Instruction Manual
Composite-ARF Extra 260, 2.6 m

Instructions for Extra 260 IMAC-Airplane

Thank you very much for purchasing our Composite-ARF Extra 260 all composite aircraft, made with the revolutionary Total Area Vacuum Sandwich (TAVS) technology. It is based on our 3m version of the Extra 260, but reduced in size to suit the most popular 75 - 120cc engine sizes.

A few of the photos in this instructions that explain 'standard' techniques and methods are actually of parts from different planes, and this will be obvious from the paint colors/schemes - so please don't get confused !

Before you get started building and setting-up your aircraft, please make sure you have read this instruction manual several times, and understood it. If you have any questions, please don't hesitate to contact us. Below are the contact details:

Email:	**feedback@composite-arf.com**
or	**techsupport@composite-arf.com**
Telephone:	**Phone your C-ARF Rep!!! He will be there for you.**
Website:	**http://www.composite-arf.com**

Liability Exclusion and Damages

You have acquired a kit, which can be assembled into a fully working R/C model when fitted out with suitable accessories, as described in the instruction manual with the kit.

However, as manufacturers, we at Composite-ARF are not in a position to influence the way you build and operate your model, and we have no control over the methods you use to install, operate and maintain the radio control system components. For this reason we are obliged to deny all liability for loss, damage or costs which are incurred due to the incompetent or incorrect application and operation of our products, or which are connected with such operation in any way. Unless otherwise prescribed by binding law, the obligation of the Composite-ARF company to pay compensation is excluded, regardless of the legal argument employed.

This applies to personal injury, death, damage to buildings, loss of turnover and business, interruption of business or other direct and indirect consequent damages. In all circumstances our total liability is limited to the amount which you actually paid for this model.

BY OPERATING THIS MODEL YOU ASSUME FULL RESPONSIBILITY FOR YOUR ACTIONS.

It is important to understand that Composite-ARF Co., Ltd, is unable to monitor whether you follow the instructions contained in this instruction manual regarding the construction, operation and maintenance of the aircraft, nor whether you install and use the radio control system correctly. For this reason we at Composite-ARF are unable to guarantee or provide a contractual agreement with any individual or company that the model you have made will function correctly and safely. You, as operator of the model, must rely upon your own expertise and judgement in acquiring and operating this model.

Supplementary Safety Notes

Pre-flight checking:
Before every flying session check that all the model's working systems function correctly, and be sure to carry out a range check.

The first time you fly any new model aircraft we strongly recommend that you enlist the help of an experienced modeller to help you check the model and offer advice while you are flying. He should be capable of detecting potential weak points and errors.

Be certain to keep to the recommended CG position and control surface travels. If adjustments are required, carry them out before operating the model.

Be aware of any instructions and warnings of other manufacturers, whose product(s) you use to fly this particular aircraft, especially engines and radio equipment.

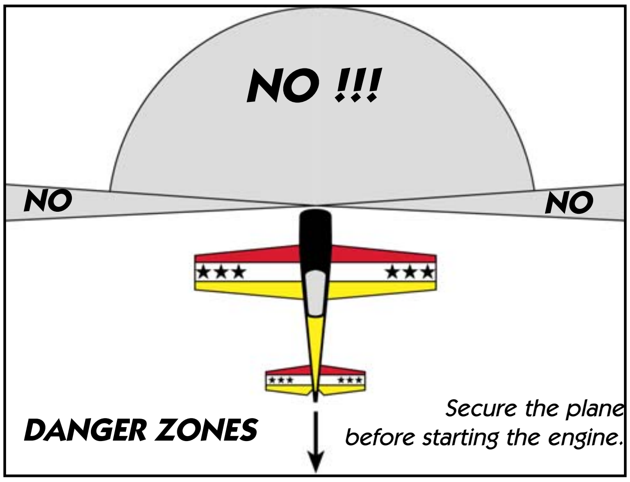
Please don't ignore our warnings, or those provided by other manufacturers. They refer to things and processes which, if ignored, could result in permanent damage or fatal injury.

Attention !

This IMAC-Aircraft is a high-end product and can create an enormous risk for both pilot and spectators, if not handled with care, and used according to the instructions. Make sure that you operate your Extra according to the AMA rules, or those laws and regulations governing the model flying in the country of use.

The engine, servos and control surfaces have to be attached properly. Please use only the recommended engines, servos, propellers, and accessories supplied in the kit.

Make sure that the 'Centre of Gravity' is located in the recommended place. Use the nose heavy end of the CG range for your first flights, before you start moving the CG back to a more critical position for 3D-maneouvers. If you find that you need to relocate your batteries or even add weight in the aircraft to move the CG to the recommended position, please do so and don't try to save weight or hassle. A tail heavy plane, in a first flight, can be an enormous danger for you and all spectators. Fix any weights, and heavy items like batteries, very securely to the plane.



Make sure that the plane is secured properly when you start the engine. Have at least 2 helpers hold your plane from the tail end, or from behind the wing tips, before you start the engine. Make sure that all spectators are behind, or far in front, of the aircraft when running up the engine.

Make sure that you range check your R/C system thoroughly before the first flight. It is absolutely necessary to range check your complete R/C installation first WITHOUT the engine running. Leave the transmitter antenna retracted, and check the distance you can walk before 'fail-safe' occurs. Then start up the engine, run it at about half throttle and repeat this range check with the engine running. Make sure that there is no range reduction before 'fail-safe' occurs. Only then make the 1st flight. If you feel that the range with engine running is less then with the engine off, please contact the radio supplier and the engine manufacturer and DON'T FLY at that time.

Check for vibrations through the whole throttle range. The engine should run smoothly with no unusual vibration. If you think that there are any excessive vibrations at any engine rpm's, DON'T FLY at this time and check your engine, spinner and propeller for proper balancing. The lightweight sandwich composite parts don't like too much vibration and they can suffer damage. The low mass of all the parts results in a low physical inertia, so that any excess vibrations can affect the servos and linkages.

Make sure that your main and stab tubes are not damaged. Check that the front and rear anti-rotation pins for the wings and horizontal stabiliser are located correctly in their holes, and are not loose. Check that the 4 plastic wing retaining nuts are tight, that the M3 bolts retaining the horizontal stablisers on to the aluminium tube are installed and tight, and that the hinge wires for the rudder and elevators cannot come out.

If you carefully checked all the points above and followed our advice exactly, you will have a safe and successful first flight - and many hours of pleasure with your Composite-ARF Extra 260.

General information about fully-composite aircraft structure and design

All the parts are produced in negative molds, manufactured using vacuum-bagged sandwich construction technology. All parts are painted in the moulds, either single colour or designer colour schemes. A new production method, called TAVS (Total Area Vacuum Sandwich), enables us to present this aircraft with incredible built-in strength, while still being lightweight, and for a price that nobody could even consider some years ago. This production process has huge advantages, but a few disadvantages as well. These facts need to be explained in advance for your better understanding.

Description of Parts

The Wings:

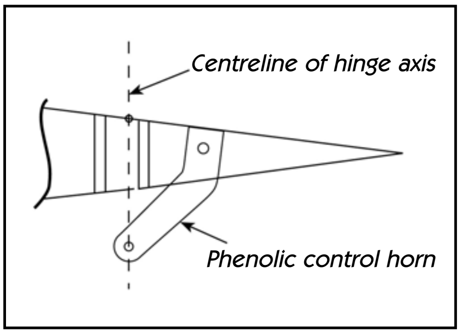
Both wing halves are made in negative moulds, fully vacuum-bagged, using only 2 layers of cloth in combination with a hard 2mm foam sandwich to form a hard and durable outer skin. Because of this TAVS technology no additional structural parts are needed except for the main spar tube.

The ailerons are already hinged for you. They are laminated in the wing mould and are attached to the main wing with a special nylon hinge-cloth, sandwiched between the outer skin and the foam. This nylon hinge is 100% safe and durable. You never have to worry about breaking it, or wearing it out. There is no gap at all on the top wing surface, and there is a very narrow slot in the bottom surface, where the aileron slides under the main wing skin during down throw. This hinge setup is the cleanest you can ever obtain, but you have to take some care during assembly for proper installation and servo set up.

First, the hinge line is on the top surface of the wing, not in the centre. This is NOT a disadvantage, if you set in about 10% NEGATIVE aileron differential in your transmitter program. This means that the 'down' throw needs to be about 10% more than the up throw.

Why? Because the axis of the hinge is not at the centreline of the aileron, so it moves slightly in and out when it travels, and the aileron gets a little "bigger" in surface area when moving up, and "smaller" when moving down. This is why you have to set the negative differential in your transmitter to compensate for the size changing. 10% is a good starting point, and you will find out the exact setting during the first flights, doing fast vertical rolls and watching the fuselage rolling in a perfect line. You can set it perfectly, this is guaranteed.

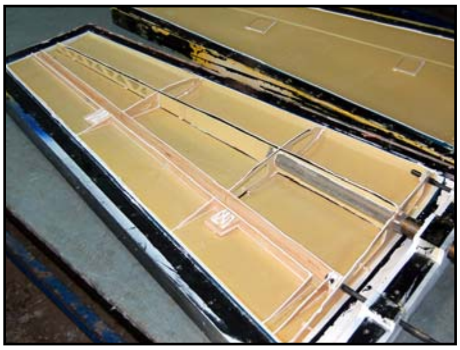
The bottom slot needs some explanation, too. The cut line is exactly in the correct position so that the aileron slides under the wing skin smoothly. If the cut was a few mm forward or back, it would not work properly. So, make sure that the lip is not damaged, and that the aileron slides under this lip perfectly. It will NOT lock at any time, as long as the lip is not damaged. If damage occurs to the lip, you can cut off 2-3 mm, but you should NEVER need to cut off more than this.

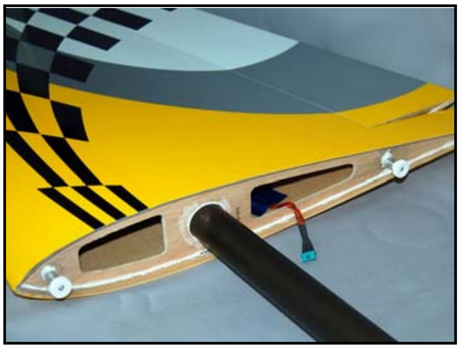


Make sure that the control horns are glued into the ailerons properly. The hole in the phenolic horn for the quick-link needs to be exactly perpendicular to the hinge axis line, and in this manual we show you a simple way to ensure that the horns in all pairs of control surfaces will be identical, making it easy to set up your R/C for accurate flying manoeuvres.

The wings are already set-up with servo covers and hatches for 2 servos per aileron, and we recommend a pair of high-torque servos, for example the JR DS8411, in each wing. Our servo covers and milled plywood mounts make installation, and exchange if necessary, very quick and easy and provide a rock solid servo mounting and linkage system.

The wings are attached to the fuselage with the 4 threaded aluminium dowel anti-rotation pins, with 4 plastic nuts inside the fuselage. If the aluminium dowels come loose in the wing, the wing will slide outwards, away from the fuselage, and the main spar tube will definitely break. So take great care to inspect the glue joints of these anti-rotation dowels in the wing REGULARLY. Excessive vibrations or hard shocks can cause the glue joints to weaken or break. Monitor these joints whenever you set up your plane. Never forget to tighten the nuts inside the fuselage. Please DO NOT modify these attachment dowels in any way, their perfect function is proven for many years.





The Fuselage:
The fuselage is also made in negative moulds, and is all constructed using TAVS technology. All the loadbearing internal parts are installed during manufacture, to ensure accurate location and reduce your assembly time. The fibreglass tubes in the wings to receive the wing spar tube, the stab spar tubes, and the holes and reinforcement plates for the anti-rotation dowels, are already installed. There is no need to even check the incidences - you can be assured that these are already set in the moulds so that no adjustment is necessary.

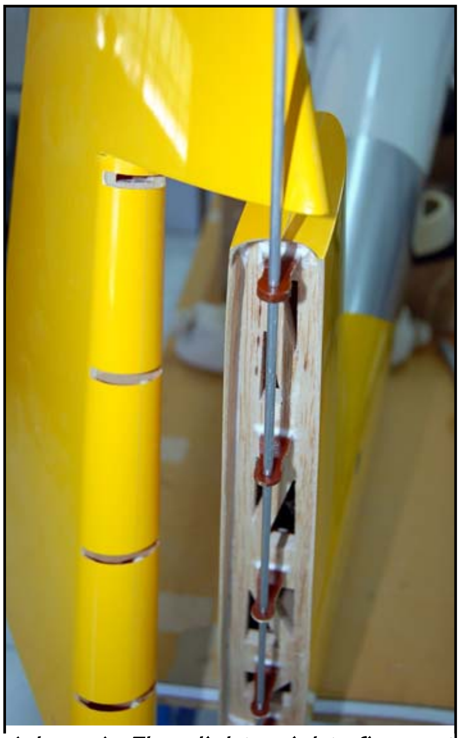
The landing gear mount is strong and doesn't need any extra reinforcement. The fuselage is extremely light weight, and the gear loads need to be led into the structure gently. No glue joint needs to be stronger than the materials that it is attached to, as it would just result in increased weight for no advantage. The landing gear is a fairly flexible design, which works very much like shock absorbers. This plane is not made for crashing, but the landing gear will take some hard landings without problems. Do not change or modify it, as the results would only be negative. We had plenty of time and experience to engineer the strength needed in this area - and we did !

The motordome and firewall are a fully integral parts of the fuselage, and provide plenty of strength for any engines up to 120cc on the market today. See the Engine Installation section for details of engine and setting thrust angles.

The engine cowling should be attached using the method shown. It is only a little work and this mounting has been tested and proven for many years.

The Stabilisers:
The stab parts are also vacuum bagged sandwiched. The rudder and the elevator control surfaces are hinged with 4mmØ tubes, fitted through phenolic hinge bearing plates which are jig-installed during manufacture for perfect alignment.

The rudder and elevator design allows for at least 50 degrees throw. For the Extra it is mandatory that the tail area is extraordinarily light weight, so the stab is designed for one powerful servo installed in each half. All the structural parts are preinstalled. The horizontal stabs are mounted with one 20mm aluminum tube and one 10mm carbon anti-rotation pin each.



(above) The lightweight fin-post has the phenolic rudder hinge posts already installed and aligned at the factory. The corresponding tubes are also installed in the rudder for the hinge tube.
(below) The elevator and rudder hinging uses 4mm diameter aluminum tubes, inside phenolic hinge posts that are factory-installed and aligned.

Servo Screws:
Fix the *all* the servos into the milled plywood servo mounts using the 2.9 Ø x13mm sheet metal screws provided in the kit, ***not*** the standard screws normally supplied with servos by the servo manufacturer. This is because all the holes in our milled servo mounts are 2mm diameter, due to our CNC manufacturing process, and this is too big for the normal screws.

Take Care:
Composite sandwich parts are extremely strong, but fragile at the same time. Always keep in mind that these contest airplanes are designed for minimum weight and maximum strength in flight. Please take care of it, especially when it is being transported, to make sure that none of the critical parts and linkages are damaged. Always handle your airplane with great care, especially on the ground and during transport, so you will have many hours of pleasure with it.

Accessories

Below are the things you may need to get your Composite-ARF Extra 260 (2.6m) in the air. Some of them are mandatory, some of them can be chosen by you. What we list here are highly recommended parts, and have been thoroughly tested.

1. Power servos (min. 8 required). We highly recommend JR 8411 or 8511/8611 for all con trol surfaces. For Futaba users, we recommend 2 x S9351's for each Aileron, 1 x S9351 for each elevator, and 2 x S3951's for rudder.
2. Aluminium servo output discs, or full metal arms (8 pieces). We strongly recommend that you attach the phenolic servo extension arms provided in the kit to metal servo output discs, or use full metal servo arms (eg: SWB 'Double-Loc' type). The rudder phenolic servo horns must be attached to metal servo output discs (eg:'Hangar 9' #HAN3526 or 3520).
3. Throttle servo. Any standard servo will do (eg: JR/Graupner 4041/5391)
4. Aluminum Spinner 115 - 125 mm/4.5 - 5" dia. eg: Tru-Turn. (Ø120mm carbon spinner & CNC T6 alu. backplate available from C-ARF as an option, #810100 - 810105+)
5. Main wheels 115 - 125 mm (4.5 - 5"). Kavan Light or Dubro wheels are recommended.
6. Engine 75 - 100cc. The DA-100 is probably the most commonly used engine for our 2.6m span Extras, and the mounting dimensions are shown for this motor. However in these instructions we also show the installation of a lightweight option with a 3W 80cc single cylinder and tuned pipe set-up.
7. Muffler/Canister or Tuned pipe(s) and headers. (Headers, canisters, tuned pipes and Teflon joiners are available from C-ARF as options. See our webpage for availability)
8. Tailwheel assembly. (Available as an option from C-ARF. Product # 801000.)
9. High quality heavy-duty servo extension cables, with gold connectors. High quality receiver and ignition switches, etc.
10. Receiver and Ignition batteries.
11. Powerbox and dual powerswitches for dual batteries (available from C-ARF as an option)
12. Fuel tank (750 - 900 ml) with gasoline stopper. We used a Dubro #690 in this plane.
13. Cable ties in various lengths.
14. Propeller. Carbon Meijzlik or Menz 28 x10 for DA-100. 26 x 12 or 27 x 10 for 3W 80cc.

