WACO SRE

Designed by Peter Rake

The WACO SRE was from a long line of WACO aircraft, mostly dominated by open cockpit biplanes. WACO had produced some closed cockpit designs and marketed to the general civil population. In 1940 WACO brought out the ARE, SRE, WRE (same airframe, different power options) to appeal the the growing number of affluent who wanted fast, comfortable transportation without the need to follow airline schedules. The SRE was the most powerful of the three with an R-985 P&W 9cyl radial producing 450hp. The WACO cabin biplanes, along with the Beech Staggerwing, were the epitome of the age of the biplane in the civil market. The arrival of WWII also affected the WACO production and just about every WACO cabin plane was purchased and given the designation UC-72. UC-72 referred to the SRE, while other WACO cabin planes had a letter suffix, eg, the ARE was the UC-72A, the AGC was the UC-72P.

This model of the SRE, designed as a sport scale model by Peter Rake, is a fast build for the intermediate builder. Construction is made easier through Peter's used of two piece fuselage construction. The front box section is built with slab sides and formers that help keep the sections square. The rear section is the familiar stick build with longerons and cross pieces built over the plans. When the front and rear are completed they are aligned and glued together. This method is simple and alleviates most problems associated with stick type fuselage construction.

The parts supplied are for the 3 channel version of the SRE, using Rudder/Elevator/Throttle for aircraft control. The dihedral shown on the plans is sufficient for control of the aircraft. Adding ailerons is a simple matter and is my preferred method for building and flying. The only restriction on aileron control is finding servos that will fit in the fairly thin wing section. You can use the outline provided for the ailerons (which is close to scale) or extend the ailerons an extra bay or two for more authority.

The recommended power for this plane is a geared sp400 and 8xNiMH cells. It has flown on a sp400 and it does fly well. The prototype was flown with a sp480 and 3sLiPo and flew with a surplus of power, with loops from level flight and short takeoff rolls. Other modelers have installed brushless motors with great success. The only real modification necessary for upgrades is in the motor mount.

The model is intended to have fixed wings, however, it would be fairly simple to make them detachable for those with space limitations. Tim Hooper's EZone build thread shows his approach to this problem.

Construction:

General: Use of CA or PVA for all cosnstruction with epoxy used for motor, landing gear, and wing mounts. I like med CA for stick type builds. Besides, it is so much fun to sand it off your fingers at the end of a day of building. When sheeting I change to thin CA. If you use CA I recommend having some acetone handy. That way when you stick your fingers together there is a chance to avoid an emergency room visit (acetone disolves CA). Covering can be just about any type desired. Doculam can be sued but must be painted (it is clear). So-Lite (Coverite Microlite) works well. Solarfilm, tissue, silkspan, silk, and polyspan would also make good covering material. Monokote and it's competitive types are a bit heavy and will tend to warp the structure when shrinking. Hinges can be any type suitable for park fliers, tape, CA type, mylar, dubro, etc. I used the dubro micro hinges on mine, but, they are much stronger than needed on this plane. Control is through the use of GoldenRod sleeve and wire control to the elevator and rudder. Pull-pull would also be a good choice on this one. Ailerons are controlled with servos in each wing with direct links from the servo arms to the aileron horns.

Before you begin:

Make sure you have all the parts listed on the inventory sheet. Then use the ID sheet to mark each lasercut piece and see where it goes on the plans. I recommend removing the pieces as you need them. That way you have a hope of identifying a loose piece halfway through your build. Pay special attention to the ribs as there are some subtle differences. If you have any discrepancies please email or call. Note that the plans include full size parts on them. That's so if you break a piece then you can use the outline on the plans to make a new one. Or, you can give the plans to a buddy so he can scratch build a twin to yours. Better yet, have him order a short kit from us and you can do airshows together!

Go over the plans and the instructions at least once to make sure you know where all the parts go and in what order you build them. If anything looks confusing go over it until it is clear, or, shoot me an email (or phone call). If you're in the UK you could call Peter. On the other hand, Peter hasn't built one of these and I've built two, so follow your inner voice. Some folks like to build wings first, or tails, but, I like to get the fuselage over with. Since I'm writing the instructions that's what comes first.

NOTE: To scale purists. The full size plane had counterbalances on the elevators and rudder, the plans do not show them. The removable cowl makes scale windshield location a bit difficult. The kit is set up so the bottom of the windsheild is behind the cowl. Early models of the ARE/SRE family had visible stringers on the fuse and one on top of the fuse. These are not included here. If you want a more scale look I would suggest you look at the Walt Mooney or Earl Stahl free flight plans.

