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## **2.5 METER EXTRA 300 ARF Manual**

**Please read through the entire manual first. It contains important instructions and warnings concerning the finishing of the model.**

### **WARRANTY AND PRODUCT DISCLAIMER**

Radiowave Hobby Ind. guarantees this kit to be free from defects in both material and workmanship at the date of purchase. This warranty does not cover any component parts damaged by use or modification. IN NO CASE SHALL RADIOWAVES' LIABILITY EXCEED THE ORIGINAL COST OF THE PURCHASED KIT. Further Radiowave reserves the right to change or modify this warranty without notice.

In that Radiowave has no control over the final assembly or material used for final assembly, no liability shall be assumed nor accepted for any damage resulting from the use by the user of the final user-assembled product. By the act of using the user-assembled product, the user accepts all resulting liability.

**IF THE BUYERS ARE NOT PREPARED TO ACCEPT THE LIABILITY ASSOCIATED WITH THE USE OF THIS PRODUCT, THEY ARE ADVISED TO RETURN THIS KIT IMMEDIATELY IN NEW AND UNUSED CONDITION TO THE PLACE OF PURCHASE AT THE BUYERS EXPENSE.**

## **INTRODUCTION**

Congratulations and thank you for purchasing the Radiowave 2.5m Extra ARF.

Flying the Radiowave is a very rewarding experience, as it should be for such an aerobatic model. With the aircraft control surfaces set for precision aerobatics, the aircraft will perform prescribed aerobatic patterns as used in IMAC (International Miniature Aerobatic Club) events exceptionally well. With control surfaces set for freestyle flying, the aircraft will perform today's modern 3D aerobatic maneuvers to really showcase the aircraft's aerobatic potential.

## **PRECAUTIONS**

Please finish the Radiowave ARF according to the instruction provided in this manual. We do not recommend altering the model in any way that could result in an unsafe model. To prevent any possibility of flutter, please make sure that there is no slop or backlash on the control linkages. Install gap seals, especially on the ailerons. Use only high quality, high-torque servos (minimum 120 in-ozs each) for all the control surfaces.

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## **ULTRACOTE COVERING AND CARE**

Humidity and temperature changes can cause the Ultracote covering to wrinkle during shipment and exposure to the sun at the flying field. This is normal and can be easily remedied.

Wrinkles can be removed by using a heat gun and sealing iron. (With iron sock). When shrinking the Ultracote do small sections at a time. Once the Ultracote is heated and shrunk, rub the heated area with a soft cotton glove or cloth while cooling. This will cause the Ultracote adhesive to bond both to the wood and Ultracote.

Be careful not to over heat the sections when different colors meet (seam) it can cause the seams to become wavy and unsightly. Make sure that all seams are sealed tightly.

It may be necessary to repeat this procedure one or two more times until the wood and Ultracote have settled in to the humidity and temperature conditions in your area.

### Required Hardware

Some hardware has been provided with this ARF. These are the hinges, bolts and nuts required to mount the fiberglass cowl, the front hatch, and the plug in horizontal stabilizers. The wing panels have ¼-20 blind nuts imbedded in the plywood wing roots for mounting the wings to the fuselage, but the bolts are not included. For ease of assembly in the field, we recommended the use of ¼-20 bolts with knobs, so that a tool will not be necessary to mount the wings on the fuselage.

We suggest the following hardware:

Item Used	Number	Recommended Brand	For
5/16 Inch Axles	2	Du-Bro	Landing Gear
5/16 Inch Wheel Pant Mounts	2	Sig or Sullivan	Landing Gear
8-32 Socket Head Bolts and Self-Locking Nuts	4		Landing Gear
5/16 Inch Wheel Collars	4		
4 or 4 ½ inch Wheels			
1 Inch Wheel			Tail Gear
Rudder Control Horns	2	Rocket City / Dubro	Rudder Control Horns
Aileron Control Horns	4	Rocket City / Dubro	Aileron Control Horns
Elevator Control Horns	2	Rocket City / Dubro	Elevator Control Horns
Ball Links	8	Rocket City / Dubro	Push-rods for control surfaces
Carbon Fiber Tube for 4-40 all thread			Push-rods for control surfaces
Clamp Loks	assorted package	JTEC	Securing servo extensions, fuel lines
Fuel Tank (32 Oz)	1	Dubro	Fuel Tank
¼-20 Alum or Steel Bolts/knobs	4	Supplied	Bolting Wing to Fuse
4.5 inch Spinner Extra 5 inch Spinner Panzl	1	Tru-Turn / Dave Brown	Spinner