Tools

This is a very quick and easy plane to build, not requiring difficult techniques or special equipment, but even the building of Composite-ARF aircraft requires some suitable tools! You will probably have all these tools in your workshop anyway, but if not, they should be available in all good hobby shops, or hardware stores like "Home Depot" or similar.

1. Sharp knife (X-Acto or similar)
2. Allen key set **(metric)** 2.5mm, 3mm, 4mm & 5mm.
3. Sharp scissors
4. Pliers (various types)
5. Wrenches **(metric)**
6. Slotted and Phillips screwdrivers (various sizes)
7. M3 tapping tool **(metric)**
8. Drills of various sizes
9. Small spirit level, or incidence meter.
10. Dremel tool (or Proxxon, or similar) with cutting discs, sanding tools and mills.
11. Sandpaper (various grits), or Permagrit sanding tools (high quality).
12. Carpet, bubble wrap or soft cloth to cover your work bench (most important !)
13. Car wax polish (clear)
14. Paper masking tape
15. Denaturised alcohol, or similar (for cleaning joints before gluing)

Adhesives and Solvents

Not all types of glues are suited to working with composite parts. Here is a selection of what we normally use, and what we can truly recommend. Please don't use inferior quality glues - you will end up with an inferior quality plane, that is not so strong or safe.

High performance models require good gluing techniques. We highly recommend that you use either a slow (minimum 30 minute cure) epoxy resin and milled fibre mixture, or a slow filled thixotropic epoxy for gluing highly stressed joints (eg: Hysol 9462). The self-mixing nozzles make it easy to apply exactly the required amount, in exactly the right place, and it will not run or flow onto places where you don't want it! It takes about 1 - 2 hours to start to harden so it also gives plenty of time for accurate assembly. Finally it gives a superb bond on all fibreglass and wood surfaces. Of course there are many similar glues available, and you can use your favourite type.

1. CA glue 'Thin' and 'Thick' types. We recommend ZAP, as this is very high quality.
2. ZAP-O or Plasti-ZAP, odourless, or ZAP canopy glue 560 (for clear canopy)
3. 30 minute epoxy (stressed joints must be glued with at least 30 min & NOT 5 min epoxy).
4. Loctite Hysol 9462 or equivalent (optional, but highly recommended)
5. Epoxy laminating resin (12 - 24 hr cure) with hardener.
6. Milled glass fibre, for adding to slow epoxy for stronger joints.
7. Micro-balloons, for adding to slow epoxy for lightweight filling.
8. Thread-locking compound (Loctite 243, ZAP Z-42, or equivalent)

We take great care during production and Quality Control at the factory to ensure that all joints are properly glued, but of course it is wise to check these yourself and re-glue any that might just have been missed.

When sanding areas on the inside of the composite sandwich parts to prepare the surface for gluing something onto it, do NOT sand through the layer of lightweight glasscloth on the inside foam sandwich. It is only necessary to rough up the surface, with 80/120 grit, and wipe off any dust with acetone or de-natured alcohol (or similar) before gluing to make a perfect joint. Of course, you should always prepare both parts to be joined before gluing for the highest quality joints. Don't use Acetone for cleaning external, painted, surfaces as you will damage the paint.

TIP: Lighter fluid is excellent for cleaning small marks, clear wax, uncured glue, or similar off the painted surface of the plane - without damaging the paint.

Tip: For cleaning small (uncured) glue spots or marks off the painted surfaces you can use old-fashioned liquid cigarette-lighter fuel, like 'Ronsonol' or equivalent. This does not damage the paint, as Acetone and many other solvents will, and this is what we use at the factory.

At Composite-ARF we try our best to offer you a high quality kit, with outstanding value-for-money, and as complete as possible. However, if you feel that some additional or different hardware should be included, please feel free to let us know.

Email us: feedback@composite-arf.com.

We know that even good things can be made better !

Did you read the hints and warnings above and the instructions carefully?

Did you understand everything in this manual completely?

Then, and only then, let's start assembling your Composite-ARF Extra 260

Building Instructions

General Tips:
We recommend that you follow the order of construction shown in this manual for the fuselage, as it makes access to everything easier and saves time in the end. The wings and stabs can be done at almost any point, and only need servos and control horns installing anyway.

The first thing to do is protect the finished paint on the outside of the model from scratches and dents during building - so cover your work table with a piece of soft carpet, cloth or bubble-plastic. The best way to stop small spots of glue getting stuck to the outside of the fuselage is to give the whole model 2 good coats of clear car wax first, *but* of course you must be sure to remove this 100% completely before adding any decals or markings. Additionally you can cover the majority of the fuselage with the bubble-plastic used to pack your model for shipping, fixed with paper masking tape, which also protects it very well.

When sanding any areas of the inside of the fuselage to prepare the surface for gluing something onto it, do NOT sand right through the layer of glasscloth on the inside foam sandwich !
It is only necessary to rough up the surface, with 60/80 grit or equivalent, and wipe off any dust with alcohol (or similar) before gluing to make a perfect joint.

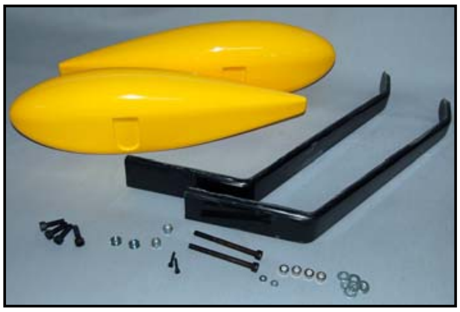
Before starting construction it is a good idea to check inside the fuselage for any loose glass fibres that could cut your hands, and a quick scuff over any of these with a coarse Scotchbrite pad will remove them.

Note: It is very important to prepare the inside of the fuselage properly, by roughing up and cleaning the surface, before gluing *any* parts to it.

Landing Gear

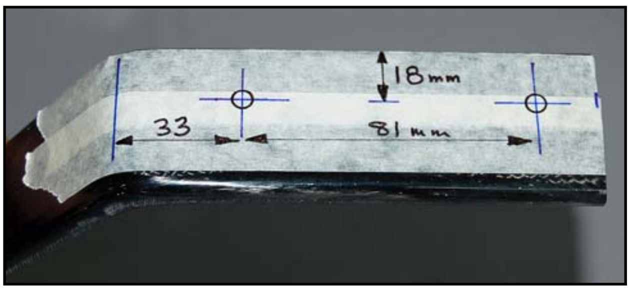
The 1st job is to fit the landing gear legs, and you can leave these in place, as they will protect the bottom of the fuselage during assembly and gear installation.

The Composite-ARF landing gear for the Extras consists of 45 deg laminated carbon fibre and fibreglass cloth and a huge number of rovings inside, all made under vacuum and heat-cured. However it is still light weight, and retains enough flexibility to take the shock out of any landings that are less-than-perfect!

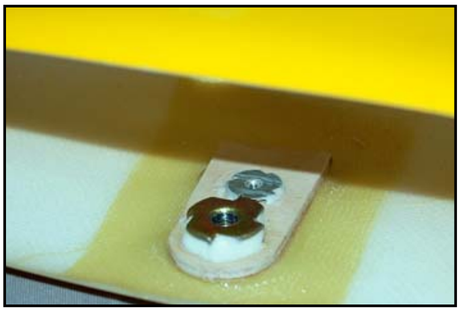


(above) The main parts used to assemble the Landing Gear.
(below) Drill 2 x 6.5mm Ø holes for bolting in the Landing Gear.

The 4 undercarriage fixing bolts are installed from the outside, bottom, of the fuselage, as shown in photo P1.



Mark the position of the holes on each carbon leg, and drill the holes with a sharp 6.5mm Ø drill. The centres of the holes are measured from the centre of the bend in the leg that will be positioned about 8mm outside the fuselage surface (photo P1). The outer holes are 33mm from the bend, and the inner holes are 81mm inside them. The centre of the holes should be 18mm from the front edge of the carbon (photo above).



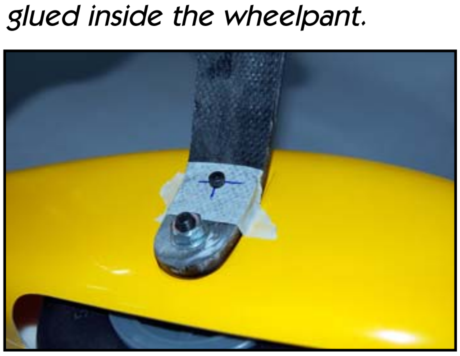
(above) Glue the milled plywood reinforcements to the inside of the wheelpant as shown, using a 30 minute epoxy and microbaloons mixture.

The legs are fixed to the plane with the M6 x 20 bolts and 13mm Ø washers into the blind nuts that are installed in the plywood supports during manufacture (photo P2). Both main legs are identical, until you have drilled the mounting holes, and can be used either side.

The method of fixing the wheelpants and axles to the landing gear legs is slightly different to the method we have described in the past, but it is even easier and works better. The wheelpants have a moulded-in recess for the end of the landing gear legs, which also sets the correct angle relative to the ground. Drill an 8mm Ø hole through the moulded-in 'dimple' for the axle, and another 8mm hole directly opposite, on the outside surface of the wheelpant for inserting the axle bolt. You can spin the head of the axle bolt against a sander to reduce the diameter a little if you wish (see photo right).

Prepare the inner surface of the wheelpants by sanding the kevlar patch. Take the 2 milled plywood 'U' shaped pieces and enlarge the 6mm Ø holes to 8mm diameter. Press the M6 T-nuts into the holes, just far enough so that the end of the T-nut projects through the hole a maximum of 1mm. The 'spikes' will still engage in the plywood, and the gap between the T' nut and the plywood is filled with epoxy and microballoons mixture. (see photo P3)

(above) The moulded dimple in the bottom of the carbon legs. Drill a central hole of 6mm diameter. (below) shows the M3 bolt thru' the carbon leg, into the T-nut glued inside the wheelpant.

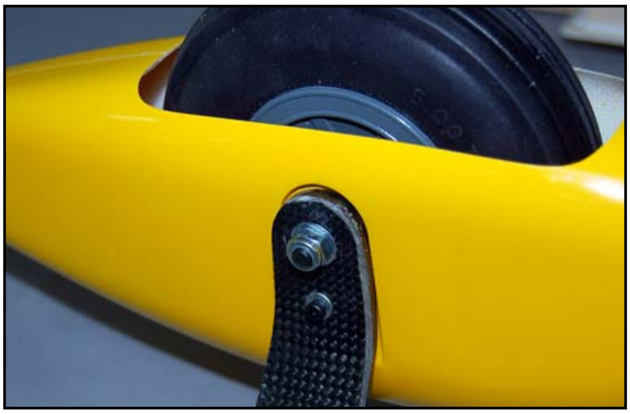


Glue the 2 'U' shaped milled plywood pieces to the inside surface of the wheelpants with 30 minute epoxy and microballoons mixture, over the kevlar reinforcement, in line with the moulded recess, and so that the hole in the plywood is exactly in line with the 8mm hole you have drilled in the wheelpant. Temporarily use the LG mounting bolts to secure the plywood to the wheelpant while the glue dries. At the same time secure the T-nut to the plywood with some of the thick epoxy/micro mixture, as shown.

Drill 6mm Ø through the centre of the moulded dimples in the bottom of the carbon legs, and bolt to the wheelpants temporarily with the axle bolt. You might need to sand the ends of the carbon LG legs a little so that they fit into the molded recesses in the wheelpants perfectly.

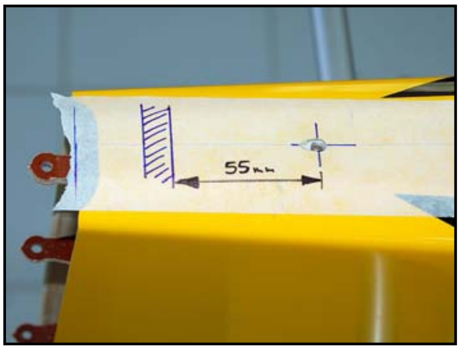
Bolt the LG legs to the wheelpants, and drill a 3mm hole thru' the carbon leg and wheelpant, about 25mm above the axle. Fit an M3 bolt and washer, and use an M3 T-nut inside - also secured to the plywood 'U' shape with epoxy/micro mixture. This bolt sets the precise angle of the wheelpant to the carbon landing gear leg. Do not use a bolt of larger diameter, as a larger hole required could weaken the leg.

Install your chosen wheels (Ø5" Dubro 500TL shown), inserting the M6 x 70mm steel axle bolt through the hole you drilled in the outside surface of the wheelpant. Depending on the thickness of your chosen wheel, you will need 2 or 3 of the M6 washers either side of the wheel to centre it - and also an M6 wheel collar (supplied) on the inner side as well, between the washers and the 'T' nut.



Tighten the axle bolt securely into the T-nut, and then secure the assembled wheelpant to the carbon leg using an M6 washer and M6 locknut as shown right. A drop of loctite on the M6 lock-nut is good insurance. Finally insert the M3 bolt thru' the carbon leg into the T-nut.

(above) Completed wheel pant.
(below) Position of Ø 4.8mm hole for C-ARF optional tailwheel.



You can use any 4.5" - 5" main wheels. Kavan wheels are very lightweight, but not very durable on asphalt runways, and Dubro wheels are a little heavier but much more solid.

Tailwheel

The tail wheel setup shown in these photos is an optional part available from C-ARF (# 801000), and is mounted with 2 sheet metal screws and 2 plastic 'U' brackets under the fuselage, screwed into the plywood reinforcement that's installed in the fuselage at the factory. Drill a 4.8mm diameter hole, 55mm in front of the finpost and insert the tailwheel wire (photo right).

(below) Tailwheel assembly installed. It can be connected to rudder horn OR rudder cables with springs for improved steering.

You don't need to make the tailwheel steerable if flying from grass surfaces, a simple castoring action is fine. However, for hard runways you may prefer to connect it either to the rudder horn with 2 small springs, or even better to the rudder pull-pull cables about 130mm in front of the rudder leading edge - as shown here. It's easy to make the springs, if necessary, by winding some 0.5 - 0.8mm Ø piano wire around a 5mm drill bit, turned slowly in a battery-drill, with a small hook in each end to connect to the tailwheel steering arms. (see also photo P4)

Remember - keep it lightweight at the tail end!

Cowling

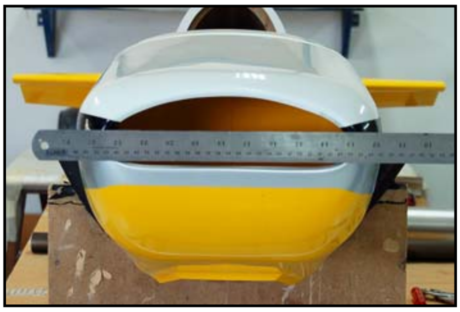
The 1 piece cowling is already cut and trimmed at the factory, and should need very little adjustment for a perfect fit. With the main undercarriage legs bolted into place, install the wing tube in the fuselage sleeve and place a small spirit or incidence meter level on top of it to set the plane exactly level (side to side). Pack under one undercarriage leg as necessary to get it level on your building table.

If necessary, sand the fibreglass joining tapes inside the back edge of the cowl slightly to get a perfectly flush fit between the cowling and the fuselage sides. Trial fit the cowling, and use a straight-edge on the lower (flat) part of the cutout at the front of the cowl to make sure that it is parallel with the wing tube, or stab, and properly centred. Tape the cowl firmly into position, and mark a centreline on the top of the cowl and the fuselage, on masking tape.

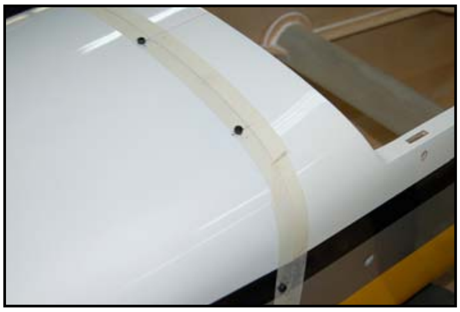
The cowling is held in place with 9 bolts (M3 x 12mm), washers and blind nuts. Drill one 3mm diameter hole at the top/centreline of the cowl, approx. 8mm (5/16") in front of the back edge of the cowling, and insert an M3 x 12mm bolt. Thread a T-nut onto the bolt inside the fuselage, and secure it to the fuselage with one small drop of thick CA.

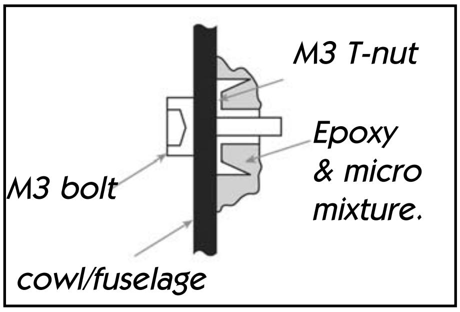
Note that the blind nuts are fitted *reversed*, with the spikes pointing inwards! Check alignment again, and then drill and fit the other 8 bolts in the same way, securing the blind nuts to the inside of the fuselage with a single drop of thick CA. Space the 9 bolts 110mm (4.5") apart, so that the lowest 2 bolts will be about 25mm from the edges of the square cutout in the bottom of the cowling, to retain it properly.

Don't forget to wax, or oil, the M3 bolts first, to make sure that you don't accidentally glue any of the bolts to the cowling or into the blind nuts! Finally glue the 9 blind nuts in place properly using a medium-thick mixture of 30 minute epoxy and micro-balloons, as shown. During final assembly, add the supplied M3 washers under the heads of all the M3 bolts.



