CARF MODELS

Instruction Manual

CARF Models 'Eurosport'

TAVS Technology

version 1.0

Instruction for CARF-Models Eurosport jet airplane

Thank you very much for purchasing our CARF Eurosport all composite aircraft, made with the revolutionary Total Area Vacuum Sandwich (TAVS) technology

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: *info@carf-models.com*

Website: *http://www.carf-models.com*

This instruction manual aims to do 3 things:

1) Show you how to build your aircraft accurately and properly.
2) To explain about your fully-composite aircraft, and how to handle and maintain it.
3) How to set up and trim your finished jet model to give you the most enjoyment from it.

The 'New' 2004 CARF Eurosport is based on our extraordinarily successful Eurosport, which has become one of the most prolific sport and 3D jet models in the last 3 years - with over 700 sold around the world.

We have taken advice from many of the world's top jet pilots to improve our original design even further, and make it even more 'ARF' to get you into the air faster. Using the latest composite moulding technology and techniques we have been able to improve the strength, without adding to the weight, and will be releasing several stunning new colour schemes throughout the year for your enjoyment.

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 CARF-Models 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 CARF-Models 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. Under 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 CARF-Models 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 CARF-Models 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 jet model aircraft we strongly recommend that you enlist the help of an experienced jet 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.

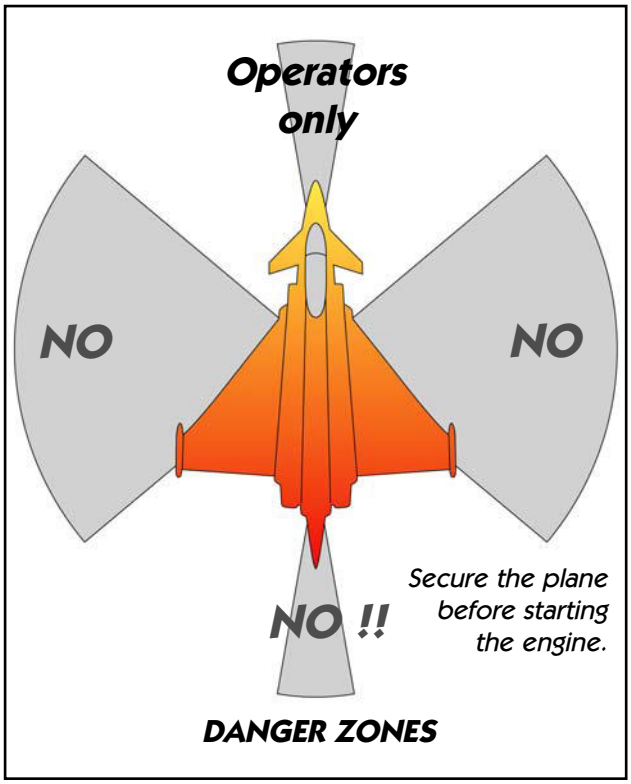
Please don't ignore our warnings, or those provided by other manufacturers. They refer to things and processes which, if ignored, could result in permanent damage or fatal injury.

Attention !

This jet model airplane 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 and servos, and the accessories supplied in the kit.

Make sure that the 'Centre of Gravity' is located in the recommended place. Use exactly the recommended CG position for your first flights. If you find that you need to relocate your batteries or add weight in the aircraft to move the CG to the recommended position, please do so and don't try to save weight. 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 up the engine. Have at least 1 helper hold your plane from the nose end before you start the turbine, and have a fire-extinguisher ready at all times. Make sure that all spectators are far behind, or in front, of the aircraft when starting and running the engine.



Make sure that you range check your whole R/C system thoroughly before the first flight. It is absolutely necessary to range check your complete R/C installation first WITHOUT the turbine running. Leave the transmitter antenna retracted, and check the distance you can walk before 'fail-safe' occurs. Then start up the engine, and repeat this range check with the engine running at above half throttle. Make sure that there is no range reduction at all 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.

Note: Before operating your turbine motor, please carefully study and understand the manufacturers instructions and safety warnings, especially in regard to Danger Zones.

Make sure that your main spars and tubes are not damaged and fit tightly together. Make sure that the two M6 Wing retention bolts are fitted. Check that the front anti-rotation pins for the wings are located correctly in their holes, and are not loose. Check that the M6 bolt that secures the front of the removable vertical fin is tight and that there is no side-to-side movement at all in the fin assembly. Check the Canard linkages and neutral setting carefully. Operate the retractable landing gear, to check that it 'locks' in both the 'up' and 'down' positions, and that there are no air leaks.

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 'Eurosport'.

General information about fully-composite aircraft structure and design

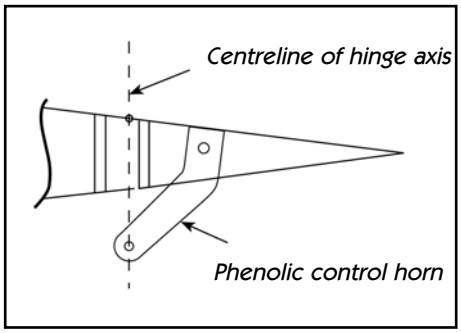
All the parts are produced in negative molds, manufactured using vacuum-bagged sandwich construction technology. All parts are painted in the moulds, either single colour or designer colour schemes. A new production method, called TAVS (Total Area Vacuum Sandwich), enables us to present this aircraft 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, and fully vacuum bagged, using only 3 layers of 80gm/2.5 oz. cloth in combination with a very hard 2 mm foam sandwich form a hard and durable outer skin. Because of this TAVS technology very few additional structural parts are needed, as can be seen in this photo.

(above) The 'New EuroSport' wing structure in the mould before the wing halves are joined. The landing gear mount, support structure and root ribs are now completely constructed from high-quality plywood for extra strength.

The elevons are already elastic-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 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 only a very narrow slot in the bottom surface, where the elevon 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 elevon differential in your transmitter program. This means that the 'down' throw needs to be about 10% more than the up throw to give nice axial rolls.

Why? Because the axis of the hinge is not at the centreline of the elevon, so it moves slightly in and out when it travels, and the elevon 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 axial line. You can set it perfectly, this is guaranteed.

The bottom hinge 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 wouldn't 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 phenolic control horns are glued into the elevons properly. The holes in the horns for the ball-links (or quick-links) need 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 both 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 wing, although only the inner servo positions have the plywood reinforcement and slotted hatch covers for the servo output arms. This is because we recommend that you use only 1 high-quality digital servo (JR/Graupner 8511/8611 or 8411) per wing which is quite sufficient for all flying styles when the model is powered by a turbine within the recommended thrust range. For turbines at the lower end of the thrust range a single JR/Graupner 8411 servo will be enough, but 8611/8511's are recommended for turbines of over 13 kg thrust.

A single high-torque digital servo like the JR8511/8611 is more than enough for each elevon, but a second servo bay is moulded-in to allow dual servos if required.

However, if you choose to fit lower specification servos you can fit 2 in each wing and split the control surface between the central ribs that are moulded-in to allow this. Do ***not*** split the functions of the control surfaces (ie:: elevator only on the inner and aileron only on the outer surfaces) as the reduced surface area for each function severely limits the flying performance of this model, and in some circumstances, for example at very slow airspeeds, you will not have sufficient control.

Our servo covers and milled plywood mounts make both installation of the elevon servos, and exchange if necessary, very quick and easy and provide a rock solid servo mounting and linkage system.

The main landing gear mounts are now even stronger than before with a fully composite plywood structure tied in to a plywood root rib, to better withstand grass field operation - and the occasional 'rough' landing - and don't need any extra reinforcement. We had plenty of time and experience to engineer the strength needed in this area, assisted with advice and feedback from customers, and we are confident that the revised structure will satisfy even those who operate from very short and rough fields. In addition all the openings for the retracts and wheels are cut out for you at the factory.

Canards:
The vacuum-bagged sandwich canards have the 6mm Ø carbonfibre shafts pre-installed, together with the composite root ribs, using an accurate alignment jig. The Canard servo mounting plate and 'P' plates are also installed.

The canard shafts and tubes are carefully aligned and installed for you at the factory, using a specially moulded jig for accuracy.

Fuselage:
The fuselage is also made in negative moulds. All the load-bearing internal parts and bulkheads are now glued in using jigs and templates during the moulding and assembly stages in the factory, to ensure accurate location and reduce the assembly time for you. The 4 main wing spar tubes, canard shafts and tubes, canard servo plate, vertical

fin spar tubes, rear bulkhead, and the holes and reinforcement plates for the wing anti-rotation dowels, are already installed. All incidences are already set in the moulds and proven so that no checking or adjustment is necessary.

The nose landing gear mount plates are also fully installed at the factory, together with the glassfibre tow reinforcement, and are also stronger than before.

The revised mounting rails for the turbine are pre-installed, and are strong enough for any currently available commercial turbines up to 16kg thrust.

Additionally we now include a moulded fibreglass canopy frame, painted in the moulds to match the fuselage colour, at the request of many customers, which will allow you to make a really nice cockpit if you wish.

Take Care:
Composite sandwich parts are extremely strong, but fragile at the same time. Always keep in mind that these 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.

(above) A general view new removable vertical fin assembly. (below) The carbon-fibre canard shafts and tubes are now pre-installed in the factory using a jig.

(Left and above) A couple of views inside part of the new factory, showing a small section of the 'Finishing' and 'Quality Control' areas, as well as the EuroSport Assembly line, and the revolutionary vacuum-oven tables.

The 'Paint Job'

Occasionally customers notice certain problem areas with composite parts.
But the question is: Are these real problems, or are they just a misunderstood sign of high-tech construction, proving the high-end composite technology?

Seams:
ALL composite parts have seams. They are there today, and they will be there forever. You will have to get used to them ... or you'll have to touch up the paint yourself !

But what is a seam? A seam on the fuselage, especially already painted in the mould, proves that this is a vacuum-bagged high-tech part, made in negative moulds. Our seams are fine and straight, no negative impression at all ... but they are there. When possible we include 5mm wide strips of self-adhesive vinyl, painted in exactly the same colour as the plane for you to cover the seams if you want.

(above) The latest 'new for 2004' colour scheme for the Composite-ARF range is the 'Jetcat Eurosport'. Stunning colours and blends/fades in metallic paint make this truly difficult to mask and spray in the moulds - but we think that the result is well worth it!

Paint flaws:
If the aircraft is painted in the moulds, you can save a lot of weight. At least 2 lbs ... and that is definitely worth saving !

A negative paint job is very complicated to make. The painter never sees the result of his job. He cannot see the design growing and developing - he is painting 'blind'. He even cannot see little mistakes and flaws, and even if he COULD, he could not correct them. The maximum time to apply a designer paint scheme in the mould is no more than 20 minutes. It is a big rush against time, because even if it is just few minutes too slow then the masking cannot be removed without pulling off the paint itself ! This is a BIG challenge, but the result is extraordinarily impressive. Even with slight flaws the general appearance of these one-of-a-kind paint jobs is unique.

(below) The 1st of the "New-for-2004" ES paint schemes ... ... the stunning 'Fantasy Red/Yellow' version. Don't forget your sunglasses !

In a ‘positive’ paint job some effects can never be done. Just think about the shadows, peel backs, highlights, and 3D effects - and all with a perfectly flat and uniform surface for optimum airflow and aerodynamics.

Truly hard to do, but still possible, are the paint jobs which seem to be so simple at first glance: Schemes with straight lines and stripes. Quite easy with positive painting, but it’s very hard masking the lines in the negative moulds, because we cannot assemble the parts before masking. To get the stripes lining up exactly at the rudder, wing and vertical fin joints is therefore almost impossible. This is why we suggest using thin vinyl trim to make sure that these stripes line up perfectly. Sometimes it is necessary to do that, and it is definitely not a quality problem or a "flaw". It comes back to what is possible, and what is impossible.

If you want to have a really perfect paint job, then you may decide to have a single colour version and paint it by yourself, or with a friend.

But don’t forget: Consider the additional cost, consider the additional weight, consider that even if it is painted ‘positive’ there will be areas you won’t be happy with. Of course you won’t complain, because you created these flaws yourself… !

(above) A view of our big Yak-55SP showing some of the details of the incredibly complex colour scheme - all painted in the moulds.

(above) The new ‘Grey’ EuroSport, allowing customers to paint to their own design, or finish in a ‘scale’ paint scheme. Various scale details, such as missiles and pylons, and a decal set, will be available in the future.

(left) Another view of the new C-ARF ‘JetCat’ scheme Eurosport, outside the new factory.

(below) This is the FiberClassics (now ‘Composite-ARF’) force at the TOC 2000, with all models painted in the moulds.

Tools and Adhesives

Tools etc:

This is a fairly quick and easy plane to build, for a jet model, not requiring difficult techniques or special equipment, but even the building of CARF-Models 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 & 5mm
3. Sharp scissors, curved type for canopy
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. Battery drill and Dremel tool (or similar) with cutting discs, sanding tools and mills
10. Sandpaper (various grits), and/or Permagrit sanding tools (high quality - recommended)
11. Carpet, bubble wrap or soft cloth to cover your work bench (most important !)
12. Car wax polish (clear)
13. Paper masking tape
14. Denaturised alcohol, Acetone, or similar (for cleaning joints before gluing)

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.

Jet models require good gluing techniques, due to the higher flying speeds, and hence higher loads on many of the joints. We highly recommend that you use a slow filled thixotropic epoxy for gluing highly stressed joints, like the hinges and control horns, into position and the most commonly used is 'Aeropoxy' (Bob Violett Models, USA). 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 you favourite type.

1. CA glue 'Thin' and 'Thick' types. We recommend ZAP, as this is a very high quality.
2. ZAP-O or Plasti-ZAP, odourless (for gluing the clear canopy)
3. 30 minute epoxy (stressed joints must be glued with 30 min and NOT 5 min epoxy).
4. Aeropoxy/Loctite Hysol 3462 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 epoxy for lightweight filling.
8. Thread-locking compound (Loctite, or equivalent)

At CARF-Models 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: info@carf-models.
We know that even good things can be made better !

Accessories

Here is a list of the things you may need to get your CARF-Models Eurosport in the air. Some of them are mandatory, and some of them are optional and can be chosen by you. What we list here are highly recommended parts, and have been thoroughly tested.

1. Power servos (min. 4 required). We recommend JR 8511/8611's for the Elevons, and JR8411's for the Canards and Rudder.
2. Nosegear steering servo. Any standard sized metal-geared servo of min. 5kg torque.
3. 2 servos for Landing Gear and Wheel Brake valves, unless electronic valves are used.
4. Landing gear set with wheels, struts, and brakes. (available from CARF as an option)
5. Pneumatic support set for landing gear (air tubing, valves, Tee's, fill valves, air tanks etc.)
6. Turbine motor, with thrust range between 11kg and 16kg, with ECU, fuel pump, battery and solenoid valves, mounting strap etc. One of the common choices is the JetCat P120, although we have shown a P160 in these instructions, and the turbine installation shows JetCat accessories. In future we hope to show installations of other turbines.
7. Fuel Tanks of capacity to suit your turbine (available from CARF as an option).
8. Fuel tubing, Hopper tank (or BVM UAT), festo fittings, fuel filters, fuel tube clamps etc.
9. High quality heavy-duty servo extension cables, with gold connectors. High quality receiver switch, 'Y' leads, ceramic/ferrite chokes etc.
10. Receiver Nicad. One 4 cell 1800 - 2400 mAH pack, or 5 cells with voltage regulator.
12. Cable ties in various lengths. Cable management parts, Aluminium tape, safety clips etc.
13. Inlet Ducts and Turbine Bypass set (Optional - available from CARF)

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 CARF-Models Eurosport.
If not, please read it again before you start the assembly.

Building Instructions

The *CARF-Models* Eurosport:
With experience and feedback from many customers, we have re-designed and improved our original Eurosport jet model. It is now '*Much More ARF*', with about 80% of the assembly already done for you at the factory - to get you into the air even faster.

