

# BUILD THE RYAN STA

BY AL WHEELER

To many of our present-day RC fliers, their ARF, is nothing more than a means to an end, something that will get them into the air with a minimum of effort, the fact that it isn't a model of any particular real world airplane is unimportant, in most cases it isn't even considered.

This concept of RC flying is fine and it introduces many newcomers to our sport, who, were it not made easy, would quickly lose interest. They are not modelers, in the

true sense of the word, but are participants in a sport that often, through association with other fliers, leads the fledgling to develop an interest in and appreciation of "real airplanes." Once interested, the many variations of RC modeling become apparent; actual building, sport scale, scale, scratch building, etc. Possibly, some day, an antique or classic will captivate his or her imagination. Now, at last, you have the makings of a real MODELER!

Many of us, from the world of real aircraft: retired pilots and flight service operators from the '30s and '40s, developed attachments to certain of the aircraft we flew day after day. Some were work horses carrying cargo and passengers, and others were sport aircraft, fun machines that were a pure joy to fly; aircraft that blended with your personality and became an extension of your own thoughts, happy to roll about a point until sky and clouds and earth were but a blur.



These were happy airplanes, and such a friend was Ryan STA NC18902, an old companion whose memory is steeped in nostalgia and who, with some patient effort can still be with us today, small, but as beautiful and lively as ever!

### **BUILDING THE RYAN STA**

The plans-built STA is a sizable project, however, not a difficult one. The plans are well-detailed and the building instructions cover individual steps of the program in sufficient detail to make them easily understood. The STA is not recommended for the first-time builder, but is not difficult for those of you who have a fair amount of balsa dust under the work bench. The finished aircraft, for builders affected by a nostalgic time warp, is truly representative of Sport Aviation during the Golden Era. As it flies by, it is easy, with a little imagination, to see Clark Gable in the pilot's seat with Myrna Loy as his pretty passenger.

### **GENERAL COMMENTS**

The prototype has been flying for several years and has been a most satisfying project. Appearance of the model is outstanding and the flight performance on an OS .25FP with a 9X6 Master Airscrew is quite scale. Ground handling, despite the somewhat narrow landing gear, is good. The aircraft tracks well and directional control with the rudder is positive. Aerobatic flight is pleasing, particularly in rolls, which are absolutely axial. You will find the STA a pleasing effort and one that will give something to take to the flying field that is a real attention getter.

Familiarize yourself with the plans and the building instructions and cut out all parts so that once you start construction you can keep going . . . just like a kit, except you won't have the box in which to put the pieces.

### **FUSELAGE**

Mark both FS1 structural side pieces with bulkhead locations. Attach doublers FD1 3/16-inch back from the forward edge of FS1. Install FD2 1/4-inch behind FD1 and FD3 1/8-inch behind FD2. Use scrap pieces to establish the required spacings. When you have completed the two sides (ONE LEFT AND ONE RIGHT, please!), lay one side flat on the work area with the doublers up. Cement B1 and B1A together. Starting with B1/B1A, cement it into the slot between FD1 and FD2, follow with B3 in the slot between FD2 and FD3.

Bulkhead B4 is installed against the rear



face of FD3 and B5 on your mark on FS1. The opposite side may now be installed. Place it flat on the work surface and insert the bulkheads from the first side in the appropriate slots. Use a square to assure a straight assembly. The firewall may now be installed in the slot provided forward of the FD1 doublers. Use epoxy and install the triangular vertical braces behind the firewall.

Bulkhead B2 may now be installed and the flat sheet between it and the back side of B1. Use epoxy on this installation as it supports the wing locating pin. Install W1 and W2 on the forward face of B4 and against the inside of FS1. Locate the position for B6 and B7, carefully pull the aft end of the fuselage together and install them. The FS1 sides may be scored behind B5 to accomplish the bend. On the actual STA, the fuselage skin angles at B5 and the sides are straight to the tail cone, no compound curves. Join the fuselage at the rear, being careful to keep it straight. The side pieces of all bulkheads may now be attached. Install the servo support rail on the forward face of B4 and the forward servo support at the correct distance to accommodate the servos to be used.

Using a straight edge, check the fuselage sides from the B1 bulkhead back to B5, sand as required to be sure the 1/16-inch skin will lay flat against all frames. Accomplish the same from B5 back to the tail. Study the skin application sketch and cut 1/16-inch medium balsa to fit from B1 back to B5. Edge join the top and side sections, wet on the outside and wrap around the fuselage. Use

tape or rubber bands to hold in place, rewet if required and let dry, the skin should retain its curve. Trim the bottom sides of skins 2 and 4 even with the bottom of the FS1 sides. Accomplish the same skin application (fitting) from B5 aft to the tail. A little more care is required in this section due to the taper. Paper templates are a good way to obtain an initial fit prior to cutting the balsa. Following fitting of these sections, install them using a good amount of cement on all frames and along the bottom edge of FS1. A six-minute epoxy works well, as it gives you a bit of "fitting" time. After drying, cut, fit and bend the sections (No. 1 on the sketch) that fit on the bottom. Again, wet, form, allow to dry and trim for a good final fit and epoxy into place.