(above) Check cowl opening is parallel to stab or wing tube, and tape in position.
(below) Secure with 9 equally-spaced M3 x 12 bolts, into T-nuts glued inside the fuselage.





(above & below) Tack glue the T-nuts in position with a small drop of thick CA first. When cowling is correct, secure all the T-nuts with a drop of, fairly wet, epoxy and microballoons mixture as shown.

Canopy Frame

The fibreglass canopy frame mountings are already completed for you at the factory. It is secured to the fuselage with four M4 x 10mm allen bolts, fitted from the outside of the fuselage, through the plywood tabs that are glued to the canopy frame, into M4 T-nuts. This system has been very well proven on all of our aerobatic planes, and is a strong and rigid solution.

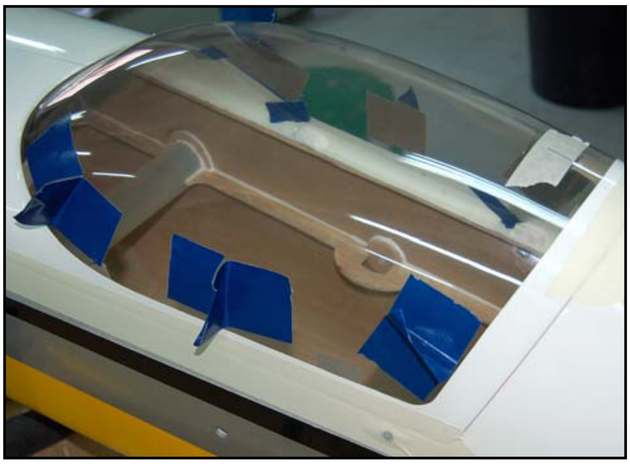
(above) The canopy frame is secured to the fuselage with 4 tabs, M4 bolts and T-nuts, all finished at the factory for you. Also note the bead of epoxy to secure the canopy to the inside of the fibreglass frame.

Fitting the clear canopy into the frame can be a little bit tricky, and this is a step by step guide of how we do it. Of course you can use own your favourite glue and method if you prefer.

Sand the inside edges of the canopy frame carefully with 120 grit sandpaper, especially the fibreglass joining tapes, to ensure a perfect fit of the canopy. Fit the canopy frame on the fuselage and secure with all 4 bolts. Lay the canopy on top of the frame, view from the front to check that it is centred and symettrically positioned, and then mark the approx. shape with a felt pen or wax crayon. There is an approx. 'cut-line' molded into in the edges of the canopy to assist you, and you should start by trimming 4 - 6mm outside this line. Unless you are in a very warm room, we recommend that the canopy is slightly warmed up with a hair dryer to prevent cracking - but be careful not to melt or deform it! When the canopy fits inside the frame, tape it into position temporarily, and accurately mark the edge of the frame on the canopy with a wax crayon. Remove the canopy and trim exactly to shape, leaving about 6mm overlap outside the line all around.

(above) Mark centrelines on the clear canopy at front and back and visually check that it is straight. (below) Duct-tape handles used to pull clear canopy against the canopy frame while gluing it in position with a few small drops of odorless-CA. Remove canopy and secure the edges of the clear canopy with a bead of epoxy to trap it in place (see above)

Refit the canopy into the frame, and tape into position from the inside. Push the canopy up tightly inside the back of the frame and fix the bottom 2 back corners with one small drop of odorless CA each (ZAP-O recommended).



Note: Do NOT use any CA accelerator/kicker - you will immediately 'fog' the clear canopy!

Make visual check from the front and back to make sure sure that the canopy is straight. Make several hand-holds with strong tape to make holding and positioning the canopy easy. Remount the frame to the fuselage (use all 4 bolts), and tape the canopy frame tightly to the fuselage all around.

Tip: The sides of the fuselage and canopy frame are almost straight and so, if you wish, you can temporarily stiffen the edges of the canopy frame (while gluing the canopy in) by tacking some strips of 10mm balsa to masking tape on the fuselage sides. This makes it easier to pull the clear canopy against the frame, using the tape 'handles' while tacking it in to place - without deforming the canopy frame.

Using the tape handles to pull the canopy outwards firmly against the frame, working from the back towards the front, glue the edges of the canopy in place in 2 more places each side, with just a single small drop of CA at each position, all the time checking that the edge of the canopy is tight up against the frame at the front.

Now that the canopy is fixed in position and cannot twist or warp anymore, you can carefully remove the canopy frame from the fuselage, and use a 30 minute or 24hr epoxy and micro-balloon mixture for gluing all the edges to the frame on the inside surface (see photo above). It is most important that the canopy cannot come off in flight, so make sure that the bead of glue traps the clear canopy firmly in place. Re-secure the canopy frame onto the fuselage with all 4 bolts while the epoxy-microballoons mixture is curing to prevent any warps or twists.

If you want a completely rattle-free canopy, you can fill the slight gaps at the front and back of the frame with a bead of clear silicone. Apply shiny brown plastic tape to the front and back edges of the opening in the fuselage and wax twice with clear car wax. Sand lightly, and degrease edges of canopy frame where the silicone will be applied. Apply a small bead of clear silicone to the front end of the frame *only,* and secure the frame into position wthl all 4 bolts until cured. Remove frame, and trim off excess silicone with a very sharp knife. Then repeat for the back edge. Do *not* try to do the back and front at the same time - or you will find it very difficult to get the canopy frame off the fuselage! See photo P5.

If you wish you can tint the inside of the canopy using one of the aerosol spray paints used for painting the inside of polycarbonate car bodies (eg: the Tamiya or Lexanit ranges). Degrease and clean the the surface very carefully, removing all finger-prints, and use many very light 'mist' coats to get even coverage.

Horizontal Stabs

The stabilisers are 95% finished at the factory, and only need the servos, horns and linkages installing. Insert the Ø20 x 330mm long aluminium tube spar in the fuselage sleeve, and slide on both stabs to check the fit between the root ribs and the fuselage. You can sand the root of the stabs slightly to make a perfect joint if needed, and if the spar tube is a fraction long you must shorten it.

The elevators are hinged to each stab using the Ø 4mm aluminium tubes provided. Make sure there is no burr on either end of the tubes, and chamfer one end slightly with fine sandpaper to make it easier to get them through the holes in the phenolic hinge plates. Be careful inserting them, and if they are a bit stiff, then use a little grease on the tubes. Don't use too much force, otherwise a phenolic hinge post inside might break loose. Leave the tubes a bit too long during assembly, and cut them to exact length when the model is finished.

(above) Bell/splay one end of each tube, countersink the hole in the root end of the elevator, & use clear tape to fix the tube in position during final assembly.

During final assembly, you can retain both ends of the tubes with small pieces of clear tape on the root and tip ends of the elevators. An alternative method is the 'bell' one end of each aluminium tube, and countersink the hole in the root end of the stab. Then you only need to tape the inner end of the hinge tube (photo above).

(above) Servo is screwed into the milled cutout in the inner rib.

Servos

You have a choice of elevator servos; either a hi-power digital JR8511/8611 in each stab, or an JR8411, which is also sufficient. Although the JR8511/8611 servos are about 1 mm longer and wider than the 8411, both sizes will fit in the milled servo cutouts in the ribs. If using Futaba servos, we recommend that you use S9351's, which also fit the milled servo cutouts. Please do not use inferior quality servos, or servo arms, in this plane. It will result in an aircraft that does not fly accurately, reliably or safely.

(above) If you use the phenolic servo arm extensions, you MUST bolt these to metal servo discs.
(below) The alternative is full metal servo arms, such as these SWB 'Double-Loc' types that we use on most of our factory planes.

The servos are installed with the output shafts towards the stab trailing edge, and they must be installed using the 2.9mm Ø x 13mm sheetmetal screws provided in the kit, *not* the standard screws provided with the servos which are too small for the Ø 2mm milled holes.

Servo arms

To obtain sufficient elevator throws, quite long servo output arms are needed (30 - 35mm/1.25 -1.5"). In the kit we supply phenolic servo arm extensions for this purpose, which can be fitted onto your servo output discs to achieve the throws. However, it is ***mandatory*** to secure these to metal servo output discs, or to use full metal servo arms (like those shown below from SWB) - and ***not*** the standard plastic output discs supplied with the servos. The extreme torque of the current hi-torque digital servos can strip the plastic splines from the inside of the disc - which will result in immediate flutter and destruction of your Extra. Several reputable accessory companies make aluminium discs and servo arms, but you should check that the CNC machined splines fit onto the servo output shaft tightly, with a minimum of lost movement/play.

Secure the phenolic arms to the servo output discs as follows: Fit the metal discs to the servos. Centre both elevator servos using your R/C and attach the phenolic servo arms to the outside of the metal discs temporarily with a couple of drops of CA, making sure that the servo arms are both at 90° to the bottom surface of the stabs using a set square. Then remove the arms and discs, drill through both, and secure with at least 2 small bolts, washers, locknuts and Loctite (M2 bolts and nuts included). Add a drop of Loctite to the bolt that secures the discs to the servos.

* *Use this same method to attach the phenolic extension arms to metal discs for the aileron & rudder surfaces also.*

At Composite-ARF we only use the aluminium 'Double-Loc' servo arms from SWB manufacturing (USA) and we highly recommend them. These arms clamp onto the servo output shaft with no lost movement (play) at all. These are high quality, properly engineered arms, and are available from many good hobby stores.

With your chosen servo arm secured to the servos, fit them in place in the milled cutouts in the stabs and secure with the 2.9 Ø x 13mm sheetmetal screws we have included.

It is ***most important*** that the linkage from the servo arms is exactly in-line with the phenolic control surface horns in the elevators, as any 'side-load' or 'twisting' could weaken or even break them, causing flutter and destruction of your Extra. If you have chosen to fit full metal servo arms, (eg: SWB), you can fit a single-sided ball-link onto the servo arm to adjust the line of the linkage if necessary - but you ***must not*** fit a ball-link to a phenolic or plastic servo extension arm, or phenolic control surface horn.

If your chosen servo arm system does not line up perfectly with the factory-milled slots for the phenolic control horns, you can either fill the slots and mill new ones - or even pack the servo off the rib slightly inside the stabiliser (with thin plywood) to adjust the alignment. Make up the elevator linkages from the hardware supplied, using M3 x 45mm threaded rods, and M3 steel clevises and nuts at both ends. If you use a full metal servo arm, then you may need to use a wider clevise with a separate pin and E-clip, because of the thickness of the arm and the sizes of the holes - as shown on the SWB arms here. This also applies to the aileron horns, of course.

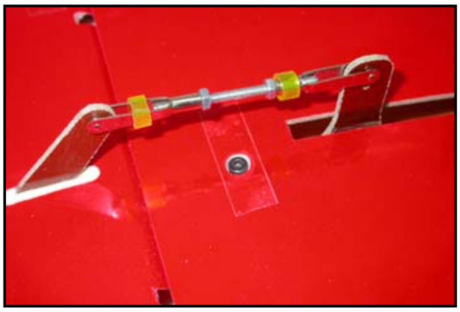
Control Horns

The slots for the phenolic elevator control horns are already partly milled in the elevators for you, and may be adjusted or repositioned if required. Extend the slot for the elevator horn to least 20mm deep, using a Dremel mill or small Permagrit file, checking alignment with the servo arm/linkage as you work. Trim the length of one of the phenolic control arms so that the hole for the clevise is approx. 25mm from the surface of the elevator, and rough-sand the part that will be glued into the balsa block inside the elevator. Ideally the hole in the horn for the clevise should be exactly perpendicular to the centre of the hinge tube.(see P7)

Wax the area with clear car wax, cover with a layer of plastic parcel tape over the area of the milled slot, re-wax the tape carefully, and then cut through the tape with a very sharp knife to allow the horn to be glued into the slots. The tape stops excess glue getting on the painted elevator, and makes the clean-up easy and quick.

(above) You can ONLY use a ball-link on a full metal servo arm to adjust linkage alignment. Do NOT use on phenolic arms or horns.
(below) Use brown parcel tape and a coat of clear wax to protect paint & make easy clean-up when gluing in all control surface horns. (NB: Extra 300SX shown here)

(above) Elevator horn alignment template from scrap plywood. Line is hinge tube axis. Use for both elevators to ensure same throws.
(below) Stab retaining bolt, with clear tape over it secure for flight. The small pieces of tubing stop the quick-links from opening.



Make up the servo linkage from the hardware provided, and connect your servo arm to the control horn, which helps to hold the horn in exactly the correct position while the glue cures. Fill the slot in the elevator with slow epoxy and micro-balloons (at least 30 minute cure), or a thixotropic resin like Loctite Hysol 9462, insert the horn, and then wipe away excess glue. Check that it is aligned perfectly with the linkage, the clevise hole is 25mm from the surface of the elevator, and is perpendicular to the hinge axis. View from the back or front to check that the horn is at 90 degrees to the surface of the elevator. See photos P6 and P7 for ideal linkage.

When cured, remove the plastic parcel tape and make a template, as shown above, so that you can copy the position to the horn on the other elevator. In this way you will get exactly equal elevator throws without lots of mixing and linkage adjustment when setting up your plane. You can make the template from scrap plywood, and use an old 1.5mm (1/16") drill bit to insert into the clevise hole, secured with a drop of CA. Using the template, glue the horn into the other elevator in exactly the same way.

The linkages between the servo arms and elevator horns are made from the 45mm x M3 all-thread, with 2 steel clevises and 2 x M3 nuts for each stab. 'Loctite' the quick-link and lock-nut on one end of each linkage. If using full metal arms, like the SWB arms shown, you will need to replace the steel clevise on the servo end with a larger type as shown here. If using clevises with aluminium pins in aluminum servo arms, we highly recommend that you apply a little grease on these joints to give smooth movement and prevent any chance of the aluminium pin binding in the servo arm hole.

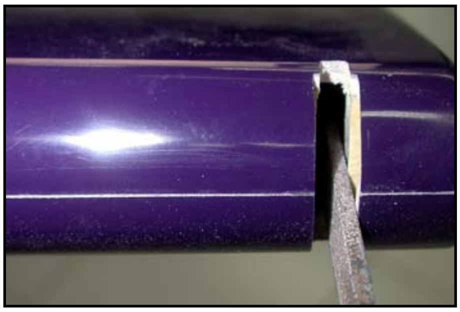
* *Use this same technique described above, using templates for the inner/outer aileron horns.*

Throws

If you need more travel on the elevators than the factory assembly allows (about 40°) you will need to increase the length of the slots in the composite/balsa false leading edge of the elevators with a small file. The outer 2 slots in particular will need to be longer, and you can extend them almost right out to the composite skin. Unfortunately it's not possible for us to mill these slots longer during manufacture - as the L.E. spar would fall apart on the CNC milling table. However, this is a very quick job with a Permagrit file, or similar (see photos right), and you can easily achieve 50 degree throws if you wish.

Note: Several photos of the stabs in these instructions show the 1.5" SWB arms on JR8511 servos, with the clevise in the outer hole - and this was used for extreme testing of the model and stabiliser servo system, with more than 50 degrees throw possible.

(above/below) You can increase available throws by lengthening the slots in the leading edge of the elevators, especially the 2 outer slots. Use a fine flat file, such as a Permagrit, and be careful not to make the slots any wider. (Extra 300SX elevator shown)



Stab Tube

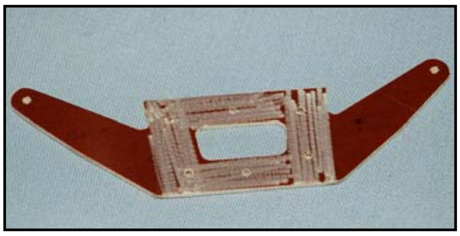
The last job is to fit the M3 stab retaining bolts. Inside the stabs you will see the small ply reinforcement plates between the spar sleeve and the bottom surface of the stab. Mark the bottom of both stabs in the centre of this plywood. Install the aluminium tube into 1 stab, and drill a 2.4mm hole right through the stab surface, the plywood plate, fibreglass sleeve and the 20mm aluminium tube. The centre of the hole will be 26 - 28mm from the stab T.E. Thread the hole with an M3 tap and secure it with an M3 x 16 bolt. Then glue an M3 blind nut (included) inside the spar tube, with some 30 minute epoxy and micro-balloons. Wax or oil the bolt first! Fit both stabs to the fuselage, check that they fit tightly to the fuselage at the roots, and then drill the hole in the other stab and spar tube, and tap the thread as before. Counterbore the holes in the bottom surface of the stabs for the boltheads so that they sit flush on the small plywood plates.

(below) M3 blind nut glued into elevator spar tube.

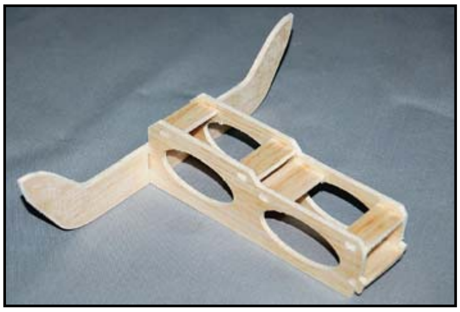
TIP: Try to always leave the stab tube fixed into one stab, and never remove that one bolt, as it is difficult to find the right position for the stab tube again if it is removed from both stabs!