## **Instruction for checking and Setting the Wing and Horizontal Stabilizer Incidence**

Although the incidence is referenced to zero within +/-1/2 degree at the factory by laser, we have found for best aerobatic performance setting the wing and stabilizer incidence angles to zero degrees will give optimum performance.

### **Setting the fuselage to zero degree**

Remove the hatch cover. Place your incidence meter or level on the top of the fuselage frame where the canopy would sit. Raise or lower the fuselage until the incidence meter reads zero, this is your zero reference point. Secure the fuselage in place so it will not move while you are checking the wing and stabilizer incidence.

### **Checking the Horizontal Stabilizer Incidence**

Plug in the horizontal stabilizers on the fuselage and bolt into place. Check the incidence of both left and right stab panels with the meter. It should be within (+/-) ¼ degree of zero. If not, it is suggested that the incidence be reset. If both panels need to be reset, make four 1/8 inch birch ply washers about ½ inch in diameter and drill holes in the center so a 6-32 bolt fits snugly in the hole. Enlarge the holes in the plywood tabs used to bolt the stab into place so that the stab incidence can move up and down about 1 degree. Now, insert the 6-32 bolts into the plywood washers and loosely bolt the stab panel into place. Set the stab panel to zero with the meter, and slightly tighten the bolt so the stab won't move. Now, carefully wick thin CA between the mounting tab and the plywood washer on the forward and aft tabs. If necessary, repeat the procedure for the (opposite?) stab panel. Remove the stab panels and reinforce the mounting tab / ply washer with medium CA around the washer.

### **Checking the Wing Incidence**

Making sure that the fuselage is still set at zero degrees, plug in the wing panels and bolt into place. Check the incidence with the meter. Both panels should be within (+/-) ½ degree of zero. If both panels are reading a positive (leading edge up) ½ deg of zero, there is no need to reset the incidence. If one panel is reading a positive incidence, and the other a negative incidence, or if both panels are at a negative incidence, then the incidence needs to be reset. Unbolt the wing panels, slide the panels slightly outboard of the tube and enlarge the wing bolt holes on the fuselage so that the wing incidence can be adjusted about (+/-) 1 to 2 degrees. *(For the next steps, use ¼-20 metal bolts, since it's possible that some thin CA will get into the bolt. If this happens with a nylon bolt, it will be impossible to remove the bolt from the wing and fuselage without breaking the bolt.)* Place the ¼ inch plywood washers on the wing bolts, and loosely bolt a wing panel into place on the fuselage and set the wing panel to zero degrees with the meter. Once set at zero degrees, tighten the wing bolts, but not too tight so that thin CA can wick in between the ply washer and the fuselage side. Now, wick in thin CA between the ply washers and the fuselage sides for both forward and aft washers. Reinforce the joint with medium CA between the washer and the fuselage side. Repeat the procedure for the other wing panel.