Up to this point we have not been concerned with cut-outs for the cockpits. This may now be accomplished, use a pattern and start with a small hole to locate the bulkheads, once you know where you are, cut away. Leave the wing cut out for the present time, as that will be accomplished after half the wing is built. Cut the openings for the elevator and rudder pushrods and the slots for the stabilizer and vertical fin. Put the fuselage flat on the work surface resting on the bottom from B1 to B5. Assure the tail is perpendicular to the work surface and measure up the sides and mark the stabilizer. Cut out area. Be sure to keep it level fore and aft as the stabilizer should be at 0 degrees. The vertical positioning may also be checked using the sides of the firewall. The fin slot should be straight fore and aft and in the center of the fuselage top. Later on at assembly, the vertical fin is attached to the stabilizer, and the assembly is slid into the back of the fuselage like an inverted T. The

fuselage may now be sanded and filled as required. Sure looks good in its oval form with the cockpits cut out, doesn't it? You might even form the headrest from soft balsa at this time, but do not attach it yet. Round off the forward section of B1A and radius the corners of the fuselage from the firewall to the face of B1A, this makes it easier for the cowl to slide on. Put the fuselage aside for the present and we'll go on to the engine cowl.

### COWLING

The cowl is not as difficult as it may seem when you first look at it. Study the drawings and follow the instructions and you won't have any trouble. Laminate the nose sections C1 through C5. Install C6, 7 and 8 into C1. This is best done by laying C1 flat on the work area and installing C6, 7 and 8 in a vertical position. Make sure they are straight in relation to C1. Now fit the nose section over the top of the four verticals into the slots cut in C2. Align and cement. The nose section may now be carved and sanded to shape and the three holes cut as indicated in the front view. The rear section of the nose may be routed out for a rough fit over your engine. Provide adequate clearance in the area of the carburetor throat to assure good air flow and to permit priming if required. Trial fit the cowl over the front of the fuselage; it will fit up against the front of B1A. The cowl may be skinned with 1/16-inch balsa in the same manner as the fuselage, wet and form prior to attaching. The exhaust pipe opening may be cut if desired, see fuselage side view. Sand the entire cowl, fill as needed and put aside for final fitting with the engine installed.

### TAIL SURFACES

All surfaces are made from 3/16-inch medium light balsa. The elevator halves are joined with a 3/16-inch dowel. Join them on a flat surface making sure the trailing edges are even and the leading edge is straight. Install hinges in the stabilizer and slot the elevators, but do not assemble. The rudder has a fairing on the bottom that should be built up to the width of the fuselage at the rear edge. Round the fairing into the rudder at top and bottom. Install hinges in the fin and the back of the fuselage, slot the rudder but do not install. Sand surfaces for covering and put aside.

### WING

Working on the drawing, cut and edge-join the bottom 1/16-inch sheeting. With the sheeting on the drawing, mark spar, rib and rear spar locations with a ball point pen. Cut and install the spar, assuring that the faces are vertical to the bottom sheeting. Cut and install the rear spar. Install the four R2 ribs, angle the inboard rib to accommodate the dihedral angle, and slot the aft edge of the two inboard ribs to fit over the plywood wing attachment block. Install the block before the ribs. Assure the R2 ribs are flush with the top of the spar and 1/16-inch below the front top of the rear spar. Assure that the round cut-out on the front of all R1 ribs allows the leading edge dowel to seat on the bottom skin, even with the skin front edge.

Notch the four inboard R1 ribs to accept the 1/8-inch ply landing support. Install the support and all R1 ribs. Cut and sand the leading edge dowel at the tip and with the wing on a flat surface, fit the dowel into the R1 rib cutouts and assure a good fit to the bottom skin and all ribs. Cement in place. T1 and T2 may be installed and the scrap reinforcement between the leading edge and the outboard rib.

Shape and install the leading edge wing dowel support guide into the cutout in the inboard R2 rib. The dowel support will extend out from the end rib and will be inserted into the opposite wing as they are joined. Do not insert the dowel until after the wings are joined. Install the skin support strips between the aft end of the R2 ribs, flush with the top of the ribs and 1/16-inch below the top of the rear spar. These support the rear edge of the center section skin. Between the two inboard ribs install the one-inch square "J" bolt support pads, these are of 1/8-inch ply.