Rudder

Trial fit the the double-sided phenolic control horn in the slot that is already milled in the base of the rudder, mark the central part that will be glued in, and scuff it well with coarse sandpaper. There is a balsa block above the horn position inside the rudder, and this should also be scuffed with sandpaper or a small file. Adjust the milled slot in the rudder so that it is a little higher than the phenolic control horn thickness, so that all the glue is not scraped off the horn when you insert it into the rudder !



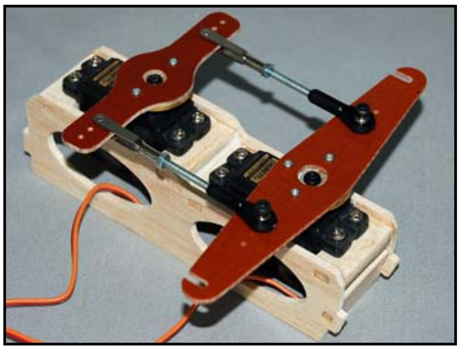
(above) Scuff up the gluing surfaces on the phenolic rudder horn and glue into the slot in rudder.
(below) The Tank base/Rudder tray is assembled from the milled parts included. Shown here with the bulkhead glued to the front of the tray, for fitting in the rear position (for large motors)



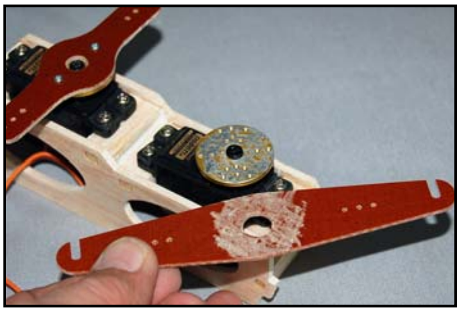
Cover the rudder both sides around the slot area with masking tape, wax the area, and then cut through the tape to expose the slot with a sharp knife - in the same way as described for the elevators. You can also protect the outsides of the phenolic horn with tape, and this makes it easy to clean off excess glue afterwards. Glue the horn in position with slow (min. 30 minute) epoxy & micro-balloon mix, making sure that it is perfectly centred and level in the rudder. (Photo P8.)

When the glue has cured, fit the rudder to the vertical stabiliser with the Ø 4mm aluminum hinge tube. Check for smooth movement. You can increase the lengths of the slots in the rudder L.E. in same way as for the elevators for extra throw if necessary.

The rudder servo mounting tray can be installed in 2 different positions, and the milled parts are supplied for both options. If using a lightweight engine, such as the 3W shown here, you will definitely need to install the rudder tray as far forward as possible for correct Centre of Gravity, against the back of the landing gear mount. If using a 100 - 125cc twin, then you may be able install it at the back of the cockpit, as shown in the photo right, but this will also depend on the weight and position of your batteries and exhaust system.



(above) Make sure that the phenolic arms are parallel when you glue them onto the discs.
(below) Scuff the discs and arms before gluing. Secure with at least two M2 bolts provided.



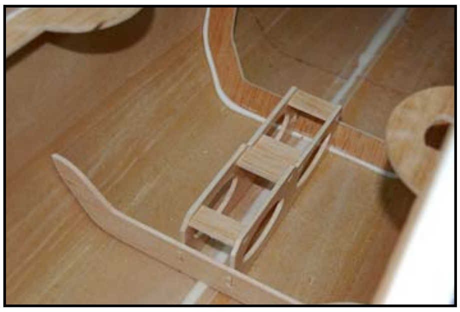
Assemble the tray and install the servos and phenolic arms outside the model, and decide which position you will install it in. Lightly sand all composite balsa milled parts, and glue together with thin CA. Add the 3mm thick plywood strips underneath each servo rail, cut from the 12mm wide ply strips provided. Then reinforce all joints with 30 minute epoxy. (see photo P9)

Servos

The recommended choice of servos is similar to that for the elevators, either a pair of JR/Graupner 8411/8511/8611's or a pair of Futaba S9351's.

Servo arms

The supplied phenolic rudder servo output arms ***must*** be bolted to 1" or 1.25" diameter metal servo output discs in the same way as the elevators. We used 'Hangar 9' # 3520's. Please do ***not*** use the standard plastic discs for this, as there is a chance that the internal plastic splines can be stripped by the current hi-torque servos - causing instant rudder flutter, and probable loss of your plane.



(above) Rudder tray and sub-bulkhead shown in the (optional) rearwards position.

Fit the 2 rudder servos into the tray, with the output shafts nearest to the tailplane, and screw into position using the 2.9mm Ø x 13mm long sheet-metal screws supplied. Fit the metal servo discs, and centre both servos using your R/C. Rough sand and clean the bottom surface of the 2 phenolic horns, and the top of the metal discs.

With the R/C still switched 'ON', place the C-ARF rudder servo horns on top of the output discs, with the 'hooks' of the back arm facing forwards, and align them exactly parallel. Tack glue the phenolic arms on top of the output discs with a couple of drops of thick CA. When the glue has cured, remove the arms and discs, drill through both and secure with at least 2 small bolts, washers, locknuts and Loctite (M2 bolts and nuts included). Finally add a drop of Loctite to the bolts that secure the discs to the servos.

Make up the linkages between the phenolic 2 arms from the M3 ball-links, threaded rod and steel clevises included, as shown above. You will need to drill the inner holes on the back arm out to 3mm diameter for the M3 x 16mm bolts that secure the ball-links. Fit just one of the linkages between the phenolic arms, and adjust the length of the linkage very carefully until so that there is minimal buzzing or humming from the servos at idle, and at full throw. When satisfied, add the other linkage and follow the same method of adjustment.

Install the completed tray in the fuselage, prepare the area for gluing with sanding, and glue the assembly in position with at least 30 minute epoxy. Fit the small balsa sub-bulkhead to the back of the tray if in the forward position, or the front if the tray is in the rear position (photo P10).

The pull-pull cables that connect the rear arm to the rudder horn should be crossed, so that they exit under the stabs. With the rudder servo tray fitted in the forward position, then the back of the slots that you must cut for the pull-pull cables to the rudder is 195mm (7 3/4") forward of the back edge of vertical fin, and 40mm (1 5/8") up from the bottom of the fuselage. If the servo tray is in the rearwards position, then the slots will need to be about 10-15mm further back. Cut out a small slot first with a very sharp knife, check the position using the pull-pull wire, and then adjust and open up the slots with a small file as needed. The slots should be about 3mm high and 35mm long.

(below) Cable exit slots in the fuselage, for the rudder servo tray in the forwards position. Slots move back approx. 10mm for rear tray position.

Make the pull-pull wires from the hardware supplied, with a loop at the front that goes over the hooks on the output arms, and a quick-link with threaded extender (turnbuckle) and locknut at the rudder end.

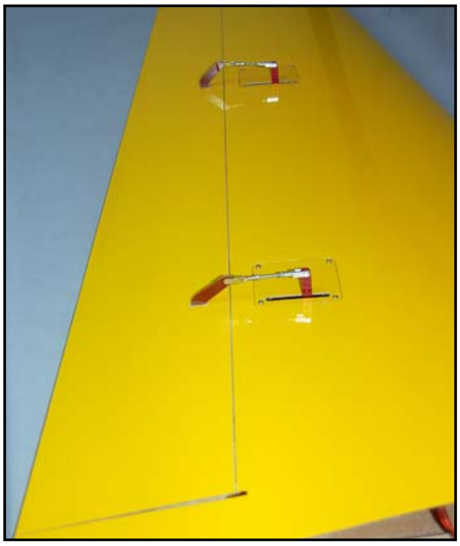
Pass the closed loop cable through the supplied 'crimping tubes' 2 times before squashing flat with pliers (see photo). Make sure that the wires are tight, and check and adjust after the first few flights as the cables straighten out. Even a small amount of slop will prevent your Extra from perfect tracking. You can glue a very small scrap of ply or balsa across the front of the slots on the servo arms with a drop of CA to prevent the wires coming out of the slots accidentally.

Wings

The wings are 95% finished at the factory, and have already been installed on your fuselage to set the alignment. Slide the wings onto the wing tube, fit the 4 plastic wing retaining nuts onto the M6 threaded aluminium wing dowels, and check for a perfect fit. You can sand the edges of the wing roots a little if needed.

Wing Tube

The wing tube is a 40mmØ T6 alloy tube, which slides inside a fibreglass tube in each wing, and it should be 980mm (38.5") long. Please check the length to make sure that it passes through *both* plywood ribs in the wing, that are about 325mm (13") from the root, otherwise the wing could fail in flight.



(above) Each aileron has 2 servos, mounted on hatches in the moulded-in pockets in the wings.

Each wing has 2 servos for each aileron, and the openings for the servos and hatches are already pre-cut in the wing for you, and supplied with matching servo covers and milled plywood servo mounts (photo P11). Sand and clean the inside surface of the servo hatch covers very well, and the milled plywood parts that make up the servo mounts to make sure you have a good gluing surface. This is very important ! We highly recommend that you mark the 4 hatch covers now so that they are always fitted in the correct positions (eg: Starboard Inner/Outer etc).

Servos

The choice of servos is similar to that for the elevators, a pair of JR/Graupner 8411/8511/8611's or a pair of Futaba S9351's in each wing. The servos are installed with the output shafts towards the wing leading edge. The ailerons have enough torsional flexibility to prevent servo damage if each pair is not perfectly matched.

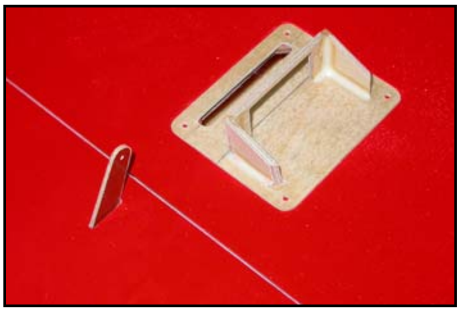
Servo arms

To obtain the maximum possible aileron throws quite long servo output arms are needed (30 - 35mm/1.25 -1.5"). In the kit we supply phenolic servo arm extensions for this purpose, which can be fitted onto your servo output discs to achieve the throws. However, it is ***mandatory*** to secure these to metal servo output discs, or to use full metal servo arms (like those shown from SWB) - and ***not*** the standard plastic output discs supplied with the servos. Secure the phenolic servo arm extensions to the metal output discs in the same manner as used for the elevators, centering the servos with the R/C and making sure that all 4 arms are all at 90° to the side surface of the servos.

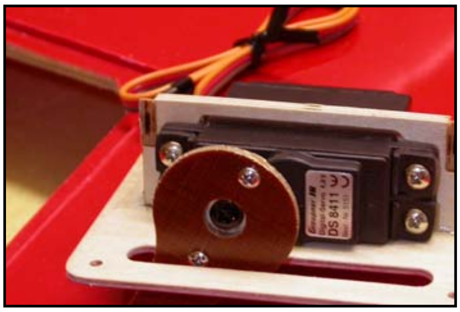
Assemble the servo mounts from the 3 CNC milled plywood parts supplied for each servo, using thin CA, as shown in the photos here, and P11. Fix the servos into the mounts with the 2.9mm Ø screws provided in the kit, and secure your chosen type of servo output arm to the servos.

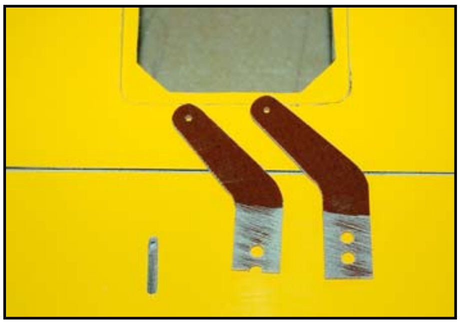
Place the servos in their mounts on the inverted hatch covers to check the alignment so that the servo output arms are exactly in-line with the pre-milled slots in the wing for the control surface horns. The same principles apply here as for the elevators, and you can adjust the slots in the ailerons, or the slots in the hatch covers slightly, if necessary, depending on your servo arm type. Tack the mounts in place onto the hatch covers with a drop of thin CA.

When satisfied, glue the servo mounts to the hatch covers permanently, with thin CA, and then remove the servos, and reinforce the glue joints between the servo mount and the servo cover plate with slow (at least 30 minute) epoxy and milled fibre, with a nice glue fillet all around. These are important glue joints!

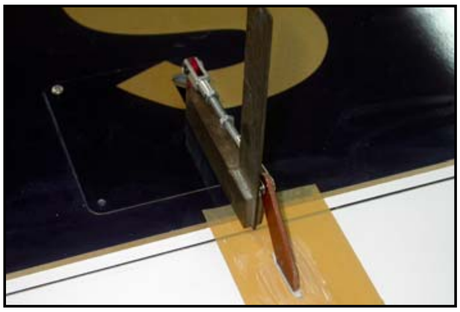


(above) Adjust position of servo mounts on hatch covers so that servo output arms align exactly with phenolic aileron horns.
*(below) Phenolic servo arm extensions may **only** be fixed to metal servo output discs.*





(above) Aileron horns must extend into the wing by at least 18mm (3/4"). Inner & outer horns shown.
(below) Make sure control horns are perpendicular to aileron surface and parallel to servo arm.



Each servo hatch is fixed to the underside of the wing with of the 4 sheet-metal screws provided, Ø2.9 x 10mm. These servo mounts allow you to change a servo within a few minutes, if needed, easily within the time between 2 flying rounds of a contest.

Control Horns

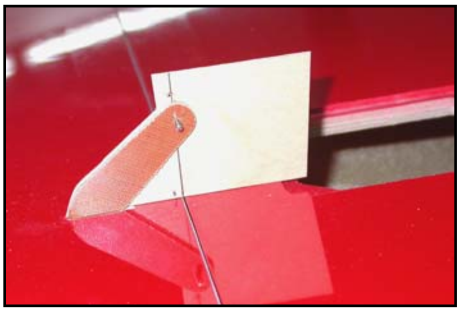
The slots for all 4 phenolic control horns are already partly milled in the ailerons for you, but may be adjusted if required. Extend the slots for the horns to least 18mm (3/4") deep, using a Dremel mill or small Permagrit file, checking alignment with the linkage as you work.

Fit *just one* inner control surface horn to start with, using the same method as described for the elevators. Trim the length of one of the phenolic control arms so that the hole for the clevise is approx. 23mm from the surface of the aileron, and rough-sand the part that will be glued into the balsa block inside the aileron. Ideally the hole in the horn for the clevise should be exactly perpendicular to the centre of the hinge axis on the top of the wing. (P12)

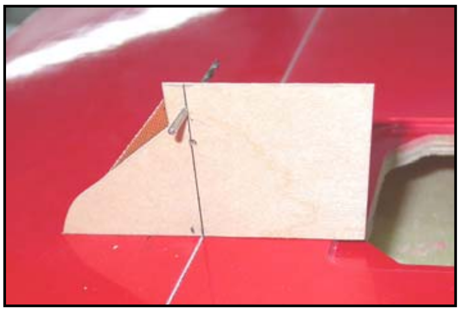
Use a layer of parcel tape and clear wax to protect the aileron surface. Install the corresponding servo and hatch, make up the linkage from the M3 clevises, 45mm long threaded rod and nuts provided - and connect the linkage from the servo arm to the control surface horn while the glue is curing to help maintain perfect alignment. When cured, remove the plastic parcel tape and make a plywood template, as shown right, so that you can copy the position for gluing in the inboard horn on the other aileron.

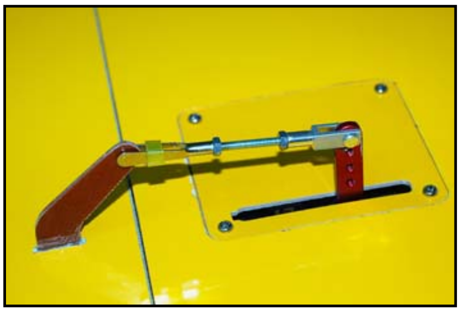
The 2 outer control surface horns are completed using the same method, first finishing one, and then using a template to glue in the other one. However, the distance between the clevise holes in the phenolic horns to the hinge axis line (*top* surface of the wing) should be the same for the inner and outer horns. However, because the wing/aileron is *7mm (5/16") thinner* at the position of the outer horns, these outer horns must project of the aileron *7mm more* than the inner horns. This is to ensure that the aileron servo throws are similar and that the servos don't 'fight' against each other.

Because of the difference between the inner and outer horns, the easiest method is to make the template for the inner horns and glue them both in place first, and then drill another hole in the same template *7mm* higher, exactly on a line drawn on the template that is perpendicular to the hinge axis - and use this for the outer horns.

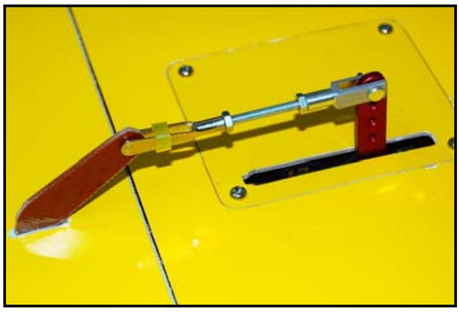


(above) The aileron horn template used to position the inner horns for gluing in place. The line is perpendicular to the hinge axis.
(below) Same template, with an extra hole drilled exactly 7mm higher, for installing outer horns.





(above) Outer aileron horn. Clevise hole is 30mm from aileron surface.
(below) Inner aileron horn. Clevise hole is 23mm from aileron surface.