The main undercarriage mounting system in the wings and nose have been considerably strengthened, with high-quality all plywood construction, and we now offer 2 choices of optional retractable landing gear - the original *'Economy'* set, and a new *'High Performance'* set, which is complete with all the pneumatic tubing, filer and valve, 'Tees', quick-disconnects, and air tank.

The main bulkheads are now factory-fitted and aligned, together with the support structure for the all-new removable vertical Fin and Rudder - to aid storage and transportation. The canards and mounting shafts/tubes, as well as the servo plates, are all improved and factory installed.

All-new moulded carbon-fibre canard control arms are also now included to improve the canard operation. The jigs and templates used for the wing mounting spars are now more accurate, making it easier to order replacement parts if you have an accident.

Many new CNC milled plywood and composite-balsa parts, such as ECU/Receiver, fuel pump mount, and R/C gear installation plates, are now included as standard in the kit. A fully moulded fibreglass canopy frame is now included - painted in the moulds to match your plane of course!

Furthermore we have introduced several new 'options', including a complete moulded kevlar fuel tank set (with support bulkheads), and a new full-flow inlet and turbine bypass system. Other options, like external armament, pylons and scale decal sets will follow shortly.

Many of the other improvements and modifications are described in the 'Description of Parts' (page 5), and below in the details of each section of the kit. We even went to the trouble of milling holes through all the main bulkheads for the installation of all the extension cables, tubes and other services !

If you have any questions during assembly of the Eurosport, or can suggest any information or details that should be included in these instructions, please don't hesitate to email us at:
ordersupport@carf-models.com

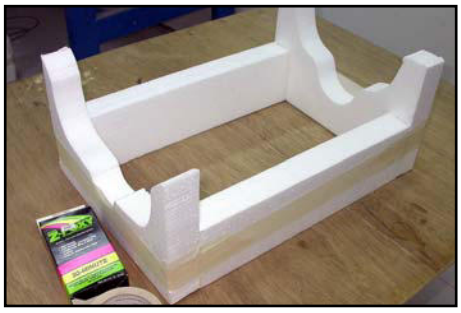
We know that even a great product can be made better !

General Tips:
We recommend that you follow the order of construction shown in this manual for the main assembly, as it makes access to everything easier and saves time in the end.

It is up to you whether you want to complete the R/C installation for each part as you do the main assembly - or all together at the end. Certainly thought should be given to the routing of airlines for Landing Gear and wheel brakes, extension cables for elevons and rudder servos, and fuel/gas tubes for your chosen turbine as you proceed with that section, and many of these can be installed as you proceed with the assembly.

(above) As 75% of the work on the wings and fuselage are done with them upside-down, we recommend that you protect all top surfaces by covering with 'bubble-plastic' sheet during assembly.

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% properly 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.



(above and below) To make assembly easier, we have redesigned our packing so that the foam parts can be assembled as a temporary cradle to support the fuselage upside down. See 30 minute epoxy and tape together while drying.

Because of the slightly more complex shape of a jet model, and the fact that much of the assembly is done with the model upside-down, it is a big advantage to have a foam cradle to support the model. By redesigning our packaging of the fuselage, you can now use the foam packing parts to build a simple cradle to support your model, as shown here.

Simply take the 4 pieces of polystyrene foam from the box and glue (30 minute epoxy) and tape them securely together. If you wish to make a more permanent cradle, for future storage and maintenance of your model, then use the included foam packing pieces as templates to cut your cradle from denser foam, or plywood.

Important Note: Preparation of all mating surfaces for gluing all parts and components is extremely important. Scuff both surfaces properly, with 80/120 grit sandpaper or a Permagrit tool, and then clean off the dust with alcohol, or similar. Sanding and then gluing *without* cleaning the surfaces gives nearly as poor joints as not sanding at all !

Before starting construction it is a good idea to check inside the fuselage for any loose glass fibres that could cut your hands - particularly around the cockpit, inlet and turbine mounting areas, and a quick scuff over all of these with a coarse Scotchbrite pad or 120 grit sandpaper will remove them. It is also useful to protect the edges of the cockpit cut-out in the fuselage with a layer of paper masking tape during the R/C and gear installation to protect you hands in this, relatively, small space.

Of course we also include reflective protection bags for the Wings, Canards and vertical Fin in the kit, and after your model is completed you can use these for storage and transport.

CARF Models Eurosport Evolution hatch update – www.carf-models.com

The Eurosport Evolution is the latest version of the world favourite Eurosport jet. This is the most accurate outline version yet produced. Constant advances in moulding technology developed by CARF have allowed a lighter airframe that is torsionally stiffer than previous versions, with little change in weight.

This kit is provided with a manual from the Mk2 Eurosport as most of the construction is identical. The main difference in construction is the lower access hatch which now features a recessed design with angled edges to maintain hatch rigidity. The new design allows quicker access and no tools are required to fix it in position. The hatch is held with two pegs at the front and two spring catches to the rear, both supplied with the kit.

The hatch is factory trimmed ready to install. Very small seams at the front edge may need filing flush to allow a perfect fit. The fuselage opening has seams on the centre line of the fuselage front and back, if these protrude slightly use a fresh sharp scalpel to make these flush.

With these simple procedures complete the hatch should fit flush with the fuselage lower surface.

The rear part of the hatch features a sculptured surface to match the twin tail pipe layout of the full scale aeroplane. We recommend you fit the two rear hatch latches at approx 160mm centres, this puts them in the centre of each full scale jet tube position.

To guarantee maximum retention we recommend you pack the catch off the inner surface using a piece of scrap plywood. This will ensure the latch hole in the fuselage will be 8-9mm below the surface. Mount the body of the catch against the inside lip on the fuselage hatch, this ensures as much pin is inserted into the fuselage as possible.

Cut two slots to suit the latch operating pin in the removable fuselage hatch 22mm back from the rear edge, 12mm long. This is easily achieved by drilling a 2.2mm hole to mark each end and then drilling several holes between. This can be slotted using a small flat file or sharp scalpel.

Tack glue the catch in position only, so that you can check the operation before permanent fixing.

Two holes need drilling in the fuselage to accept the catch pins. Marking these is easy with the following method.

Place a small amount of gloss paint on the tip of the catch pin, retract the pins fully and tape them open. Position the fuselage hatch in the fuselage and with a little more tape or a pair of helping hands hold the hatch, before releasing the pins. The pressure of the spring is sufficient to mark the fuselage with a spot of paint for drilling.

Carefully remove the hatch and drill 3.1mm where marked. Check the hatch fit and when satisfied reinforce the back of the lip with some scrap plywood. Drill through the plywood once dry.

The two front pegs are installed at the same centres as the hatch catches. Drill 6mm dia holes 10mm from lower fuselage surface (do not drill the hatch at this stage) at 160mm centres. Re fit the hatch

using the catches to hold it in position at the rear and tape to position the front. Using a sharp pencil or fine pen, mark the hatch by accessing the holes through the wheel openings in the fuselage.

Remove the hatch and drill 5.9mm to suit the pegs supplied. Sand a chamfer on each end of the peg to ease fitting. Install the pegs with epoxy and scrap wood to fill the void between the peg and hatch. Note the pegs should only protrude 10-12mm.

Fuselage Hatch

Finished in 1.5 hours

The very large fuselage/engine hatch on the underside of the fuselage provides great access for installation and servicing of the turbine and thrust tube etc, but also needs to be secured to the fuselage properly. A few Europort owners in the past have had the hatch come off in flight, but if this assembly is carried out properly, and our advice is followed, you do *not* need any additional strengthening or fixing. This method has been tested and proved by many hundreds of ES owners over thousands of flights, some with very powerful turbines, without any failures.

Important Note: *If you are installing the standard inlet liner and thrust tube, **without** the optional full-flow inlets and turbine bypass system, it is important to remember to cut the 2 vent holes (25mm / 1" diameter) in the rear bulkhead(in the centre of each 'dummy' nozzle) to prevent excess air pressure inside the model, which could lead to the hatch coming off at high speed. You can also make these holes even if you are fitting the full-flow ducting, to be certain that there will be no over-pressure inside the fuselage*.

The hatch is mounted using 2 wooden dowels at the front, and two M4 x 20 bolts and blind at the rear. In the middle of each long edge you can install 2 small plywood tongues, if needed, just for alignment purposes - they are not used to secure the hatch. Actually when the wings are installed they help to align the hatch, so these tongues are optional.

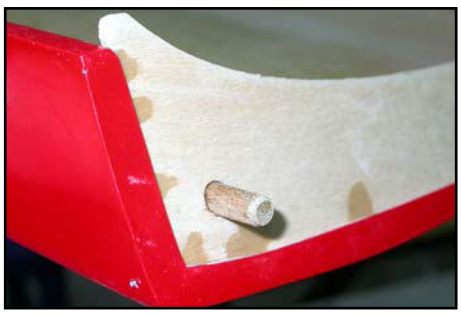
Put the fuselage upside-down in the styrofoam cradle. Trial fit the hatch moulding on the fuselage. You may need to sand the edges of the hatch or fuselage flanges and joint lines slightly for a perfect fit. Make sure that the hatch fits properly over the radius of the wing spar tubes that are installed in the rear main bulkhead in the fuselage.

Glue in the 3mm milled plywood formers, one in the front edge of the hatch, and the other in the bottom of the fuselage. You may need to notch the corners of the bulkhead in the hatch slightly, as shown. Tack glue first with a couple of drops of CA, check that the fuselage and hatch shapes are not distorted at all, and then secure properly with a mixture of slow (at least 30 minute) epoxy and milled fibres. Don't forget to properly scuff up all the gluing areas first to ensure a good bond.

Glue the 2 wood dowels (6mm Ø) into the front corners of the bulkhead in the hatch, where shown, and secure with epoxy. Check that they are aligned straight and parallel to the sides of the hatch. Lay the hatch on the fuselage and mark the positions of the dowels on the bulkhead in the

(above and below) The two 3mm milled plywood bulkheads are glued into the hatch & fuselage. Tack glue with a drop of CA, check, and then secure with slow epoxy and milled fibre.

(above/below) Glue the two 6mm Ø wood dowels into the front edge of the hatch bulkhead, making sure they are aligned straight and parallel to the hatch sides. Tack glue first with a drop of CA, and when checked secure properly with slow epoxy and milled fibre.



fuselage as accurately as possible. Drill these 2 holes a little oversize (say 8mm) and check that the hatch fits.

Take the 2 milled 3mm plywood squares (20 x 20mm) with the radiused corners and drill a 6mm hole in the centre of each, so that they fit nicely on the dowels.

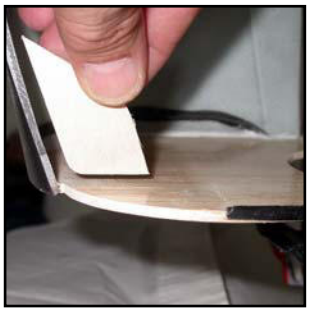
Put some small scrap pieces of soft foam over the dowels, and then the plywood squares. (The scrap foam is just temporary to make sure that the plywood squares are pushed onto the fuselage bulkhead properly while the glue dries.) Apply one drop of thick CA, or a little 30 minute epoxy, onto the front face each plywood square and push the hatch into the correct position and secure with tape until the glue is dry. Remove the hatch and secure the plywood squares to the fuselage bulkhead properly with epoxy and milled fibre.

Remove the hatch and install the shaped plywood parts in the fuselage as shown, noting that they are double thickness (glued together with CA). Chamfer the edges for a good fit to the fuselage and against the composite-balsa back bulkhead, and scuff up all surfaces with coarse sandpaper or a Permagrit first to ensure a good glue bond. Tack in place with CA for the moment, and secure them all properly afterwards with slow epoxy and milled fibre. The parts for the right and left sides of the fuselage are slightly different, and you will find that one pair fits better on one side.

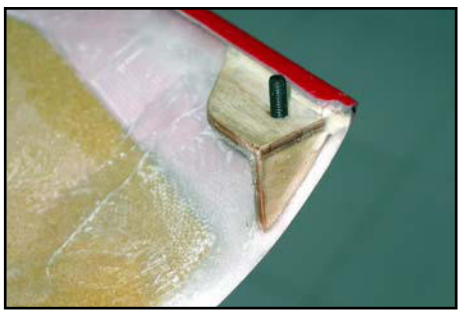
Do the same in the hatch, using one of the spare milled plywood plates (cut in 2 pieces at 45°) as a filler at the back end. Make sure that they are installed about 4mm from the back end of the hatch so that they clear the rear balsa bulkhead of the fuselage. Glue in place with CA for the moment, and reinforce with all joints with epoxy/milled fibre mix after this section is complete.

Install the hatch on the fuselage and tape in position securely. Drill through the hatch in both corners as shown with a 4mm drill, thru' the hatch skin, and both the sets of plywood plates in the hatch and fuselage. Remove the hatch, and open up the holes in the fuselage plates to 5.5mm Ø for the blind nuts. Use a bolt and large washer to pull the blind nuts into the plywood plates from the bottom

(above) Small pieces of foam on the dowels, behind the plywood squares, make sure that they stay in place while the glue cures.
(below) Note that the milled parts to secure the back of the hatch are not exactly the same for the left and right side.



(above) Use a straight edge across the fuselage flanges to make sure the plates are parallel to bottom of fuselage. When the hatch fixings are complete, secure both the plates in the hatch and the fuselage with short lengths of 1" fibreglass tape and slow epoxy.
(below) Tack glue the milled parts into the hatch with CA, 4mm from the back of the hatch to clear the rear bulkhead. Reinforce with glasscloth tape and laminating epoxy as shown.



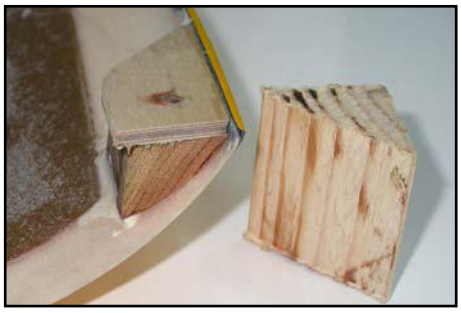
face, and secure the blind nuts to the plates with a drop of epoxy or thick CA.

Open up the holes in the outer skin of the hatch to 7.5mm Ø to clear the heads of the M4 bolts. Re-install the hatch and trial fit the bolts, before finally securing all joints with a mix of slow epoxy (minimum 30 minute) and milled fibre mixture.

Note: *As these are very important joints to prevent the hatch coming off in flight, we strongly recommend that you also add a 2 or 3 short lengths of glassfibre tape with laminating epoxy to secure all 4 of these ply plates to the fuselage and hatch.*

(above) Drill through the plywood plates with a 4mm drill, while the hatch is securely taped into the correct position.

Alternative: We also include 2 blocks of solid wood in the kit, cut at 45°, and if you prefer you can sand these to a rounded profile, and glue these inside the hatch under the plywood plates, drill 4mm, and then counterbore the hole to 7.5mm from the outside for the bolt head to sit flush with the surface of the hatch.



(above) Alternative method for reinforcing the plates in the hatch uses the supplied wood blocks.

Wings

Finished in 4 hours

The wings only require the installation of the wing securing bolts, elevon servos, control surface horns, and main landing gear.

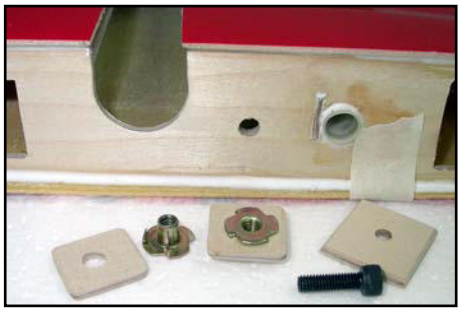
Fit both wings onto the fuselage with the four 12mm Ø glassfibre joining rods, and check that the fit of the wing roots against the fuselage is OK. If necessary you can sand the wing root a little. Note that the front glass rods are 280mm long and the back ones 270mm.