## *Installation of the Control Surfaces*

1. Trial fit the vertical fin onto the fuselage. Before the fin is glued in permanently make sure that it is perfectly straight. To do this, slide in the stab tube and center it by measuring both sides from the fuselage. Once you have the tube centered, measure from the end of the tube to the tip of the fin on both sides. This measurement should be exactly the same if the fin is straight. The best and easiest way to measure is to tie/glue a string to a "T" pin and pin it to the tip of the fin. Then extend the string to one side of the fuselage to the end of the tube and make a mark, next, without removing the pin, move the string to the other side of the fuselage to the end of the tube. The mark should be at the same place for both sides. If the measurement is not the same, carefully sand the fin base on the fuselage to "straighten" the fin. Once you feel that it is straight, use 30 minute or slower epoxy to permanently install the fin, while the glue is drying, use tape to secure the fin.
2. Glue in the Hinges for the Ailerons, Elevator, and Rudder. Use epoxy or hinge glue works very well for this application. Grease (Vaseline) or oil the hinge line to prevent any adhesive from getting into the hinge line, which would bind the hinges.
3. The hard points for the control horns are plywood plates that are glued to the foam core at the top and bottom of the control surface flush with the balsa skin. Drill holes at the top and bottom hard points for the aileron and elevator, and at the left and right hard points for the rudder. The trick to drilling the holes for the control horns is to drill from both the top and bottom of the hard points, making sure that the drill marks at the top are exactly at the same location as the marks for the bottom. Since you will be drilling only thru 3/32 skin and 1/8 or 3/16 ply, it not very deep, so there's no need to be exactly perpendicular to the control surface centerline. Once you have drilled from both sides, then go back and drill again from one side only, and let the drill go thru the other side, but carefully, making sure you don't drill a new hole. Now the holes are perpendicular to the control surface centerline. When installing the control horn bolt, as you get close to the other side, keep an eye on the bolt from the hole in the other side to be sure that it is starting well on the hole, otherwise you might push the plate and cause it to debond from the foam. *When installing the plastic nut for the control horn, don't tighten too much, or you will crush the foam beneath the hard point.* Put a dab of loc-tite or 5-min epoxy on the control horn bolt and nut to prevent them from rotating and becoming loose from engine vibration.
4. The locations for the hard points are as follows:

Ailerons: Locate the centers of the hard points on the aileron. The hard points are located at the top and bottom of the aileron. After locating the hard points, make a mark ½ inch behind the bevel line. It is recommended that the location of the hole be offset slightly towards the servo (not on the center of the hard point, or directly in line with the point where the pushrod is attached to the servo arm) so that when the servo is at full deflection, the pushrod is perpendicular to the hinge line axis. This will give maximum torque to your control surface at the maximum servo deflection. Repeat the procedure for the hard points at the bottom.

Elevator: Locate the center of the hard point. The size of the hard points are 1/8 inch thick, and are located at the top and bottom of the elevator. Use the same procedure for marking the holes for control horn bolt as described for the aileron above.

Rudder: Locate the center of the hard point from the bottom of the rudder along the bevel line. The size of the hard point is 2" (top to bottom) and 3 1/2" (front to rear). This is of sufficient size for mounting the Andy Kane rudder control horn. Locate and mount the horn such that the hole for bolting the clevis is at the hinge centerline.

### **Install Fuel and Smoke System**

Install the fuel tank on top of the fuel tank plate located in the front of the fuselage. We like spot gluing in a piece of foam for the tank to rest on, and cutting slots on the fuel tank plate so pieces of Velcro or Zip-ties can be used to secure the fuel tank. You also may want to make preparations for a smoke tank now, should you decide to install a smoke system later. Install and route the fuel tubing using J'TEC Clamp Loks to secure the fuel tubing.

### **Install Main and Tail Landing Gears**

1. The landing gear does not have pilot holes drilled for the axle. We suggest measuring 1/2" up from the bottom of the landing gear. Center, mark, and drill at this point. Once this is done, bolt on the axles. Mark the location of the wheels on the wheelpant, drill, and then install the wheel pant mounts. Install the wheel, and wheelpant, and bolt the main landing gear to the fuselage gear mounting plate with four 8-32 bolts and self-locking nuts.
2. Install the tail wheel assembly.

### **Prepare Cockpit Area and Install Canopy**

1. Paint the cockpit area with a color of your choice, and install front and rear instrument panels, and a pilot.
2. Trim the canopy slightly larger than the trim line marked on the canopy and check the fit to the front hatch, and re-trim, if required. When satisfied with the fit, glue the canopy to the removable front hatch. Do this with the hatch bolted to the fuselage. After the glue has dried, add some vinyl trim (approx 3/4 inch wide) around the canopy/hatch glue line for improved looks. Vinyl trim is available in any sign shop in your area.

## **Radio Installation**

1. Install the servos for the ailerons and elevators at the servo mounts provided. These mounts may need some sanding to achieve a proper fit for your particular brand of servo. Once the servos are installed, fabricate the push rods to connect the servos to the control horns.
2. We recommend that the rudder servos be installed in the fuselage underneath where the pilot would sit in the aircraft

However, if you like, there are pre-cut holes in the rear of the fuselage for 2 standard size servos should you decide to install them in the rear for a push-pull system. Please be advised that installing the servos in the rear may result in a tail-heavy airplane and should be used for pilots more interested in 3D and freestyle aerobatics rather than precision aerobatics.

