Instruction Manual

Composite-ARF Extra 300L, 2.12m (84”)

Instructions for Extra 300L IMAC-Airplane

Thank you very much for purchasing our Composite-ARF Extra 300L 2.12m (84" span) all composite aircraft, made with the revolutionary Total Area Vacuum Sandwich (TAVS) technology

Please note that some photos in these instructions show our 2 x 2 Extra, which has almost identical assembly in many areas (especially wings and stabs), but of course the colour scheme is different - so don't get confused by this !

If you want a full-color version of this manual, you can download it free of charge from our website, as an Adobe Acrobat .pdf file and print it. Just go to the Extra 2.12 page on our website, and click on the link named 'Download Instruction Manual' link above the top photo of the product.

NB: *Please* read all of the important information on pages 3 - 7 of this Instruction Manual carefully *before* starting the assembly of your Extra 300, especially if this is one of your first fully-composite ARF type aircraft.

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.

Important Supplementary Notes

Pre-Assembly Checks:

At Composite-ARF we take every possible precaution to make sure that all our products are carefully checked before they leave the factory - but of course it is always possible that human error creeps in occasionally with high-volume production, and that an important part has been incorrectly installed or glued into position.

Therefore we ***strongly recommend*** that you double-check the following critical structural components ***before*** starting the assembly of your aircraft - and ***also*** regularly before every flying session as a hard landing, shock loads during transport, or vibrations from unbalanced propellers, etc., could all damage the glue joints to these critical components that ensure the structural integrity of your plane, and the safety of people nearby.

1) Check that the plastic wing bolts, and the front and back fibreglass rod anti-rotation dow els, are securely glued into the wing root ribs. Check that the fibreglass rod anti-rotation pins are securely glued into the front of the stabiliser root ribs.
2) Check that the fibreglass sleeves for the wing and stab spar tubes are securely glued into the fuselage.
3) Check that the alloy wing tube and carbon stab tubes are the correct lengths, as shown in the hardware list at the end of these instructions, not bent or damaged at all, and that they fit into the sleeves in the fuselage and wings/stabs without too much 'slop'.
4) Check that the plywood landing gear support plates are securely glued into the bottom of the fuselage, and reinforced with a layer of fibreglass cloth and epoxy resin.

If you see any of these important joints that don't seem to have enough glue on them, then lightly sand the area with 120 grit sandpaper, clean the area carefully with Acetone (or denatured alcohol or similar) on a paper towel, and apply some 30 minute or laminating epoxy and microballoons mixture when you are mixing it for use in another part of the normal assembly.

Pre-Flight Checks:

Before every session check that all the model's 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. Be certain to use 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 aircraft.

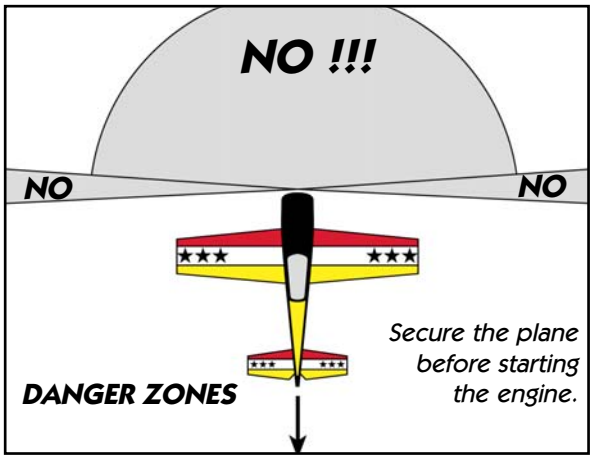
Make sure that your wing and stab spar tubes are not damaged. Check that the anti-rotation pins for the wings and stabiliser are not loose. Check that the plastic wing retaining nuts are tight, that the M3 bolts retaining the horizontal stabilisers onto the carbon tube are tight, and that the rudder hinge wire cannot come out with a piece of clear tape.

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 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. 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. A tail heavy plane, especially in the first flight, can be an enormous danger for you and all spectators. Fix any weights, and heavy items like batteries, very securely into the plane.

Make sure that the plane is secured properly when you start up the engine. Have a helper 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 1st 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 the range with engine running is less then with the engine off, please contact the radio supplier/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, and any excess vibrations can affect the servos and linkages.

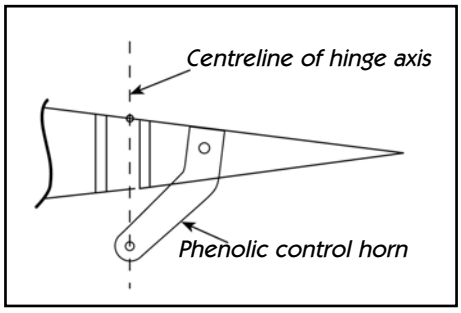
Fully-composite aircraft structure

All the parts are produced in negative molds, manufactured using vacuum-bagged sandwich construction technology. All parts are painted in the molds, either single color or designer schemes. A 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 also. These facts need to be explained in advance for your understanding.

Description of Parts

The Wings:
Both wing halves are made in negative moulds, and fully vacuum bagged, using only 2 layers of 2 oz. cloth in combination with a very hard 2 mm foam sandwich to form a hard and durable outer skin.

The ailerons are hinged already for you - laminated in the mould and attached to the wing with a special nylon hinge-



cloth, sandwiched between the outer skin and the foam. This nylon hinge is 100% safe and durable. You will 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 means that the hinge axis line is on the *top* surface of the wing, *not* in the centre. This is NOT a disadvantage, if you program in about 10% NEGATIVE aileron differential in your transmitter. 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 operated, and the aileron gets a little "bigger" in surface area when moving up, and "smaller" when moving down.

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, if 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.

The Fuselage:

The fuselage is also made in negative moulds, constructed using TAVS technology. The main internal parts for the landing gear, composite engine firewall and exhaust tunnel, wing and stab spar supports are glued in during manufacture, to ensure accurate location and reduce the assembly time for you. There is no need to even check the incidences - you can be assured that these are already set in the molds so that no adjustment is necessary.

The all-composite combined firewall and exhaust tunnel is factory-installed and aligned for your convenience, and contributes greatly to the strength of the airframe.

The pre-installed landing gear mount is strong and doesn't need any extra reinforcement. You have an extremely light weight fuselage, and the gear loads need to be led into the structure gently. The new landing gear is a flexible design, which works very much like shock absorbers. Do not change or modify it, as the results would only be negative.

The Stabilisers:

The stab parts are also vacuum bagged sandwiched. The rudder is hinged with a Ø 2mm steel wire, and the elevator control surfaces are factory-hinged with proprietary hinge-points, 4 on each stab.

The rudder and elevator design allows for at least 45 degrees throw. The horizontal stabs are mounted with one Ø 14mm carbon tube and one 6mm anti-rotation pin each.

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.

Tools and Adhesives

Tools etc:

This is a very quick and easy plane to build, not requiring special techniques or 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 are 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 and 4mm.
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. Dremel tool (or Proxxon, or similar) with cutting discs, sanding tools and mills.
10. Sandpaper (various grits), or Permagrit sanding tools (high quality).
11. Carpet, bubble wrap or soft cloth to cover your work bench (most important !)
12. Clear Car wax polish (for protecting painted areas close to glue joints).
13. Denaturised alcohol, or similar (for cleaning joints before gluing)
14. An Incidence meter is helpful for engine thrustline alignment.

Adhesives:

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.

1. CA-Glue 'Thin' and 'Thick' types. We recommend ZAP, as this is a very high quality.
2. 5 minute-epoxy (highest quality seems to be Z-Poxy)
3. 30 minute epoxy (stressed joints must be glued with 30 min and NOT 5 min epoxy).
4. Epoxy laminating resin (12 - 24 hr cure) with hardener.
5. Milled glass fibre, for adding to slow epoxy for strong joints.
6. Microballoons, for adding to slow epoxy for lightweight filling.

We take great care during production and Quality Control at the factory to ensure that all joints are properly glued, but strongly recommend that you double-check these yourself and re-glue any that might just have been missed. See 'Pre-assembly' notes on page 3.

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 or paint 'thinners' for cleaning external, painted, surfaces as you will damage the paint.

Tip: For cleaning small (uncured) glue spots or marks off the painted surfaces you can use old-fashioned liquid cigarette-lighter fuel, (eg: '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. We know that even good things can be made better !

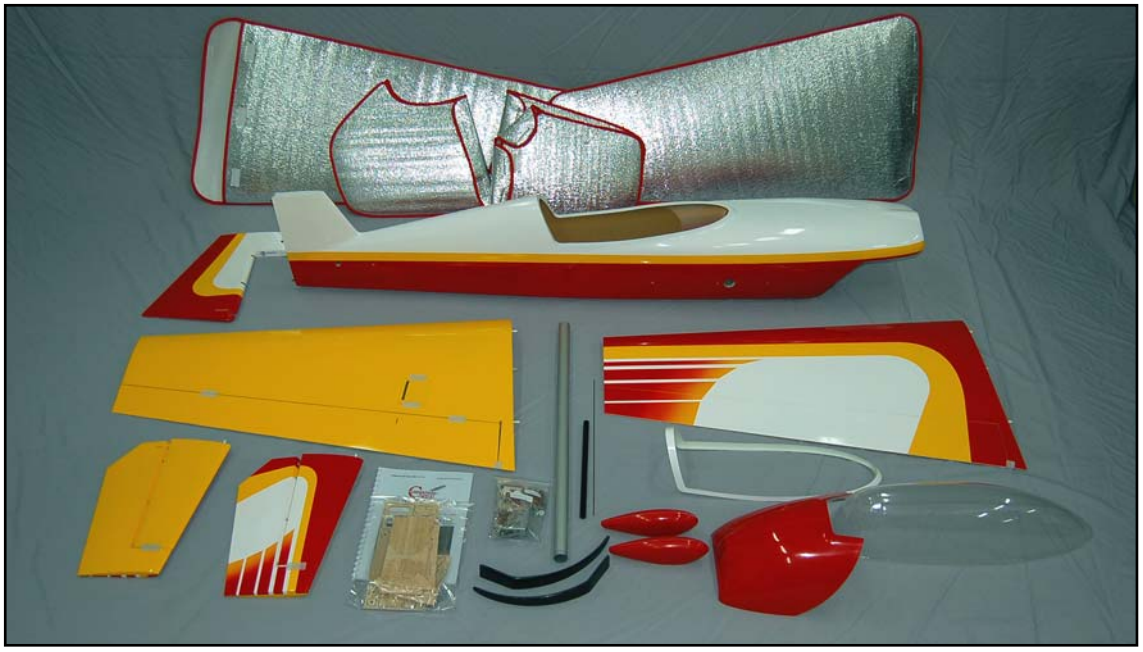
Email us: feedback@composite-arf.com.

Lighter fluid is excellent for cleaning small marks, clear wax, uncured glue, or similar off the painted surface of the plane.

Accessories

This is a list of the things you may need to get your Composite-ARF Extra 2.12m (84") into 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. 5). We recommend JR 8511/8611's or Futaba S9351's for the ailerons, elevators & rudder.
2. 5 metal servo output discs, 1" or 25mm diameter. We strongly recommend that you use metal discs instead of the standard plastic discs when using hi-torque digital servos.
3. Throttle servo for gas/methanol motor. Any standard servo will do.
4. Aluminium Spinner 82 - 88 mm dia (3.25 - 3.5"), eg: Tru-Turn.
5. Main wheels 65 - 70mm (2.5 - 3"). Kavan Light or Dubro wheels are recommended.
6. Engine DA-50, or equivalent. The instructions show this engine, but you could use any other 35 - 50cc gas engine, eg: Zenoah 38 or ZDZ 40 - or a big 4 stroke (eg: OS140/160, YS140/160).
7. Exhaust system, muffler or minipipe if using gas or methanol engine. C-ARF can supply headers and mini-pipes for the DA-50 as an option (see our website).
8. High quality servo extension cables, with gold connectors. High quality receiver and ignition switches, 'Y' leads, ferrite chokes etc.
9. Receiver battery. Either one or two 1200 -1400 mAH NiMH (or Li-Ion/Duralite) packs.
10. Fuel tank (500 - 700 ml) with gasoline stopper. Dubro #424 fits perfectly.
11. Propeller, to suit motor choice. Carbon 23 x 8 is suitable for the DA-50



A view of the complete Extra 2.12m (84") kit contents - Product #721000

About the Extra 2.12m (84")

The Composite-ARF Extra 2.12m is far more pre-fabricated than our original 2 x 2 Extra. The fin post, rudder hinging, composite firewall and exhaust tunnel, wing and stab anti-rotation pins, wing fixing bolts, landing gear support..... all these are now factory completed for you. In addition a clear cockpit canopy is now included, for those of you that prefer this to the fibre-glass canopy. The elevators are now factory-hinged for you, using 4 Robart pin-hinges per side - to allow additional throw for those wild 3D manoeuvres that this plane loves to do!