Wing Bolts:
The wings are held onto the fuselage with two M6 x 20 allen bolts, into M6 Blind nuts that are installed inside the plywood wing ribs. Mark the position of the 2 holes on the outside of the fuselage on a piece of masking tape, as shown. The centreline of the hole is on the centreline between the tubes for the 2 glass joining rods and 32mm behind the centre of the tube for the front glass rod. Drill 6mm Ø.

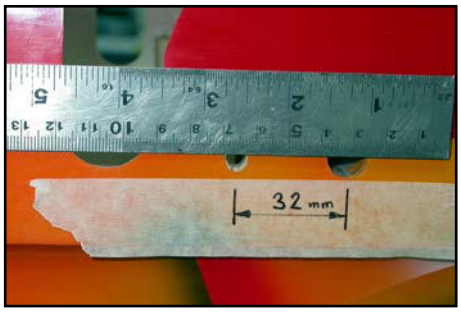
Refit the wings and drill through both holes into the wing root ribs from inside the fuselage. It is just big enough to get a standard battery-drill inside to do this ! Take the two 3mm milled plywood plates supplied (25 x 25mm), drill a 6mm hole thru' the centre of each and glue them inside the fuselage with epoxy, using an M6 bolt the align them with the 6mm holes. Scuff up mating surfaces first.

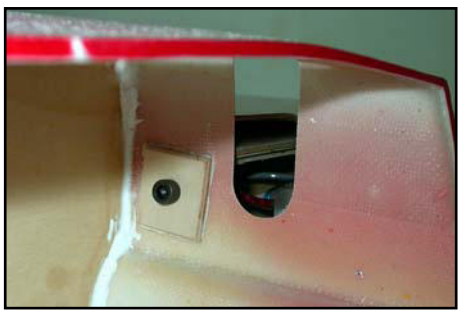
Remove the wings and glue the two M6 blind nuts into a 7.5mm Ø hole drilled in the centre of the 20 x 20mm milled 3mm plywood parts shown. Open up the holes in the wing root from 6mm to 7.5mm Ø. Rough up the inside surface of the plywood root rib in the area of the holes and glue the blind nuts on their plates in position inside the root rib with 30 minute epoxy and micro-balloons mix. Before the glue has dried, re-install the wings and bolt them tightly in place with the M6 bolts to ensure accurate alignment and easy wing fitting at the airfield. We advise you to wax or oil the bolt threads first to prevent them getting glued in place!

Main Landing Gear:
The bottom skins of the wings have already been cut away for you at the factory for installing the landing gear, but you may need to adjust these slightly with a sharp knife or a file. For these instructions we have assumed that you are using the *'Economy'* landing gear supplied by us, but the fitting of our new *'High Performance'* gear and most other types will be very similar. With the wings still installed on the fuselage, trial fit the main retracts, making sure to centre them between the plywood mounting rails in the wings carefully.

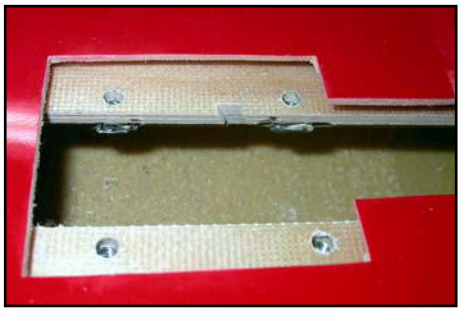


(above) Milled plywood parts and M6 allen bolts with blind nuts for the wing fixing.
(below) The centre of the hole should be about 32mm behind the centre of the front wing rod.



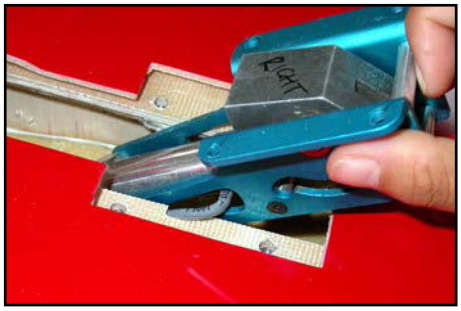


Fit the main wheels to the oleo legs and install them in the retract units and tighten up the M4 pinch bolts a little so that you can align them approx. parallel to the wing root. Operate the gear gently by hand and check to see if the wheels fit inside the openings that have been pre-cut in the fuselage at the factory. Adjust the position of the retract units on the plywood mounting rails, towards the wing root or tip, as needed.



(above/below) Note the 5 x 5mm angled slot in the mounting rail for inserting air tubes without kinking or damage.

Drill the 4 mounting holes (4mm Ø) for each retract unit in the plywood mounting rails, and install the M4 blind nuts provided, retained with a little 30 minute epoxy. Oil or wax the M4 x 15mm allen bolts and install the retracts before the glue has dried, tightening the bolts fully to ensure perfect alignment between the bolts and the blind nuts. You may find that you need to grind a little off the inside edges of the blind nuts, so that they are flush with the inner edge of the plywood mounting rails, otherwise they may touch the retract unit.



Cut the axles to length, and grind flat spots or small dimples in the axles for the retaining screws. Refit the oleo legs and wheels and align the wheels carefully parallel with the centreline of the fuselage (*not* the wing roots !), with 1 or 2° degrees of 'toe-in' for good ground tracking, and tighten the pinch bolts firmly. Note that the wheels should be fitted on the *outside* of the oleo legs.

(above) Adjust the factory cut-outs in the fuselage to suit the scissor link on your oleo legs.
(below) 3 coloured tubes for gear up, down & brakes through an angled hole drilled in the balsa web behind each main gear unit.

Operate the landing gear by hand again and make any small adjustment needed to the cut-outs in the fuselage sides to ensure safe clearance around the wheels. You will need to file an angle at the front of the cut-outs to accommodate the scissor link on the bottom of the oleo legs.

Note: *If using our 'Economy' Landing gear, at this point we recommend that you remove both main gear units and check them, as described at the end of the manual, before final installation.*

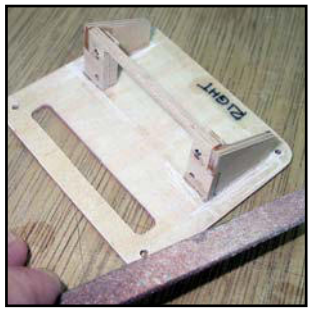
Fit about 200mm or air tubing onto the nipples of each retract unit (2 different colours makes installation and maintenance easy) with a quick-disconnect at the ends of each tube. We use the ones from Robart, which have proved very reliable and leak-free, and it is a good idea to use a female connector on one tube and a 'male' connector of the other. This not only prevents incorrect assembly on the field (it's very embarrassing when one wheel comes down as the other goes up!) but also you can connect the tubes together when the wings are stored and this prevents any dirt getting in the air system. If you are fitting wheel brakes, also install a length of tubing for each brake at this time. Drill an angled 10mm Ø hole through the balsa support web behind each main gear for the tubes and connec-

tors to fit through (see photo).

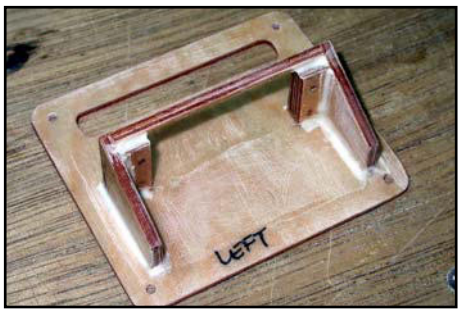
We find that it is easiest to orientate the retract units so that the nipples on the air cylinders both face to the front of the unit. To make it easier to install the retract units without kinking or damaging the air tubing file an small angled slot (about 5 x 5mm) in the front retract support rail mid-way between the mounting bolt holes so that you can slide the retract and tube into place (see photo above)

(above) Milled plywood servo mount, with unused parts coloured black. Use a 90° square to glue parts together. Plastic tape prevents gluing them to your workbench!
(below) Spare plywood can be used as doubler on back of mounts. Sand CA glue joints before securing with slow epoxy/milled-fibre mix.

Elevon Servos and Horns:
We highly recommend that each elevon is controlled by a single high-power digital servo such as the JR/Graupner 8411, or preferably the 8511/8611, which is more than sufficient for all flying manoeuvres - even when this model is powered by a turbine at the upper end of the recommended thrust range.

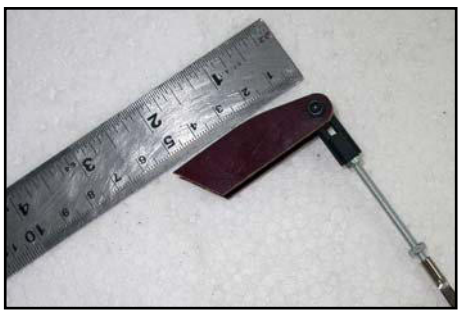


Assemble 2 plywood servo mounts from the 3mm thick CNC milled plywood supplied, as shown here. Don't forget to make a 'Left' and a 'Right' version! Tack glue the parts together, using a small 90° square, and check for servo fit. If using the 8511/8611 servos, which are about 1mm thicker and longer than the standard sized JR8411, you will need to carefully file the mounts a little for a good fit, and redrill 2 of the holes for the servo fixing screws. A Permagrit file makes this a very quick job. You can use the scrap parts from the milled servo mount as doublers on the bottom of the mount as shown in the photo if you wish.



(above) Completed servo mount, with 80gm glassfibre tape reinforcement between the sides.
(below) Cut the large phenolic elevon horns as shown, about 55mm long, with a 30° angle on the bottom ends.

Temporarily screw the servo into the mount, with a CARF horn against the standard 25mm diameter servo output disc, and mark the position of the mount on the hatch cover when the CARF arm is in the centre of the slot. You will probably need to make the slots in the servo hatches about 1mm wider for clearance of the screws that secure the C-ARF horns to the standard servo discs, quickly done with a Permagrit file or similar. Tack glue the servo mount onto the servo hatch cover with CA. Remove the servo, and scuff up the joints where the servo mount butts against the hatch cover, and secure permanently with a mix of epoxy and milled-fibre, or thixotropic epoxy (Aeropoxy or equivalent). Make a nice glue fillet here - these joints are very important!



To be really safe, you can add a strip of 2 - 3 oz cloth (60 - 80 gm) in a 'U' shape on the inside of both supports and across the base, laminated on with 24 hr epoxy as shown in the photo above. Don't use a heavier weight glass cloth

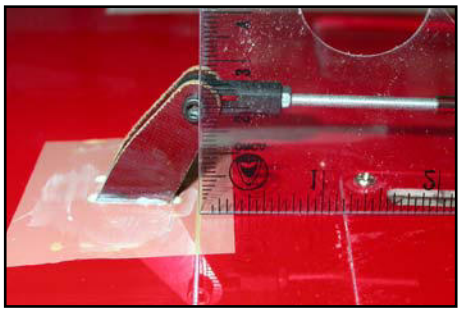
a space is limited here.

Take 4 of the long phenolic elevon horns and cut them as shown in the photo. The longest side should be approx.55mm long (2.25”). Sand an approx. 30° angle on the bottom edges. Join together using an M3 x 20 bolt, ball-link, and an M3 locknut on the other side.

(above) Elevon horns must be scuffed up with coarse sandpaper before gluing in place. Carefully mark centreline of the linkage at 90° to servo so that there is no twisting moment applied to the elevon horns by the servo.
(below) The M3 bolt through the phenolic horns should be perpendicular (@ 90°) to the hinge axis, and approx. 20mm above the surface of the elevon. Use a 90° square to check carefully.

Refit the servo and hatch into the wing and mark the position of the 2 slots in the elevon for the dual phenolic elevon horns on a piece of tape. Use a 90° square to make sure that the linkage is at 90° to the servo, which is *not quite* at 90° to the leading edge of the elevon.

Firmly tape the elevons in the neutral position at the tip and root. Mill the slots for the elevon horns with a Dremel or similar, about 3mm wide and 18mm deep.



The slots need to be about 18mm long, and the front of the slots should start **10mm** from the front edge of the bottom elevon skin, otherwise you will not get enough 'down’ elevator travel before the horns touch the T.E. of the wing. Adjust with a Permagrit file until the horns fit well and the centre of the M3 bolt is exactly perpendicular to the front edge of the elevon, and about 20mm above the skin. Use a 90° square to check this carefully. Scuff up both sides of the horns where they will be glued into the elevon.

Now glue in the pair of horns *into 1 elevon only*. Wax a piece of plastic tape and cover the milled slots with it to prevent getting glue on the surface of the elevon and wing, and then cut the tape away over the slots with a sharp knife so you can glue the horns in place. Glue the horns in with slow epoxy (minimum 30 minute) mixed with a little milled fibre, or better still use Aeropoxy. Before glue sets double-check to make sure that the horns are aligned correctly and vertically to the elevon surface.

(above) Use waxed plastic tape around the slots for the horns to protect the elevon from glue.
(below) Make the elevon horn template, using the paper template at the end of this manual.

To make sure that both elevons have exactly the same travels, (without making lots of adjustments in your Transmitter), we recommend that you make a plywood template of the 1st elevon horn after it is glued in place, and use it to glue the horns in the other wing (see photo). The paper template at the end of this manual can be used to cut out the shape, from thin plywood or plastic sheet, and then drill a 3mm hole to match the M3 bolt in the 1st elevon horns.

Note: *If you chose to fit 2 servos per wing, then you should use the shorter, single phenolic elevon horns supplied, with*

quick-links instead of ball-links for connection to the horn (see photo). If using these horns, do NOT use ball-links on the servo arms or the control-surface horns, because they will twist the arms/horns and cause flutter. This is a solid experience and you should consider it a FACT.

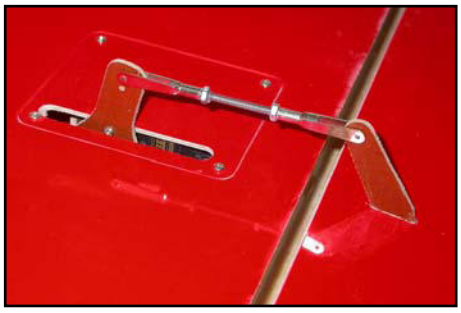
Of course, if you are using 2 servos per elevon, then you will also need to make 2 different templates, and the hole for the M3 bolt in the outer horn will need to be 1.5mm further out of the elevon - to maintain the same distance between the hinge and the ball-link. This is because the wing/elevon is 1.5mm thinner at the outer servo position.

Rough sand the top surface of the 2 standard 25mm Ø plastic servo arms, and one side of 2 CARF phenolic servo horns to prepare for gluing. Then refit both servos to the completed hatch covers and install in the wings. Connect both servos to your R/C and centre them, making sure that sub-trims are set to 0.

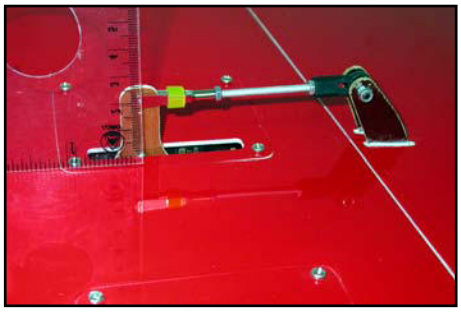
With the servos centred, insert the phenolic CARF servo arms through the slots in the hatch covers and glue them to the plastic servo arms with one or two small drops of thick CA, making sure that they are at 90° to the btm. surface of the wing using a small 90° set-square. When the CA has cured, remove the arms from the servos, and glue and screw the phenolic arms onto the plastic servo arms properly using at least two 2.2 x 10mm sheet-metal screws for each servo arm (see photo below). We prefer to mark the plastic disc and the phenolic arms for alignment, and then re-glue them together using Aeropoxy or equivalent.

