. Enlarge the mounting holes in the wing to accept the bolts.

Glue the 3/8" front bottom block in place. The next step is to construct the engine cowling area. Start by mounting your engine, minus its muffler. (Be sure to seal the exhaust, carburetor venturi, fuel nipple, and the gap between the prop thrust washer and case, in order to keep dust and dirt out of the engine.) Glue 1/16" scrap pieces of balsa or plywood, as spacers, to the backside of the spinner backplate with a removable adhesive such as rubber cement, and then align and glue the 1/16" plywood nose ring (F1) to these spacers, also with rubber cement. Bolt the spinner backplate in place on the engine. (Note: if you intend to use a spinner, such as a plastic type that does not have a flush surface backplate, you cannot use this alignment method.) Bevel the ends of the top and bottom 3/8" cowl blocks to fit between the 1/16" plywood nose ring (F1) and the face of the F2 fire wall area, and glue them in place. The 3/8" side blocks are now installed in the same fashion. Obviously, the right side block must first be provided with an opening for the engine to be removed and reinstalled. Make this opening only as large as is necessary. Remove the spinner backplate and 1/16" scrap spacer pieces (these should easily separate from the 1/16" plywood nose ring) and then remove the engine. The fuselage nose area, top, and turtledeck can now be trimmed, shaped, and sanded to the indicated contours. When this is done, reinstall the wing so that the stabilizer and vertical fin can be properly aligned to it and glued in place. If you have an incidence gauge, use it. As the plan sheet shows, the engine, wing, and stabilizer should all be installed at 0° of incidence. The bottom filler block that contours the fuselage bottom smoothly into the wing is now glued to the wing and contoured. After the stabilizer and vertical fin have been glued in place, remove the wing and set it aside. If you have not already done so, hinge the rudder to the fin and the coupled elevators to the stabilizer. Do not permanently install the hinges yet, however.

Glue the soft balsa fairing blocks in place on both sides of the vertical fin and sand them to the proper contour. At this point, I prefer to install the servos, elevator, and rudder control rods before the aft, bottom fuselage sheeting is glued in place. It's a lot easier (and quicker) to do it this way, and be sure that everything is properly aligned and working freely, rather than to be poking around after the bottom sheeting is in place. Once this is done, the bottom 1/8" sheeting, along with the 1/8" lite ply tail wheel plate, can be glued in place and the entire fuselage fine sanded to the indicated contours.

The windshield should be installed and faired into the fuselage now if you are planning on using a painted finish on the fuselage. If film type covering is to be used on the fuselage, it may be easier to install the windshield after covering the fuselage, by simply cutting a thin curved channel to accept it, and then just glue it in place with cyanoacrylate.

Finishing:

The wing and stabilizer/elevator assembly on my Scallywag were finished with Top Flite EconoKote film (yellow) covering material. The fuselage and vertical fin/rudder assembly were finished using K&B Superpoxy primer and paint (yellow, red, and black). It should be stressed that a painted finish on the fuselage certainly isn't necessary. Film type covering could be used equally well on those areas also. I just preferred to paint mine. The graphics (both appliqués and painting mask stencils) were prepared by Ward Graphics, 812 Blackstone Drive, Meriden, CT 06450, who being avid RC'ers, cater specifically to fellow R/C modelers' needs.

The simple cockpit details consisted of a Williams Bros. pilot bust and a very basic instrument panel. The cockpit interior was finished by gluing cut pieces of 600 grit black (wet or dry) sandpaper in place. This

produces a quick, neat appearing smooth matte finish. The cockpit combing was made from black "shrink tubing" that was glued in place. When installing the landing gear legs, wheels, and axles, "tweak" the axles a bit after they are bolted in place, to produce about 1/4" of "toe-in." The aircraft will track much straighter on the take-off and landing runs with this toe-in and it will not affect the ground handling at all.

As mentioned, my finished Scallywag weighed 4 lbs. 3 oz., less fuel, ready to fly.

With the radio system components installed as shown on the plan sheet, my Scallywag balanced with the C.G. exactly 3" aft of the leading edge of the wing. Keep in mind that I used a K&B (No. 4011) .40 engine which is lighter in weight than most other .40-.46 engines. Should you be using an engine that weighs a bit more than the K&B (which weighs approximately 13.6 oz., complete with muffler) you may have to reposition the radio system components a bit, in order to obtain the proper C.G. point without adding dead weight.

Flying:

The initial test flights of my Scallywag were made on an ideal winter day. The temperature was a "balmy" 45° to 50°, with sunny skies and only a light breeze. For us New Englanders, this is almost "beach weather" when it occurs in February!

A customary radio range check was performed and the engine was started and adjusted. Only a brief period of time was spent on evaluating the Scallywag's ground handling characteristics as it appeared to handle very good, in spite of the field being a bit bumpy and muddy. The Scallywag was then turned into the slight wind and full throttle was gradually applied. The take-off run was short and straight with only a bit of right rudder being used. The climb-out was smooth and uneventful. A few clicks of up elevator were all that was necessary to have the Scallywag flying straight and level, thumbs off. I had set my control surface travel throws up for use with both high and low rates. It rapidly became apparent that my elevator throws had been set just about right, as on high rate the aircraft was very responsive, and on low rate more subdued and gentle. The ailerons were, however, a bit overly responsive on high rate and a little sluggish on low rate.

The remainder of the maiden flight was spent trying various aerobatic maneuvers, both at full and reduced throttle. The Scallywag will easily perform all of the usual maneuvers and, at slow speed, is stable and predictable. With the throttle cut back to idle, stalls are clean with no tendency to drop a wingtip. The first landing, a full flare, three-point type, proved easy to perform. The next few flights were spent "dialing in" the exact amounts of aileron movement that I preferred for both high and low rate, and generally having fun "punching holes" in the sky. Wheel type landings were as easy to perform as three point types. While I set my Scallywag up to take advantage of high and low rates for the ailerons and elevator travel limits, this certainly isn't necessary. Any 4-channel radio system, without dual rate switches, will perform very well. With this in mind, the suggested control surface travel limits are as follows: Ailerons — 7/16" up, 5/16" down, Elevator — 3/8" up and down, Rudder — 1-1/4" left and right. These measurements should be made at the widest portion of each control surface. If you intend to use dual rates on ailerons and elevator, just add a bit of throw to these suggested amounts on high rate and a little less on low rate. Please remember that these control surface travel limits are a suggested starting point. You may then wish to change them a little to suit your own preferences.

In summary, the Scallywag measured up to all of my hopes and expectations; it is an easy-to-build, aerobatic, fun-to-fly aircraft that is also stable and forgiving, with no undesirable in-flight traits. To those of you who decide to build one, I hope that your Scallywag will provide countless hours of airborne enjoyment and that "all your landings will be intentional."