A very complete hardware pack is included, with almost everything needed to complete the servo/motor and landing gear installation in the plane. Of course, all the small wood parts, phe-nolic servo arm extensions and control horns, milled plywood firewall and servo mounts are also included in the kit.

The flying characteristics of the 2.12m Extra are quite similar to the original 2 x 2m Extra. The 5% larger wing allows a bit more overall weight without increasing the wing loading, and gas engines of between 40 and 50 cc power the new 2.12m Extra ballistically!

Great performance, very similar to the full blown Extra 300s of Composite-ARF, very neutral, light-winged and extremely precise. The 2.12m Extra is an ideal 'Everyday Workhorse', allow-ing you to keep the more sophisticated larger planes for those "special days".

.....And all this at a never before achieved value-for-money price !

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 ...

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.

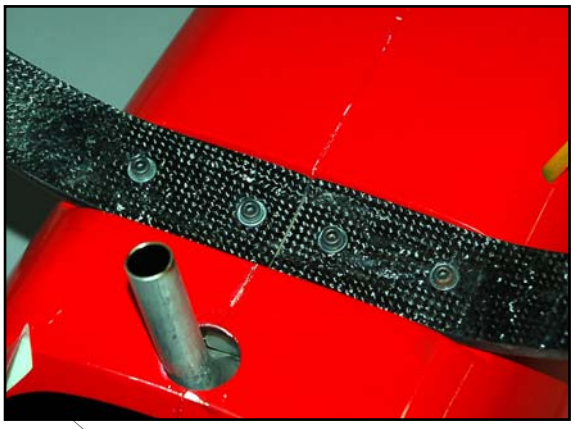
The first thing to do is protect the finished paint on the outside of the model from scratches and dents during building - so cover your work table with a piece of soft carpet, cloth or bubble-plastic. The best way to stop small spots of glue getting stuck to the outside painted surfaces is to give the whole model 2 good coats of clear car wax first, *but* of course you must be sure to remove this 100% properly before adding any additional paint, decals or trim. Alternatively 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 areas 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, and wipe off any dust with alcohol (or similar) before gluing to make a perfect joint. 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.

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.

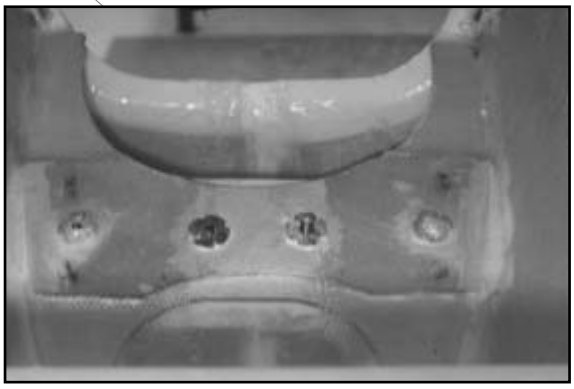
Landing Gear

The 1st job is to fit the landing gear legs and you should leave these in place to protect the bottom of the fuselage during the rest of the assembly.



The landing gear legs consist of 45° laminated fiberglass and carbon cloth with a huge number of carbon tows inside, all made in negative molds and heat-cured. However it is still light weight, and is flexible enough to take the shock of any landings that are less-than-perfect!

The plywood support for the landing gear is already factory-installed. Please double-check now that this is properly glued in, and that the glasscloth reinforcement is well laminated to the area around it.

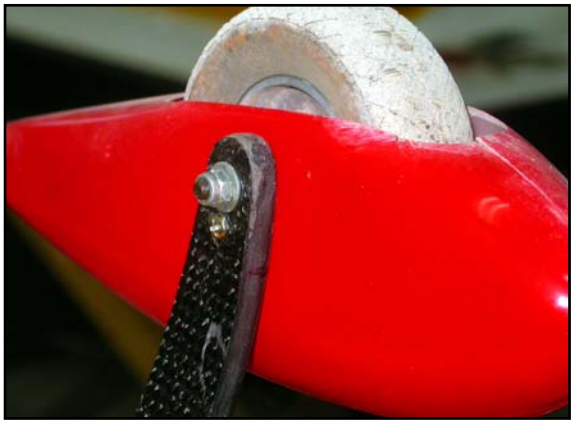


Both main legs are identical. Fit the landing gear in place on the fuselage in the molded recess for it as shown, and drill through 4 holes Ø 4mm for the M4 bolts and washers. Centres between each pair of bolts should be approx 40mm (1.5"), and the outer bolt position is already marked for you with a small dimple in the leg.

Remove the carbon legs and open up the holes in the fuselage and ply supports to Ø 5.5mm. Refit the legs with the washers and M4 bolts, and install the T-nuts inside the fuselage. Secure the T-nuts to the ply mount with a little 30 min epoxy.

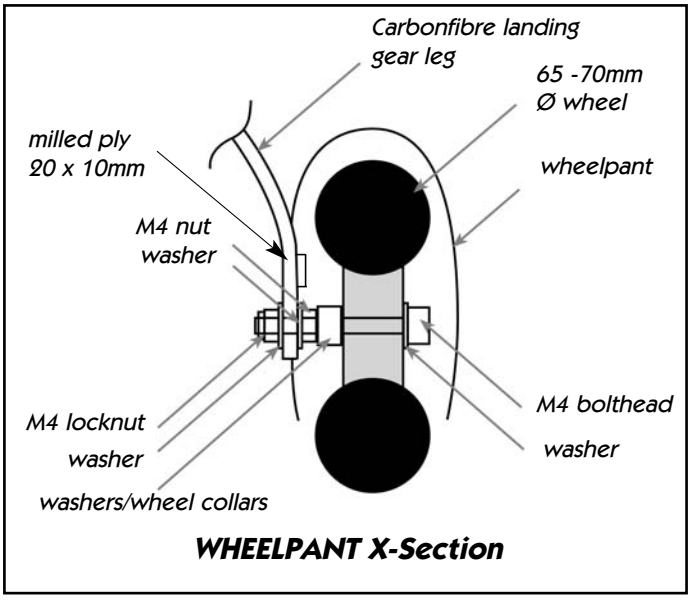
Drill 4mm Ø thru' the molded dimple in the bottom of the carbon legs, and the mark in the inside face of the wheelpant for the M4 x 45mm axle bolt. Drill 6mm Ø on the outside of the wheelpants, directly opposite the axle hole, to insert the bolt. Don't forget to make a 'left' and 'right' wheelpant !

Glue the small milled plywood part (20mm x 10mm) inside the inner surface of each wheel pant, about 6mm above the 4mm Ø hole for the axle bolt. (see drawing). This part is for the small sheetmetal screw that holds the wheelpant at the correct angle to the carbon leg. (see photo right)



Insert the wheels of your choice (65 - 75mm Ø) in the wheelpant. The head of the bolt goes on the *outside* of the wheel, inside the wheel pant. The order of the items on the bolt is: Bolthead, washer, wheel hub, washer, washers or wheel collars to centre the wheel in the wheelpant, M4 nut, washer, fibreglass wheelpant, carbon landing gear leg, and finally another washer and the M4 locking nut. A drop of Loctite before tightening the locknut is good insurance.

To set the correct angle of the wheelpants in relation to the ground, set the fuselage on a level surface and pack up the tail of the plane until the wing is at about 0 degrees incidence to the ground. Eye through both wheelpants so that they are parallel and level, and secure with a Ø 2.9 x 13mm sheetmetal screw in each, as shown, through the carbon leg into the small plywood plate inside the wheel pant.

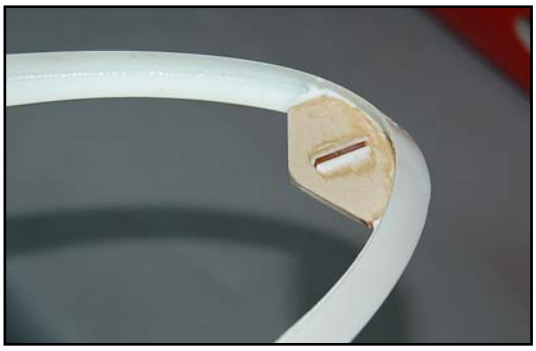


WHEELPANT X-Section

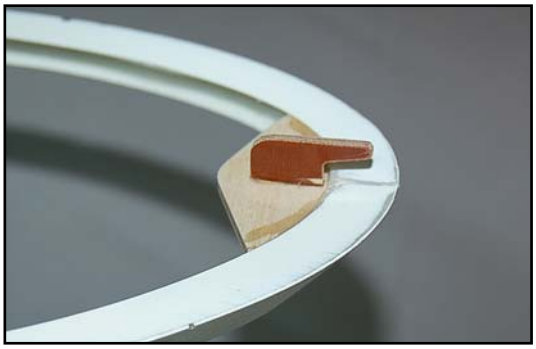
C-ARF do not supply an optional tailwheel assembly for this Extra, but any 25mm/1" Ø lightweight wheel assembly from a hobby store will do. You do not need to make the tailwheel steerable unless you fly from a hard runway - on grass a simple fixed, or castoring action, is fine. A 3mm plywood plate (15mm x 60mm) is already factory-installed in the bottom of the fuselage in front of the fin post to secure the tailwheel assembly to.

Cockpit Canopy

A painted moulded fibreglass canopy frame and clear cockpit canopy are provided in the kit. Fitting is quite simple, as the canopy is quite small and rigid. Complete all the canopy frame fixings *before* gluing in the clear canopy.

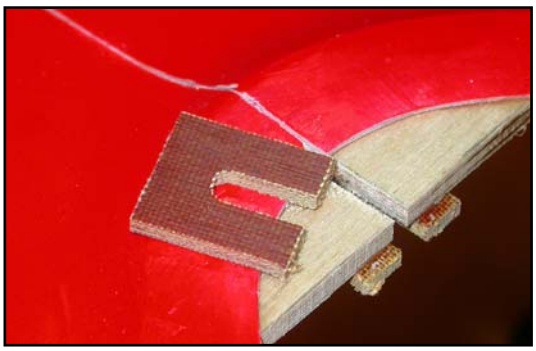


There are several methods of securing the canopy frame to the fuselage, and these depend on the type and size of motor you will fit, and your own favourite method. However, if installing a large single-cylinder motor (eg: DA-50), then we highly recommend that you fit the 2 plywood tongues at the back of the frame - secured with two M3 bolts and T-nuts, as this is a very rigid and rattle-free solution - instead of the single hatch catch as this could vibrate 'open' in flight !



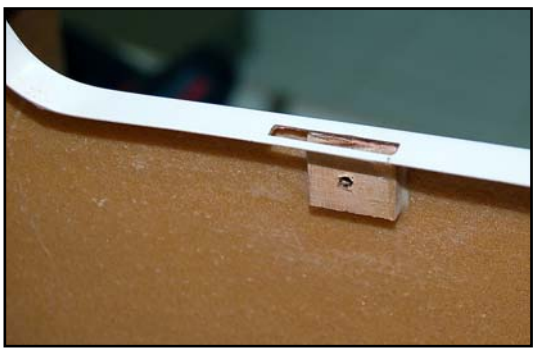
If fitting a glow engine, or electric motor, without too much vibration then it should be OK to use the hatch catch to secure the back of the canopy frame. Both methods are shown below, and the hardware for both methods is included in the kit.

For both methods the front of the canopy frame is secured to the fuselage by a phenolic hook, installed in a small milled plywood plate, and 2 or 4 small phenolic tabs in the side rails to align the frame with the fuselage exactly.



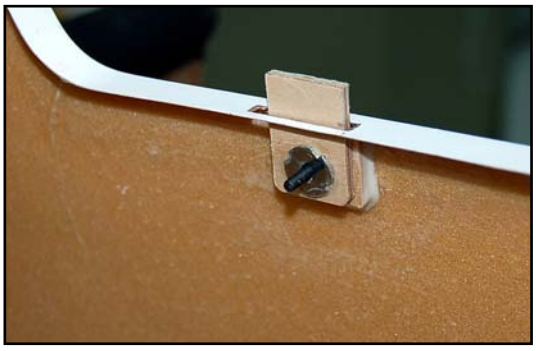
Lightly sand (or scrape with the edge of a sharp knife) the joint seams on both the fuselage and the canopy frame that could prevent it sitting perfectly flush, and check the fit to the fuselage.