The completed servo hatch covers are fixed to the underside of the wing with four 2.9 x 10mm sheet-metal screws provided, into the plywood reinforcing plate that is installed in the wing at the factory. Note that you may need to sand 2 small radiuses in the inner corners of the cut-outs in the wing to clear the ends of the servo mounts, as shown in the photo here.

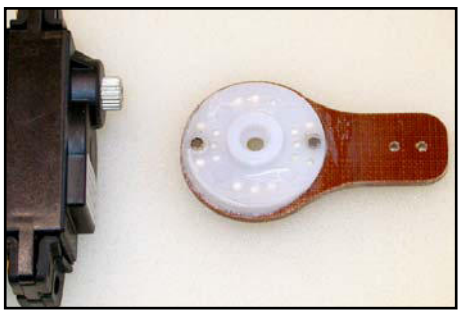
This kind of servo mount allows changing of a servo within a few minutes, if needed.



(above) If using 2 servos per elevon, use the small single elevon horns and quick-links as shown. (below) Centre the servos with your R/C and glue the phenolic servo arms onto the standard plastic discs, at 90° to btm. of wing.



(above) Completed servo mount, with JR8511/8611 servo, also showing small radius needed in the wing for clearance of the mount. (below) Secure the C-ARF servo horns to the plastic servo discs with slow epoxy & at least 2 small sheetmetal screws (supplied).



Vertical Fin and Rudder

Finished in 2.5 hours

The new Eurosport has a removable vertical fin supported on a 10mm Ø carbon-fibre rod spar (205mm long), which slides into a tube in the vertical fin, and is glued into another carbon tube that is bonded to the plywood bulkhead in the fuselage at the factory. When the fin is installed on the model it is secured with an M6 x 50 allen bolt that goes through the front of the fin into an M6 blind nut in the fuselage - which has also been factory-installed and aligned factory for your convenience.

Important Note: *When you fit the vertical fin onto the carbon spar rod in the fuselage you will see that there is a small gap (approx. 2 - 4mm) under the front of the moulding, which is intentional, as it puts some tension on the carbon spar when the M6 securing bolt is tightened fully, and this helps to prevent any chance of 'Flutter'.*

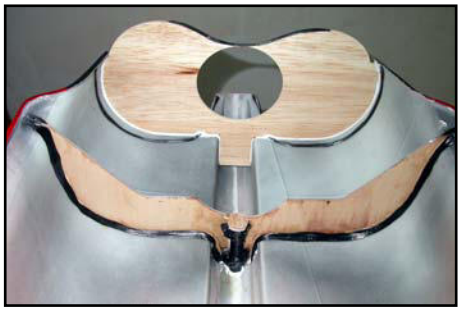
Mask off a length of 65mm on one end of the carbon spar and rough it up with coarse sandpaper, and also scuff up the inside of the tube that is installed in the fuselage a little with a small round file. Drill a 1mm hole in the balsa cap that is glued to the bottom of the tube in the fuselage so that air can escape when the spar is glued in. Glue the rod into the tube with slow epoxy, preferably Aeropoxy. Tape in position until dry.

The carbon spar rod *must* be a tight fit in the tube in the vertical fin, otherwise it could cause flutter. However, if it is a little bit loose, then gently scuff the outside of the rod with green Scotchbrite, or 800 grit sandpaper, and apply a very thin coat of the thinnest CA (Pink ZAP works well). Make sure that the CA has fully cured before testing the fit in the fin again ! Fit the vertical fin to the fuselage and tighten the M6 bolt in the leading edge to check for a good tight fit from side to side.

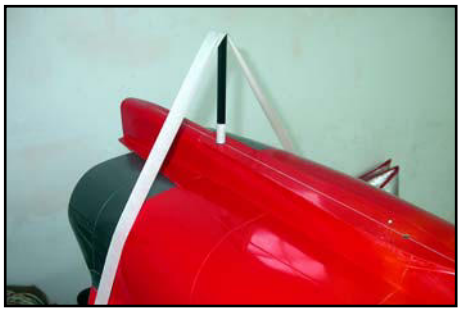
NB: Do **NOT** glue the carbon rod into the fin, and install into the fuselage tube for flying - as the length of the tube in the fuselage is too short to prevent flutter.

The rudder is hinged with 4 large Robart hinge-points, and it is important that the hinge axis of these is in the centre of the radius on the front of the fin. We have made this easy for you, as the balsa false leading edge inside the rudder is in exactly the correct position, and all you need to do is push the barbed part of each hinge in until the wider square part (for the hinge pin) sits against the balsa.

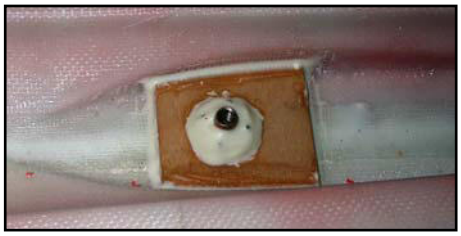
The false trailing edge of the fin already has the 4 hinge holes marked. Transfer these to the leading edge of the



(above) The bulkheads & tube for the Fin spar are factory-installed. (below) Glue the carbon fin spar into the fuselage tube with slow epoxy/milled-fibre or Aeropoxy



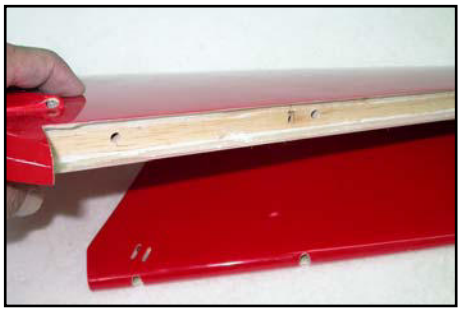
(below) The M6 blind nut is fitted at the factory during manufacture.



rudder, mark them, and file a slot in each position with a small round file. Mark the centre of each hinge and drill thru' the balsa L.E 4.5mm in each position.

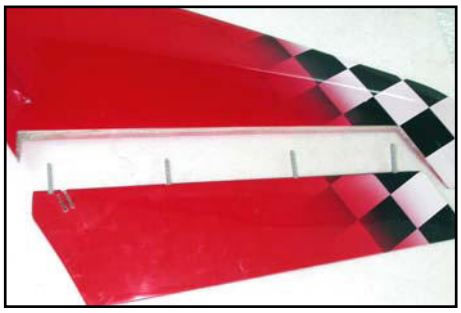
NB: The bottom hinge position may be incorrectly marked on some vertical fins. It should be 15 -20mm *below* the factory-milled slots for the dual phenolic rudder horns.

Install the 4 hinges in the rudder and test fit in the vertical fin. Adjust the holes as needed with a small round file. Scuff up the barbs on the hinge-points a little with some Scotchbrite, and protect the hinge pins from glue by putting a drop of silicone grease on them. Inject some slow epoxy/milled-fibre (Aeropoxy is best for this job, and the glue gun with mixing nozzle makes it so easy!) into each hole in the rudder leading edge, and then wipe just a little on one end of the hinges. Insert them into the rudder, check alignment and leave to cure. Do *not* glue them into the vertical fin yet!



(above) The positions of the four rudder hinges are already marked in the Fin T.E. for you.
(below) Shows a Robart pin-hinge in place in the Rudder, ready for gluing into the false T.E. of the Fin. Inject plenty of Aeropoxy into the holes in the Fin, and put only a small smear of glue on the hinge. Oil or grease the hinge pins 1st!

Now install the dual phenolic rudder horns in the rudder, mark the area that will be, then scuff this area with sandpaper. Inject a little Aeropoxy (or equivalent) into the 2 slots, and push the horns into position, making sure that they project equally both sides. Wax or oil the M2 bolts and nuts, and install them with the ball-links provided and tighten securely to secure the horns in place. Drill a 4mm hole through the leading edge of the rudder, directly between the 2 phenolic horns, and inject plenty of Aeropoxy into the hole to secure them in place



(above) 4 Robart pin hinges secure the Rudder to the Fin.
(below) Inject plenty of Aeropoxy into the extra hole drilled between the rudder horns to secure them.

When cured remove the ball links and bolts. Check that all hinges are free, and that there is still some silicone grease on the hinge pins. Inject a liberal amount of epoxy into the 4 holes (4.5mm Ø) in the T.E. of the vertical fin, apply a very small smear of glue to the hinges, and push the rudder into place. Check alignment of the T.E. of the rudder against the fin with a steel ruler, and tape firmly into position until dry. It is easiest to install the vertical fin on the model for this. If the rudder is not exactly central in the back of the fin you can push some small balsa wedges in place until the glue dries. Don't forget to check for free movement of the rudder before the glue cures.

Servo Choice:
We strongly recommend that you fit a high-torque digital metal-geared servo for the rudder, and the internal fin structure was designed around a JR8411 servo (It would be very difficult to fit an 8511/8611, without reducing the strength of the support structure, as it is about 1.5mm wider).

The plywood servo mount is already installed in the fin at the factory for you. Fit the servo into the fin, using the rub-

ber grommets and brass eyelets supplied with the servo, but using the 2.9 x 13mm sheetmetal screws supplied in the ES kit to secure it.

The output shaft must be at the back end of the servo. Take a standard long JR servo arm, and cut off the ends so that only the 2 inner holes are remaining (see photo). Trial fit the 2mm Ø steel rods with M2 quick-links to connect onto the servo arm and the ball-links to connect to the dual rudder horns. Mark the lengths required accurately, cut the steel rods and solder the quicklinks on, preferably with a low-temperature silver solder (ie:: Stay-Brite). You will need to drill out the M2 thread in the quicklinks with a 1.9mm drill to fit on the rods.

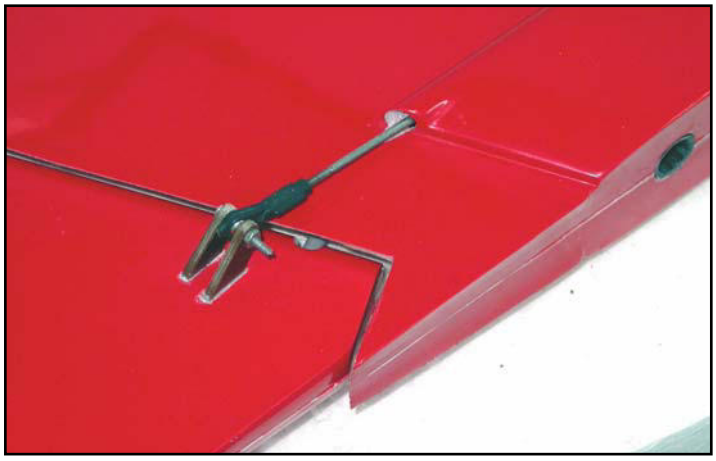
Open up the holes in the back edge of the fin base moulding as needed for adequate clearance of the M2 push/pull linkage with a small round file. A Permagrit needle file in a battery drill makes a very quick job of this (see photo).

Refit the linkage, tighten up the M2 bolts through the ball-links and adjust carefully. Don't forget to put one small drop of Loctite on the screw that secures the servo arm onto the servo, and on the M2 nuts that hold the ball-links to the phenolic rudder horns for security.

You will find that you can get at least 45 mm of rudder throw (measured at the root trailing edge), which is quite enough, but if you are careful with the linkages it is possible to obtain almost 60mm each side without any binding. Make sure you adjust the linkages accurately so that there is no 'buzzing' from the servo at all at the neutral position.

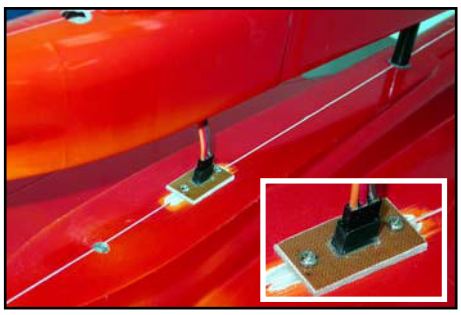
Finally make a small plywood or phenolic plate and glue the female socket of the extension lead for the rudder servo into it as shown. Cut a suitable slot in the top of the fuselage and secure the plate with 2 small self-tapping screws.

(below) The completed rudder linkage system.



(above) Install Fin on fuselage while hinge glue dries, and use balsa wedges and tape to centralise rudder in Trailing Edge of Fin if needed.
(below) JR8411 servo and linkage installed in the Fin base. Cut a JR long servo arm as shown inset.

(above) Use a round Permagrit needle file in a battery-drill to open up the linkage holes in the Fin base as needed.
(below) The socket of the extension cable is glued into a small plate, screwed to the fuselage.



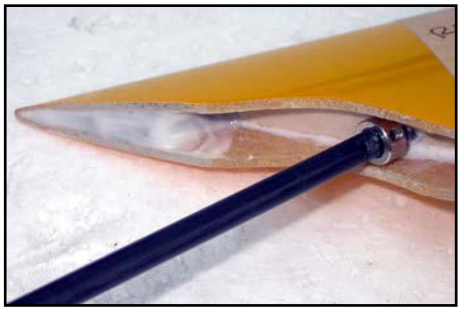
Canards

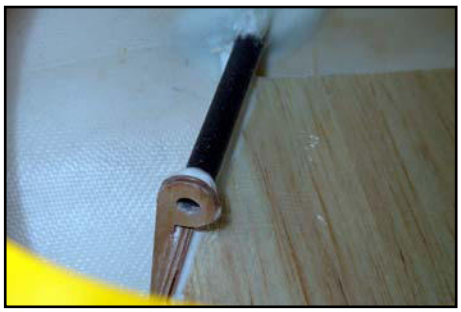
Finished in 2 hours

The Canards already have the 6mm Ø carbonfibre shafts pre-installed at the factory, together with the composite root rib, and the tubes and support structure are also installed in the fuselage - so there is not much to do. Trial fit each canard with a short 6mm wheel collar installed on the shaft as a spacer, and check for a nice even gap at the root, which can be adjusted by sanding a little if required. We supply four 6mm Inside diameter plastic washers in the hardware pack, and if necessary you can add one of these on each shaft between the wheel collar and the fuselage, which also gives a nice smooth movement. The carbon shafts should be a nice free, but not loose, fit into the carbon tubes, and if they are a little tight you can give them a light rub over with green Scotchbrite.

(above) The canard root should be about 1mm from the fuselage side. (below) Glue about 25grms of lead into the L.E. of each canard.

To prevent any chance of high-speed flutter we recommend that you statically balance the canards. Mill a slot in the leading edge of the root rib, roughen up the surfaces carefully, and glue in about 25 grams (3/4 ounce) of lead with 30 minute epoxy and micro-balloons until the canards balance level on the shafts.





Using some fine sandpaper (400 grit), smooth the inside faces of the plywood 'P' plates at the ends of the carbon tubes where the moulded carbon control arms will be. If you like you can give these surfaces a thin coat of epoxy before sanding for a super-smooth surface. Install both canards and tape them securely to the fuselage with the leading, or trailing, edge joint exactly on the moulded-in panel line as shown.
Note: *This is also the neutral position for flying.*

(above) Plywood 'P' plates are factory-installed on the canard tubes.

(below) Completed canard linkage

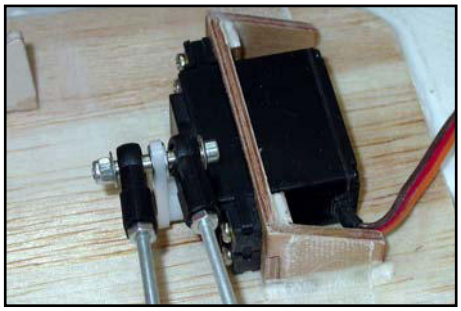
Fit a plastic 6mm Ø washer onto each shaft against the 'P' plates. Then fit the carbon-fibre moulded control arms as shown in the photo and, with the canards taped in the 'neutral' position, set the angle of each arm a little forward of vertical, about 10 - 15° degrees. This builds in a little bit of mechanical differential, as you need twice as much 'down' T.E. movement as 'up' movement. Clamp the arms tightly onto the canard shafts with the M3 x 20 bolts, 2 washers, and M3 locknuts underneath. You will need a 5.5mm spanner or very small adjustable wrench to hold the nuts while you tighten the M3 bolts securely.