Engine and Exhaust Installation

We strongly advise you to complete the motor and exhaust installation before the fuel tank base is installed, as it provides much easier access.

The most commonly installed motor in our 2.6m Extras seems to be the DA-100, very often with a pair of MTW TD75k canisters, and this is an excellent combination. We have shown photos of the installation of this popular set-up below.

For the 260 prototype we chose to use a single-cylinder 3W 80cc Xi, and single 'Greve' tuned pipe set-up, to show a lightweight and lower cost option. This has proven to be a very nice combination, having plenty of power - and a weight reduction of about 800 grams over the DA-100 version. Full details of this installation are also described below. Any similar 75 - 85cc single-cylinder motor could also be used, for example the ZDZ 80 or the EVO80.

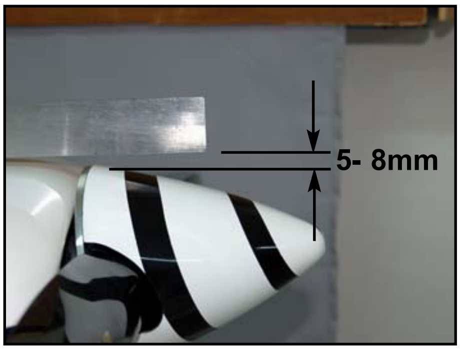
The complete motor-dome is an integral part of the fuselage molding - which saves weight, increases rigidity and ensures accurate alignment of the firewall. The front face of the molded motor-dome/firewall on the Extra 260 is set at 0 degrees downthrust, and 0 degrees sidethrust.

Whichever motor you are using the vertical location of the centre of the motor on the firewall can be set as follows: Lay a steel straight-edge on top of of the fuselage (on the joint seam) in front of the canopy as shown in the photo above, and measure vertically downwards 88mm. If using a 120mm diameter spinner (as we used here) this will make the top edge of the spinner backplate about 5 - 8mm below the top surface of the installed cowling.

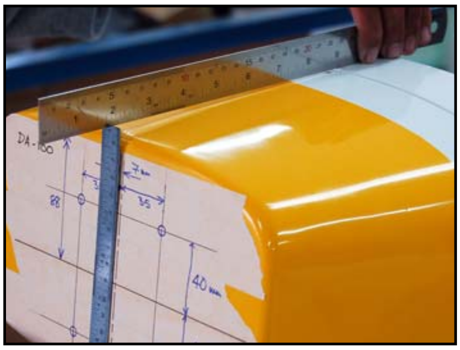
If you are using a smaller diameter spinner, then you can raise this line by half of the difference in diameter between your spinner and 120mm. Mark the horizontal centreline (for your choice of spinner diameter) on the tape on the front of the firewall now, making sure that the line is level by eyeing thru' a steel ruler and the wing tube.

The side-to-side location of the centre of your motor is also easily set. It is 7mm to the (pilots) left of the central vertical seam of the motor-dome. (see photo right). With the correct length stand-offs to set sidethrust at 2.5 - 3 degrees then spinner will be centred on the cowling horizontally.

Note: We installed both motors in the same fuselage for these instructions, so you may notice some extra holes and cutouts in the photos.

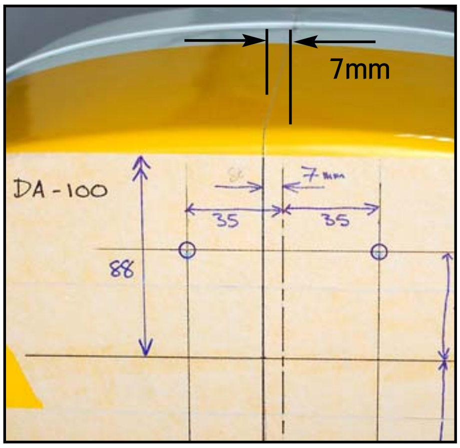


(above) The top of the spinner should be about 5- 8mm below a straight edge laid on the cowling.



(above) For a 120mmØ spinner, measure 88mm down from a steel straight edge placed on the fuselage in front of the canopy frame. This is the vertical centreline of the motor position.

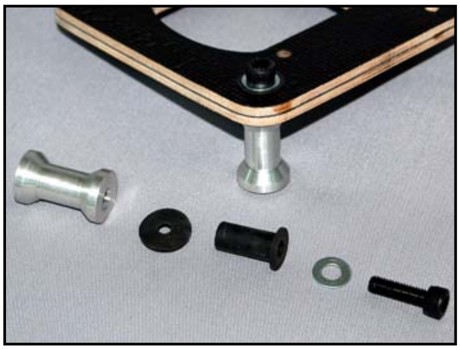
(below) The side-to-side centre of the motor should be 7mm to the pilots left of the motordome seam. The cutout shown here is for the rear-mounted 3W carburettor.



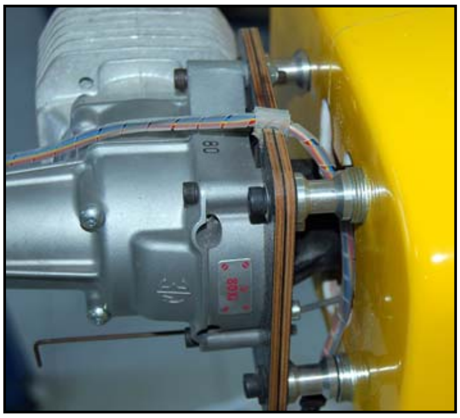
3W 80cc Xi.

For this set-up we used a C-ARF 120mm diameter carbon spinner (# 810105), a Greve tuned pipe (# 910200), with the original manifold supplied with the 3W motor, and a Mejzlik 27 x 10 carbon 2-blade prop.

3W state in their instructions that the engine must not be mounted directly to metal stand-offs, as unequal lengths, or unequal tightening of the bolts could cause crankcase distortion. Therefore we made a mounting plate from 2 layers of 3mm carbon-composite plywood, glued together with 24hr laminating epoxy, and bolted the engine to this with M5 bolts, washers and lock-nuts. Then the carbon-ply mounting plate was secured to the firewall using 4 stand-offs of 20mm length, with the M6 bolts and washers included in the hardware. (see P13 - P16)



(above) Shows the order of assembly of the anti-vibration mounts in the carbon-ply mounting plate.
(below) Sidethrust and upthrust are set with stacks of large diameter washers between the 20mm standoffs and firewall. The wire below operates the choke.



(above) Shows the cutout for the 3W carb, and also the holes from the DA-100 mount plugged with 6mm hardwood dowels.

As it is a single-cylinder engine we chose to use anti-vibration mounts in the carbon-plywood mounting plate, made from the usual 'well-nuts' (or short lengths of hard silicone or rubber tube) to isolate the mount from the firewall, and it certainly does helps to prevent transmission of vibrations to the airframe.

Four 9.5mm diameter holes were drilled in the carbon plate for the M6 bolts, and the well-nuts were inserted from the front face, with the excess length trimmed flush with the back surface. The M6 bolts should be a fairly tight fit inside the well-nuts or tubes used. If you use short lengths of hard rubber or silicone tube, instead of the well-nuts, then you will need to add a rubber washer on the front face, instead of the flange on the well-nuts. Rubber washers can be easily cut from motorcycle tire inner tube with a sharpened brass tube. An M6 steel washer is used on the front face, under the head of the M6 bolt.

On the back face, between the carbon/ply plate and the aluminum standoffs, another 16mm (5/8") Ø rubber washer was added. Use Loctite on the M6 bolts that pass thru' the isolation mounts in the carbon plate to secure them firmly into the stand-offs - and be careful not to tighten the bolts up so much that you completely compress the rubber and eliminate the anti-vibration system! Make sure that you add Loctite to all the M5 and M6 engine mounting bolts, and check them regularly. The photo (above) shows the order of assembly of the parts.

You need to cut a hole in the firewall for the rear-mounted 3W carburettor, and the 3W instructions include a full-scale drawing of the engine mount positions and carburettor which is very useful when making the mounting plate and carb cut-out. We *highly* recommend that you fuel-proof all bare wood inside the motordome/tank base area with a thin coat of laminating resin, as these carbs can spray a thin mist of gas (petrol) from the venturi.

To set the sidethrust we added a stack of large diameter washers between the left-hand two standoffs and the firewall, of 5.5mm thickness. To add a very slight upthrust, we also added one thin washer (0.7mm thick) behind the lower 2 standoffs. These can be adjusted by adding or removing washers to finalise the thrustline after first flights.

The header/manifold used was the original aluminium PEFA item, supplied with the motor. If used, you will need to carefully bend it - opening up the bend a little, to fit as shown in this installation. Approx. dimensions of the header used are on page 45 oif this Instruction manual.

Tuned Pipe.

Although a bit more complicated to install than a canister muffler, we fitted a tuned pipe as it gives some increased power, improved throttling characteristics and reduced noise levels - especially important in Europe where there are quite strict laws on this. We used the Greve pipe as it is quite small diameter (49mm). Using the layout shown here you would be able to install a pipe of up to about 55mm diameter. You must maintain a gap of at least 6mm between the pipe and the wing tube sleeve, and also above the landing gear mount and carbon legs.

The pipe is supported at the front and back on 2 cnc milled plywood mounts which are included in the kit (to suit Ø 49mm pipes), together with enough of the 10mm Ø hard silicone tube to make the isolation mounts. Cut the silicone tube into 20mm lengths and insert in the milled slots as shown in the photos below/right. The front pipe mount is secured to the back face of the plywood landing gear mount with 2 large sheetmetal screws (Ø 3.5 x 18mm).

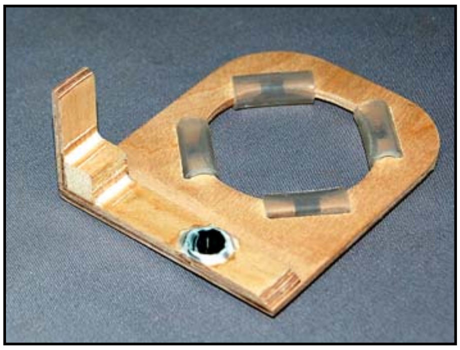
The rear mount must be secured to a 3mm thick plywood reinforcing plate (cut from the 12mm wide strip supplied) glued firmly onto the side of the fuselage, on the back face of the rear cockpit bulkhead, as shown - and you can use two of the M3 bolts and T-nuts included in the spare hardware pack for this.

Make sure that the tuned pipe cannot move forward (or backwards) and touch against the end of the manifold, as the metal-to-metal contact could cause terminal R/C interference! 2 small sheet metal screws through the teflon joiners and pipe/manifold side walls prevent this.

Canister mount

Depending on your motor and header, you should find that a single canister (MTW TD110K shown here) will fit in front of the wing tube sleeve, but you will may need put the canister on the opposite side of the fuselage to the cylinder -

(above) Prevent the canisters or tuned pipe moving forwards or backwards with 2 small sheetmetal screws thru' the teflon coupler. (below) Rear pipe mount is secured with two M3 bolts and T-nuts to a 3mm thick plywood plate glued securely to the fuselage side behind the rear cockpit bulkhead. (only 1 T-nut shown here)

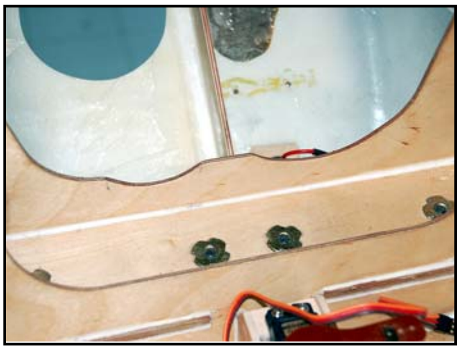


(above) Front pipe mount is screwed to back of LG mount.

and use a 'cross-over' header to give you enough length.

Included in the kit is one cnc milled plywood mount to suit the TD110K, or similar 80mm diameter canister. Insert 20mm lengths of the hard silicone tube in the corner slots to make the isolation mounts, in the same way as shown for tuned pipe mounts. The plywood mount can be screwed to the front of the landing gear mount bulkhead with 2 of the Ø3.5 x 18mm sheetmetal screws included in the hardware pack. 2 small holes drilled in the bottom of the motor dome allow access from the front with a long screwdriver. If necessary you can sand a small notch in the top of the forward landing gear mount bulkhead to maintain at least 6mm clearance between the plywood and the canister/pipe.

(above) A single 80mm Ø canister (TD110K shown) can be fitted - but you may need to use a cross-over header to get the correct length.
(below) You can sand shallow notches in the forward landing gear mount, if necessary, for exhaust system clearance.



Desert Aircraft DA-100

The DA-100 installation and set-up uses the same principles and motor centreline positions as detailed above. Because it is a twin-cylinder motor it has lower vibration levels and it is not necessary to incorporate an anti-vibration mount. The motor fits fully enclosed in the cowling (see P20). For this set-up we recommend a C-ARF 120mm diameter spinner, MTW TD75k cans and headers, and a Mejzlik 28 x 10 carbon 2-blade prop.

Mark the horizontal and vertical motor centreline positions accurately on the front of the firewall in same manner as described at the beginning of this section, dependant on your spinner diameter. The 4 mounting holes for the DA-100 are 70mm apart horizontally, and 80mm apart vertically. Mark half of these dimensions equidistant either side of the centrelines and bolt the motor to the stand-offs. Drill the 4 mounting holes through the firewall, 6mm diameter, and secure the 20mm long standoffs using the M6 x 16mm allen bolts and washers supplied in the hardware pack, with a little Loctite for security. Set the side and up thrust using stacks of large diameter washers, in the same way as described above. (see photos P17, P18 and P19)

(below) MTW headers & canisters are available as optional items from C-ARF. Shown here are the TD75K cans and headers for the DA-100.

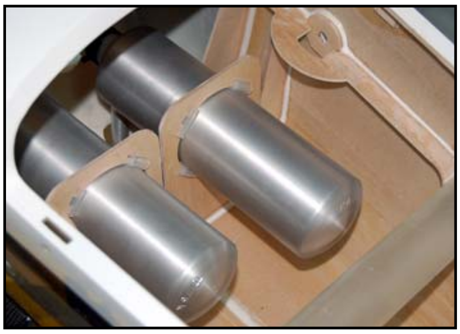
Fit your headers/manifolds to the motor and cut the necessary holes in the lower part of the motor dome to suit.

Canister and Header Installation

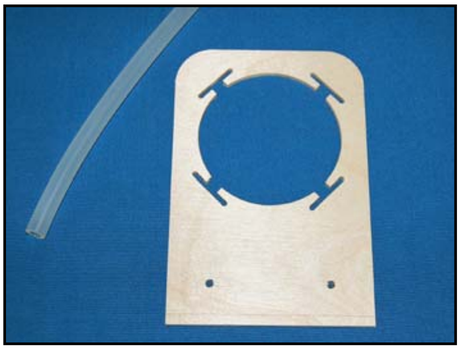
Shown here is the installation of a pair of MTW headers and TD75k canisters, as included in the optional set available from Composite-ARF. (see relevant webpage for details of currently available accessories & options).

The assembled canisters and headers are inserted into the fuselage through holes that you need to cut in the lower surface of the motordome, as shown in the photo below, but do not cut through the 25mm fibreglass joining tape in the centre of the motordome.

Included in the kit are 2 cnc milled plywood mounts to suit the TD75K canisters, or similar 70mm diameter cans (eg: Zimmerman). Insert 20mm lengths of the (included) hard silicone tube in the corner slots to make the isolation mounts, in the same way as shown for tuned pipe mounts. The plywood mounts can be screwed to the front of the landing gear mount bulkhead with 2 of the Ø3.5 x 18mm sheetmetal screws included in the hardware pack. No other support is needed. Install 2 of the small sheetmetal screws though each the teflon joiner into the canister entries and headers to make sure that the cans cannot slide forwards or backwards.



(above) Plenty of room to install a pair of MTW 75K cans in front of the wing tube, supported with the milled mounts supplied in the kit.
(below) Typical cnc milled plywood canister/tuned pipe mount & hard silicone tubing included in the kit to suit Ø 49mm pipes, and both Ø 70mm & 80mm canisters.



Motor Cooling

It is imperative that your chosen motor not only receives sufficient air to cool it through the opening in the front of the cowl, but that the air is forced to go through the cooling fins of the cylinder(s) - otherwise the air will just take the easiest route and exit the bottom of the cowl without doing any cooling. In this case you will overheat, and damage, your valuable motor.

Depending on your motor you will need to make some sort of baffle to force the air through the cooling fins, and this can be made from scrap 1.5mm plywood or 3mm balsa. The full-size template at the end of this manual fits the cowling, positioned about 6mm below the bottom of the front cutout, and the back edge of the baffle can be adjusted slightly to suit your chosen motor.

Make the back edge of the baffle about 6mm (1/4”) clear of the cooling fins of the cylinder(s) and the crankcase. Glue the baffle plate into the cowl with epoxy. It looks neater if you paint it matt black first, using heat-proof spray paint (as used for car manifolds/exhausts).

(above/below) Baffle installed in the cowl for the 3W motor.

The air exit at the bottom/rear of the cowl is rather small on the Extra 260 and, especially if you fly in a warm climate, we recommend that you extend it to the front by 50mm - as shown in the photo below. Cut the cowl, following the shape of the original molded sides as shown.