Sand under the front lip of the fuselage where the plywood plate for the hook will be, and also inside the front of the canopy frame. Using 30 minute epoxy, glue the plywood plate into the fuselage, under the front lip, with the slot aligned with the joint seam of the fuselage, and the front of the slot 1 - 2mm back from the edge of the fibreglass as shown in the photo.



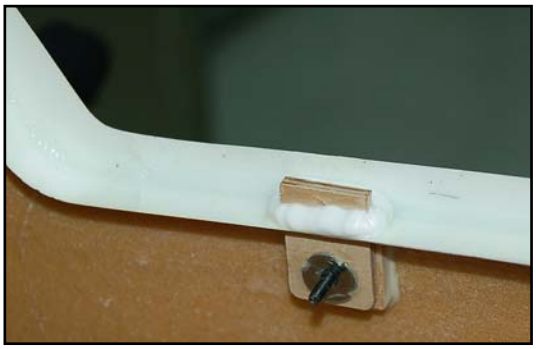
Firmly tape the canopy frame into the exactly correct position on the fuselage. Rough up the top of the phenolic hook, and press it into the milled slot in the other milled plywood part, and trial fit into the front of the canopy frame to make sure that the hook engages properly with the slot in the fuselage ply part. Adjust height of the hook to achieve this, and then secure the hook to the ply with a single drop of thin CA. Now glue the complete plate into the front of the canopy frame

with a little thick CA. Finally glue the phenolic 'U-shaped' plate under the slot in the fuselage ply plate and use this to adjust the final canopy fit at the front. Filing the slot at a slight angle to match the phenolic hook gives the final fine adjustment to make sure the front of the frame cannot lift up from the fuselage.



If fitting the 2 plywood tongues, instead of the hatch catch, proceed as follows:

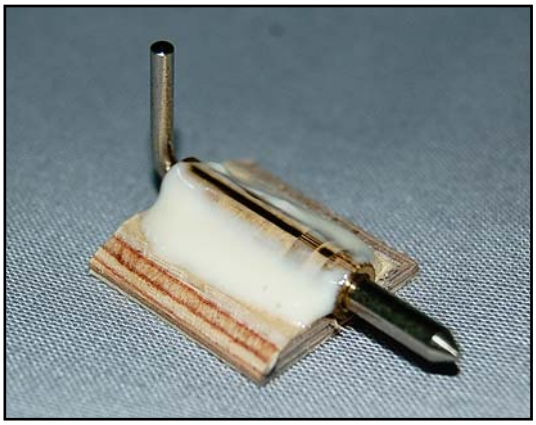
Fit the canopy frame to the fuselage, tape into position accurately, and cut 2 slots thru' the frame and fuselage, 3.5mm wide x 20mm long, and with the outside edge of the slots about 4mm from the outside of the fuselage. The slots should be about 50 - 70mm from the back of the cockpit.



Glue 2 of the milled ply squares (20 x 20mm) inside the fuselage, exactly under the 2 slots, at 90 degrees to the flanges around the cockpit opening, using a thick mixture of 30 min. epoxy and micro-balloons, as shown in the photo. You can taper these squares a bit for a good fit against the angled fuselage sides. Transfer the position of the holes in the milled plywood tongues to the squares in the fuselage, and drill through the fuselage sides and the ply squares Ø 3mm for the bolts.

Extend the length of the slots in the fuselage flanges only, backwards, by 6 - 8 mm to allow the canopy to slide backwards and disengage the front hook.

Carefully wax the area around the slots on both the canopy frame and fuselage in case some epoxy gets on there in the next steps.

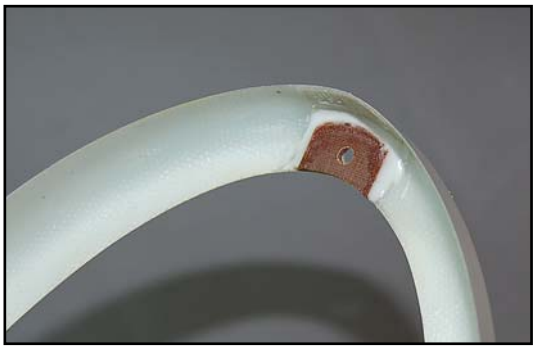


Fit the M3 T-nuts into the holes in the milled plywood tongues, and bolt them in position with M3 x 16mm bolts, with the tabs projecting up through the slots in the fuselage flanges.

Fit the canopy frame again, and tape firmly in position. Glue the tongues into the canopy frame using a thick mixture of 30 min. epoxy & microballoons. Cut off any excess length above the canopy frame afterwards.

If you chose to fit the hatch-catch, then proceed as follows: Use one of the milled ply squares (20 x 20mm) and file a half-round slot in the top of it for the catch. Apply a little light oil to the mechanism of the hatch catch to prevent it being glued together. Tack the catch place on the plywood with CA, and then secure with a good fillet of epoxy on both sides, as shown. Taper the

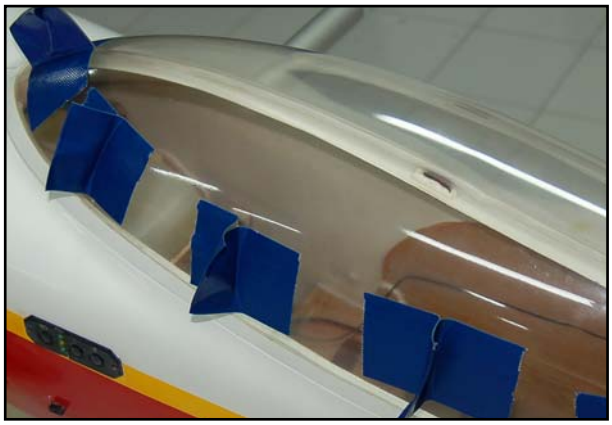
edges of the plate if necessary for a good fit in the fusleage.



Mill and file the slot on the fuselage centerline, behind the canopy frame, for the handle of hatch catch. The slot should be 2.5mm wide x 15mm long, and the front of the slot about 20 - 22mm behind the front edge of the fuselage moulding. Sand inside the fuselage in the area where the catch will be glued later.

Without removing the canopy frame from the fuselage, drill a Ø 3mm hole through the centre of the back of the canopy frame and the fuselage for the hatch catch. The centre of the hole should be 8 - 9mm down from the top/outside surface of the fuselage.

Glue the hatch catch in position with 30 min. epoxy and microballoons, with the 3mm pin projecting right thru' both holes into the canopy frame. Tape into position until fully cured (with the fuselage upside down). Add a short length of the fibreglass tape (supplied) over the ply plate afterwards, using slow epoxy to fix it to the fuselage. Fine adjustment of the alignment in the canopy frame can be achieved by drilling a 3mm hole thru' a small scrap of the phenolic plate, and gluing it over the pin where it projects inside the canopy frame afterwards. (see photo above.)



Remove the frame, check the fit, and reinforce all the joints properly with some 30 minute epoxy and micro-balloon mixture.

To make sure that the sides of the canopy match perfectly with the fuselage shape we recommend that add 2 (or 4 if you fitted the hatch-catch) small phenolic tongues, as shown, and file matching slots in the fuselage lip. We have included a some strips of phenolic plate (15mm x 50mm) for this purpose. With the canopy frame fixed in place with the hook and catch, and taped in position at the sides, use a very small cutting wheel in a Dremel tool (or similar) to start to cut the slots thru' the canopy frame and fuselage together, which sets the alignment perfectly. Then remove the frame and finish the slots with a small fine flat file. Glue the tabs into the fuselage, *not* into the canopy frame, using 30 min. epoxy and microballoons. They should only project out of the fuselage about 3 - 4mm, and the corners should be rounded to make it easy to fit and remove the canopy frame.

Now glue in the clear canopy. Sand the inside edges of the canopy frame carefully with 80 - 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 it. 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. Trim the canopy approximately to size so that it is about 6 mm bigger than the edges of the frame. When the canopy fits inside the frame, tape it into position temporarily, check that it is aligned properly, 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. Unless you are in a 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!

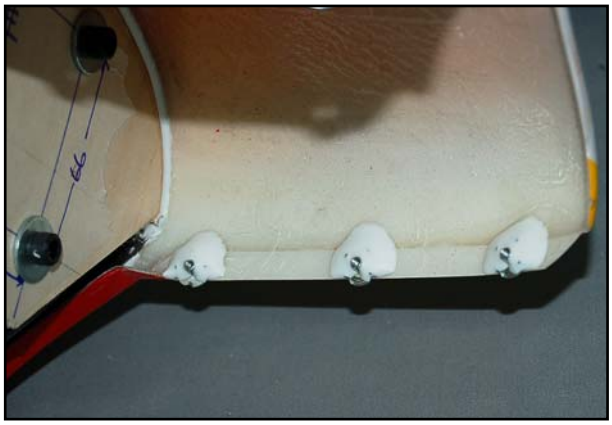
With the canopy frame fitted to the fuselage, tack the canopy into position with a couple of *very* small drops of 'odourless' CA, at the back lower corners and at the front centre also. You can make some 'handles' from strong tape (see photo) to allow you to 'pull' the canopy in position while you do this. When the canopy is tacked into the frame, and it cannot twist any more, you can carefully remove the compete canopy frame and secure the inside edge of the clear canopy with a small bead of 30 minute epoxy and microballoons. Alternatively you can use a specialist canopy glue that dries clear and bonds well the the clear plastic. We have used the ZAP 'Formula 560' canopy glue with good success, and any drips of drops can be cleaned up with water before it cures. Whichever method you chose, *make sure* to secure the canopy frame in it's final position on the fuselage while the glue dries to ensure that nothing can deform.

Cowling

Attaching the 1 piece cowling is easy, as it is already cut and trimmed at the factory. We suggest that you fit this now, and make any cutouts, cooling and access slots after you fit the motor.

The cowl is secured to the fuselage with six M3 x 12mm bolts, and six T-nuts that are glued to the inside of the horizontal flange on the fuselage. Additionally you should add 2 small phenolic tongues at the back lower corners of the fuselage lip to maintain alignment, and prevent any rubbing or damage due to vibration (see photo). Fit these in the same way as for the canopy frame.

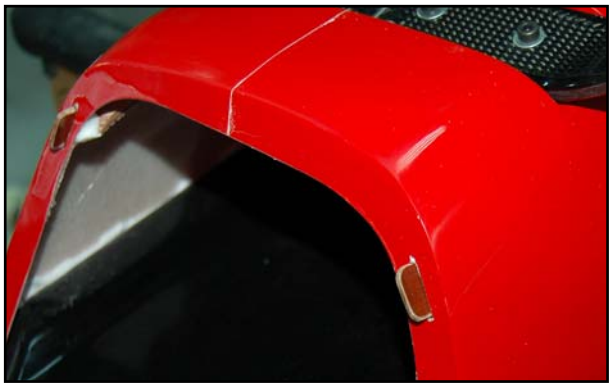
Sand or scrape any seams on the fuselage and cowling that might prevent it sitting perfectly flush. File a notch in the back flange of the cowling to allow it to fit over the flange on the fuselage. Sand the inside surface of the flanges on the fuselage. Now carefully wax all around the mating surfaces of the fuselage and cowling in case you should get some glue on there during the next steps.



Tape the cowling firmly into position on the fuselage. Drill 6 holes of Ø 3mm through the cowling and flanges of the fuselage as shown. Space the holes about 65mm (2.5") apart, and 6mm (1/4") from the edge of the cowling.

Apply some wax or thin oil to the M3 bolts and push them into the 3mm holes. Reach thru' the front of the cowling and screw the T-nuts into

position against the flange, with the flat side against the flange. Apply one drop of thick CA to each T-nut to hold in position, then remove the cowl carefully and secure properly with some 30 min. epoxy and micro-balloons mixture. You can grind or cut off the lower edges of the T-nuts that project below the fuselage flange after the glue has cured.



using epoxy, glue the 2 small phenolic tabs, as mentioned above, at the lower back corners of the fuselage and file matching slots in the cowl to ensure correct alignment.