Make up the linkages as shown, using the two 150mm long M3 all-threaded rods with a ball-link at each end. Secure the linkages to the top of the control arms, on the inside face as shown, with an M3 x 20 bolt, a washer on both sides of the ball link, and an M3 locknut on the outer face, with a drop of Loctite.

Servo Choice:
We strongly recommend that you fit a high-torque digital metal-geared servo for the Canard control, such as a JR8411, or JR8511/8611 if you prefer.

Make up the servo mount from the milled plywood parts, in the same way as the elevon servo mounts. Mark a centre-line on the composite balsa mounting plate. Using the linkages bolted through a long servo arm on the servo, with the M3 x 25 bolt supplied, mark the exact position of the servo mount, with the servo arm at 90° to the servo case. Scuff up the area where the servo mount will be fixed with coarse sandpaper, and glue it to the composite-balsa mounting plate with 30 minute epoxy and milled fibre, making a good fillet all round. When cured add a couple of short lengths of glassfibre tape to make sure that the mount is securely fixed to the composite-balsa mounting plate. (see photo).

(above) The 'neutral' position of the canards is when the mould seam on the Leading Edge is on the moulded-in panel line.
(below) Secure the canard servo mount to the balsa plate with 2 short pieces of 1" glassfibre tape



Note the correct sequence of the items on the M3 x 25 allen bolt is: Bolthead, M3 washer, ball-link, M3 washer, servo arm, M3 washer, ball-link, M3 washer, and finally an M3 locking nut. Add a drop of Loctite to the locknut to be sure! We advise that you use a high strength/heavy duty (preferably metal) servo arm for this linkage because of the high torque placed on it.

(above) Use a heavy duty, or metal, servo arm for the canards.
(below) View of the moulded carbon canard arms with linkages connected. Please fit one plastic washer between the Canard arm and the plywood 'P' plate. You may need to file a small slot under the each canard arm for clearance of the M3 locknuts on full 'down'.

Use the hole in the servo arm that is about 16 - 17mm (5/8") from the centre, NOT the outer hole as normally the width of the servo arm is too thin there to drill for an M3 bolt. Redrill this hole 2.9mm (NOT 3mm) so that the bolt will be a tight fit in the servo arm.

Re-install the servo, with the 2.9mm Ø x 14mm sheetmetal screws provided. You will need a short X-head screwdriver for this; alternatively you can drill 2 small (3mm Ø) holes through the side of the fuselage on the canard neutral panel-line, for the shaft of a long screwdriver, where they will be almost hidden when canards are at neutral anyway.

With the R/C switched on, centre the servo and set the arm so that it is perpendicular (at 90°) to the the servo case and mounting plate, and adjust the lengths of the linkages carefully so that both canards centre on the panel lines when the servo is at the neutral position. Reduce the throw limits in your transmitter so that the servo cannot rotate so much that the M3 x 25mm bolt touches the servo case.

Measured at the root trailing edge of each canard, you should be able to get at least 30mm of 'down' Trailing Edge movement (which will be mixed with 'UP' elevator) and about 15mm of 'up' (which will be mixed with 'DOWN' elevator).

It is important that the Canard linkage is as free of play as possible, otherwise the plane may 'hunt' around neutral/straight and level flight, and it will be difficult to trim properly.

Landing Gear - Nose

Finished in 2 hours

The plywood mounting plates and fibreglass reinforcement for the nosegear is installed at the factory, and the opening for the noseleg and retract is already cut out for you.

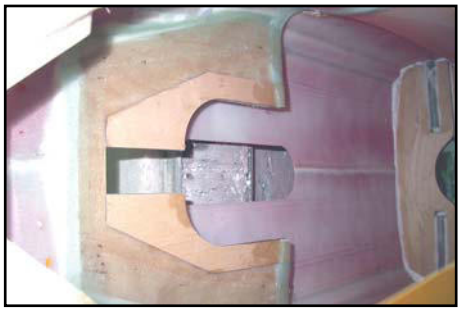
Assemble the noseleg oleo and wheel onto the retract, in the same way as the main gear. Position the retract in the plywood mounting plate, making sure that it is far enough backwards that the steering arm will clear the back edges of the plywood plate when the gear retracts. Mark the 4 mounting holes and drill them 4mm Ø for the M4 x 15mm allen bolts supplied. Open up the holes to 5.5mm for the M4 blind nuts and glue them into place under the plywood plate -in the same way as for the main gear. You may need to grind off one edge of the blind nuts so that they do not touch the retract unit.

Make up the steering servo mount as shown from the milled composite-balsa and plywood parts. The photos should make construction clear. It is a simple sliding mount that allows you to remove the servo in it's plywood tray easily, even if you install the optional inlets. Before assembly, give all the bare balsa and plywood a thin coat of laminating epoxy, to seal them, as they can be subject to a lot of dirt and damp when operating from grass or wet asphalt runways and will expand if not sealed. Sand all sealed surfaces smooth with 400 grit, especially the rails and the edges of the tray so that they slide nicely.

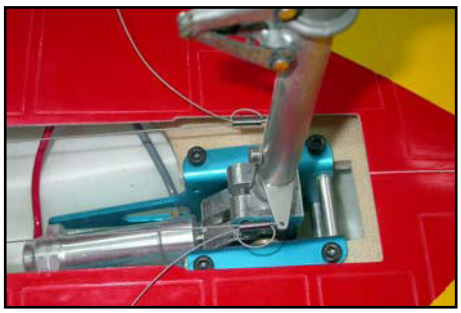
When completed, screw the servo into the tray, inverted, and glue the mount to the fuselage floor with 30 minute epoxy and micro-balloons mix, with the front of the mount approx.30mm (1 1/4") behind the back edge of the nosewheel cut-out. Don't forget to scuff up the surface well with sandpaper first, and after the epoxy has cured, reinforce this joint with 4 short pieces of 1" glassfibre tape and laminating epoxy onto the fuselage floor.

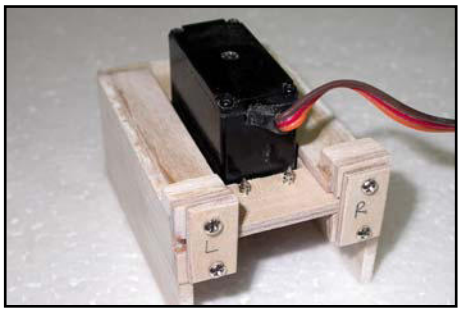
We have shown a JR8411 servo here, but any standard size servo of at least 4 kg, preferably with metal gears, is suitable for the nosegear steering.

Connect the steering cables as shown, using the crimping tubes and cable supplied, and make sure that you keep the crimp tubes very close to the servo arm and steering arm so that the cables cannot 'catch' when the gear is retracted, preventing it from extending properly for landing. Don't make these cables too tight - as this may also stop the gear extending and locking properly.



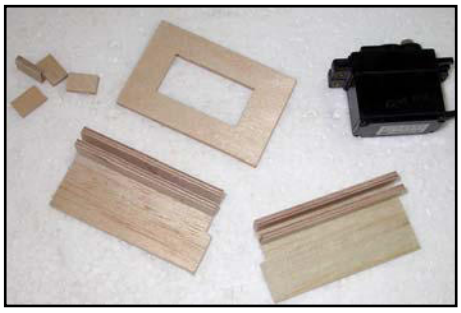
(above) The nosegear opening, and plywood mounting plates and fibreglass reinforcement are fitted in the factory.
(below) Nosegear retract bolted into position with M4 bolts and blind nuts. Steering cables are crimped onto the steering arm, as close as possible. Pass the cable through the crimping tube 2 times, as shown here.

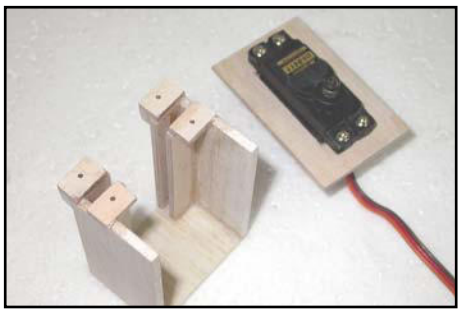


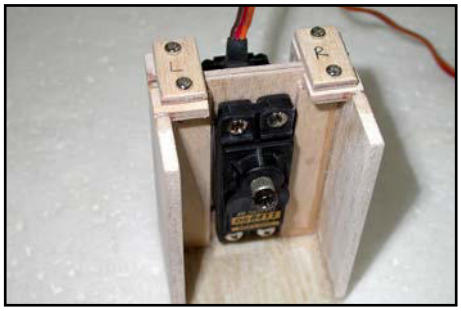


(above) The steering servo in the completed 'sliding' mount.

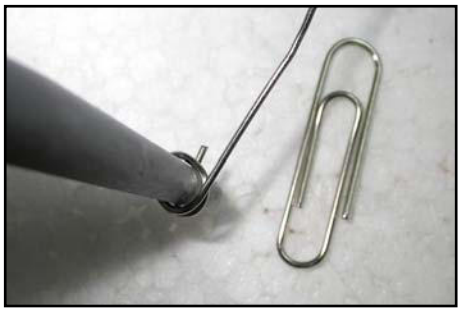
To make sure that the loose cables cannot catch in the oleo leg when the gear is retracted, make up the simple hooks as shown. Use 1mm steel wire, or paperclips, bending them around needle-nosed pliers and securing under scrap balsa blocks. Glue the blocks to the back of the balsa bulkhead at the rear of the nosegear mounting plate and hook a couple of small rubber bands over the steering cables. These will gently pull the steering wires to the sides of the noseleg when the gear is retracted.

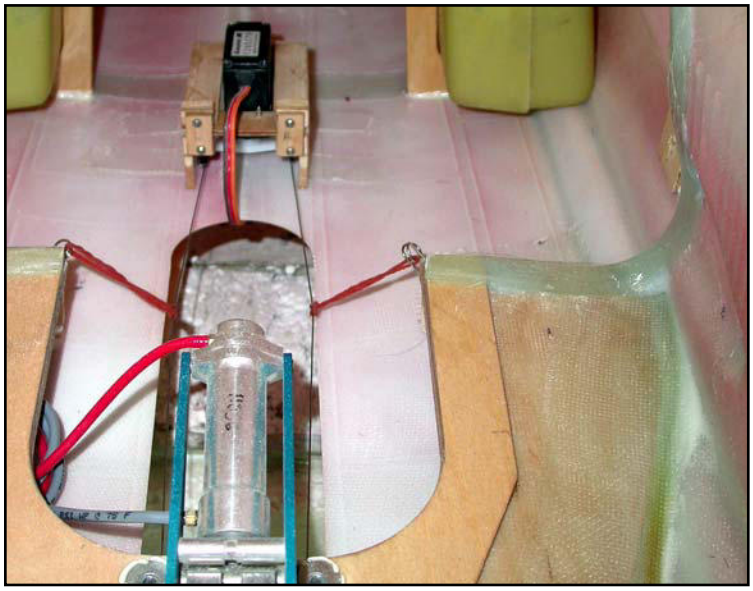






(above) The sliding servo tray is secured with four small sheetmetal screws through plywood plates.
(below) Use 2 small rubber bands on wire hooks to pull the steering cables out of the way of the noseleg when it is retracted.





(above) General view of the completed nosegear retract unit and the sliding servo mount for the steering.

Fuel System

Finished in 3 - 4 hours

If you are fitting the optional 'Full-flow inlets and bypass 'ducting you should complete the fuel system now, but if you are installing the standard inlet liner, you can do this step later in the assembly.

The fuel system is an extremely important item in any jet model, and a large proportion of turbine problems, 'flame-outs' for example, are actually caused by incorrectly installed fuel systems - rather than the turbine itself.

CARF highly recommend that you install 2 main fuel tanks, of a capacity to suit your turbine, plumbed together in parallel, and a 'Hopper' tank to prevent any air bubbles reaching the fuel pump and turbine, which could cause the turbine to stop.

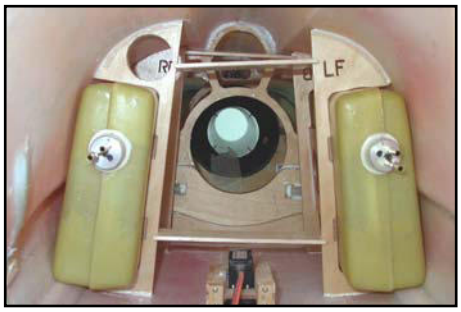
The normal place for the main tanks is on either side of the fuselage, immediately in front of the forward main bulkhead, which as close to the centre of Gravity as possible. Actually this position will make the model slightly nose-heavy at take-off with full tanks, and therefore 'Centre of Gravity' checks should be made with the main tanks empty, but with the 'Hopper' tank full of fuel.

Several companies manufacture fuel tanks suitable for the CARF Eurosport, (most notably 'Jet-Tech/Gary Mueller" in the USA), but CARF now offer a set of moulded kevlar tanks especially designed for our plane, which are available as an 'Option' direct from us when you order your plane. These tanks have a capacity of 2 litres each, and come complete with the aluminium stopper hardware, 4mm Ø brass tubing, milled plywood bulkheads and 1" glassfibre tape necessary for installation. At the moment we do not include the rubber stoppers in the optional fuel tank set, so you will need to purchase these (Sullivan or Dubro#400 etc) suitable for kerosene fuels. For the purposes of this Manual we have shown these optional fuel tanks in this section, but others can be installed in a similar way.

The choice of 'Hopper' tank or BVM 'UAT' (highly recommended) is up to you, but we also show here how to make your own hopper tank using a standard Sullivan R-10 Pylon Brand tank, which is available in all good model shops.

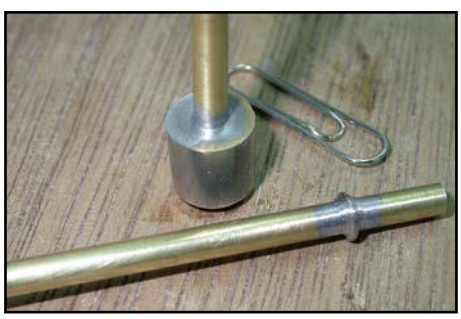
Note: *Whatever type of 'Hopper' tank you choose, it is important to install it where you will see it easily after each flight, as a large amount of air in the tank will immediately give you an indication that there is an air-leak, or other problem, with your fuel system - before your turbine decides to quit in flight!*

(above) Assemble the 3mm milled plywood parts to support the fuel tanks. The back bulkhead should be about 20mm from the back of the tanks. Make sure you fit the 'left' tank in the left side of the model - from a pilots view.



(above) The optional C-ARF fuel tanks installed, and retained with balsa sticks while the glue dries. Note that left and right tanks are different! The large hole on the top of the Right Front tank bulkhead is for a small air tank for the wheel brakes.

(below) 4mm O.D. brass tube soldered into a large clunk, and a small ring soldered onto one of the stopper tubes to prevent the tubes coming off.



Note that if you are installing the optional full ducting set it is not possible to remove the fuel tanks easily after installation, but if you fit only the standard ABS inlet liner they can be removed for inspection and service. However, when the full inlet ducts are installed it is still possible to remove the stoppers, together with all the internal tubing/clunks for servicing which is normally quite sufficient. If you fit only the inlet liner and wish to be able to remove the fuel tanks for service, then you should sand the inside of the bulkheads to make the tanks a slightly loose fit, and secure them in place with some silicone glue.