Exhaust Cooling

Whatever type of exhaust system you chose to fit, make sure that the assembled headers and canisters, or pipe, can be inserted from the front, through the motor-dome - and make the hole(s) at least 18mm (3/4”) bigger than the exhaust all around to ensure enough air enters the fuselage to cool the exhaust system. For the tuned pipe set-up described above, we cut a hole of 85mm (3.25”) diameter.

Of course, this warm air must also exit the fuselage - so you also need to cut sufficient air exits in the bottom of the fuselage. As a general rule the total area of the air exits must be *at least* double the inlet area. For example if the hole in the motor dome for the tuned pipe is 75mm (3") diameter (area = 4400mm^2), then the total air exit area should be minimum 8800mm^2. This is equal to 2 slots of 50mm (2") wide x 90mm (4") long. The slots shown here for the single tuned pipe are 35mm wide and 150mm long.

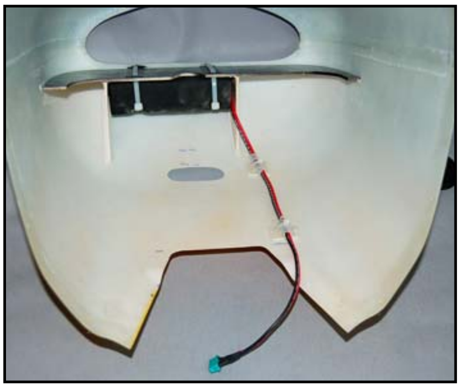
The balsa fin post also has cnc milled cut-outs in it, to help prevent a build-up of hot air inside the fuselage. From our experience we have found that 2 slots, each of about 150mm x 35 - 40mm wide provide excellent cooling for both the 3W and DA-100 set-ups shown here. If you fit dual canisters, then the slots will need to be positioned just behind the landing gear mount, either side of the rudder servo tray.

Cut the air exit slots in the bottom of the fuselage with a sharp knife, or mill with a dremel tool, and sand the edges to shape with 240 grit sandpaper - remembering to radius all the corners to help prevent tearing of the composite sandwich skin. It is advisable to reinforce the edges of the cutouts inside the fuselage with a few carbon rovings, or narrow strips of plywood. (photo P21)

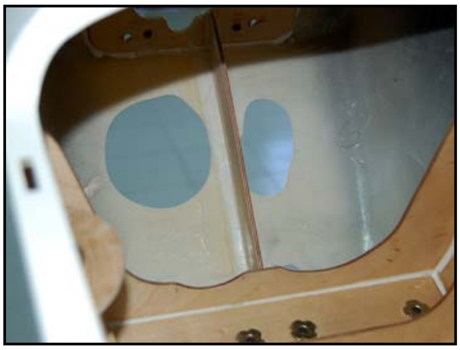
It is also helpful to make small tabs at the front of the cooling slots to make sure that the warm air is sucked out of the fuselage. These can easily be made by making 2 cuts in the skin, about 20mm long, bending the skin outwards about 30 degrees, and creasing the inner surface with the back (blunt) edge of the knife blade. Hold in position, and apply a couple of drops of thin CA to the sandwich from inside the fuselage to maintain the angle. (photo above)

Firewall Brace

Included in the kit is a milled 3mm thick plywood firewall brace, which should be securely glued between the bottom back edge of the firewall and the front of the landing gear mount, with slow epoxy and micro-balloons mixture. You may need to adjust the length slightly due to manufacturing tolerances. This brace helps to eliminate vibrations, and is especially important if you fit twin canisters as there will be 2 quite large holes in the bottom of the motordome.



(above) Extend the exit in the bottom of the cowl by 50mm, following the line of the original moulding for additional cooling. Note the Ignition Nicad securely fixed to the bottom of the baffle, and small slot for access to the choke arm.
(below) Radius the corners of all air exits, and cut angled tabs at the front to create some turbulence & make sure the air is sucked out.



Glue the plywood brace securely between the firewall & LG mount.
(below) The milled plywood firewall brace is supplied in the kit.

Fuel Tank Base

The Fuel tank base supplied is a cnc milled balsa/composite assembly, that also provides space for mounting the receiver and Powerbus system. It is reversible - so you can fit the Rx and Powerbus on either side of the fuselage.

It is sized to fit a Dubro 950 cc tank (part #690), but can be adjusted to suit your choice. Depending on the size of your fuel tank, glue a scrap balsa block at the front of the tank base to stop the tank moving forwards. Secure the fuel tank to the tank base with cable-ties through the milled slots, as shown in the R/C installation section.

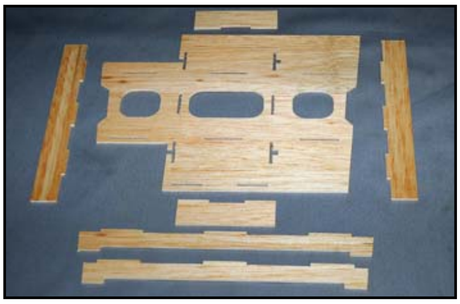
Lightly sand all the parts, assemble with thin CA as shown, and then reinforce all joints with a fillet of 30 minute epoxy and micro-balloons. If fitting a motor with a rear mounted carburettor - then don't forget to seal the bare edges of the balsa sheet with a brushed-on coat of thin epoxy.

You can choose to permanently glue the tank base in place to the sides of the fuselage, or make it removable - which is more convenient for maintenance and access - especially if you have the rudder servo tray in the forward position.

If you want to make it removable you can use the 10mm thick balsa strip and 8 of the 20 x 20mm milled plywood squares included in the kit to make 4 mounting blocks as shown. Glue 2 of the milled ply squares to the top of each balsa block. Sand the blocks to fit against the fuselage sides, prepare the areas well for good glue adhesion, and glue in position with at least 30 minute epoxy and micro-balloon mixture.

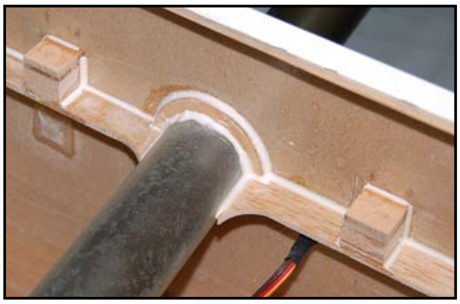
When cured, the complete tank base assembly is held in position with 4 of the large (Ø3.5 x 18mm) sheetmetal screws provided. Use washers under the screw heads, and glue some some scrap 1.5mm (1/16") plywood plates to the top of the tank base in the position of the screws to spread the load over the surface. (see photo right). Make sure that the tank base is very securely fixed in position.

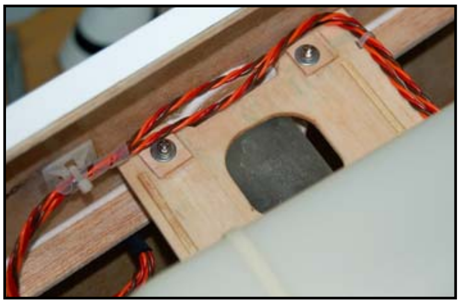
See also photos P22 and P23.



(above) Tank base assembled. Production base is larger giving space for receiver and Powerbox.

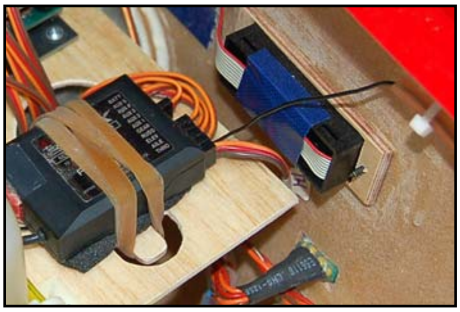
(above/below) Make 4 blocks from the balsa & plywood parts - and glue securely into position.
(bottom) Tank base is fixed to the blocks with 4 of the large sheet-metal screws, and washers.



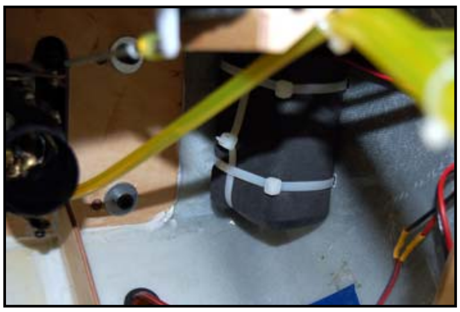


R/C & Gear Installation

(above) There is plenty of space to fit the Powerbox Evolution and Rx on the right (or left) side of the fuel tank base.
(below) An alternative method of securing the Rx to the mounting plate, using 2 rubber bands.



(below) 2 Rx batteries wrapped in foam & secured in cowl with cable-ties for the 3W powered plane.



Everyone has their own favourite methods and layouts when fitting the R/C and gear. The installation shown here, and on the full-color photosheets, are just a guide, but have worked perfectly in all of our planes flown by C-ARF factory staff, and many of our customers.

You have several choices of R/C system. You could keep it simple, and use Dual receiver batteries and a Powerbox sensor switch, which includes a regulator and battery-backer, or you could go for a 'full-house' set-up using a high-quality servo powerbus system for the ultimate in safety and security. It's your choice, but the dual Nicad and powerbus installation does give extra 'peace of mind' and protects your investment, and therefore this is what C-ARF recommend and have shown here.

The PowerBox Evolution power control unit is designed especially for large models and provides dual battery inputs with hi-amp connectors, multiple outputs for 5channels/18 outputs (no 'Y' leads needed), automatic voltage regulation and stability, built-in servo amplifiers for those long servo cables, as well as dual visual LED battery displays. It comes complete with hi-current connectors and is fitted with anti-suppression chokes on all channels. The full 'PowerBox' range is available from C-ARF as an option. Please visit our website for more details.

Ignition Batteries
We always use 2400 (sub-C sized cells) for the ignition system. The 4-cell pack for the DA-100 should be secured inside the front of the motor dome with cable-ties, and the 5-cell pack for the 3W motor was fixed to the underside of the motor baffle plate in the cowling to move it as far forward as possible - for correct Centre of Gravity. Small plywood strips were glued to the balsa baffle to spread the load of the cable ties (photos on page 28 and 29). The battery cable plugs into a Multiplex connector that is glued into the bottom of the motor dome, for ease of removing the cowling.

Receiver Batteries
To save weight in the 3W powered plane, we chose two 5-cell (AA+ sized) 1400 mAH packs - and these were both fixed inside the front of the motor dome, using cable-ties thru' the fibreglass fuselage skin. All battery packs should

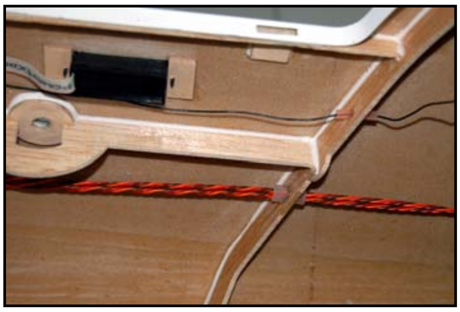
be wrapped in foam to isolate the soldered connections from vibration as much as possible.

For a DA-100 powered example you should find that with all 3 batteries (2400 sub-C size) secured in the cowling, and the rudder tray in rear position, will easily give you the correct forward 'pattern' CG position.

Make sure that all batteries, and other heavy items, are very securely fixed in the plane - remember how much they will effectively weigh when subjected to 4 or 5 G's!

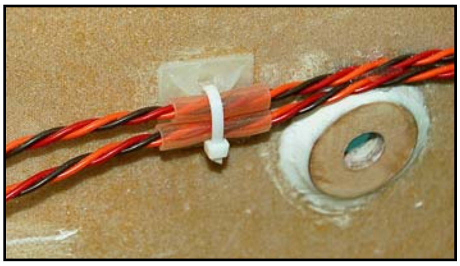
Receiver
C-ARF strongly advise that you position the receiver as far away from the high-voltage ignition unit as possible - at least 200mm (8") for the minimum interference risk. We positioned the Powerbox Evolution and the RX on the balsa-composite plate on the right side of the tank base.

Please mount the sensitive Receiver on a rubber or foam sheet, at least 3mm thick, to isolate it from vibrations. You can easily secure the Rx either using 2 small cable-ties, or by gluing a plywood stick across 2 large holes in the mounting plate - using 2 rubber bands around the Rx case. (see photo above)

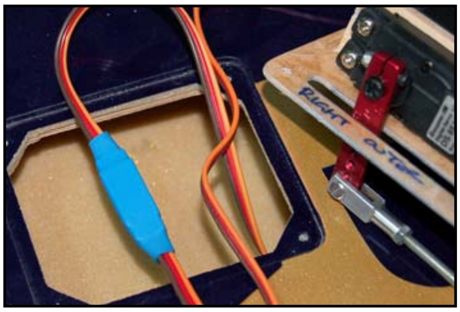


(above) PB Switch mounted in fuselage side, with ply reinforcement. Antenna wire and stab extension cables are routed thru' silicone protection sleeves and fixed securely.

RX Antenna
The Rx antenna was routed to the side of the fuselage, then backwards along the fuselage side and out of the top of the fuselage immediately behind the canopy - and taped to the top of the fuselage. Secure it in short lengths of silicone tube to make sure it cannot be cut through by any sharp edges. Keep it as far away as possible from the cables for the elevator servos and the closed-loop rudder wires.



(above) Protect all wires and tubes where they pass thru' bulkheads, or near sharp composite parts, with a short length of silicone tube, and cable-tie firmly in position.
(below) Secure all hidden servo plugs/sockets with heatshrink.

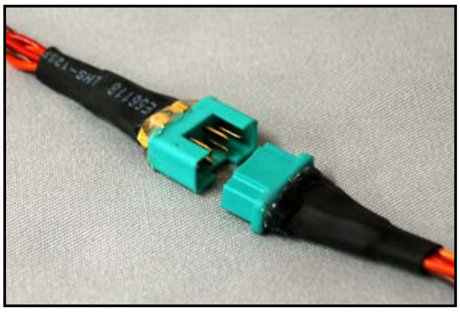


Switches
Often regarded as the 'weakest-link' in an R/C system, it is very important to use quality switches for both Receiver/Powerbox and motor ignition, and we only use high quality switches from Power box. The electronic switch included with the Powerbox Evolution is a 'Fail-ON' type, as is the Powerbox 'Sensor' switch. We use the analog 20 Amp power-switches, also from Powerbox, for the ignition system.

If fitting the switches into the outside surface of the fuselage, as shown, please reinforce the area inside with a small patch of 3mm thick plywood to reduce vibration transmissions to the switches. It only adds a few grams. The Powerbox switches come with paper templates, making it easy to cut the slots in the fuselage accurately.

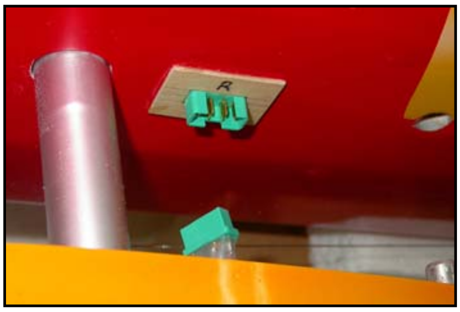
Servo Extension leads etc.
Please make sure that you use good quality twisted-cable extension leads, of heavy gauge wire with gold-contact connectors, to all the servos. Certainly we recommend that all servo leads and extensions longer than about 30cms

(12”) are fitted with ceramic chokes (ferrite rings) to prevent RF noise, at the receiver end - normally within 100mm (4”) of the receiver. Of course, if you are using a ‘Powerbox’ this unit is already fitted with all the ceramic chokes. Also no ‘Y’ leads are needed, as the powerbox provides multiple inputs for each channel.

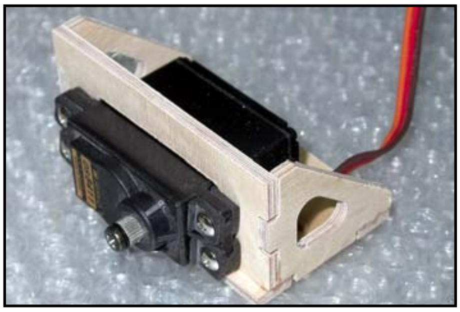


6-pin MPX connectors are used for extension leads, with one half mounted in the fuselage sides.

At C-ARF we hard-wire all our servos with twisted cable leads of the exact length required and Multiplex 6-pin connectors (see photo right). For the 2 aileron servos you can use 1 pin for each wire, and for the elevators you can gently squeeze pairs of adjacent pins together and use a pair of pins for each cable. We glue the female connectors into small plywood plates in the sides of the fuselage for connecting the stabs and ailerons when assembling the plane. Making up the proper extension cables and connectors is only a little work, if you are proficient with a small soldering-iron, and makes assembly of the model at the airfield very quick and easy! Once all wires are soldered to the gold-plated pins, fit a short length of heat-shrink tube over each one. Finally protect all the connections from vibrations etc with a nice blob of glue from a hot-glue gun. Job done.



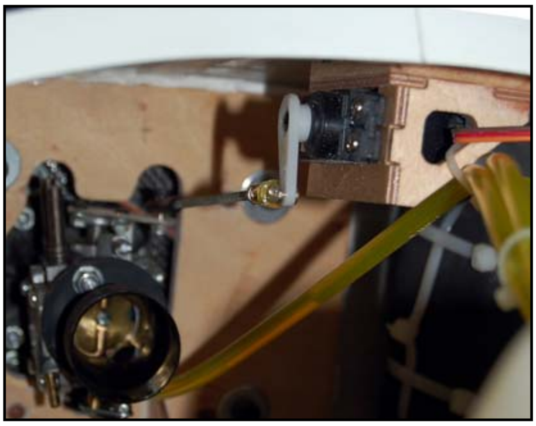
Make sure that any plug/socket servo cable connections that cannot be easily seen and regularly checked, for example the servo connections in the wings, are secured together with tape - or a short length of heatshrink tubing as shown here. Also tape down any loose cables that could get trapped or caught in linkages.