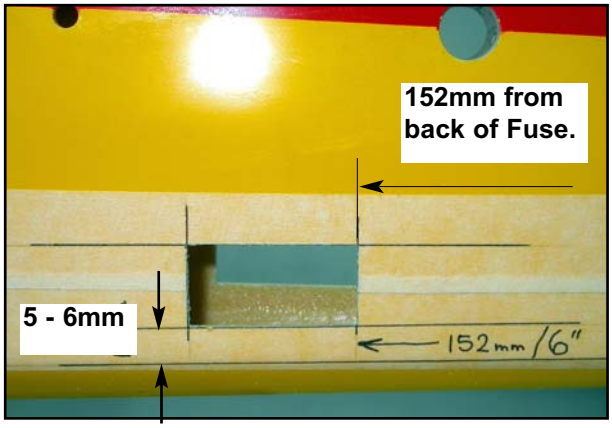
Note: If you have a flexible drive, or 90 degree attachment for your Dremel then you can cut the slots thru' both the cowl and fuselage via the cooling opening in the bottom of the cowl - which ensures perfect alignment.

Horizontal Stabs

The stabs are 95% finished and the hinging is already completed for you, using 4 large Robert hinge-points in each elevator - so you only need to install servos, horns and linkages.

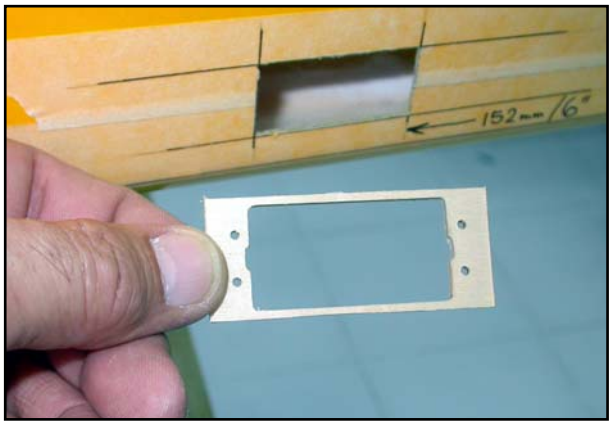
The fibreglass tube inside the fuselage that accepts the carbon stab spar, and the holes for the anti-rotation pins are also jig-installed at the factory, so the alignment and incidences are already perfectly set. Double-check that the 6mm fiberglass anti-rotation pins are securely glued into the root ribs.

Insert the 14mm Ø carbon spar in the fuselage sleeve, and slide on both stabs. Check the fit between the root ribs and fuselage, and if necessary you can sand the roots of the stabs slightly for a perfect fit. The carbon tube may need to be shortened a little to 275mm long.

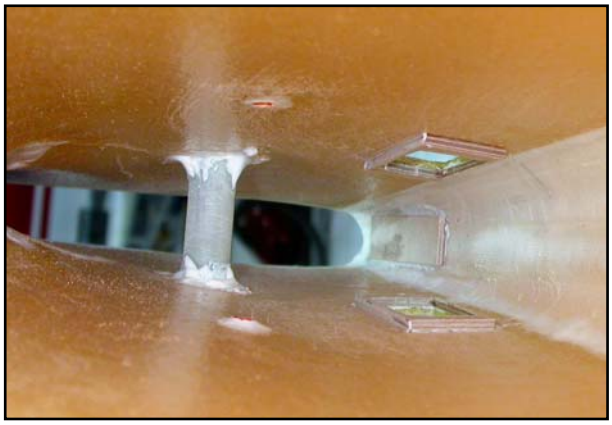


Servos: The elevators can travel more than 45 degrees, and if you are going to use the maximum throw for 3D manoeuvres, we strongly recommend hi-torque digital servos like JR8511/8611 or Futaba S9351. It is not just that

the torque of a standard servo is not enough - it is the play in the gears which could cause problems centering, and might result in high speed flutter.



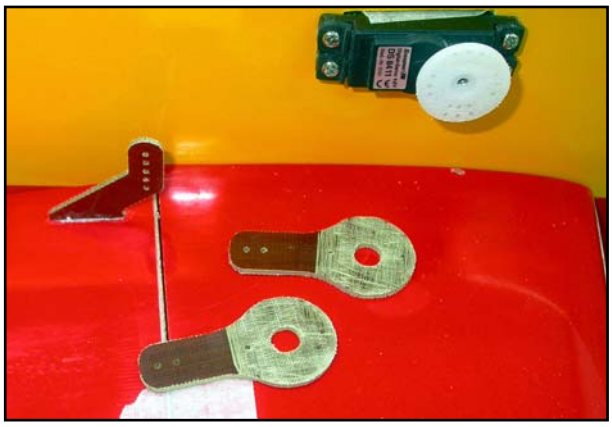
IMPORTANT - Servo Output Discs:
*We strongly recommend that you fit metal output discs to **all** hi-power servos that will have the phenolic servo arm extensions fitted to them, and not the standard plastic discs - as shown here. This is because the extreme torque of the current digital hi-torque servos can, in some cases, strip the splines from the plastic discs - causing instant flutter ... and probable destruction of your plane.*



The phenolic arms are tack glued to the metal discs in the same way as described for the plastic type, and then secured with a couple of small (M2) bolts and nuts. Suitable metal output discs are available from many companies, for example the 'Hanger 9' type, part numbers: #HAN3526 or 3520. (photo right)

This applies to the elevator, rudder and aileron servos in this plane.

The elevator servos are installed in the fuselage, due to the thin stab profile. Put some masking tape on the fuselage and carefully mark and cut out the 2 holes to the size for your servos. If using a standard sized servo, like the JR/Graupner 8511/8611, then the back of the servo cutout holes should be 152mm (6") from the back of the fuselage, and the bottom edge 5-6mm above the lower chine (angled corner) of the fuselage. This position gives clearance for the rudder pull-pull cables, which pass just above the servo case.



Use the 3mm milled plywood reinforcing plates to mark the holes accurately and file to shape with a Permagrit file or similar. Rough up the inside of the fuselage carefully, and glue the ply plates in place inside with 30 min epoxy and micro-balloons mixture (see photo above).

NB: Screw the servos into place with the Ø 2.9 x 13mm screws provided in the kit - ***not*** the standard screws that come with the servos.

The slots are already partly milled in the elevators for the horns, but you will need mill them deeper - to about 13mm (1/2") depth so that the phenolic horn fits into the balsa block in the elevators right up to the small shoulders on the horn (see photo on page 21). It is important that both

horns are in identical positions in relation to the hinge axis to give equal elevator movements.

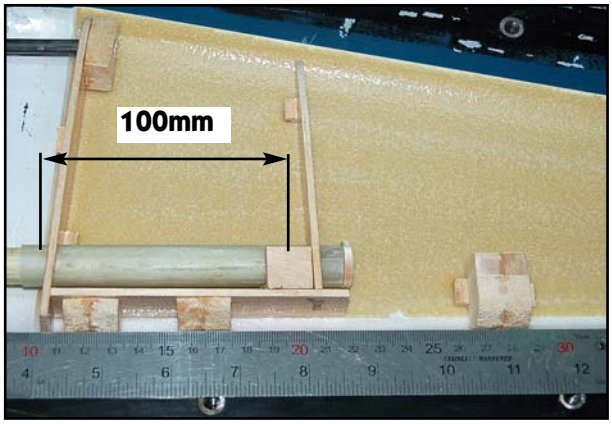
(above) Completed stab servo & linkage, also showing the position of the M3 stab securing bolt, recessed into the bottom of the stab. Note positions of clevises on the horns for the maximum mechanical advantage.

Put a layer of plastic parcel tape over the area of *one* of the the milled slots, wax it, and then cut through the tape with a sharp knife to allow the horn to be glued into the slots. This stops excess glue getting on the surface of the elevator. Adjust the slot in one elevator so that the holes in the horn for the clevise are exactly perpendicular the elevator hinge axis, rough up the gluing surface of the horn, and glue it into the slot with 30min. epoxy and microballoons.

When the glue has fully cured on the first horn, remove the tape, and make a horn alignment template from thin plywood (see photo in wing section) and a 1.6mm drill or piece of wire, and use it to install the horn in the other elevator. This ensures identical elevator throws.

Make up the extension leads for the 2 elevator servos, and centre both servos with your R/C. Rough up the outer surface of two Ø 25mm metal servo output discs, and do the same on the inner surface of two of the phenolic C-ARF servo arm extensions supplied. Glue the phenolic arms to the discs with 30 minute epoxy and milled-fibre mixture, making sure that they are both exactly at 90° to the bottom surface of the stabs. Remove the servos, and secure the phenolic arms to the servo discs with 2 small bolts and nuts (M2 or equivalent) for each servo.

Make up the elevator linkages from the 60mm long M3 threaded rods, with 2 clevises and 2 x M3 nuts for each stab, as shown in the photos. The clevise should be on the *inner* hole of the servo extension arm, and on the elevator horn it should be on the *3rd or 4th hole out* from the elevator surface - to maximise the mechanical advantage and reduce any chance of flutter. With your transmitter throws set at maximum (125%) this will still allow even the hi-rate/3D throws mentioned at the end of the manual.



'Loctite' the quick-link and loc-nut on one end of each linkage. Add a couple of short lengths of silicone tube over all clevises to prevent them opening accidentally in flight. Do ***NOT*** use ball-links on the servo arms or the control-surface horns, because they will twist the servo arm/horn and cause flutter. This is a solid experience and you should consider it a ***FACT***.

The stabs are secured to the carbon tube using two M3 bolts, screwed thru' the bottom surface of the stabs, into T-nuts that you must glue

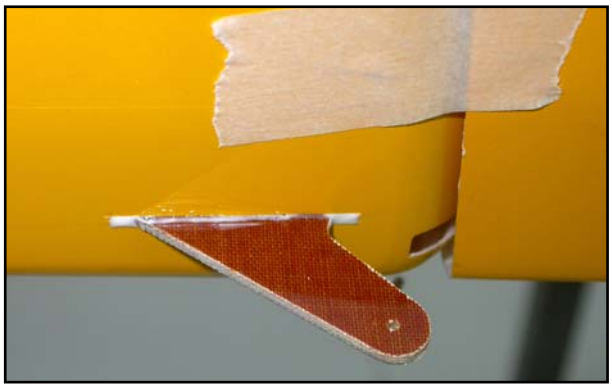
inside the carbon tube. There is a small plywood reinforcing plate inside the stab that the bolts will pass thru', and the centre of this is 100mm from the root. Apply some masking tape to the bottom of the stabs and mark the centre line of the stab tube on it. Fit the carbon tube into one stab, and drill a Ø 2.4mm hole 100mm out from the root of the stab, thru' the bottom surface, the ply reinforcement, the fibreglass sleeve and the bottom of the carbon tube. Tap the hole M3. Remove the carbon tube and glue in the M3 T-nut, using a thick mixture of 5 minute epoxy and micro-balloons, with the M3 bolt temporarily in place to ensure alignment. Wax or oil the bolt first !

Fit both stabs tightly to the fuselage, and then drill the hole in the other stab and spar tube, thread and glue in the T-nut as before. Counterbore the holes in the bottom surface of the stabs for the boltheads so that they fit almost flush with the bottom surface of the stabs, and put a piece of clear tape over the bolt-heads for flight.

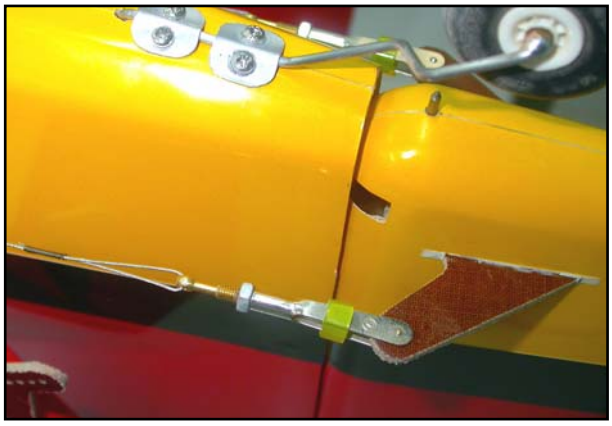
Note: Try to always leave the stab tube fixed in one stab, and never remove that one bolt, as it is difficult to find the right position for the stab tube again if it is removed from both stabs!