Fuselage:

Begin by building the rear fuselage section over the plans. Cut the 1/8" sq sticks for the top and bottom longerons and pin in place. Fit the lasercut piece between them at the rear of the fuselage. These pieces are cut to clear pushrods for rudder and elevator. Then cut and fit the 1/8" square vertical joiners. When both sides are dry, remove from the board and pin them down over the top view of the fuse. Make sure the sides are square to the board. Fit the 1/8" liteply piece at the tail first, joining the tail of the fuse sides at the same time. Make sure everything stays straight and square as you do this. Then fit and glue the horizontal joiners as shown on the plans. There should be a horizontal joiner at the top and bottom where each vertical joiner is located. When finished you

should have a completed rear fuselage!

The front fuselage is a box. Start by bending the landing gear wire! Yes, bend the wire because then you have to attach it to F2 prior to assembling the fuselage. Holes are provided in F2 to lace the wire to the former. I used copper wire, but, other material, like kevlar thread, can also be used. Now you can start on the box itself. Join the top and bottom pieces of each fuselage side (1/8" balsa parts).

Now use F2 and F4 to join the fuselage sides together. Use squares and bracing to hold eveything square until the glue sets. It is a bit of a challenge with the U/C wire sticking out the bottom. This is probably the most difficult part of the build so take your time. Try assembling with everything upside down. Make up F3 with the dihedral sticks as shown on the plans. Then add F3 to the fuselage. The surface of F3 should be at the edge of the square cutout in the fuselage side piece (that's where the wing spar will enter the fuse). The dihedral brace should be at the top edge of the square cutout.

Now install the servo mounts. Determine the desired location and install the servo mount rails. I like to use a 2"x4" sheet of 1/8" hard balsa for a servo mount plate. Cut to the fuse width, cut out sections for each servo, and glue in place.

Next, join the front and rear fuselage sections together. It is easiest to do this over the plans, making sure everything is lined up straight and square. Doing this upside down is easier too. You may have to shim one side to make it line up correctly.

Now move onto the front of the fuselage and the motor mount. Regardless of what type of motor you use I recommend using at least the rear section of the supplied motor mount and F1 (top and bottom pieces) to help reinforce the fuselage and keep it square.

To start you need to break the fuse sides at the front edge of F2 as shown on the plans. The simplest way to do this is to cut most of the way through (or all the way through) the side sheet with a sharp knife first. Mark where the motor mount plate should fit on the fuse sides. The mount plate is set for a bit of downthrust and will align the prop shaft with the center of the cowl (when using an Olympus or MPI gear drive). Fit F1 top and bottom sections as well as the motor mount plate. This only takes three hands so go slowly. The motor mount plate will help keep everything aligned as you glue in place the F1 parts. If you can do this without CA sticking your fingers to the mount you get a gold star. Note: if you used epoxy for this, then keep some rubbing alcohol handy. After you're finished it comes in handy for wiping all the epoxy residue off of your fingers.

Now on to the cowl. One of the 1/8" liteply rings is fitted up against F1, centering it using the fuse sides as a reference, and glued in place. The other ring is glued into the plastic cowl. The cowl is not joined to the fuse at this time. It remains removable so you can get at the motor for maintenance.

You have a choice now. The fuselage needs to be filled between the square sides and bottom to the round cowl ring. You can use balsa blocks or foam blocks glued in place and then carved/sanded to shape (pink foam is included for this purpose). Or, you can use 1/16" sheet (which is also included). I have used both and find sheeting easier for me. If you do use the foam, once it is carved, paint it (be sure your paint won't melt the foam!). The lighter weight coverings (like Solite) will show the pink if it is not painted. I like to paint the foam the same color as the covering. Same holds true if you have to use bondo to smooth out the balsa. Painting will even out the colors.

Before filling or sheeting the bottom you should bend and fit the rear section of LG wire as you won't

be able to get at it afterward. Soldering can be done now as well. I wrap the joints with light copper wire and use acid flux with soft solder (50/50). While you're bending wire you might as well make the tailwheel wire at this point. Bend as shown on the plans and epoxy in place. More adventurous types can make the tailwheel steerable. A number of methods will work so that part is up to you.

Also, plan at this point for a hatch to access the battery. The design includes a hatch through the top of the fuse for this (between the wings). An alternative is to make a hatch in the cowl with some balsa bits. If sheeting the bottom, you can make a hatch in the bottom.

So, based on your choice, go ahead and finish the sheeting/filling/shaping of the fuse to cowl sections.