(above) Throttle servo mount assembled from milled plywood. (below) In the 3W set-up this was glued to the top of the fuselage

Throttle servo

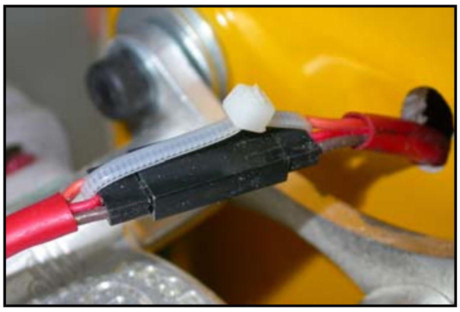
You can install the throttle servo anywhere you chose, using the milled plywood mount that we supply (photo right). In the 260 for the 3W motor we glued it securely to the underside of the top of the fuselage, on a 10mm thick balsa block, with epoxy/milled fibre mixture, in front of the fuel tank.



In a plane with a DA-100 and dual canisters, you could glue the mount to the side of the fuel tank base and use a balsa or carbon-tube pushrod through the firewall to the carburettor. We advise you *not* to mount it directly on the back of the firewall, due to higher vibration levels which can quickly ‘kill’ the servo. Note that all DA motors need quite a lot of servo throw to get the full throttle range, so make sure you can fit a long output arm on the servo.

M3 all-thread, steel clevises and locknuts are included in the hardware pack to make up your throttle pushrod.

Make up a wire lever so that you can operate the ‘Choke’ for starting thru’ the cut-out in the front of the cowling. In the 3W installation this wire is very long, because of the rear-mounted carb, so the wire pushrod passes through a length of silicone tube in the bottom of the carbon plate to support and isolate it. (see photo on page 25, and P16)



Motor Ignition System

The ignition unit is normally fixed to the motordome, as close to the engine as possible - because of the length of the HT leads that connect to the spark plug(s). Mount it on a foam pad and secure with cable-ties, or use sheetmetal screws into small plywood pads with rubber grommets for vibration isolation. Don't forget that the ignition unit also gets warm during use, so it is wise to put it in a location where there is some cooling airflow. Keep the ignition unit as far away from the receiver as possible.

(below) Secure the connectors between the motor & ignition unit.
(below) Fit barbs to all brass tubes and fuel connections for safety. Easily made from a paper-clip, soldered onto the brass tubes.

Use a very small cable tie, 'safety clip', or a length of heat-shrink tubing to securely connect the plug and socket from the motor pick-up to the ignition unit.

Fuel Tank

The fuel tank is held to the tank base with 2 large and 2 small able-ties. Drill a hole in the motor firewall if necessary for the fuel feed tube from the tank to the carburettor, and protect it where it passes through the hole using a rubber grommet or similar. Fix the tubing securely to the underside of the top of the fuselage with a couple of cable-ties or equivalent, to make sure that it cannot come in contact with the headers or hot exhausts.

Fit the correct stopper to the fuel tank for the fuel type used. (If using Dubro tank the gasoline stopper has a small 'O' moulded in the top of it). We use the excellent 'Tygon' brand of fuel tubing for all our aerobatic models. It is totally gasoline and kerosene-proof, and does not go hard and crack with age. Secure the feed tube inside the tank to the clunk with a small cable tie. If the tube is even a little loose on the brass tubes though the stopper, you can be sure it will come off at just the wrong moment and your engine will quit ! Therefore please solder some small rings onto both ends of the brass tubing (easily made from the soft wire of a paperclip wrapped around a small screwdriver, or short lengths of brass tube) and also secure with a fuel-line clamp or cable-tie. Don't miss this small detail - it could cost you your plane !

We use the normal 3 tube plumbing system, one from the clunk to feed the motor, one out of the bottom of the plane (vent/overflow - leave open) and one at the top for filling (close for flight).

Final Check

Now check that you have fixed all components securely. Keep in mind that all the components inside the aircraft are loaded with the same G's as the wing and the wing spar during aerobatic maneouvers. Check engine, cowling, wing and stab mounts carefully again.

- Are all extension leads, cables & fuel tubes securely fixed to the side of the fuselage and cannot come loose when subjected to high 'G' forces during flight.

- Are all tubes and wires protected from chafing where they pass thru' the holes in fibre glass parts or bulkheads with rubber grommets, or short lengths of split silicone tubing?
- Especially if you have installed the internal mini-pipe set-up, you also must make sure that no fuel tubing or wires can come into contact the exhausts. Use the plastic spiral-wrap to tidy up groups of cables and make sure that they cannot move around in the plane under high 'G' manoeuvres by fixing them to the sides with small cable ties. If using the easily-available cable-tie plastic fixing plates, please do not trust the double-sided tape that they usually have on them which can fail under vibrations. Peel it off, rough up the back face with coarse sandpaper and glue to the fuselage sides with 30min. epoxy.
- Did you fit small Tygon or silicone tube pieces over all the clevises?
- Did you tighten the M3 locknuts against all the clevises to make sure they cannot turn?
- Are the swages crimped up nice and tight on the rudder cables?
- For added security add one small drop of loctite/thread locking compound on all the bolts that hold the servo arms to the servos, especially important with digital types.

Then you can go on set up all the linkages, control throws and R/C system as described below.

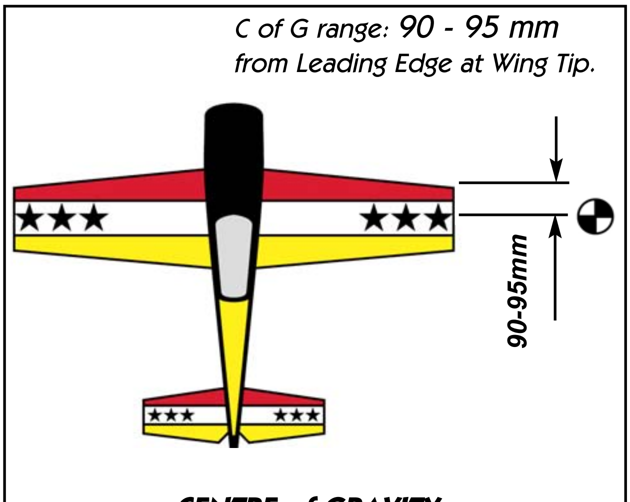
Setting Up Your Aircraft

Centre of Gravity:

Set the Centre of Gravity to 90 - 95mm (3.5 - 3.75") from the leading edge at the wingtip for the 1st flights. Hold it with a helper at both wing tips in this position and make sure the plane balances horizontally. This is the 'pattern' CG position.

After you are confident with the plane, you can move it backwards by up to 15mm (5/8") maximum, but this is definitely a '3D - Freestyle' CG setting and should not be used for the first flights. With this rearward CG you will need to use the high rate control throws shown below.

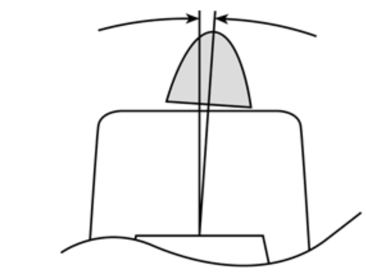
Don't forget to balance the plane laterally, holding the spinner central bolt and a fingertip under the rudder and, if necessary, add a small weight to the light wing tip to make it track correctly.



CENTRE of GRAVITY

Engine Thrustline:

Already given in the instructions, upthrust should initially be set at 0.5° degrees and right thrust 3 degrees, depending on the prop used. We recommend a 27 x 10 on a 75 - 80cc motor, and a 28 x10 carbon prop for any 100cc engine. It is a very quiet and powerful solution. They are normally CNC-designed, so the prop is balanced perfectly statically, dynamically and aerodynamically, which keeps the vibration down to a minimum.



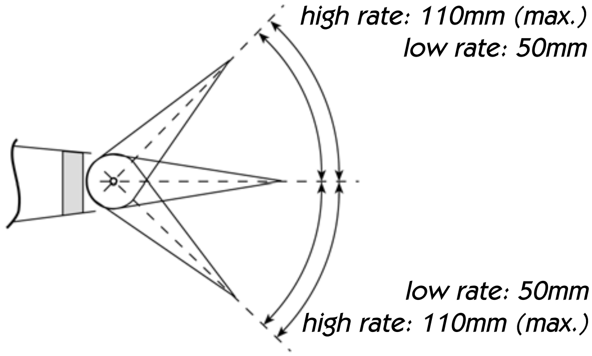
SIDETHRUST

Control Throws:

All measurements are at the root/trailing edge position. All controls should be set with a dual rate switch.

Elevator

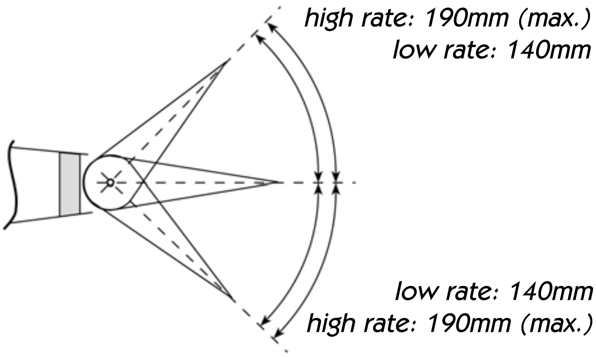
On high rate the elevator should really be at maximum, up to 50 degrees both sides (approx. 110mm), but in this case with 50% exponential. Low rate should be no more than 50mm (2") both sides. This is the perfect throw for nice and crisp snaps. If you like you can add about 20% exponential to the low rate setting as well.



ELEVATOR THROWS

Rudder

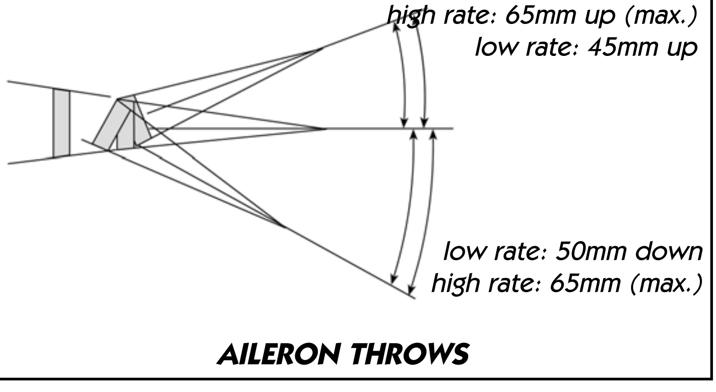
Set the high rate to maximum throw (about 190mm) both sides, and at low rate reduced to about 140mm. The Extra needs quite a lot of rudder for nice stall turns, so you should at least add 25% exponential for smooth tracking corrections. At the same time you should remember that the Extra rudder is very sensitive, and the plane starts shaking at high speed if the rudder linkage is not really rock solid. So check your linkages and closed-loop cables again and make sure that there is NO slop at all ! On the other hand these characteristics are also the reason for best rudder sensitivity at the slowest 3D-speeds.



RUDDER THROWS

Ailerons

Aileron throw for high rate is 65mm up and down (measured at root). Use at least 30% exponential at high rate. For low rate you should decrease the throw to the TOP to 45mm, to the BOTTOM to 50mm. Yes, you're right - this is a reversed differential due to the hinge line being in the top skin instead of on the centre line. You will have to finalise this differential figure



AILERON THROWS

during flight, as mentioned earlier in this instruction book. At high rate, for 3D maneouvers, this doesn't effect the rolling too much, so you can maximize the throws to whatever is mechanically possible, even more up than down if you wish. You may need to lengthen the slots in the servo hatches by 2mm or so at the front to obtain these high rate throws.

General

Your Extra has very large control surfaces. This makes it very sensitive and reactive. It is always possible that these huge control surfaces can flutter at high speeds if the assembly, servo installation and linkages are not made perfectly, and if a servo gear or output disc/arm strips the flutter will not stop until the plane hits the ground….

So please do yourself a favour, and make sure that you only use the best servos available, and take the utmost care making your linkages. Check every linkage for slop, and rather reduce the maximum throw than risking a high speed flutter due to sloppy servo gear or linkages. To prevent this for sure, we recommend reduced control travels (reduced by using short servo arms, not by using electronic settings). Using 2 servos per aileron as described in this manual will never overload or damage high quality servos, even if the maximum travel of each servo is slightly off. The aileron control surfaces have enough torsion flexibility so that damage to the servos should not occur.

Flying the Extra 260

The Composite-ARF 2.6m span Extra 260 builds on the experience with our 3m Extra 260, Extra 300's and Yak's. The structural design is very similar, combining the incredible strength of the airframe with light weight. Lots of input from Jason Shulman, who's basic design it is, and from Frazer Briggs, who has been flying Extra 260's for as long as he can remember, united with 15 years of composite production experience, has made this plane structurally and aerodynamically unique.

The advantage of a 260 over all 300's is the mid-wing design. The full scale aircraft had to abandon this design because of the poor visibility, and the limited space in the cockpit due to the wing spar. That's why Extra have moved the wing down, which was never an advantage for us modellers, since we watch our plane from the ground, and visibility is not a problem there. Still, the 260 had a very low profile fuselage, due to the small canopy, and this had to be changed slightly in our model. We tried to move the canopy forward as much as the 10% rule would allow, and also raised the turtle deck, to get an even better knife-edge and rolling performance than what the mid-wing design itself would already promise.

So now the Composite-ARF Extra 260 really is even more than expected. The performance in rolling circles, knife edge and point rolls is really breathtaking. This was also confirmed by the long time TOC competitor Frazer Briggs from New Zealand, who has up already had many, many hours on our 3m version. And he really had tried to push the 260 to the point where we would see what is the limit of this design: There is no limit. The only limit is the pilot....

However, some mixing is required to compensate for the rudder coupling. Depending from your CG settings, we have found that about 4% opposite aileron and 6% up elevator is a good starting point (taken from the low rates, that's why you almost don't see the deflection). Thrust lines are quite standard, and a slight up thrust will reduce the need to mix 1 - 2% down elevator at idle for the perfectly straight downlines. But again, this depends very much on your preferred CG settings. With the settings given in this manual, you can go right into your first IMAC contest and will feel great with the plane.

3D capabilities are unlimited. Since the elevators do not have a counter balance, we only could hope that the efficiency would be enough. We were positively surprised after the first serious 3D maneouvers, what this plane can do. Harriers are rock stable, tumbles and knife edge spins are so easy to perform. We tried to keep the stab size at the lower end, so it would not be "over-stable", and this might be the deciding factor for how great the 3D capabilities of this 260 are. And the huge wing makes the plane feel even lighter than it really is, especially in High-Alpha Rollers and other slow-motion stuff.

So, it is again one of those best flying planes on the planet... and you will just love it from the first day on you fly it.

We hope that you enjoyed building your Extra 260. Please let us know if you think that any hard-ware is missing or inadequate. We tried to make this airplane as complete as possible. With good feedback from customers you will help us to continue making good things even better. We appre-ciate your comments very much.