Rudder

The rudder is hinged to the fin with a Ø 2mm wire which passes thru' the 3 phenolic hinge posts that are factory-installed and aligned. File a point on one end of the wire, and a short 90° bend on the other end and push it through the rudder from the top, capturing the 3 phenolic hinges on the way. Don't forget to secure the bent end of the wire with clear tape for flight.



Trial fit the double-sided phenolic rudder horn in the slot that is already milled in the base of the rudder, and mark the part that will be glued in. Remove it, mask the exposed parts and scuff the centre part on both sides with coarse sand-paper. Glue in place with slow (*not* 5 minute!) epoxy and microballoons mix, making sure that it is centred in the rudder. The front edge of the phenolic horn should be flush against the back of the balsa false leading-edge.



Servo: The rudder is a huge surface on the Extra which definitely needs a hi-torque power servo, and we recommend the digital JR/Graupner 8511/8611, or Futaba S9351, for this very important control surface.

The servo is mounted in a CNC milled composite balsa plate, with a milled 3mm plywood reinforcement glued underneath it, and 2 balsa/glass stiffening rails, in the fuselage under the canopy area. The exact position you chose is up to you, but position the mounting plate at

least 86mm above the bottom of the fuselage to make sure that the pull-pull cables will clear the top of the stab servos.

NB: We recommend that this servo mount is finally glued into the fuselage after completing the motor and fuel tank base installation, form easier access.

Glue the ply plate to the bottom of the balsa with CA and mount the servo with the Ø 2.9 x 13mm screws provided, *not* the standard ones that come with the servo. The composite balsa rails are glued into the milled slots under the front and back of the plate with thin CA. Rough up the fuselage sides before gluing the complete assembly into place with 30 min. epoxy, and then reinforce these important joints with the glassfibre tape provided in the kit, and 24hr laminating epoxy (see photo).

The milled balsa parts for the rudder mount are a bit long, so you can chose the position to suit your motor and sand them to length, and help to set the correct Centre of Gravity. If you are using a lightweight set-up, like a glow engine, then you should move the rudder servo mount as far forward as possible, so that the front of the plate is against the back of the fuel tank mount. If you are using a larger motor, like the DA-50, you can install it at the back of the cockpit area (as shown in the photo here) without CG problems.

Note: Fit the wings to the fuselage before gluing in the rudder servo mounting plate - so that you cannot accidentally deform the fuselage.

With servo mounted under the cockpit as shown, the slots (30mm x 3mm) for the cable exits need to be approx. 360mm (14.5") from the back of the fin. If you prefer to 'cross' your pull-pull cables inside the fuselage, then the exit slot positions will be above the stab servos and just behind the leading edge of the stabs.

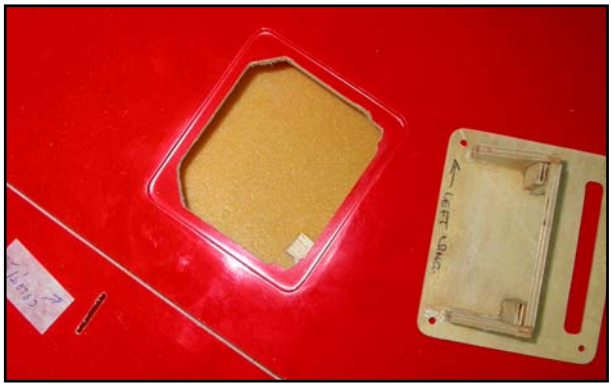
Rough sand the top surface of a 25mm (1") Ø metal output disc, and the bottom of the phenolic rudder servo arm. Centre the servo using your R/C and glue the phenolic horn in place perpendicular to the servo, using 30 minute epoxy. Then remove the assembly and secure the phenolic arm to the disc with the 3 small M2 bolts and nuts included, in a similar manner as for the stab servo arm extensions.

Make up the pull-pull wires for the rudder from the hardware supplied, with a loop at the front that goes over the hooks on the output arms, and a quick-link with turnbuckle and locknut at the rudder end. For security pass the closed loop cable through the supplied 'crimping tubes' 2 times before squashing flat with large pliers. 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.

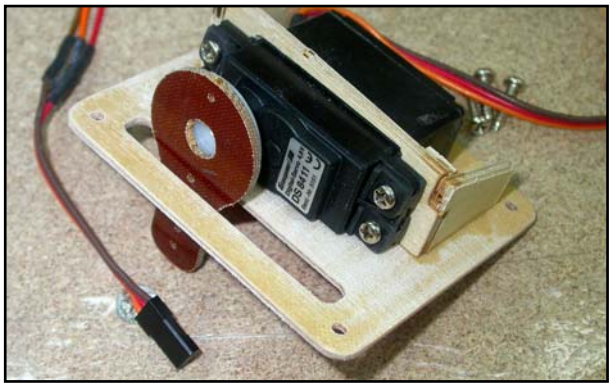
Wings

The wings are 95% finished at the factory, and have already been installed on your fuselage to check alignment. They fit on a 30mm Ø aluminium alloy spar tube, with 6mm Ø fibreglass rod anti-rotation pins at the front and back, which are all completed for you. Each wing is secured to the fuselage with a large M6 plastic nut, that screws onto the bolt that is factory-installed in the wing root. All you need to do is mount the servos, glue in the aileron horns and make up the linkages using the included hardware.

Please double-check now that the front and rear anti-rotation pins, and the M6 plastic wing bolt, are securely glued into the root ribs of the wings. You can also check the inside structure of the wings easily at this point, thru' the cutouts in the root ribs - to make sure that all critical components are properly glued in position.



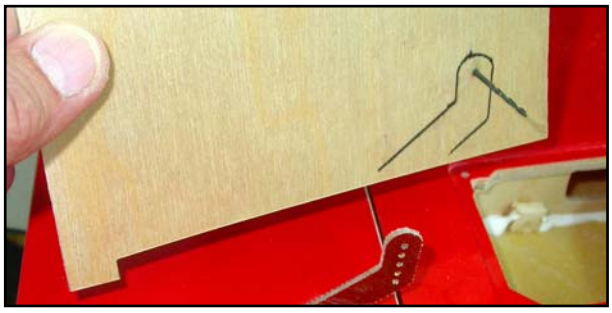
Glue the phenolic aileron horns into the milled slots in the same way as the elevator horns, making sure that the clevise holes are perpendicular to the hinge axis. As before, we advise you to fit just *one* horn first, then make a template (see photo right) to ensure that the other horn is positioned the same.



Servo choice: We highly recommend using a hi-torque digital servo (eg: JR/Graupner 8511/8611 or Futaba S9351) for each aileron as the surfaces are very large. We also strongly recommend that you secure the phenolic servo arm extensions to *metal* output discs on the servos, and *not* plastic discs. See page 16.

The servo hatches are pre-cut in the wing, and supplied with matching servo covers and CNC milled plywood servo mounts. Sand the inside surface of the servo hatch covers and the milled plywood parts that make up the servo mounts to make sure you have a good gluing surface.

Assemble the servo mounts from the milled plywood parts for each servo, using thin CA and a 90° square. Fix the servos into the mounts with the Ø 2.9 x 13mm screws, and place them on the hatch covers to check that the servo arms are in the centre of the slots milled in the hatch covers, and aligned with the aileron horns. Don't



forget to allow for the extra thickness of the C-ARF servo horns that will be fixed onto the servo discs. You may need to make the slots in the servo hatch covers a little wider, by 1mm or so.

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

Centre the servos using your R/C and fit the C-ARF phenolic servo arms to the servo output discs using the same method as for the elevator servos. Secure with 2 small bolts and nuts each. Fix the covers to the wing with 4 sheet-metal screws Ø 2.9 x 10mm.

Finally make up the linkages from the M3 x 60mm threaded rods supplied, with 2 clevises and 2 x M3 locknuts for each.

Important: The clevise should be on the *inner* hole of the servo extension arm, and on the aileron horn it should be on the *outer hole* from the aileron surface - to maximise the mechanical advantage and reduce any chance of flutter. With your transmitter throws set at maximum (125%) this will still allow even the hi-rate/3D throws mentioned at the end of the manual. Please do *not* use the outer hole on the servo arm, and do *not* reduce the throws electronically in your transmitter !

Don't forget to 'Loctite' the clevise and lock-nut on one end of each linkage, and fit short lengths of tube to prevent clevises from opening accidentally. Do NOT use single-sided ball-links on the phenolic horns, because they will twist the servo arm and cause flutter. This is a solid experience and you should consider it a FACT.

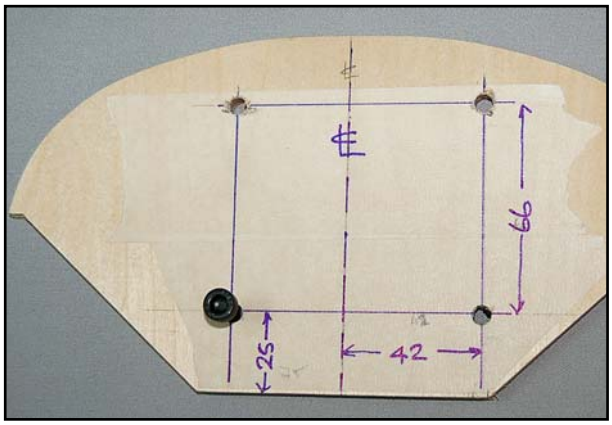
Motor Installation

The new Composite-ARF 2.12m design allows so many different choices of power unit that it's impossible to provide mounting bulkheads & hardware for all of them! Therefore, depending on your choice of gas/methanol engine you may need to modify the 'generic' milled plywood parts we have included, or even make a few of your own. It should also be possible to fit a Hacker C-50 or Plettenberg Xtra outrunner electric installation, using the 'Electric Option pack' originally designed for our Extra 2 x 2 (Product #610900), but of course you will need to modify the fire-wall and supports to fit.

The original prototype was flown with a DA-50, probably the top end of the power range that any-

one could possibly want ... and it has *lots* of vertical performance! There are many other gas engines that would be suitable, for example the Zenoah 38 or ZDZ 40, and ready-to-fly weight with these will be in the range of 6.7 - 7kg (15.5 LBS)

You could also use a powerful 2 or 4-stroke glow engine, like the OS140/160 or YS140/160 - which will give excellent, and quiet, flight performance and a very lightweight airframe.



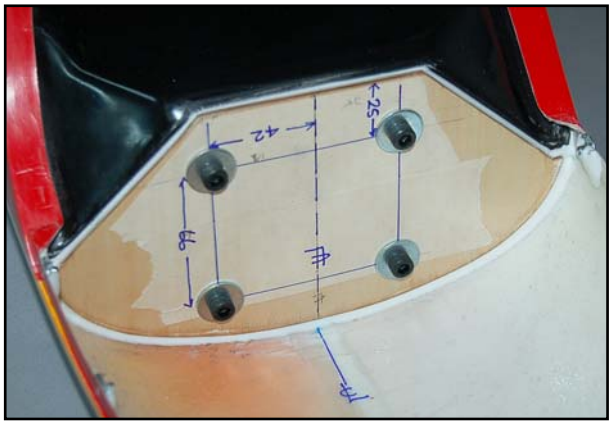
(above) The dimensions shown here suit the standoffs for a DA-50 with Ø 3.5" spinner. (below) The firewalls are glued into the fuselage, and temporarily secured with the bolts and T-nuts. Fill the 3 - 4mm gap between the firewall and the top surface of the fuselage with a glue fillet. Use slow epoxy and microballoons to glue the firewalls in the fuselage.

DA-50 (gas engine installation)

Installation of gas or methanol engines will vary considerably, depending on your motor and exhaust system choice, but here we show a typical set-up of a DA-50 and MTW TD75 mini-pipe. The method shown here can be modified to suit your preferred set-up.

The integral black fibreglass firewall and exhaust tunnel is factory installed in the fuselage and jig aligned, so that the front face the front face of the firewall has, nominally, 0 degrees side thrust.

However the manufacturing process does not allow us to set the up/down thrust exactly, and this could be as much as +/- 1 or 2 degrees from the wing incidence. Of course when you install the engine the upthrust required is easily adjusted by using a stack of washers between the back face of the motor stand-offs and the front of the plywood firewall.



The firewall consists of 2 identical milled 3mm plywood sheets. One of these must be glued to the front of the fibreglass firewall, and the other to the back face, with the black fibreglass part sandwiched in between them. With the DA-50 and carbon Mejzlik 23 x 8 prop the correct thrust line is approx. 3.5 degrees right thrust, and between 0.5 and 0.75 degrees 'upthrust', but this will vary a little depending on your motor/prop combination.