Cut the ailerons to length. The inboard end of the aileron material, from the aileron to the center of the wing, will be grooved out for a section of Nyrod to house the aileron actuating rod and then cemented to the rear spar. Cut the slots for the hinges into the spar only. Fabricate the aileron actuator rod from 3/32-inch rod, bend the end that goes into the aileron, slide the rod through the Nyrod and bend up the control (servo) end. Cement the section to the rear spar, leaving clearance at the aileron end. Assure that it is level with the bottom surface of the wing. Mark and drill aileron for the actuator rod, insert the rod and feed the aileron onto its hinges until seated. Provide clearance wherever it is needed until the aileron operates freely, and the actuator arm has adequate clearance.

The center section between the outboard R2 ribs may now be sheeted with 1/16-inch balsa. Sheet from the front of the rear spar to the center of the front spar. Cut a piece of 1/16-inch balsa to fit the leading edge from the rear face of the spar to midway of the leading edge dowel, notch to clear the center section sheeting at the top of the spar. Moisten the top, use ample cement on the spar top, the top of all ribs and the top of the leading edge dowel. Tape in place to assure a good fit as the adhesive sets. When both wing halves are completed, sand the inboard ribs square and angle to obtain a good fit with one tip elevated 1-1/2 inches (In my shop, that is a 2x4 block turned on its side, accuracy counts you know!). Sand until a good butt-to-butt fit is obtained (another new dance step, sanding butt-to-butt).

Check to make sure the leading edge is straight. When satisfied with the fit, puncture a series of holes in each butt rib for better epoxy penetration. Double check the fit of the leading edge dowel support in the wing to be joined. When satisfied, join the two panels with epoxy, assuring there is enough epoxy on the leading edge dowel support. Be sure the butt ribs are both flat on the work surface and the 1-1/2 inch block is

square under one tip. Allow to dry. Carefully cut the leading edge sheeting to allow installation of the dowel, trim the top of the center ribs back to the dowel support, staying level with the bottom of the wing, drill a 1/4-inch hole in the support. Cut the dowel to length and trial fit, do not epoxy in place at this time.

Now comes the task of fitting the wing to the fuselage. Using a test pin, locate and mark the rear face of B2 on the bottom of the fuselage, also the forward face of B4. Mark a center line between the two bulkheads and cut out a piece of sheeting one-inch wide centered on the line. Measure the distance between the two bulkheads and, on the wing, measure that distance back from the leading edge. Trim the trailing edge 1-1/2 inch wide forward to the line. This allows the wing to fit in between the two bulkheads. Place the wing on the building surface and block up each tip 3/4-inch so the wing is level.

Place the fuselage over the wing and carefully trim the side skins a little at a time, until the bottom of the fuselage rests flat on the work surface with the sides of the forward fuselage vertical. Use a triangle to check this at the firewall. When you are satisfied with the fit, measure the position of the wing attach dowel above the bottom of the wing (the work surface) transfer this dimension to the rear face of B2 measuring from the bottom of the fuselage and, on a center line, drill the 1/4-inch hole for the dowel. The dowel may now be epoxied into the wing, assuring an ample amount of adhesive on the cross support, the top of the ribs and the leading edge dowel, as well as the edges of the leading edge skin.

Install sufficient wedge material between the rear wing attachment points and the top of the wing to place the bottom of the wing even with the bottom of the fuselage. These attachment holes may now be drilled, assuring the wing is straight across by measuring from a point on each tip to a point on the rear end of the fuselage. Drill 1/4-inch holes in the wing and 3/8-inch holes in the fuselage supports to be tapped out to 1/4X20. Start with the 3/8-inch holes in both the wing and the fuselage to assure alignment, opening the wing holes to 1/4-inch later. The glass tape may now be applied to the center wing joint, top and bottom. Do not interfere with the aileron controls at the center section. The wing may now be finish sanded for covering. Remember, if the structure has bumps, the covering has lumps!

### LANDING GEAR

Again, it isn't as bad as it looks and the looks are really important on the STA. A popular ARF on the market left the struts and pants off and that plus the BT-13 shaped tail surfaces make it pretty devoid of any resemblance to an STA Ryan, and of course there is the John Gosney paint job.

The first step is to bend the landing gear wire, 5/32-inch was used on the prototype. The drawings are adequate for patterns. Shape the struts out of two pieces of 3/16-

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inch medium balsa and provide a channel for the gear wire; do not cement together yet. Cement the center laminations of the wheel pants together with one outside panel, tack the opposite side panel in place for shaping, it will be removed later, make a left and a right. After shaping, cut out the top as shown to accommodate the bottom end of the strut. Remove the inside lamination from one pant and, inserting the gear wire through the strut hole in the top, mark and route out its passage down the inside of the pant. Be careful, it gets a bit thin in places.