Assemble the CNC milled 3mm plywood bulkheads and spacer plates as shown. Note that they are marked RF (Right Front), RB (Right Back), LF (Left Front) and LB (Left Back) and should be fitted in the correct location as the fuselage is not quite symmetrical. Sand the inside of the bulkheads a little if needed for a perfect fit, which vary a bit due to the moulding and joining process. The back bulkheads should be fitted approx. 18 - 20mm (3/4") from the back ends of the tanks.

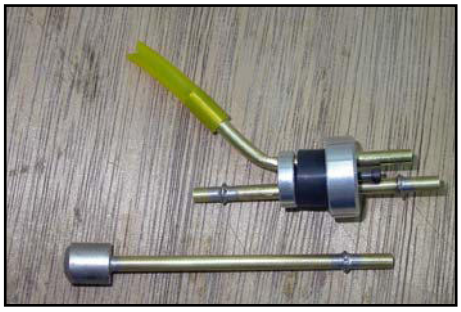
Trial fit the tanks and bulkheads in the model, pushing the tanks back against the front main bulkhead and *carefully* check that they do not deform the fuselage at all. The bulkheads are milled a little bit big to allow you to sand the outer edges for a prefect fit, but they *should not be tight* in the fuselage. Mark the position of the bulkheads on the fuselage, and sand all the surfaces to prepare for gluing. Also sand a strip about 25mm (1") wide across the bottom of the fuselage between each pair of tank bulkheads, which should have 2 layers of 1" wide fibreglass tape (supplied) glued on with slow epoxy as reinforcement before the tank bulkheads are glued in place.

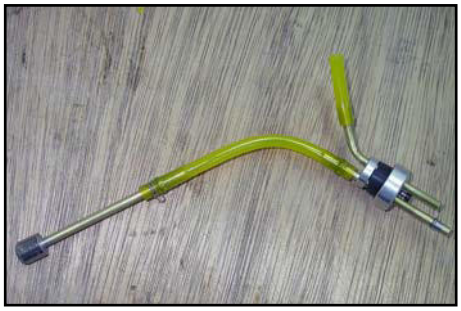
Note that much of the weight of the tanks is taken on the edge of the moulded missile-grooves in the fuselage, rather than by the bulkheads - so please make sure that the bottom outside edge of the tanks sits firmly on these as shown.

Prepare the internal plumbing for both tanks as shown, using Tygon tubing and the correct stoppers for kerosene based fuels. The brass tubing supplied is 4mm Ø outside, and 3.1mm Ø inside, which is big enough for the recommend turbines for the Eurosport.

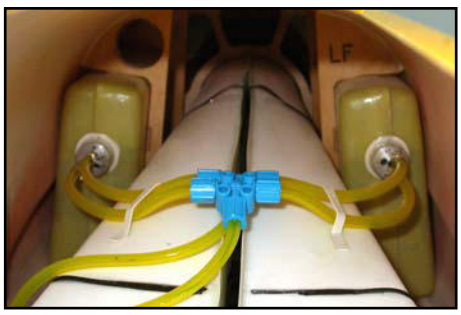
Take special care that the fuel feed lines cannot come off the tubing, or leak air, by either fitting proprietary fuel barbs (ie:: Dubro) or soft-soldering small rings onto the brass tubes made from a paperclip or similar, and retained with a metal fuel-line clamp, or very small cable-tie, as shown. Because of the large size of the fuel tanks, and the fact that Tygon tubing is not as supple as the silicone tubing used for

(above) Make sure that the fuel feed tubes cannot come off by using fuel line barbs, or making your own with a small ring of soft wire, and a metal fuel line clamp.
(below) The CNC aluminium stopper hardware and Tygon tubing for the C-ARF fuel tanks, with wire rings soldered on.





(above) A completed internal system for one tank, showing the extended clunk.
(below) The C-ARF kevlar moulded fuel tanks installed and connected in parallel with Festo 'Tees'. Carbon tows to stiffen inlets are only necessary if a powerful turbine is used.



glow-fuel engines, we recommend that you use large clunks and extend them by soldering a 115mm (4 1/2") long brass tube onto them (as shown) which also prevents the clunks from turning under '3D' manoeuvres and getting stuck at the front of the tank.

Wash out both fuel tanks carefully to remove any dust and other particles, and then fit the completed tubing and stoppers to the tanks, and tighten the M3 bolt to secure the stoppers.

Using a slow epoxy mixed with a little milled fibre, or preferably Aeropoxy, glue the bulkheads into the fuselage, with the tanks in place, and temporarily hold them in position with a few strips of balsa as shown. You can fit the tanks, with the bulkheads fitted on to them, through the cockpit opening.

(above) Hopper tank made from a Sullivan R-10, with a felt clunk fixed to the feed tube in the 3-D centre of the tank.

(below) The milled plywood supports for the hopper tank are included in the kit.

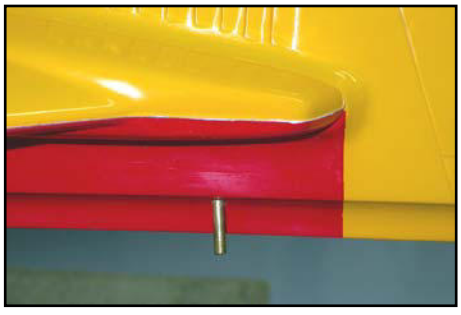
Hopper tank:
Included in the kit are 2 milled plywood support bulkheads for the hopper tank shown, which is not supplied, but can be easily made from a Sullivan R-10 tank. Alternatively you can use a BVM 'UAT', which is an excellent system and extremely reliable, but in this case you will need to design and make your own mounting.

Our preferred method is to have a felt clunk (ie:: Webra #1121) fixed to the end of the feed tube that goes to the fuel pump, in the 3-dimensional centre of the fuel tank. In 'IN' tube that goes to the top of the tank is connected to the 2 main fuel tanks, via a 'Tee' piece. If you wish you can fit a 3rd tube for filling the fuel system. Alternatively you can install a quick-connect Festo fitting between the feed tube and the fuel pump and disconnect here to fill, and this has the added advantage that you cannot accidentally fill the turbine with fuel if the manual valve has been left open, or the fuel solenoid valves allows a small amount of fuel to pass thought it. It's your choice.

(above) The completed hopper tank installed, and retained with a rubber band in the slots of the front bulkhead.

Use the same method as for the main tanks to assemble the tubes, with either fuel barbs or small rings soldered onto them to make sure that there can be no leaks.

Scuff up the mating surfaces and glue the 2 bulkheads in with 30 minute epoxy and micro-balloons as shown. Fit a small balsa 'stop' behind the tank to prevent it moving backwards. The Hopper tank is held in position with a rubber band hooked into the 2 slots that are milled in the front Bulkhead, which makes it easily removable for inspection and service.

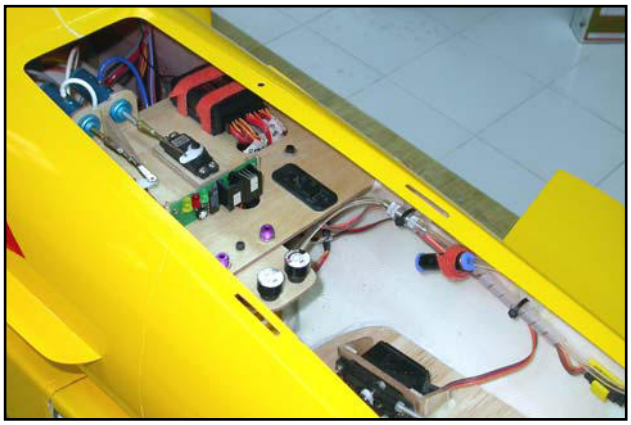


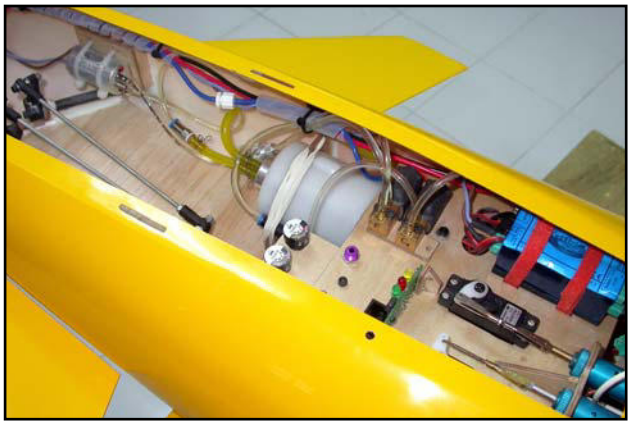
(above) Run the 'vent' from the 2 main tanks to a connection on the bottom of the model. (ie:: in the missile rail groove as shown here.)

Fuel System connections:
We recommend that you use Tygon tubing for all the con-

nections inside the fuel tanks, and to connect them together, up until the turbine fuel pump. It is totally gasoline and kerosene-proof, and does not go hard and crack with age. From there onwards you should use the tubing recommended, or supplied, by the turbine manufacturer.

Connect the feeds from the clunks of the 2 main tanks together, using a 'Tee' piece, and making sure that the lengths of tubing are the same to ensure equal fuel usage from each tank. From the 'Tee' connect to the 'vent' tube at the top of the Hopper tank. From the 'feed' (output) of the hopper tank connect to the fuel pump. Don't forget to install a high quality fuel filter as recommended or supplied by the turbine manufacturer, normally immediately after the fuel pump before the fuel enters the fuel solenoid valve or manual shut-off valve.





(above and below) 2 views of the completed installation showing: hopper tank, solenoid valves, fuel and gas filters, tube connections and the fuel pump mount, which is made from milled plywood parts supplied in the kit. The pump is retained with 2 small cable-ties. You can also see the one-way valve for filling the gas tank, receiver, ECU and retract/brake servos and valves, air gauges and fillers, LED I/O board etc.

Connect the vents of the main tank together in parallel, using a 'Tee' in same manner as the 'feeds' and run it to a short length of 4mm Ø brass tube that is glued in a suitable position in the bottom of the fuselage. This is the air vent, and must be left open during turbine running. You can also connect an external tank to this 'vent', if you wish, to keep the main tanks topped-up during engine starting, and while waiting to fly.

Important: Don't forget to flush out your complete fuel system before running your turbine for the 1st time, with a good fuel filter installed, to make sure there are no particles or dirt in the main tanks, hopper tank and tubing. Either use the turbine pump, if your system allows you to run it from a separate battery, or an external pump, and discard the fuel used for flushing the system afterwards.

Dirt in the fuel system is one of the most common causes of problems with turbine motors, and if particles get into the fuel pump or the turbine fuel system it can cause damage that is expensive to repair !

At the same time you can inspect the complete fuel system closely, in the comfort of your modelling room, to make sure that there are no leaks before going to the airfield.

Inlet/Exhaust/Bypass Ducting

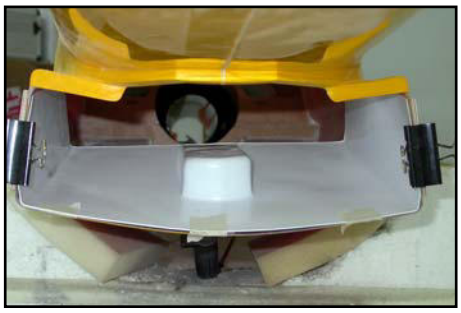
Finished in 1 - 4 hours

NB: *As 90% of this section is done with the model upside-down, all references to 'Top' and 'Bottom' are reversed!*

The new Eurosport comes complete with a ready-made exhaust ducting (Thrust tube) that is suitable for most turbines between 10 - 16kg thrust. Included is a vacuum-formed white ABS inlet liner that can be installed to smooth the airflow over the nosegear retract unit, which also improves the visual aspect from the front.

(above) This white ABS inlet liner supplied in the standard kit.
(below) Trim the sides to fit and glue in place with 30 minute epoxy/micro-balloons and clamp in place until the glue dries.

Unless you are fitting the optional 'Full Ducting' set (see below), fit the ABS inlet liner first. This needs only a little trimming at the sides to fit inside the inlet, at an angle so that it just covers the top of the nosegear retract unit, with about 8 - 10mm clearance. Roughen up the mating surfaces that will be glued on both the fuselage and the outside surface of the inlet liner and fix in place using a 30 minute epoxy and micro-balloons mix. Glue it to the inlet lip and sides of the fuselage and clamp in place until the glue is cured. Trim the front edge flush with the to the inlet lip of the fuselage and sand a small radius at the edge. The back edge (nearest to the turbine) should be reinforced with the strip of 10 x 5 x 250mm balsa supplied in the kit, glued vertically underneath it across the fuselage to stiffen it against flutter.

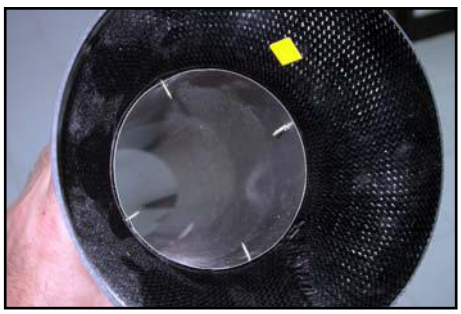


The stainless-steel/aluminium thrust tube is already cut to length and only needs the moulded carbon-fibre bellmouth to be secured to the front end of the inner tube, using 4 or 5 sheet metal screws (2.2 Ø x 10mm), as shown. Drill 1.6mm Ø holes through the thrust tube and carbon bellmouth. The front edge of the carbon bellmouth should extend about 10 - 15 mm in front of the rear main bulkhead.

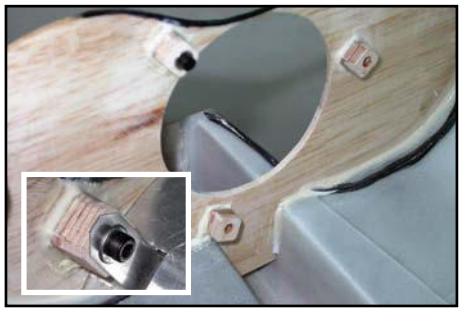
(above) Sand the hole in the rear bulkhead to obtain 1 - 2mm clearance between the thrust tube and the balsa to stop scorching.
(below) Secure the carbon-fibre bellmouth to the thrust tube with at least 4 small sheetmetal screws.

The hole in the rear composite-balsa bulkhead should be adjusted as needed to make sure that there is about 1 - 2mm clearance between the outer tube and the bulkhead, to prevent any burning after extended use. However you should find that the outer tube does not get very hot, normally not exceeding about 100°.

Trial fit the thrust tube in the fuselage. Make up 3 small mounting blocks by gluing together the 6 pieces of 10 x 10mm milled 3mm plywood provided, and drill a hole 4.5mm Ø through the centre of each one for an M3 blind nut. Glue the blind nuts to the back of each block with thick CA. Drill a 3mm hole in the centre of each of the 3 mounting tabs on the back end of the thrust tube for the bolts, and fit the blocks to the thrust tube with M3 x 12 mm bolts and washers.



Turn the thrust tube so that you will be able to access the lower M3 bolt with a ball-ended hex wrench, about 15° off the centre of the fuselage. Mark the positions of the 3 blocks, and rough up the surface of the bulkhead and the blocks/blind nuts. Glue in place with a slow epoxy and milled fibre mixture. Grease or wax the bolts first to make sure you can remove them when the glue is cured ! Mark the bottom of the tube to make future installation easy.



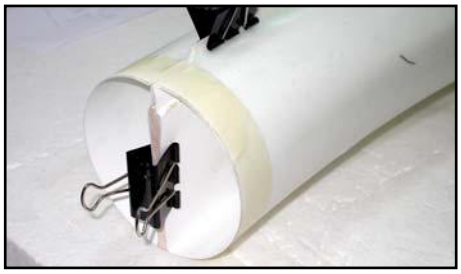
(above & below) The Thrust tube is secured to the rear bulkhead with M3 bolts and blind nuts, into small plywood blocks. Note the orientation of the thrust tube so you can access the bottom (top) bolt with a ball-end hex-key.