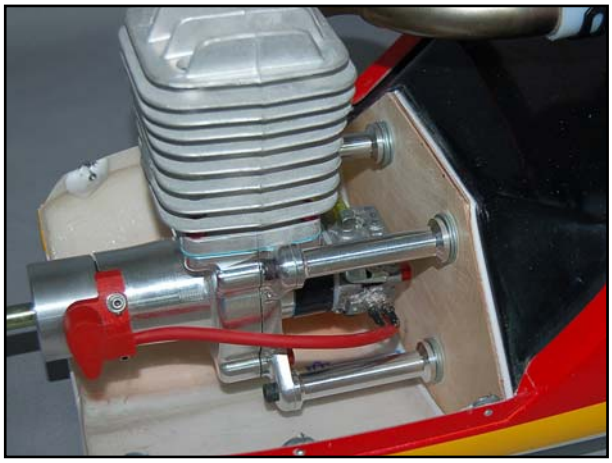
We recommend that you accurately mark and drill the engine mounting holes in the 2 plywood firewalls *before* they are glued in to the fuselage. The dimensions shown here suit the DA-50 with a 88mm (3.5") diameter spinner. Cover the front plywood firewall with masking tape and mark the vertical centreline on it, exactly at 90 degrees to the straight bottom edge of the firewall. Mark

a horizontal line, 25mm from the bottom of the firewall, which is the centreline for the lower 2 bolts of the 2.5" (65mm) long standoffs. The DA-50 has vertical mounting centres of 66mm, and horizontal centres of 78mm, so mark another line 66mm above and parallel to the 1st line.

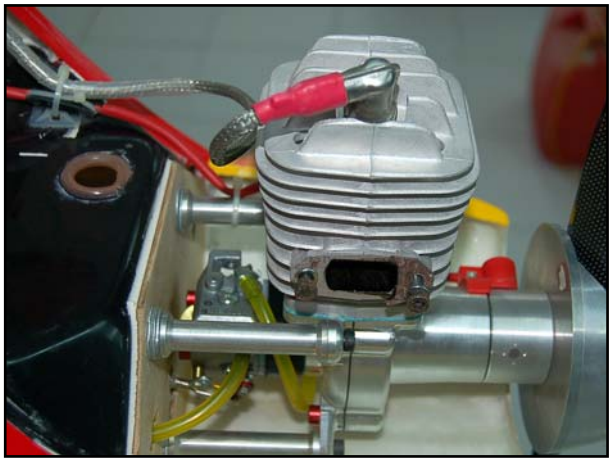
To give the correct sidethrust, and still have the spinner centred on the nose of the fuselage, the motor needs to be offset from the centreline by approx. 6mm, therefore the (pilots view) left standoff bolts are positioned 42mm from the centreline, and the right bolts 36mm the other side. The photos here should make this clear.

If you use a different diameter spinner you will need to adjust the vertical position of the motor - so that the spinner is central and aligns with the small radiused shape on the top of the fuselage.

Note: When the firewalls are finally glued into the fuselage you should leave a 3 - 4mm gap between them and the top of the fuselage and fill this with a nice glue fillet.



Place the 2 firewalls exactly on top of each other and drill thru' Ø 6mm for the 4 holes for the standoffs. With the fuselage upside down, mark the centerline of the fuselage just in front of the firewall position. Tack glue the front firewall (only) to the fibreglass firewall with 1 or 2 small drops of CA, not forgetting to leave 3 - 4mm space around the top edge, and drill thru' all 4 holes to set the alignment.



Tip: If you wish, at this point you can temporarily bolt your motor and standoffs to the firewalls, fitted either side of the fibreglass firewall, insert washers to set the sidethrust/upthrust and check for correct alignment of the spinner backplate with the fuselage. Small adjustments to the alignment can be made now by slightly moving the position of the plywood firewalls on the fibreglass bulkhead, and redrilling the holes in it, without having to redrill the holes in the ply firewalls.

When satisfied, remove the front firewall from the fibreglass bulkhead and rough up and clean the gluing surfaces of both ply firewalls, and both surfaces of the black fibreglass.

Glue both plywood firewalls into position and temporarily bolt them tightly together, with the fibre-

glass bulkhead sandwiched in between them, using the M6 bolts and T-nuts included in the kit, while the glue cures. This ensures that there are no air pockets in the firewall - especially where the standoffs will be positioned. Use a slow (at least 30 minute) epoxy and microballoons mixture and make a nice smooth fillet all around as shown in the photos.

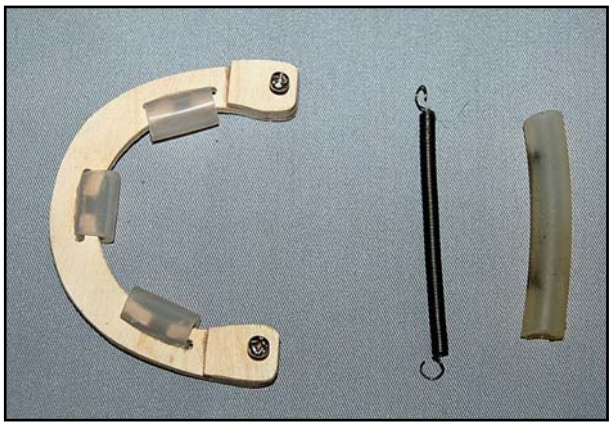
The stand-offs are mounted to the firewall with the M6 bolts and large diameter washers provided, or whatever bolt size is needed for your standoffs. Use an Incidence meter on the wing root, and against the prop-driver or spinner backplate of the motor to set the upthrust to about +0.5 to +0.7 degrees for the first flight. Add washers behind the (pilots view) left side standoffs and the front firewall the set the side-thrust to approx. 3.5 degrees, which will require a stack of washers about 4mm thick.

Fit the spinner backplate to the motor and check that the outside edge of the spinner aligns with the middle of the radiused curve on the top of the fuselage. The thrustline can easily be adjusted after trimming flights by adding or removing washers.

You will need to make a cut-out in the bottom of the cowl as the DA-50 cylinder head sticks out, but this gives excellent cooling and no internal baffles are needed in the cowling. You will see a very fine line molded into the to bottom surface of the cowl which can be used as a guide for cylinder cutout. Also open up the small cooling vent in the front lower surface of the cowl, as seen in the photo above, to approx. 30 x 30mm (1.25" x 1.25").

Mini-Pipe

A TD75 mini-pipe (Ø55 x 355mm long) and specially manufactured header from MTW is shown fitted, and these are available as an option from Composite-ARF (product #910060), as well as the DA-50. This set-up gives the engine a nice throttle response, a perfect mid-range, and also increases top end power slightly.



Now mill the large cutout in the bottom of the fuselage for the pipe cooling air exit. For the MTW TD75 mini-pipe the front of the cutout should be 230mm (9") from the front of the fuse-

lage, the length is 175 - 180mm (7") and the width should be 70mm (2.75"). Radius both ends of the cutout as shown. The dimensions of this slot can be adjusted to fit your chosen exhaust system as needed, within the overall size of the molded exhaust tunnel.

The mini-pipe is supported at the back of the exhaust tunnel in a 'U-shaped' milled plywood part which has 3 silicone buffers fitted into the slots in it, and an additional small plywood support under it at the front. Assemble the header and mini-pipe with the teflon joiner and clamps, and trial fit it in the fuselage. You will need to drill a hole of approx.18mm (3/4") diameter just behind the front flange of the fuselage for the exhaust outlet (see photos). Cut three 15mm lengths of the hard Ø10mm clear silicone tube provided, and fit them into the slots in the rear pipe support as shown. Glue the 2 small ply doublers to the ends of the pipe support, which will take the 2 sheetmetal screws for the spring that secures the pipe. You may need to sand the inside of the pipe support a little, in the area of the ply doublers, for a good fit of the TD75 pipe.

Trial fit the pipe support in the tunnel, positioned about 75mm (3") from the back of the cutout in the fuselage, and tack in place with a drop of CA. Test fit the header and mini-pipe and adust the position of the pipe support if needed. When the fit is Ok, sand the gluing position inside the pipe tunnel carefully, and glue it permanently in place with slow epoxy. The pipe is secured to the support using a short length of Ø 4mm spring (included), covered in another length of the Ø 10mm hard silicone tube. Bend a small hook in each end of the spring, and screw 2 of the Ø 2.9 x 13mm sheetmetal screws into the pre-milled holes in the pipe support doublers to hook the spring over - as shown in the photos.

Fit the additional milled plywood pipe support under the front of the mini-pipe (with a 20mm length of the silicone tube in the slot for isolation) glued to the bottom of the fuselage and on to the front of the plywood landing gear mount, using slow epoxy and micro-balloons mixture as shown.

The hard silicone tube 'isolation' buffers on the pipe supports give some flexibility for the pipe mounting, and also reduce the vibrations transferred to the airframe.

Glow Engine Installation

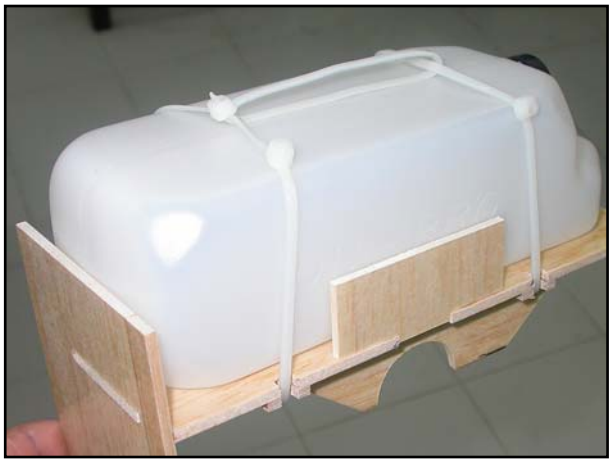
If fitting a 2-stroke or 4-stroke glow/methanol engine, for example OS140/160 or YS140/160, you can generally use the same techniques as shown above for the DA-50 (gas engine) set-up. Of course you will need to install either a solid F3A type 'beam' engine mount, or a 'Hyde' mount - bolted onto the plywood firewall provided in the kit, installed as described above.

A glow motor will result in a very lightweight aircraft, but you will almost certainly need to install all components, including the receiver batteries, as far forward as possible to achieve the correct Centre of Gravity. The Rudder servo mounting plate should also be installed as far forward as possible, and you can save some weight in the tail by using hi-torque digital mini servos for the elevators, of at least 7kg torque each.

The fuel tank base, made from the milled composite-balsa parts included, can be used and will accept a fuel tank up to 720ml if required. You can also install the receiver on the vertical bulkhead at the back of the tank base, as for the gas engine (see photo)
The exhaust system, or mini-pipe, can still be installed inside the composite exhaust tunnel - but make sure that there is sufficient cooling as described, and make a balsa baffle inside the cowling if needed to direct cooling air over the cylinder fins and prevent it just going out of the air exit in the bottom of the cowl - without passing through the cylinder head cooling fins.

Cooling

Depending on your choice of motor and exhaust system, mini-pipe or muffler you will need to make provision for enough cooling to all these components during flight. Make sure that the area of the exit hole for the air to exit the exhaust tunnel is at least 20% larger then the area of the air inlet area.



Fuel Tank Base

Included in the kit are CNC milled plywood and balsa/composite parts to make up a fuel-tank base, which also incorporates a receiver mount on the vertical back face. The photos show how the parts are assembled, and the completed unit is then glued on top of the fibreglass wing spar tube in the centre of the fuselage with epoxy and micro-balloons mix. Sand all the parts first, assemble with thin CA - and then reinforce all joints with a fillet of epoxy and micro-balloons mixture.

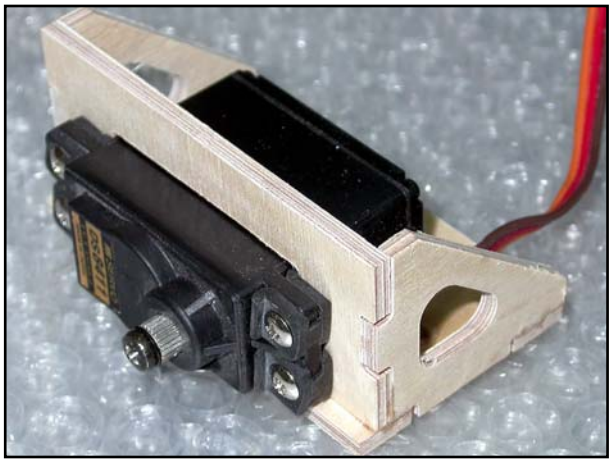
Reinforce the joint where the vertical balsa sup-

port is glued to top surface of the exhaust tunnel with a short piece of 1" glassfibre tape and laminating resin. The tank base is designed for fitting a Dubro 24 oz tank/700 ml (Part #424) and this is more than big enough, even for a DA-50. Glue a scrap balsa block to the front to prevent the tank moving forwards.