Congratulations, the hard part is over!

Fin/Rudder:

While you have this section of the plans on your board go ahead and build up the fin and rudder using the 1/8" thick stock. The outlines are made up of 1/8"x1/4" sticks cut and fit as shown on the plans. Finish by fitting the 1/16"x1/8" ribs to the fin and rudder sections. Depending on which hinging method you use, bevel the LE of the rudder. Round off the LE of the fin and TE of the rudder.

Wings:

Change over to the other sheet of the plans. You can build all four wing sections at the same time. You do have to choose if you want ailerons and how you are going to build them. I like building the wing and ailerons at the same time, but, that takes a bit of planning on your part. It is up to you as to how to make and fit the ailerons. They could even be carved from soft balsa or, as I did on my second one, use TE balsa stock. If you choose ailerons, make sure to cut holes for the servo wires in the top wing ribs before assembly.

First, select the appropriate spar pieces and cut to length. Then mark where the ends need to be tapered (the top ones also need to be notched to clear the wingtip section.

The bottom ribs that are notched to accept the struts are fragile. It is best to glue on the sides of these ribs before going further to help against breakage. The sides are short lengths of 1/8" sq sticks.

Now pin everything down to the board over the plans. Don't forget the 1/16" sheet pieces that fit in the top wing panel for strut (and servo) mounting. Note that the root and next ribs are different in section to accept the 1/16" sheet. Make sure all joints are properly glued and then sheet the inner bays of each wing panel. The 1/8" dowels are then glued in at this point. When dry all can be removed from the board and sanded. Form the leading edge and trailing edges to the shape shown. Sand the wingtips to shape.

Stabilizer/Elevator:

While this plans sheet is on the board go ahead and frame up the stabilizer and elevator. Use the lasercut parts to help align all the pieces. Cut the appropriate stick sections and fit in place. When dry remove from the board and sand the outline to shape. Round off the LE of the stab and TE of the elevator. Bevel the LE of the elevator for the hinging method you have chosen.

Controls:

At this point fit all the radio gear, motor, and controls to the fuselage. If using sleeved wire for rudder/elevator, fit the sleeves to the fuse and select the exit location in the sheet at the rear of the fuse. For pushrods, test fit so the rods will clear the slots in the rear fuse sheet. For aileron control, attach the servos to the wings. I like to use silicon caulk to secure the servos. Another good alternative is to wrap the servo with a layer of tape and secure with hot glue.

When mounting the motor make sure it has the desired down/right thrust and the prop shaft exits at the center of the cowl. Cut away the necessary cowl area to clear your chosen motor/gearbox.

Covering:

First, the wheel pants are glued together and excess plastic is trimmed close to the joint. I like to run some epoxy (or even better is fiberpoxy) along the inside of the wheel pant joint. Then sand the joint smooth. If needed, use some bondo to make the pant nice and smooth. Then they can be painted as well.

If you have ailerons in the wings be sure to run the servo wires out to the wing root. It is hard to reach them once the wing is covered.

This is the point at which I like to cover all the parts. Covering materials recommended are Solite (also knows as Nelson Litefilm and Coverite Microlite), UltraCote Lite or Solarfilm (also know as Superkote from Hobby Lobby). The plane can also be covered in Airspan or Litespan (Coverite Coverlite) it you want more of a linen look. Classic coverings such as tissue, silkspan, or silk will also work. Monokote and other heavier materials are not recommended. They will add weight and can warp the structure when shrinking. You can also use Doculam if you want to paint a specific pattern. See section on painting below.

After covering and painting the windshield can be trimmed to shape, then glued in place. The formed windshield might not fit your plane exactly. It was made from Sparky's build, which was sheeted. Your carved fuse, sheeting, or planking may be a slightly different shape. I like to trime the area around the wings first. Then the section along to top of the cowl. Finally trim around the windshield rear edges. For ease of cowl removal I recommend that the bottom of the windshield be located at the forward end of the fuse, just behind where the cowl joins up. Canopy glue is best for mounting the plastic, but, white glue will work. Use some covering material in a thin 'tape' around the bottom edges of the windshield to look like the frame. If you are <u>really</u> careful CA or even epoxy can be used for attaching the windshield. They both etch the plastic so any that gets on the clear section will fog it. An easy way to do the side windows is to simply cover with doculam. When it shrinks it goes clear. I leave off the side windows for better cooling. SRE's did have roll down windows.

Assembling:

Rigging the wings is a lot simpler than it sounds, and, there are two ways to do it!