Unless you are fitting the optional 'full ducting' set, you will need to secure the carbon bellmouth centrally into the rear main bulkhead. 2 small aluminium angles (12 x 12 x 15mm long) are provided for this, which should be screwed to the front of the bulkhead with 2.9 Ø x 10mm sheetmetal screws. Drill 3mm Ø through the holes provided in the angles, through the front lip of the carbon bellmouth, and scuff up the inside surface of the bellmouth around the holes. Fit two M3 blind nuts to the inside of the bellmouth, in the reverse direction to normal, and tack in place with a drop of CA. Remove the thrust tube and secure them permanently with a drop of slow epoxy/milled fibre, or Aeropoxy (see photo).

Be careful to make sure that the bellmouth and Thrust tube are centred accurately behind the exhaust nozzle of the turbine, otherwise you may have thrust losses and higher running temperatures.

Optional full ducting set:

As an option CARF now offer a new full-flow 'Inlet and Bypass' ducting set which allows you to complete a fully ducted turbine system. Although this does not offer much increased performance on this relatively slow-flying plane, it does have other advantages, apart from the obvious visual ones. The full intake and bypass ducting reduces the chance of FOD damage to the turbine, from small particles that can be sucked up from the runway and also the chance of anything loose in the R/C installation (servo extension leads, retract tubes, turbine supply cables and tubes etc) getting sucked into the turbine and causing serious damage, as well as improving cooling & reducing noise levels.



(above and below) Tape and clamp inlets together with balsa splitter plates in place for cutting to length.

Perhaps even more importantly, the bypass ducting protects the servo cables and tubes near the turbine in the case of a 'hot' or 'wet' start, which can occur even due to operator error - even with the best quality turbines !

The set includes a pair of white inlet ducts, a 2 part carbon-fibre bypass duct, 1" glassfibre tape, a 3mm balsa joining plate for the back end of inlets, a 10mm balsa splitter plate for the front, and the double-sided velcro for securing the bypass.

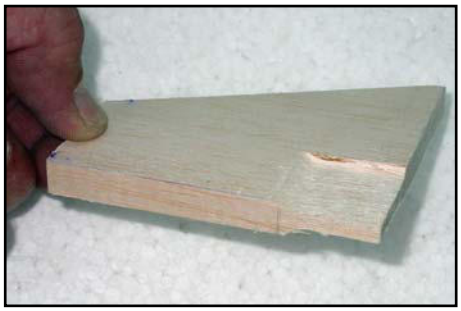
NB: The inlet ducting should be fitted 1st, followed by the exhaust duct (in a similar manner to described above), and finally the bypass duct - however you should prepare and cut all parts to length as necessary before finally gluing any of the parts into place.

(above) Thrust tube is secured to rear main bulkhead with M3 bolts and blind nuts through 2 small aluminium angles as shown. Note also the 2 wedges on mounting rails to transfer loads to bulkhead.

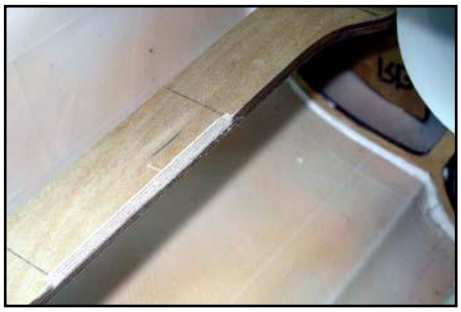
We also advise that you complete the majority of the R/C and gear installation, as well as the fuel tanks, *before* finally gluing the inlet ducts in place, as it is much easier. We prefer to prepare all the ducting parts, trial fit them, and then finally glue them in almost at the end of assembly of the model.

Firstly trial fit the inlets, one at a time, pushing them backwards *as far as possible*, and checking that the moulded recess in the underside of the ducts is far enough back to allow the nosewheel to retract fully. To insert the ducts through the hole in the front main bulkhead you will need to cut or sand away about 40mm of the joint flange on the inlets as shown. Sand the chamfer on the 10mm milled balsa inlet splitter (see photo) that fits between the inlets at the front, cover it with waxed plastic tape, and clamp between the front edges of the inlet ducts. Fit the 100 x 50 x 3mm thick balsa joint plate between the back edges of the inlets and clamp/tape in place.

(below) 10mm thick balsa splitter plate for front of Inlets needs chamfering at one corner.



With both inlet ducts installed, and the balsa splitter at the front and joint plate at the back, carefully mark the inlets at the front where they project out of the fuselage, for cutting, and also at the back. The back of the inlets should project behind the front main bulkhead by about 32 - 35mm.



(above) Sand a small chamfer on inside edge of turbine mounting rails for the bypass duct to fit flush.
(below) The back of the inlet ducts are glued in place, and the cutout made for the electric-starter motor in the balsa joining plate as shown.

Remove the inlets, and tape together with the splitter plates clamped in position, and cut/sand to length. At the same time scuff the outer surfaces where they will be glued into the fuselage, and also at the back where they will be joined with 1” glassfibre tape. Reinstall and tape firmly in position, but do NOT glue in place at the moment.

Now trial install the lower bypass duct, pushing it forward so that the inlet duct fits inside the moulded lip. Sand a small chamfer on the inner edge of the plywood turbine mounting rails to match the radius on the mounting flanges of the bypass duct, as shown. The back edge of the bypass duct should be about 6 - 8mm in front of the rear main bulkhead, so that there is an overlap with the carbon bellmouth of at least 8mm. Tape the lower bypass duct firmly in position, and trial fit the Exhaust duct/Thrust tube (assembled as described above). Check that the front of the carbon bellmouth fits into the moulded flange in the back of the bypass duct, with the back of the thrust tube bolted in place, and adjust length slightly if needed. Install the top of the bypass

duct and check fit.

Note that the bypass duct parts fit on the *outside* of the inlets, and the carbon bellmouth of the Thrust tube fits *inside* the bypass at the back.

When satisfied with the fit of all parts the inlet ducts can be glued into position, using a thick mixture of slow epoxy and joining plate in position. Make sure the mating surfaces have been scuffed up and cleaned with alcohol first.

While gluing the inlet ducts into place, temporarily install the lower bypass duct, secured with tape and carefully waxed at the front, to ensure good alignment of the inlet ducts. Also temporarily install the 10mm balsa inlet splitter, protected with clear tape and waxed so that you can remove it later! The 3mm balsa splitter at the back can be glued in permanently at this time.

Add a 75mm long piece of 1" glassfibre tape around the inlets at the back, against the back of the main bulkhead. Clamp everything securely in place until the glue has cured. Sand and trim the front of the inlet duct to match the fuselage exactly, with a small radius to the edges.

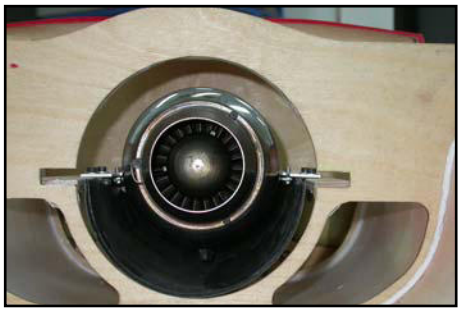
The top edges of the inlet ducts should be reinforced with a couple of scrap balsa sticks (6mm x 6mm), as shown in the photo at the end of this section.

At this point you can trial fit the turbine with its mounting straps, and cut away the 3mm balsa splitter inside the back edge of the inlets to clear the electric-starter motor (if used). Allow at least 4mm clearance all round the starter motor.

Make sure that the turbine is exactly central between the turbine mounting rails, and as far forward as possible - especially if using a turbine at the heavier end of the recommended thrust range - to prevent adding unnecessary weight in the nose of the model to obtain the correct Centre of Gravity later. Note that the fixing ears on the mounting straps for some turbines are *not* exactly in the centre of the turbine, and you may need to reverse the mounting straps, or fit plywood packers under the mounting to centralise the turbine in the bypass duct.

Carefully mark the mounting holes for the turbine and view from the back of the model to make sure that is aligned properly, and then drill the holes 4mm. Remove the turbine, open up the holes to 5.5mm Ø for the M4 blind nuts supplied, and glue them in place under the mounting rails with a drop of epoxy.

It is very important that the turbine is aligned correctly, in all



(above) It is important that the exhaust nozzle of the turbine is exactly central in the exhaust duct for best performance.
(below) View of the installed inlet ducts from the front. Carbon tows are optional and only needed if a very powerful turbine is used.

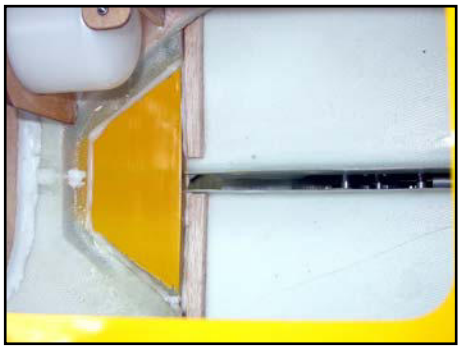
(above) The front edges of the inlet ducts are glued to the fuselage lip with epoxy/micro-balloons and clamped in position.
(below) Clamp the back edges of the ducts and balsa plate together while glue dries. Add a length of 1" glass tape over the joint also.

3 axis, so view it very carefully before drilling the mounting holes. Poor alignment can affect the performance, thrust levels and Exhaust Gas Temperatures - as well as causing hot spots in your thrust tube.

Sand the mating surfaces on the top face of the curved fibreglass plate that fits in front of the inlet (see photos), and the fuselage, and glue in place with 30 minute epoxy and micro-balloons. Tape in place until the glue has cured.

Finally you can sand the 10mm milled balsa splitter plate to a nice profile, and exactly to shape, cover it in glasscloth and epoxy, sand smooth and paint in your chosen colour. Glue in between the inlets with 30 minute epoxy and micro-balloons.

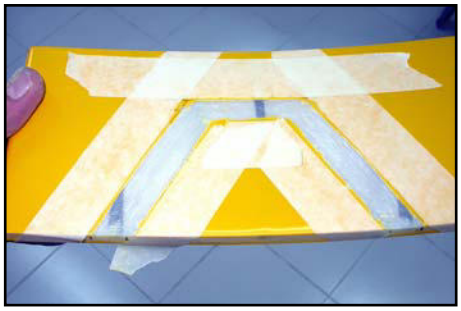
Optional: If using a turbine at the higher end of the thrust range, you may wish to reinforce the inlet ducts, to prevent any chance of them collapsing, by adding a couple of carbon tows with laminating epoxy as shown.



(above) The top edges of the inlet ducts are stiffened with a couple of scrap balsa sticks, clamped in position and glued with CA.

(below) The splitter plate between the inlets should be covered in glasscloth, sanded smooth and painted in your chosen colour.

(below) Scuff up mating surfaces and glue in the curved plate above the inlet with 30 minute epoxy. tape in place until cured.



(above left) The dummy fibreglass exhaust nozzles are glued to the back bulkhead, with cut-outs to clear the thrust tube by about 2mm. Paint the rear bulkhead gunmetal or dark grey of your choice. Don't forget to drill a 25mm Ø hole in the centre of each dummy exhaust nozzle to prevent 'over-pressure' in the fuselage.

Canopy Frame and Cockpit

Finished in 3 - 4 hours

The 'Eurosport' comes complete with a moulded glassfibre canopy frame, painted in the mould to match the fuselage, and already trimmed at the factory.

It is a good idea to sand all the edges of the cockpit opening smooth with 240 grit paper before working in this area to prevent getting small pieces of glass fibre in your hands. We also strongly recommend that you carefully wax all the outside (painted) surfaces of the canopy frame and the fuselage in this area before starting work on the canopy.

Sand the entire inside surface of the canopy frame, paying particular attention to the cut edges that will be seen when the clear canopy is glued in place, making them the same thickness all round. Tape off and sand any seams on the frame and fuselage that are a little bit raised that might stop the canopy frame sitting flush.

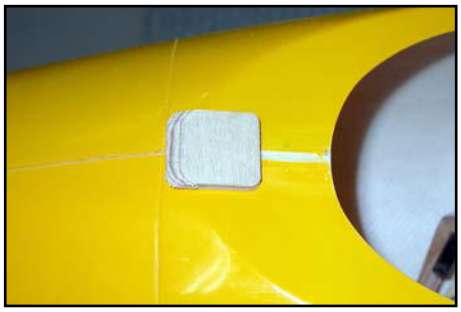
Tape the canopy frame to the fuselage tightly, making sure it is central. Note that the joint seams of the canopy frame and fuselage are *not* exactly central, so use the 'eyeball' method and carefully mark centrelines on masking tape on the frame and fuselage at the back and front.

Glue one of the 20 x 20mm rounded-corner plywood pieces under the front lip of the fuselage (where shown) with a 30 minute epoxy and microballoon mix. The front edge of this plywood part should be directly under the front edge of the canopy frame. Glue another of the same 3mm plywood parts inside the top/back of the canopy frame where the hatch latch will be. You will need to sand a curved shape at the top edge to conform to the canopy frame shape.

With the canopy frame taped firmly in position, drill a 4mm hole through the front of the canopy frame into the 1st plywood part, at approx. the same angle as the angled back face of the frame (see photo). Temporarily insert the short length (35 mm) of 4mm brass tube (supplied in the kit) to locate the canopy frame. Drill a 3mm hole through the back bulkhead of the canopy frame for the pin of the Hatch Latch, through the centre of the 2nd plywood part, into the fuselage, approx. parallel with the top of the fuselage. This hole should be about 6mm (1/4") down from the top of the frame.

Using the supplied Hatch Latch as a template, and checking regularly, file a 2mm wide slot in the top of the fuselage, directly behind the 3mm hole that you drilled, on the centreline.The front edge of the slot should be 15mm back from the canopy frame/fuselage joint and it should be 15mm

(above) Sand any raised seams for a flush fit of the canopy frame.
(below) Mark accurate centrelines on fuselage and canopy frame at back and front.



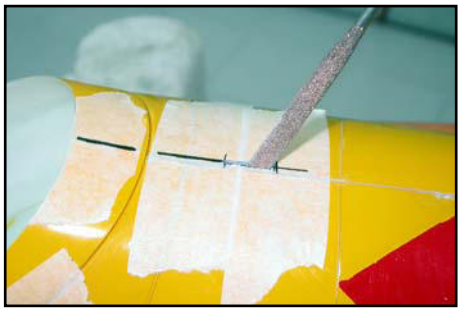
(above) Plywood part shown on top of the fuselage is to show the location only - it is glued underneath the lip, inside the fuselage !
(below) Drill 4mm Ø through the front of the canopy frame and ply plate in the fuselage for the brass tube, at about 30 degrees angle.

long. A flat Permagrit needle file works well for this.

Rough sand the outside of the brass barrel of the Hatch Latch and glue it onto a small rectangle of milled 3mm plywood with a drop of CA as shown in the photo. You will need to file a small groove in the centre of the ply for the brass barrel, and chamfer the outer edges as shown to conform to the shape of the fuselage.

(above) Drill 3mm Ø through the back of the canopy frame into the fuselage for the hatch latch.
(below) File a 15mm long slot for the hatch latch in the fuselage.

Test fit the hatch latch and make sure it fits OK. Rough up the inside the fuse in this area. Oil the mechanism of the Hatch Latch to prevent it getting glued together, and stick a piece of masking tape to the bottom of the ply part. Put a blob of thick 30 minute epoxy/microballoon mix on the hatch latch and plate and push into place, with the handle thru' the slot and the pin located in the hole in the back bulkhead of the canopy frame and secure with the masking tape while it dries. When the hatch latch is dry, remove the masking tape, and secure permanently with a 100mm (4") length of glassfibre tape and laminating epoxy.