If you wish to mount your receiver on the vertical support at the back of the tank base, then glue the milled 3mm plywood stick to the inside surface, centred on the 2 large holes, wrap the receiver in thick foam and and fix it in place with 2 No.#80 rubber bands.

The fuel tank is held to the tank base with 3 cable-ties. Drill a hole in the motor firewall where 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.

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 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 it will come off at just the wrong moment and your engine will quit. So 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) and 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).

Throttle servo

Included in the kit is a CNC milled plywood throttle servo mount, and you can fit this in any suitable position for your motor set-up. However, we advise you *not* to mount it directly on the back of the firewall as engine vibrations can damage a servo quite quickly. We mounted it on the 5mm balsa plate that is glued across the top surface of the exhaust tunnel, in front of the tank base, which also has the motor ignition unit and ignition battery secured to it with cable ties. Two M3 bolts and T-nuts are included to secure the throttle servo mount as you wish. Included in the hardware are two M3 clevises and M3 threaded rod to make up the linkage from the servo to the carburettor.

R/C & Gear Installation

Everyone has their own favourite methods for fitting the R/C and gear, but the installation techniques shown here can be used as a guide and they have worked perfectly in all of our planes flown by C-ARF factory staff, and many of our customers. The advice below applies to whatever engine type you chose to fit; gas, glow or electric.

With a plane of this size it is important to keep everything lightweight to ensure the best perform-

ance and flying characteristics. The DA-50 powered version shown here is about 7.1kg, dry. Of course, the final weight of your model will depend a lot on the power plant used, and if you decide to add any trim or paint to the model.

Receiver and Antenna

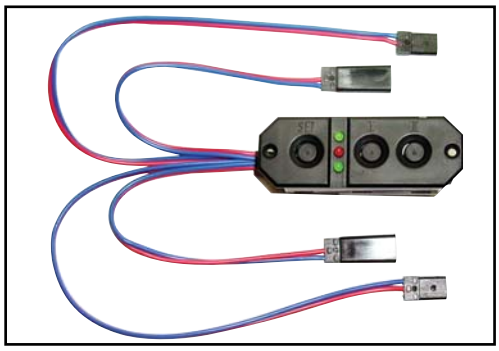
The receiver can be fitted anywhere you like, but the position shown on the back of the tank base works well, and it is easily accessible. Please protect it from vibration and shocks by mounting it on some foam rubber, and don't forget to secure the receiver crystal into the Rx with a piece of clear tape.

Run the antenna wire along the side of the fuselage in the cockpit area, taped in place, and then vertically through the top of the fuselage (in a piece of silicone tube) behind the cockpit and back towards the vertical stab. We often fit a short length of plastic tube, vertically behind the cockpit, for the Rx antenna and this does seem to give excellent range. Keep it as far away as possible from the cables for the elevator servos and the closed-loop rudder wires.

Composite-ARF strongly advise you to keep all the cables between the motor ignition battery, ignition switch, and gas-engine ignition unit, as far away as possible from the Receiver and Antenna.

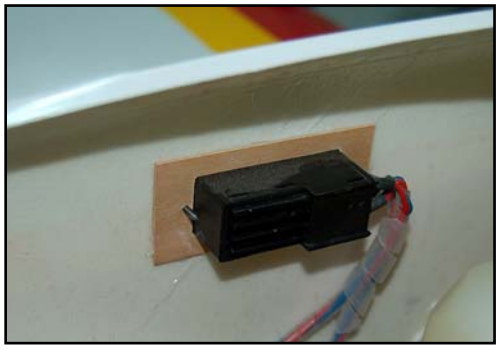
Batteries and Switches

As this model only has 5 or 6 servos, even if they are all digital types as we have used here, a single receiver battery pack of 5 cells x 1400 mAH is normally quite sufficient, or if you prefer, then 2 x 1200 5-cell NiMH packs and a Powerbox Sensor switch as we have used here. The Sensor switch incorporates both dual battery inputs and outputs to the receiver, as well as a voltage regulator for 5-cell packs which regulates the voltage to 5.9 volts. You can use this switch with 1 or 2 battery packs. An excellent lightweight unit that is available from Composite-ARF as an option.



PowerBox 'Sensor' switch

Wrap the batteries in foam, to protect the soldered joints from vibrations and shocks. The location of your batteries will depend on your motor choice and where they need to be for correct C of Gravity. We glued a 5mm thick balsa plate to the top surface of the exhaust tunnel, in front of the tank base, and installed the ignition unit and ignition battery on it. The 2 receiver packs are 5-cell 1200 mAH NiMH, and these were installed immediately behind the rudder servo mount, as shown in the photo. Of course, if you need more weight in the nose of the



'plane to achieve the correct Centre of Gravity, it is better to install a larger Nicad - rather then add lead.

When using a gas engine we highly recommend a 'Powerswitch' for the ignition cut-off, which is available from C-ARF.

If fitting the switches into the outside surface of the fuselage, as shown, you should reinforce the area inside with a small patch of 3mm thick plywood to reduce vibration transmissions to the switches. The Powerbox switches come with paper templates for cutting the slots.

NB: *Please double-check the manual for your R/C system if the use of 5-cell battery packs is recommended, or not.*

Motor ignition system
The ignition unit can be secured onto the top of the exhaust tunnel, as previously mentioned, using 2 or 3 small cable-ties. We advise that you mount it either on a foam pad to protect from vibration. At C-ARF we recommend a 4-cell 1000 - 1200 NiMH for ignition, and we use a Powerswitch for the ignition cut-off. Add a very small cable tie around the plug/socket connectors from the motor pick-up to the ignition unit for extra security.

Servo extension leads etc.
We advise you to use good quality twisted-cable extension leads, of heavy gauge wire with gold-contact connectors. Secure all loose wires and extension leads - remember that when you are pulling those 10G manoeuvres everything in the plane has 10 times more force than usual! Be very careful to fix all your batteries securely.

Make extra sure that no fuel tubes or cables can come in contact with hot exhausts.

Fuel proofing
If fitting a gas or glow motor we highly recommend that you protect both sides of the plywood firewall, and all the bare wood parts and edges inside the front of the plane with one thin coat of 24 hr laminating epoxy, or similar, brushed on. Be careful not to add excess weight here - it only needs about 25 - 30 grams (1 oz.) of epoxy to fuel proof all the wood in the whole area in the front of the plane.

Final check

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

- Are all extension leads, cables and fuel tubes securely fixed to the side of the fuselage ?
- Are all tubes/wires protected from chafing where they pass thru' the holes in fibreglass parts or bulkheads with rubber grommets, or short lengths of split silicone tubing?
- Make sure that no fuel tubing or wires can come into contact the hot exhaust.
- Did you fit short Tygon or silicone tube pieces over all the clevises?
- Did you tighten the M3 locknuts against all the clevises?
- Are the swages crimped up nice and tight on the rudder cables?

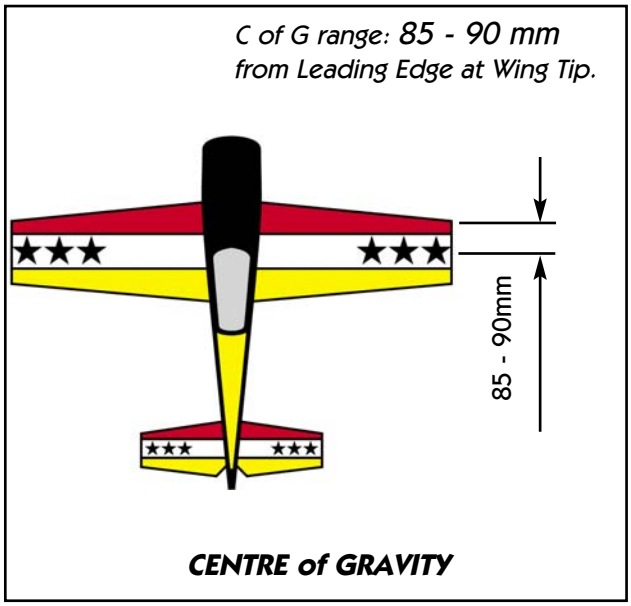
- Have you put clear tape over the end of the rudder hinge wires and on the stab bolts ? Don't forget to tighten the large Plastic M6 wing retaining nuts before flying!
- For added security add one small drop of loctite/thread locking compound on all engine mounting bolts, and those that hold the servo 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

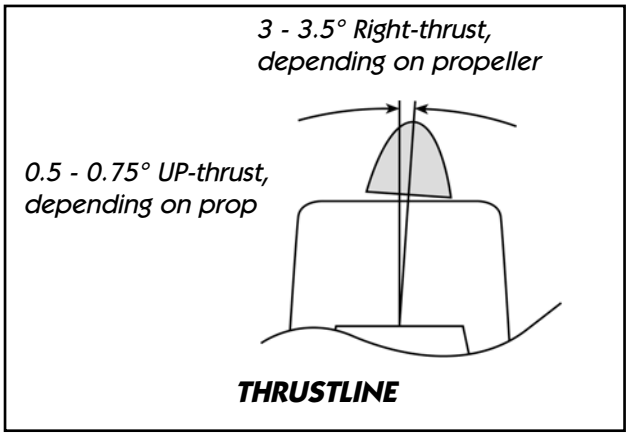
Centre of Gravity:
For the 1st flights set the Centre of Gravity at 85 - 90mm (3.3 - 3.6") from the leading edge ***at the wing tip***. Hold it with a helper at both wing tips in this position and make sure the plane balances horizontally, or slightly nose-down. This is the 'pattern' CG position.

After you are confident with the plane, you can move it backwards up to 95mm from the leading edge at the ***wing tip***, 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 and more exponential, as described below.



Don't forget to balance the plane laterally also, holding the spinner central bolt and a fingertip under the rudder, and if needed add a small weight to the light wing tip.

Engine Thrustline:
UPthrust should initially be set at 0.5 - 0.75° degrees and right thrust 3 - 3.5 degrees, depending on the power system and propeller used. Of course, final settings can be fine-tuned to your liking after the first few flights, and will ultimately depend on your motor/propeller set up.

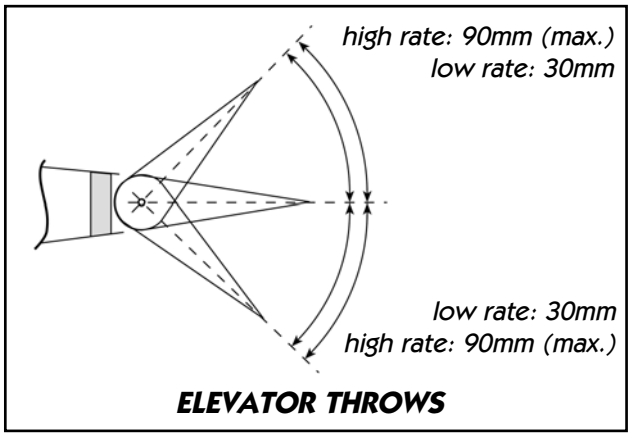


Control Throws:
All measurements are at the root/trailing edge position. All controls should be set with a dual rate switch, and we *highly recommend* that you make your first trimming flights using all of the low-rate settings listed below.

Elevator

Low rate should be no more than 30mm (1.25") 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.

On high rate the elevator should really be at maximum, up to 50 degrees both sides, but in this case with at least 50% exponential, and this hi-rate setting is definitely for 3D only !

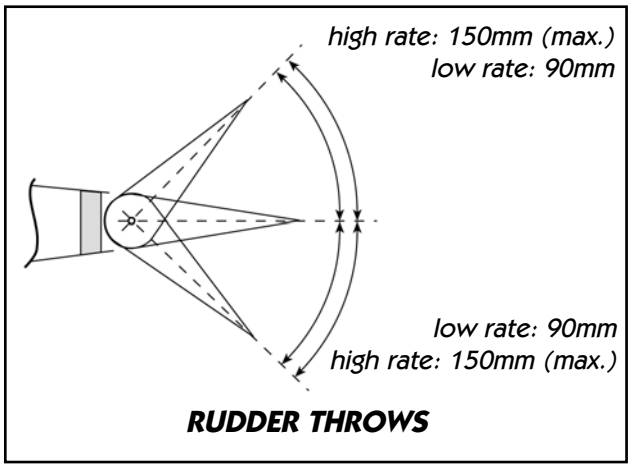


ELEVATOR THROWS

Rudder

Set the high rate to maximum throw (about 150mm) both sides, and at low rate reduced to about 90mm. 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 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.