Method A: Fit the top wings to the fuselage making sure the main spar sections are aligned to F3 and the dihedral sticks on F3. Make sure the LE is square to the fuselage and that both LE's are straight. Apply epoxy to the spar and F3 and clamp the wing panels in place. Let dry. Turn the plane upside down to fit the bottom wing panels. Insert the wing struts in the top wing, fit the bottom wing. Make

sure everything is still aligned and glue in place.

Method B: Use two flat sheets of wood/balsa/foam and support the plane under the bottom wings (the bottom wings have no dihedral). Align the bottom wings making sure they are square to the fuse and aligned straight. Glue in place. Install the upper wings by inserting the spar in the fuse against F3. Insert the wing struts and make sure all wings are still aligned and square. Glue in place.

Aileron option: Assemble the ailerons to the top wing. Don't forget to install the control horns on the ailerons. Install the aileron linkage at this point.

Assemble the elevator to the stabilizer. The elevator sections need to have a connector glued to them. I used a bamboo stick (included in the kit) to joint the two sections. You can also bend a U shape piece of wire as well (there should be enough left for this in the kit). Epoxy is the best bet for joining the elevator sections since the joiner takes quite a bit of stress. Then insert the hinges and glue the elevator to the stab. Then glue the rudder to the fin using hinges. These also have control horns that need to be installed.

Attach stabilizer to the fuse. Remove the covering where it will be glued to the fuselage (same on the fuselage). Set the plane in a steady position and dry fit the stab first. Set it in position on the fuse and align it with the wings. Measure from wingtip to stabilizer tip and adjust until both side have the same measurement. Mark the position (dry erase markers work good for this). Step back and look at the stab in reference to the wing and make sure both are 'level'. If not then shim the stab on one side or the other. Once level and position is marked then remove stab from fuse. Apply glue and put stabe back in place, checking again to make sure it is level and aligned with wings.

Once the stab glue is set, then on to the fin/rudder. Locate and mark a centerline for the fin to sit on the stab. Do a dry fit of the fin to the stab. Make sure there is free movement of the elevator and rudder, even at full travel. Remove the covering where the fin will be glued to the stab. Align the fin over the stab and glue in place. Use a square to make sure the fin is at 90 deg to the stab.

Install the wheels and wheel pants. I like to put a small piece of 1/16 ply inside the wheel pants on both sides. Keeps the LG wire from ripping the plastic. I use silicon to attach the pants to the LG strut, but, you might need to use a small saddle clamp. Install the cowl to the fuse. I like to use three small dabs of silicon to attach the cowl. It can be easily removed by slitting the caulk with a knife/razor, yet won't come off in flight. An alternative is to use some small screws inserted though the front of the cowl. You can also install the landing gear strut covers at this point if you haven't installed them already.

Connect the rudder and elevator to the respective servos. Make sure the controls are all centered when the servos are centered. This makes the maiden flight go much smoother.

Painting/Trim:

A good source for a specific trim patten is Callie's Graphics (http://www.callie-graphics.com/) She has the plans and can make you a custom set of graphics for your plane. Just send her a picture of what you want and you'll get a set of vinyl graphics to apply to your plane.

Mask areas where you don't want paint, including control horns and control wires, wheels, prop/motor, etc.

You can apply trim at this point. For masking I like to use low tack masking tape or vinyl trim tape. Do not use electrical tape, it will peel anything off, including the covering.

You are done!

Make sure all your controls are centered. Turn on the transmitter and connect the battery. Check all controls for proper direction and end point adjustment. Make sure the controls are all centered. Secure airplane. Check motor at partial and full throttle. Caution: keep body parts away from moving propellor!! Make sure propellor and moving motor parts are not rubbing against any airplane parts. Make sure battery is secure in the airplane.

Check the CG under the top wing of the airplane. It should be 2 1/4” behind the LE of the top wing (about where the spar is located). If not within 1/8" of the recommended position, add weight to the nose or tail until properly balanced.

You are ready to fly.