Email: feedback@composite-arf.com

Have Fun!
Your Composite-ARF Team

Appendix:

Extra 260, 2.6m Kit (version 1.0)

Kit Contents

Quantity	*Description*
1	Fuselage
1	Wing, right (with 2 servo hatches taped in place)
1	Wing, left (with 2 servo hatches taped in place)
1	Stab, right
1	Stab, left
1	Elevator, right
1	Elevator, left
1	Rudder
1	Cowling
1	Protection bag set (wings, stabs and rudder)
1	Canopy frame
1	Wheel pant, right
1	Wheel pant, left
1	Landing gear, carbon, right
1	Landing gear, carbon, left
1	Wing tube aluminum Ø 40mm x 980mm.
1	Stab tube aluminium Ø 20mm x 330mm.
1	Clear canopy
2	Elevator hinge, aluminum tube, Ø 4mm x 475mm. (packed in elevators)
1	Rudder hinge, aluminum tube, Ø 4mm x 550mm (packed in rudder)
1	Milled wood/phenolic parts bag
1	Hardware bag
1	Instruction Manual (English)

(above) Contents of the complete kit, Kiwi yellow, #712000

Hardware List

Fuselage Pack

Quantity	*Description*
4	Allen Bolt M6 x 30mm (engine mounting)
8	Allen bolt M6 x 16mm (engine mounting/standoffs)
8	Washers, M6, large (engine mounting)
4	T-nut, M6 (engine mounting)
9	Allen bolt, M3 x 12 (cowling)
9	Washer, M3 (cowling)
9	T-nut, M3 (cowling)
4	Allen bolt, M6 x 20mm (landing gear fixing)
4	Washer, M6 (landing gear fixing)
2	Allen bolt, M6 x 70mm (wheel axle)
4	Wheel collar, 6mm I.D, no set-screws. (wheelpants)
8	Washer, M6 (wheelpants)
2	Nut, M6 (wheelpants)
2	Stop-Nut, M6 (wheelpants)
2	Allen bolt, M3 x 16mm (wheelpants)
2	T-nut, M3 (wheelpants)
2	Washer, M3 (wheelpants)
2	Silicone tube, Ø10 x 150mm (muffler/pipe mounts)
2	Allen bolt, M3 x 16mm (pipe mounts)
2	T-nut, M3 (pipe mounts)
4	Allen bolt, M4 x 8mm (canopy frame fixing)
4	Plastic Nut, M6 (wing mounting)
2	Nut, M3 (throttle linkage)
1	Clevise steel, M3 (throttle linkage)
1	All thread, M3 x 125mm (throttle linkage)
1	Ball-link, M3 (throttle linkage)
1	Stop Nut, M3 (throttle linkage)
1	Fibreglass band, 25mm x 300mm (tank base fixing etc)
8	Sheetmetal screws, Ø3.5 x 18mm (exhaust mount & tank base fixing)
4	Washer, M4 (tank base fixing)

Wing Pack (2 sets)

Quantity	*Description*
8	Sheetmetal screws, Ø2.9 x 10mm (servo hatch fixing)
8	Sheetmetal screws, Ø2.9 x 13mm (aileron servo fixing)
4	Bolts, M2 x 15mm (secure phenolic arms to servo discs)
4	Nuts, M2 (secure phenolic arms to servo discs)
2	All-thread, M3 x 45mm (linkages)
4	Clevise, steel, M3 (linkages)
4	Nut, M3 (linkages)

Stab Pack (2 sets)

Quantity	*Description*
4	Sheetmetal screws, Ø2.9 x 13mm (elevator servo fixing)
3	Bolts, M2 x 15mm (secure phenolic arms to servo discs)
3	Nuts, M2 (secure phenolic arms to servo discs)
1	Allen bolt, M3 x 20mm (stab tube security)
1	T-nut, M3 (stab tube security)
1	All-thread, M3 x 45mm (linkages)
2	Clevise, steel, M3 (linkages)
2	Nut, M3 (linkages)

Rudder Pack

Quantity	*Description*
8	Sheetmetal screws Ø2.9 x 13mm (rudder servo fixing)
2	Allen bolts M3 x 16 mm (ball-links to rear phenolic arm)
5	Bolts, M2 x 15mm (secure phenolic arms to metal servo discs)
5	Nuts, M2 (secure phenolic arms to servo discs)
2	Nuts, M3 (to lock clevises onto threaded rods)
2	Stop Nuts, M3 (ball-links to phenolic arms)
2	All thread, M3 x 45mm (ball-link to clevise)
2	Ball-links, M3 (servo linkages)
1	Steel pull-pull cable, 1.0 mm x 3300mm (rudder linkage)
4	Crimping tubes, I.D. 2.6mm (rudder pull-pull linkage)
2	Threaded ends for cables, M3 (rudder pull-pull linkage)
2	Nuts, M3 (to lock threaded ends)
4	Clevise, steel, M3 (rudder and servo linkage connections)

'Spare' hardware pack

* *This bag contains a few extra items that might be useful in the event of future maintenance or repair.*

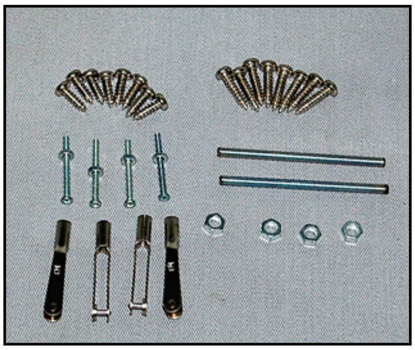
2	Plastic Nut, M6 (wing mounting)
2	Ball-links, M3
2	Phenolic control surface horns
2	All-thread, M3 x 150mm
2	Allen-bolt M3 x 20mm
2	Stop Nut, M3
1	Allen Bolt M6 x 70mm
2	Allen bolt, M4 x 12mm
2	T-nut, M4
2	T-nut, M3

Available Accessories:

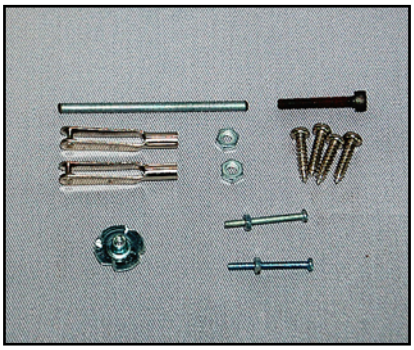
Tail gear setup with 50mm Ø wheel, size 'L'. (product #801000)
Spinner, Ø 120mm, alu. backplate & carbon spinner (product #810100 - 810103)
Desert Aircraft DA-100 motor (product #950000)
Canister set for DA-100 (product # 910100)
PowerBox 40/24, dual NiCad crossover unit. (product #960200)
PowerSwitch, pair, 20A, for dual NiCads (product #960300)

* *Please check our website : www.composite-arf.com, for current availability of options and accessories.*

(above) Contents of Fuselage hardware pack

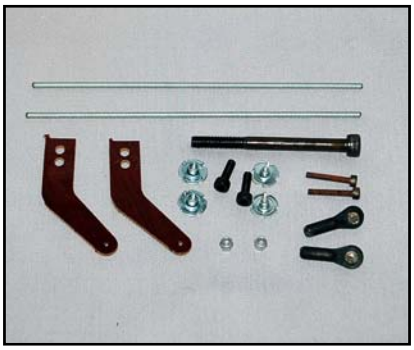


Contents of Wing Hardware pack (2 sets)

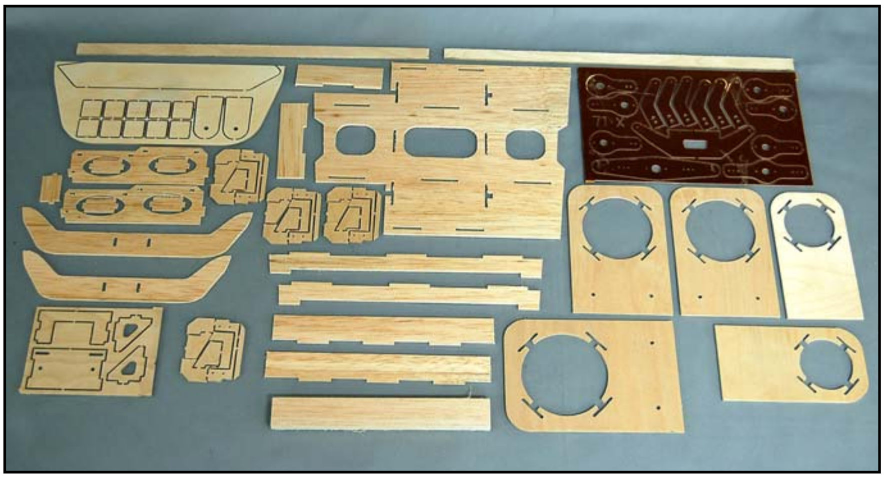


Contents of Stab Hardware pack (2 sets)

(above) Contents of Rudder Hardware pack

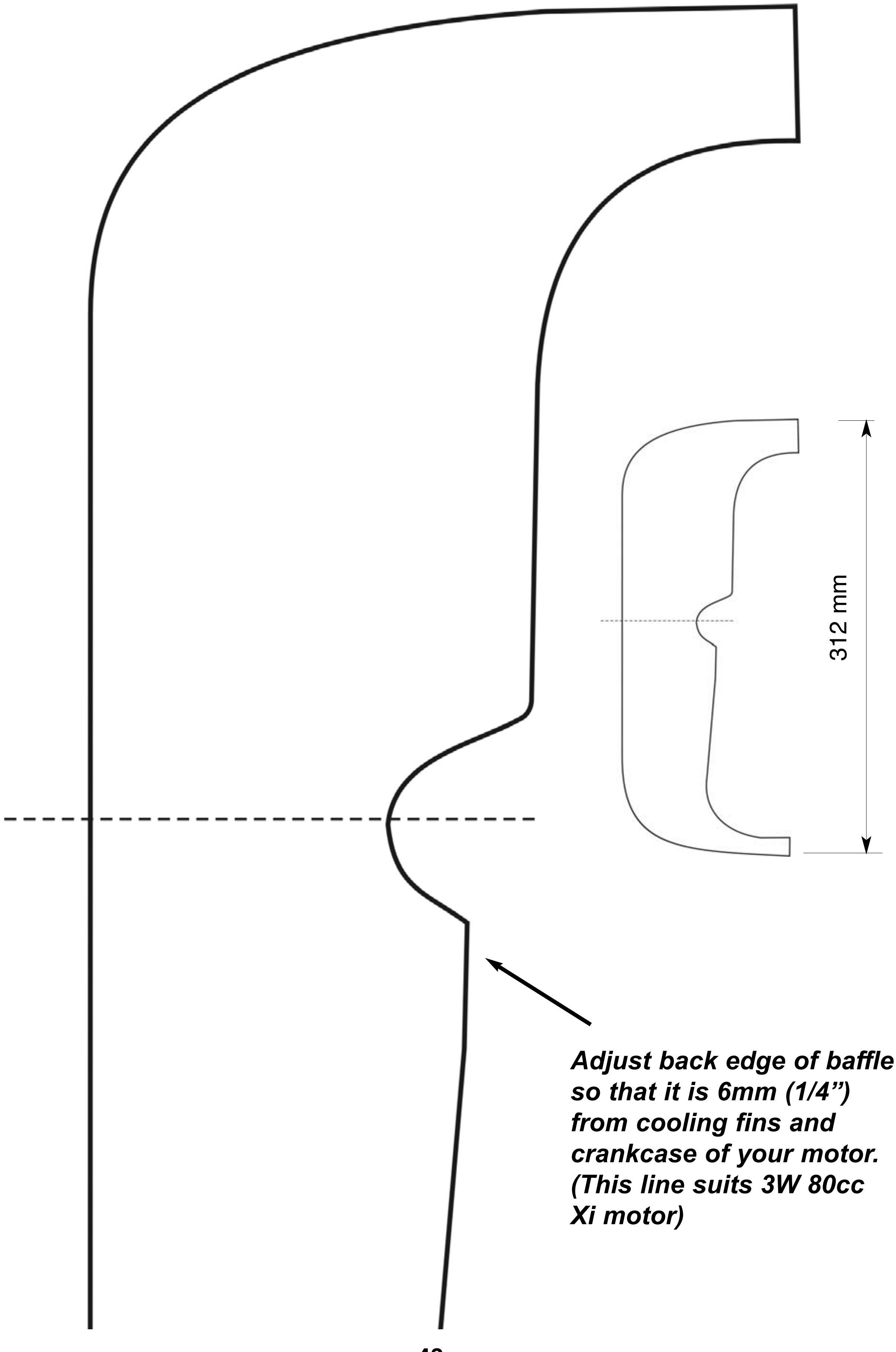


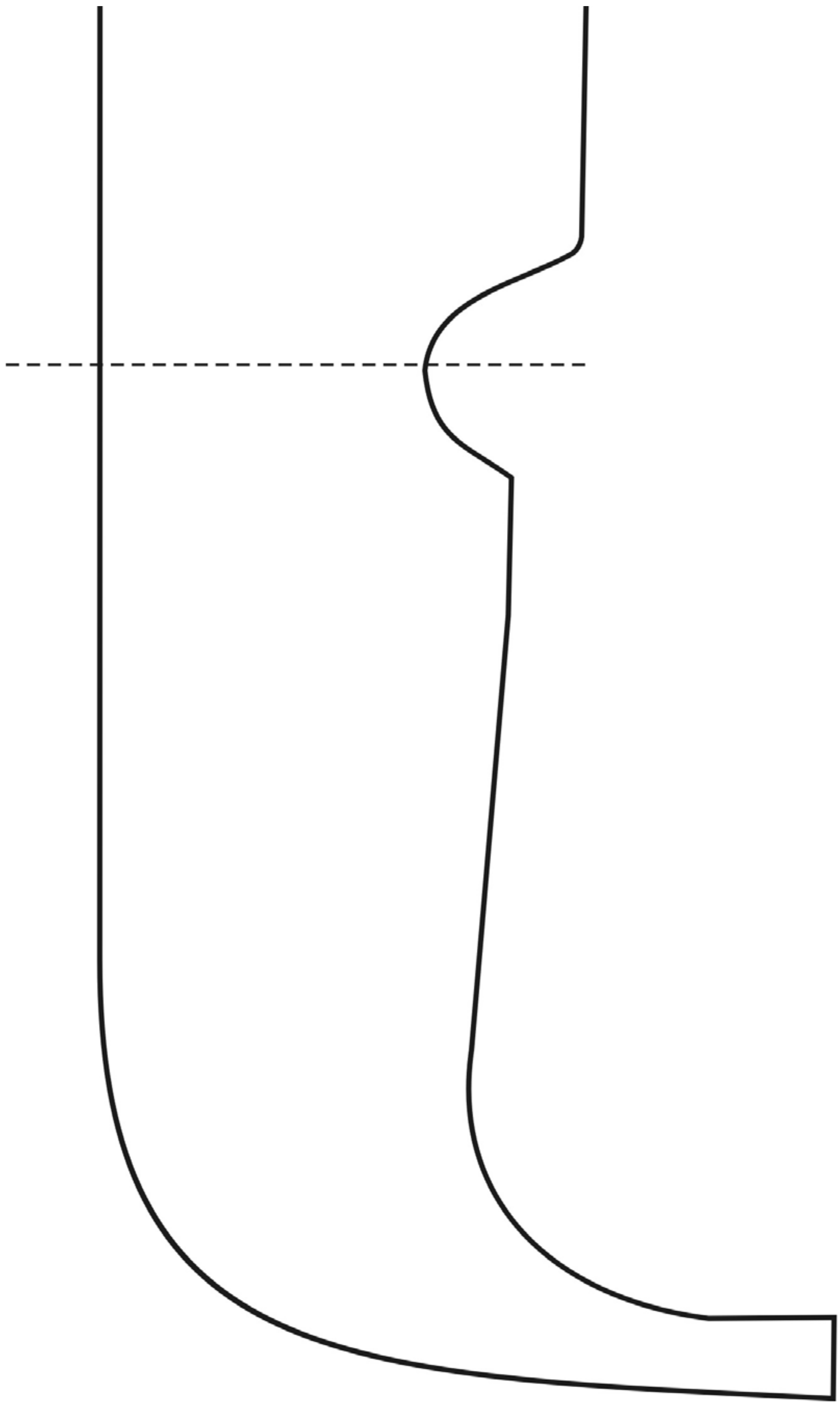
(above) Contents of Spare Hardware pack

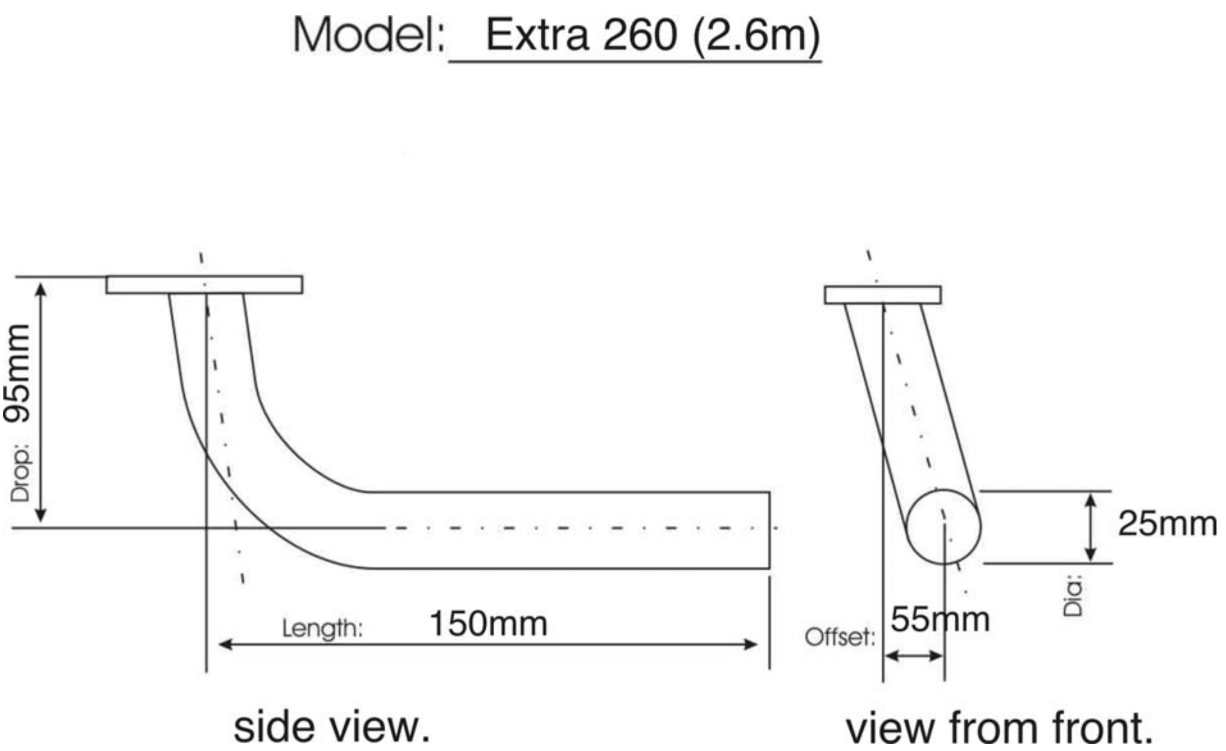


(above) Contents of Milled wood and Phenolic pack

Full-sized Baffle template for Extra 260, 2.6m span.







Dimensions of header used with 3W X1 80cc motor and Greve tuned pipe.