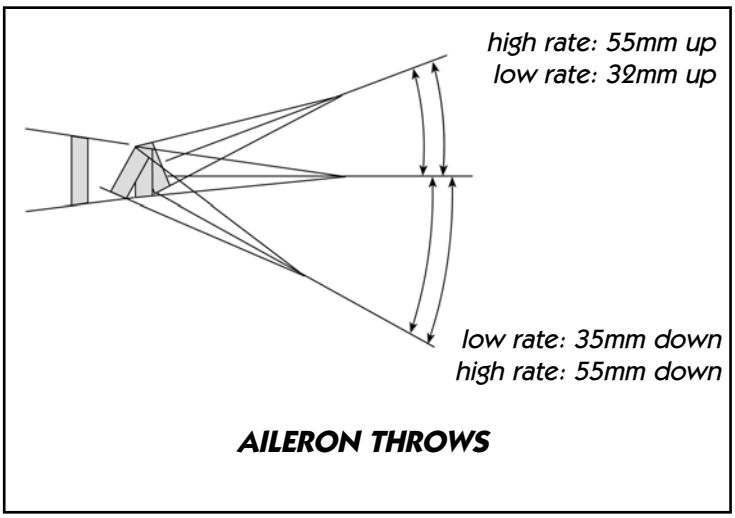


RUDDER THROWS

Ailerons

Aileron throw for high rate is 55mm up and down. Use at least 30% exponential for high rate. For low rate you should decrease the throw to the *top* to 32mm, and the *bottom* to 35mm.

Yes, 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 during flight, as mentioned earlier in this instruction book. At high rate, for 3D manoeuvres, 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.



AILERON THROWS

In General

Your Extra has very large control surfaces, which 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. 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 set up all your linkages to give the maximum mechanical advantage and correct throws - rather than reducing the throws electronically in your transmitter.

We hope that you enjoyed building your Extra 300L. Also let us know, if you think that any hardware is missing or inadequate. We have tried to make this airplane as complete as possible, and with good feedback from customers you will help us to continue making good things even better. We appreciate your comments very much.
Email: feedback@composite-arf.com

Appendix:

Kit Contents: Extra 300L, 2.12m (84") Kit

Quantity	*Description*
1	Fuselage
1	Right wing (servo hatch taped to wing)
1	Left wing (servo hatch taped to wing)
1	Right stabiliser
1	Left stabiliser
1	Rudder
1	Cowling
1	Canopy Frame
1	Clear Canopy
1	Pair wheel pants
1	Pair landing gear legs, carbon
1	Aluminum Wing tube, Ø 30 x 1.4 x 735mm (wing spar)
1	Carbon Stab tube, Ø 14 x 1 x 275mm (stab spar)
1	Set of protection bags (wings, stabs and rudder)
1	Hardware bag
1	Milled wood parts bag
1	Instruction Manual (English)

Hardware Pack

Fuselage bag

Quantity	*Description*
1	Silicone tube Ø 10mm x 125mm (muffler mounting)
4	T-nut M6 (engine mounting)
4	Allen bolt M6 x 20mm (engine mounting)
4	Washer M6 large (engine mounting)
8	Allen bolt M3 x 12mm (cowling mounting + 2 spare)
2	Allen bolt M3 x 20mm (throttle servo mount fixing)
8	Washer M3 (cowling mounting and throttle servo mount)
8	T-nut M3 (cowling mounting and throttle servo mount)
2	Clevise M3, spring steel (throttle linkage)
2	Nut M3 (throttle linkage)
1	All-thread M3 x 150mm (throttle linkage)
2	Sheetmetal screw Ø 2.9 x 13mm (to attach spring for muffler mounting)
2	Bolts M4 x 45mm (wheel axles)
4	Bolts M4 x 20mm (attach carbon LG to fuselage)
4	T-Nuts M4 (attach carbon LG to fuselage)
12	Washers M4 (attach LG to fuselage, and wheel centering)
2	Stop Nuts M4 (to secure ends of axles)
2	Nuts M4 (wheel centering)
2	Wheel collars I.D 4mm (wheel centering)
2	Sheetmetal screws Ø 2.9 x 13mm (set wheelpant angle to LG)
2	Allen bolt M3 x 16mm (to attach canopy frame)
2	T-nut M3 (to attach canopy frame)
1	Hatch Catch (to attach canopy frame)
2	Canopy hook - phenolic (to attach canopy frame + 1 spare)

2	U-shaped plate for hook - phenolic (to attach canopy frame + 1 spare)
2	Phenolic plate 15mm x 60mm (for canopy/cowling alignment tabs)
1	Spring, Ø 4mm x 70mm long (to secure muffler to rear mount)

Wing bag

Quantity	*Description*
2	Aileron horns - phenolic (2mm thick)
2	Servo arms - phenolic (2mm thick)
2	All Thread M3 x 60mm (for aileron linkages)
4	Clevise M3, spring steel (for aileron linkages)
4	Nut M3 (for aileron linkages)
4	Sheetmetal screws Ø 2.2 x 10mm
8	Sheetmetal screws Ø 2.9 x 13mm (for securing servos)
8	Sheetmetal screws Ø 2.9 x 10mm (for securing servo hatches)
4	Plastic nut M6 (to secure wings to fuselage + 2 spare)
4	Bolt, M2 x 10mm (to secure phenolic arms to metal servo discs)
4	Nuts, M2 (to secure phenolic arms to metal servo discs)

Stabiliser bag

Quantity	*Description*
2	Elevator horns - phenolic
2	Servo extension arms - phenolic
2	M3 All-thread x 60mm (elevator linkages)
4	Clevise M3, spring steel (elevator linkages)
4	Nuts M3 (elevator linkages)
2	Allen Bolts M3 x 12mm (to secure stab tube into stabs)
2	T-nuts M3 (to secure stab tube into stabs)
2	M3 washers
8	Sheetmetal screws Ø 2.9 x13mm (to attach servos to plywood mounts)
4	Sheetmetal screws Ø 2.2 x 10mm
4	Bolt, M2 x 10mm (to secure phenolic arms to metal servo discs)
4	Nuts, M2 (to secure phenolic arms to metal servo discs)

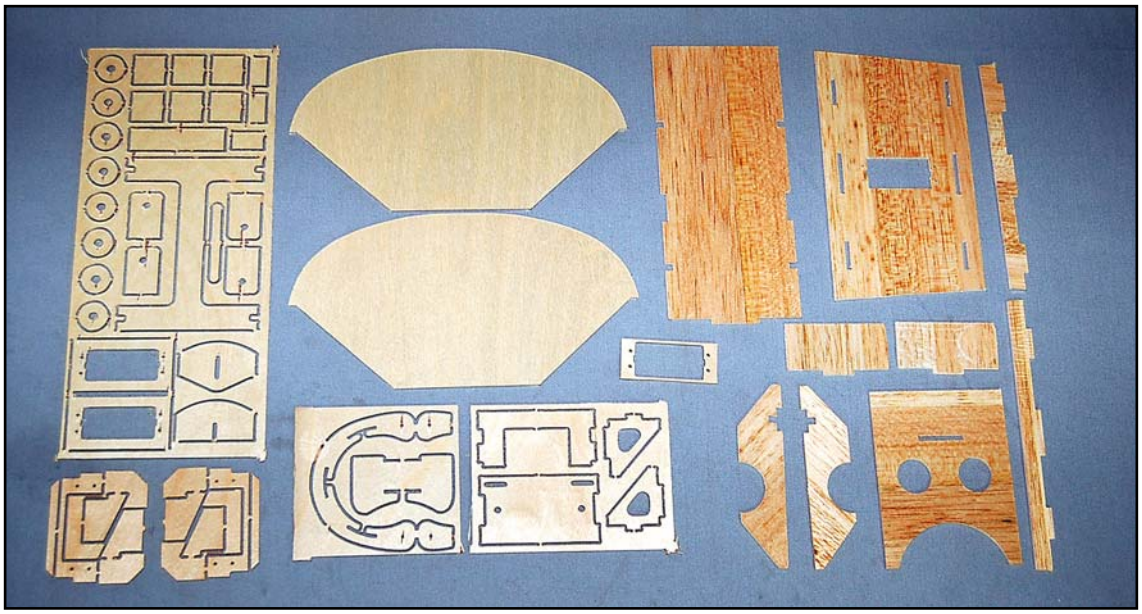
Rudder Bag

Quantity	*Description*
1	Rudder Horn - phenolic
1	Servo arm for Rudder servo - phenolic
1	Pull-Pull cable 0.8 mm Ø x 2 metres
4	Crimping tubes for cable
3	Sheetmetal screws Ø 2.2 x 10mm
2	Cable adapters with eyes for cable, M3 (rudder linkage)
2	Nut M3 (rudder linkage)
2	Clevise M3, spring steel (rudder linkage)
1	Hinge wire Ø 2mm x 400mm (rudder hinge)
4	Sheetmetal screws Ø 2.9 x 13mm (to secure rudder servo to mount)
1	Fibreglass tape 20 x 200mm long (secure servo mount to fuselage)
3	Bolt, M2 x 10mm (to secure phenolic arms to metal servo discs)
3	Nuts, M2 (to secure phenolic arms to metal servo discs)

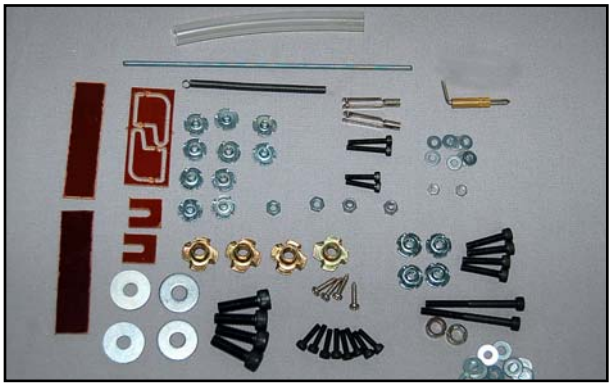
Available Accessories:

(please check our website for current list of options and accessories)

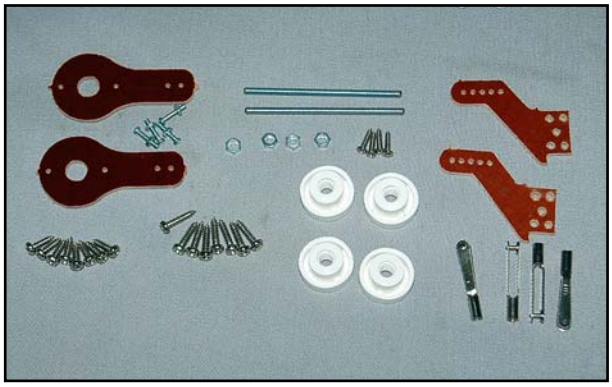
Desert Aircraft DA-50 motor
MTW Mini-pipe and header set for DA-50 motor
Powerbox 'Sensor' switch with regulator a dual inputs/outputs
Powerbox 'Powerswitches' for Ignition or Receiver batteries



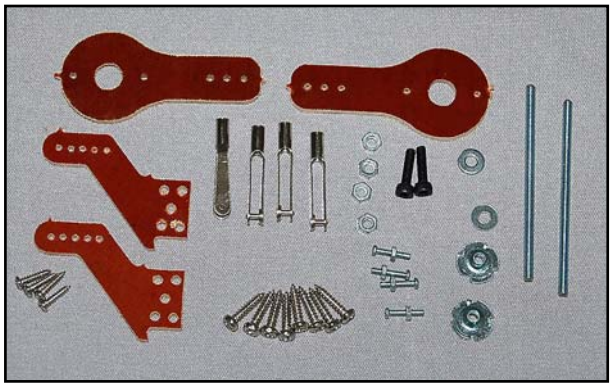
Standard Wood parts included in the kit



Fuselage hardware pack



Wing hardware pack



Stabilisers hardware pack

Rudder hardware pack

Standard Hardware included in the kit