Have fun and send pictures.

charlie bice
manzano laser works

Parts List:

-Documents
- **Instructions 1**
- **Parts list 1**
- **ID sheet 1**

-Laser cut parts
- **Sht 1 1/16” 2**
- **Sht 2 1/8” 2**
- **Sht 3 1/8” 1**
- **Sht 4 1/8” Liteply 1**
- **Ply cowl rings 2**
- **Ply struts 2**

-Balsa sheet
- **1/16 2**

-Balsa sticks
- **1/8x16 2**
- **1/8x1/8 8**
- **1/8x1/4 8**
- **1/8x3/4 1**

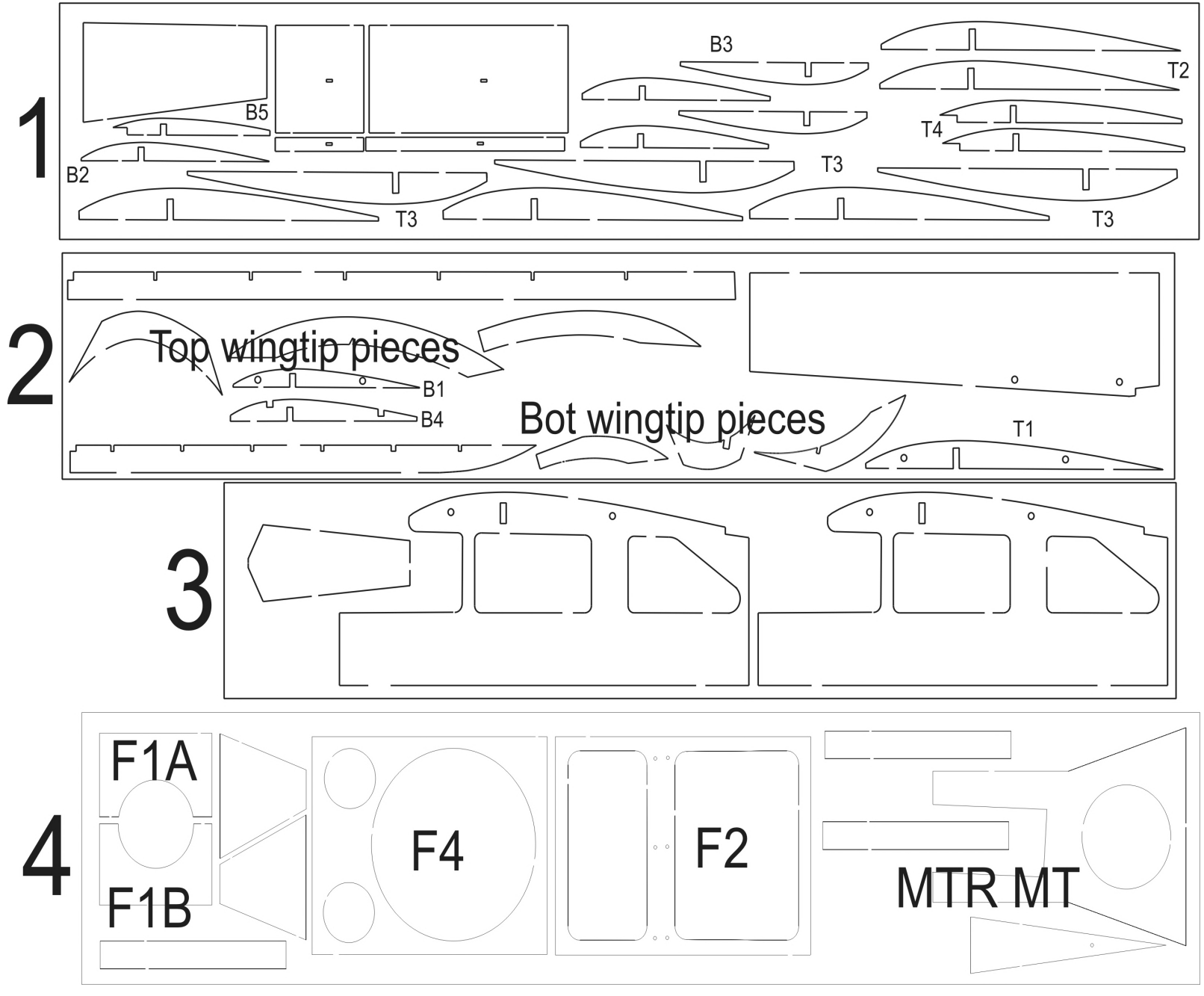
-Bass sticks
- **1/8x1/4 1**
- **1/8x3/8 2**

-Dowels
- **1/8 1**

-Wire
- **0.072” (14 ga) 1**
- **0.062” (16 ga) 1**

-Foam ~4”x20”

-Plastic parts
- **Cowl 1**
- **Wheel pants 1**
- **Windshield 1**


1
B5
B3
T2
T4
B2
T3
T3
T3
2
Top wingtip pieces
B1
B4
Bot wingtip pieces
T1
3
4
F1A
F1B
F4
F2
MTR MT