3. Make appropriate mounts for installing you receiver, batteries, switches, and antenna routing tubes. We highly recommend the J'TEC Clamp-loks for a neat installation of servo wires in the fuselage and antenna routing tubes. Remember to keep the receivers at least 12" from the ignition module and separate the antennas from the servo leads as much as possible. Spending a little extra time here to do this may save time at the flying field trouble shooting radio issues if any. Additionally, we try to keep the batteries positioned so that they can be mounted securely, but also easily moveable for quick CG changes if needed during initial set-up.

## **Servo Recommendations**

For optimum performance we suggest the following servos.

	Futaba	Digital	JR	Hitec
Aileron	S-9206 x 4	9156 x 4	8611 x 2	5955 x 4
Elevator	S-9206 x 2	9156 x 2	8611 x 2	5955 x 2
Rudder	S-5301 x 1	9156 x 1	8611 x 1	5955 x 1
Throttle	S-3002 Mini		S-8101 or any coreless	

## **Engine Installation**

This airplane was designed specifically for single cylinder engines ranging from 50cc to 85cc. Be aware if you exceed these specifications you void any warranty. The firewall is installed with 3 degrees of right thrust built in.

Locate the vertical centerline and the horizontal centerline on the firewall. Use the actual firewall itself to locate the centerlines (don't use the front of the motor box to establish the centerline).

1. If you will be using a DA-85 or 3W-85, draw another vertical line 10mm (aprox. 13/32) from the center vertical line. When looking at the firewall from the front,

draw the new vertical line to the right of the center vertical line. The intersection of the new vertical line and the horizontal line is the center of your engine mount.

2. Now locate, and then drill the engine mounting holes on the firewall
3. After you have drilled the holes for engine mount, check the back of the firewall to see where the holes are. It may be necessary to remove some of the wood that is used to reinforce the motor box and firewall joints to make room for the blind nuts. Then, install the blind nuts.
4. Prior to mounting the engine we suggest using a light weight fiberglass or carbon fiber cloth with resin to provide extra strength to the fire wall mounting. This can be done easily by laying the cloth across the firewall and down the sides of the engine box about 4 inches.
5. Cut holes as required for fuel tubing, and connect the tubing to the engine and route the vent line as necessary. Determine your throttle servo location and cut holes as necessary for the throttle push rod, and install your throttle servo.
6. Cut holes in cowl for muffler exhaust pipes and install cowl.

### **Initial Set-Up**

1. Now, with everything on the airplane such that it is practically ready to fly except for the wing panels and wing tube, check the initial CG using the method described below. Note that this method does not actually determine the actual CG, but a balance point, which, when the wing panels are installed will place the CG at a good position for initial flights.
2. Thus, with the wing panels and wing tube off, lift the aircraft with your fingertips at the wing tube socket on both sides of the fuselage. The aircraft should balance level, or with the nose just slightly low.

3. Initial control throws are as follows:

Aileron: 30 degrees up and 25 degrees down for low rate  
40 degrees up and 35 degrees down for high rate

Elevator: 12 degrees up and down for low rate  
35 degrees up and down for high rate

Rudder: Aprox.  $\frac{1}{2}$  of max available throw for low rate  
Full available throw for high rate

4. Recommended initial mix ratios:

10% up elevator with either left or right rudder

2% right aileron with left rudder

2% left aileron with right rudder

## **Flying your Extra**

Initial Flight – We suggest a shake down flight with altitude. Check glide and stall characteristics. Please land and check control surfaces, hardware and engine for tightness.

If you plan on using your aircraft for precision aerobatics please take the time to trim your aircraft properly. If your CG is set up for precision aerobatics and you want to fly 3D/freestyle aerobatics, you may want to experiment with moving the CG aft by adding weight in the aft end of the fuselage to see you like the way the aircraft flies in the 3D/freestyle mode this way.

We at Radiowave hope that you enjoy owning and flying your 2.5m Extra 300 ARF far into the future.