Now trial fit the strut over the gear wire and into the top of the pant. Once satisfied with the fit, cement the strut halves together and into the top of the wheel pant. You leave the inner pant side off until the wheel is installed. Center the wheel with proper spacers, assure there is no rubbing and then the inner panel is installed, acting as a wheel retainer, no collar required. Several coats of clear dope, filler and paint are recommended on the pants, the contours make them difficult to cover.

The landing gear may now be trial fitted to the wing. By measurement, find the location of the 1/8-inch plywood landing gear support plate inside the wing. Center the gear over it (wing inverted) mark and drill for the attachment clips (see drawing) and for the "I" bolts at the rear supports. Visually check your alignment for tracking and twist gear wire as required. The gear may be removed and put aside for final assembly.

#### **COVERING**

The prototype was covered in Super Monokote, chrome on the fuselage and silver on the remainder, this choice because it is a model of a real life STA that had a highly polished fuselage with the balance of the aircraft silver dope. The choice of covering material and colors are obviously the builder's. The basic prerequisite to a good cover job is lots of sand paper and a good cleaning to remove all dust and hidden specks prior to covering. Cut covering away from any joints to be cemented. This allows a wood-to-wood bond.

#### **ASSEMBLY**

Join the stabilizer and vertical fin, centered and 90 degrees to each other. Slide the assembly into the slots in the back of the fuselage, check alignment and cement in place. The elevators may now be installed, followed by the rudder. Trial fit the rudder to assure elevator clearance in all positions, correct if required. Install a Goldberg or similar tail wheel support, bend wire as shown and make an aluminum clip to attach to the bottom of the rudder. Servos may now be installed, along with the pushrods to the elevator and rudder. The aileron servo is mounted directly to the top surface of the wing and Du-Bro strip aileron linkage may be used. The prototype uses Golden Rod for the throttle linkage, again, your choice. The six-ounce fuel tank may be installed, a Sullivan slant flex type works well. With the inverted engine, do not mount the tank too

high. Tank outlets should be about level with the carburetor inlet. The engine mount and engine can be installed now and the throttle linkage and fuel and vent lines attached.

Now to final fit the cowl, C7 may have to be trimmed and C1 opened up. Unless you use a Pitts type muffler, the left side C8 will require cutting. This is not a structural problem, as the skin makes the cowl quite rigid. The cowl should seat against the front of B1A and a small screw into the side supports will hold it in place. You will find that a scale spinner for the STA is not available, any commercial unit will be too long but look good. Install the wing, and with the aircraft leveled and the stabilizer at 0 degrees, check the wing incidence, using the rear shims, set it at +1-1/2 degrees. Install the ailerons and linkage and with the servo at neutral, rig the ailerons flush with the bottom surface of the wing. The elevators should be rigged level and the rudder straight fore and aft. Switch and charge plug may be mounted as desired. The side struts may be pinned to the wing with a small screw attaching them to the fuselage sides. Rigging wires on the prototype are simulated with stretchy thread, through the wing and hooked over small hooks above the fuselage struts and in the aft end of the wheel pants. Exhaust stacks, fuel filler and gage and oil filler door may be added as the builder sees fit. The front cockpit may be covered; it was on many STAs. Or, left open so Myrna Loy won't be upset. Two windshields are required. The front cockpit was always covered on NC18902, the only disadvantage being that none of the airport kids ever helped wash or polish. I wonder why?

#### **PREFLIGHT**

Range check your radio, adjust control travels as follows: rudder, 1/2-inch right and left, elevators 1/2-inch up and down, ailerons 1/4-inch up and down and throttle as required to give full throttle and the desired idle plus cut-off. Recheck all controls for the proper amount of travel IN THE RIGHT DIRECTION! Adjust the engine for proper running at full throttle, a bit rich if it is new, and a good idle.. No need for an engine failure on the first flight.

#### **FLYING THE STA**

Assure that the aircraft taxis well with no wheel bind and good directional control. On take off, add the throttle with a positive movement, the prototype tracks well, the tail comes up by itself and the lift off requires a nudge of up-elevator. Climb at a moderate angle, check aileron response and correct any trim problems. The STA is quite fast, has good response and slow flight will indicate reasonable stability. Approaches are made with reduced throttle, little trim change is required and the flare and landing are routine. The landing roll is quite docile for such a narrow landing gear. As you get used to your new aircraft you will find its aerobatic ability to be most pleasing, rolls are really on a point. Control throws may be changed to suit your taste. Have fun with your new/old Ryan! **MB**