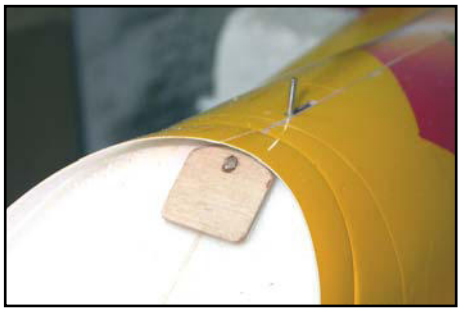


Remove the canopy frame from the fuselage, and glue the brass tube into the hole in the front of the frame with a drop of CA. Check the fit again, cut the tube off so that it only projects inside the canopy frame about 6mm, and then secure permanently with some 30 minute epoxy and milled fibre.

(above) The Hatch latch is glued to a plywood plate, and then into the fuselage with an epoxy/micro-balloons mixture. Use tape to secure until glue has dried.

Mark the 2 slots in the sides of the frame for the phenolic canopy hooks, about 25mm (1”) behind the central hoop of the canopy frame, and just start them with a cutting disk, going thru’ the frame and fuselage to ensure perfect alignment. With the frame still in position, open up the slots with a file so that they are 18mm long and 2mm wide. Remove the frame and extend the slots in the fuselage (*only*) backwards by 10mm, to 28mm long total.

Sand a small chamfer on the outside bottom edges of the 2 milled plywood parts (with slots in them) that capture the phenolic canopy hooks, so that they fit the shape of the canopy frame nicely, and tack in place with 1 small drop of thin CA. Sand the upper 6mm (1/4”) of the phenolic hooks on both sides for good glue adhesion. Check that the sides of the canopy frame align with the fuselage as best possible, and glue the canopy hooks in place with 1 drop of CA, so that they project inside the fuselage side rails by 7 - 8 mm (see photo).



(above) The completed Hatch Latch should project through the plywood plate by about 1mm.

Take the 2 'U' shaped phenolic parts and sand one face to ensure good adhesion of the glue to the fuselage. If you wish you can chamfer the slots in these 'U' shaped parts

slightly for a better sliding fit over the canopy hooks. Place 1 (*only* 1 for now) 'U' shaped part in position so that it engages slightly (only 4 - 5mm/ 3/8") with the hook, and glue in place with 1 small drop CA to the underside of the fuselage cockpit side rails. Remove canopy frame and check for smooth operation. Adust the length of the slot in the fuselage side rail if needed.

Then follow same procedure with the other 'U' shaped phenolic part and canopy hook. When happy with operation, remove canopy frame and permanently glue the hooks, slotted ply parts and the 'U' shaped parts in place with CA. These canopy hooks are not really needed for canopy retention, but do help to maintain the perfect alignment of the sides of the canopy frame with the fuselage edges.

Roughly cut the clear canopy to size with curved scissors staying about 15mm outside the moulded-in lines. This operation should be done in a warm room to prevent any chance of the canopy splitting, or it can be warmed up very gently with a hair-dyer. Now put it over the canopy frame, eyeball very carefully to make sure it is central, and mark the centrelines on the clear canopy. The moulded-in lines on the clear canopy are quite accurate and can be used for centralising the canopy, only needing minor adjustment, by maybe 2mm for perfection.

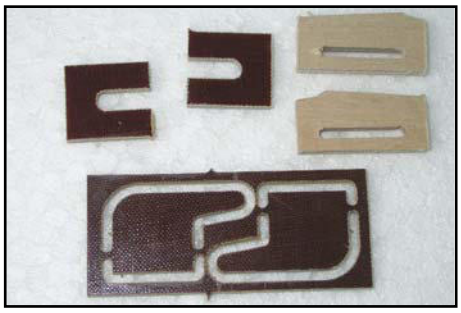
Tape the canopy firmly in place over the outside of the frame now, and mark the final cut lines on the outside of the clear canopy with a felt pen or chinagraph pencil. Cut out with curved scissors to 5mm outside this line all round. Protect canopy from scratches while checking for size and fit by putting one layer of masking tape on the inside of the f'glass hoop in the centre of the canopy frame. The canopy is inserted from the back, as shown, and can only be about 5mm bigger on all sides than the opening in the canopy frame, otherwise you can't get it in! When the fit is OK, mask the outer surface of the clear canopy about 3mm from the edges, and lightly sand the outside surface edges of the clear canopy for good adhesion with 240 grit sandpaper. Don't forget to sand a small strip across the centre that will be glued to the fibreglass hoop.

Do NOT glue the clear canopy in yet, as the inside of canopy frame has to be painted and ABS cockpit base cut out, prepared and fitted first.

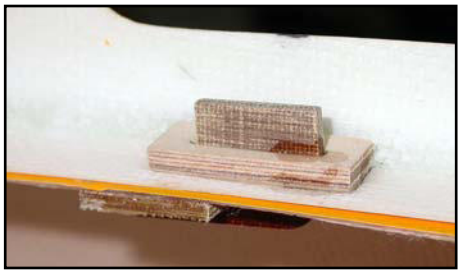
Cockpit Base:
Supplied in the kit is a white ABS vacuum-moulded cockpit base, which is not scale, but can be modified as you wish, depending on the level of detail you want in this area.

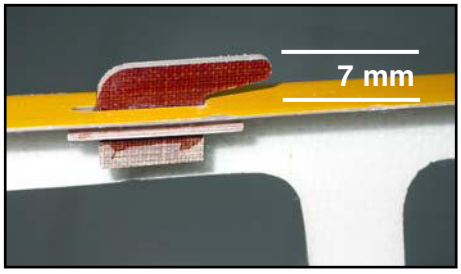
Cut out the 2 main parts to fit inside the frame, as shown,

(above) The 35mm long brass tube (4mm Ø), secures the front of the canopy frame to the fuselage.
(below) Start the slots in the sides of the canopy frame for the phenolic hooks with a cutting disc, and finish with a file.



(above & below) The phenolic canopy hooks and plywood parts that secure them to the frame.





making small notches in the underside to fit over the canopy hooks. Cut out a piece from the spare sheet to cover the angled back bulkhead, using the canopy frame as a template. Glue the front piece in place first, using odourless CA (ZAP-O or equivalent) with a small balsa stick underneath the back edge to support it. Glue the piece onto the back bulkhead in the same way. Cut out the flat part with raised panels to fit between them, glue in place on balsa stick supports and fill any joints.

(above) Support the back of the main cockpit base with a small balsa stick.
(below) Scuff the surface of the ABS cockpit base with green Scotchbrite to prepare for paint.

Lightly scuff all the inside surfaces with green Scotchbrite, and then mask of the canopy frame and paint the inside of the cockpit and frame with an aerosol paint. We advise you to use matt grey, instead of black, because this reduces the chance of deforming the clear canopy and cockpit deck if they are exposed to the sun for a long time. Grey primer from an aerosol can works well, it is matt, and takes CA very well for gluing in the clear canopy also. Leave to fully dry for at least 24 hours before proceeding to glue on the clear canopy. If you wish you can now add also add a pilot and dummy instruments etc.

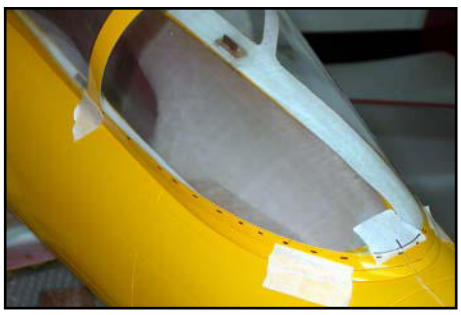
(above) The bottom surface of the cockpit tub can be reinforced with a piece of 80gm glasscloth and laminating epoxy to prevent any damage to it on the airfield.
(below) With the canopy taped over the frame, mark the final cut line about 5mm down from the edge of the cutout in the frame all around with a felt pen.

Fitting the Clear canopy:
Gluing the clear canopy into the frame is a little bit tricky, but this is a step by step guide of how to do it successfully.

Make many hand-holds with paper masking tape (see photo) to make holding and positioning the canopy easy. Fit the canopy, sliding it into place from the back, and line up the centrelines. Using the tape handles, pull the canopy up tightly inside the top back of the frame and fix with one drop of *odourless* CA (ZAP-O or Plasti-ZAP recommended).

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

Again using the 'handles', pull the canopy tightly up against the central fibreglass hoop, and secure at the top with one drop of CA, followed by the same at the front. Let these 3 fixings cure completely before going further. Then working from the top downwards, and pulling the canopy outwards tightly, secure to the rest of the central hoop with a couple more drops of CA. Then start to glue the lower edges to the frame, working on a short section, of 50mm /2" each time, working from the centre towards the ends of the canopy.



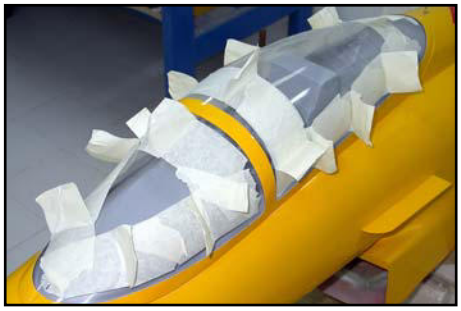
If you have carefully prepared & sanded the inside of the canopy frame, and the outside edge of the clear canopy, you will find that you only need a very small amount of CA to wick into the tight joints all around. Do not use too much CA, and work slowly, doing one small section at a time and waiting until it is cured before going on to the next section.

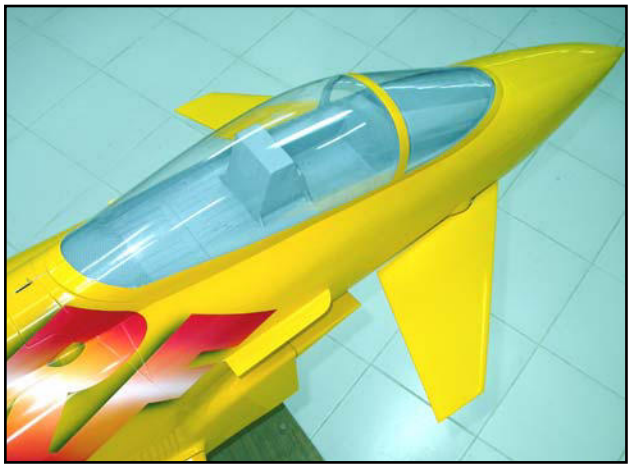
One final tip for the cockpit; because of the very deep draw of the vacuum-formed cockpit base, the edges of the lowest point (tub) are quite thin, and can be damaged when the cockpit is put down on a hard surface. Therefore we recommend that you gently scuff up the underneath of this part with 240 grit and laminate 1 layer of 80gram (2.5 or 3 oz) glasscloth on this area with laminating epoxy to reinforce it.

Note: *The above method is the 'quick-and-simple' way to do the cockpit and clear canopy. If you wish to make a fully detailed cockpit, we recommend that you glue the clear canopy in without the cockpit base, and then make the complete cockpit base and tub up on a separate sheet of thin plywood or similar, with all the details and dummy instruments etc, and fix it in place from the bottom afterwards.*

It is also easier to glue the clear canopy in using this method, because you can get your hands inside to push it firmly against the frame for tacking in place, and finally secure it with a little slow epoxy all around the edges.

(above) Trimmed clear canopy is inserted from the back. protect it from scratches with masking tape on the inside of the central fibreglass hoop as shown here.
(below) Make many 'handles' on the clear canopy with good quality paper tape to pull it into position while you glue it with a little odourless CA, wicked into the joints all around.



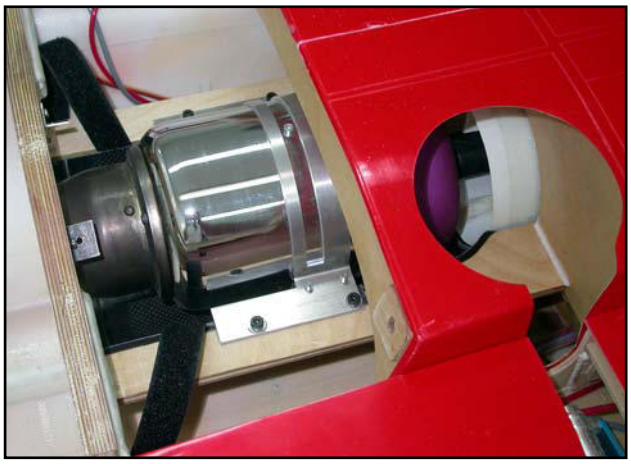


(below) Completed cockpit base, sprayed with matt grey primer from an aerosol can, with clear canopy glued in place. Of course you can add a pilot bust and dummy instruments, etc., as you wish to make it more realistic.

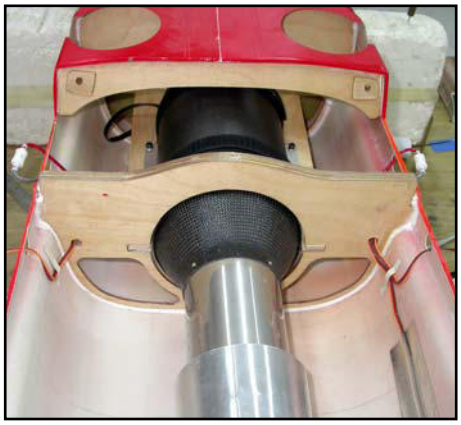
Turbine installation (JetCat shown) Finished in 2 hours

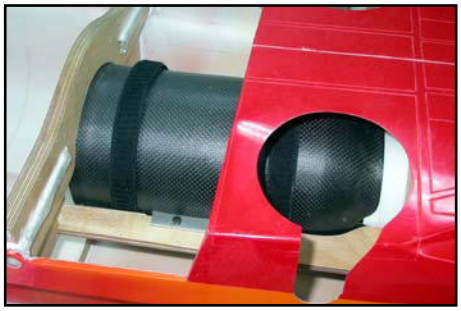
Depending on which turbine you are installing, and whether it is an 'Electric-start' or 'Air-start' motor, the actual mounting and connections will be slightly different.

For the purposes of this manual we have shown a JetCat turbine, which is perhaps the most commonly used make of miniature turbine for jet models. The P120 is the perfect choice for this model - providing sufficient thrust for all normal and '3D' flight manoeuvres, as well as being lightweight and having a good fuel consumption. The photographs here show a P160, which is almost the same physical size as a P120, because at CARF we know that it is very important to fully test all our models with a motor at the upper end of the recommended thrust range for structural integrity.



(above) Jetcat P160 installed in the optional full-flow 'Bypass' ducting system. Note Velcro straps to secure top of bypass duct.
(below) View of the complete full-flow system, showing clean and simple installation.





(above) The carbon bypass is secured with double-sided velcro, supplied in the optional set.

Important: *Whatever make of turbine you install, please read, and follow, the manufacturers instructions and recommendations before installing your motor.*

The turbine motor itself has already been fitted during the fitting of the ducting in an earlier section, and only the various connections remain to be completed.

When fitting the standard inlet liner and exhaust thrust tube, then the connections are very simple, but it is very important to make sure that none of the cables and fuel/gas/air tubes can be sucked into the turbine, or touch any hot places where they can be damaged. Make sure that there are no loose services, and secure everything to the fuselage sides or structure firmly. You can either use proprietary items, like cable-ties and cable-tie mounting plates, or even short lengths of Rubber Band glued to the sides if you wish.

If using the plastic mounting plates for securing the cable-ties, do NOT rely on the double-sided tape that is normally supplied on the back face of them for fixing. This fails very quickly when it is exposed to any kind of fuel. Peel it off, rough up the back face with coarse sandpaper or a Permagrit tool, and glue to the fuselage sides with a little 30min. epoxy and milled-fibre (see photo).

If using the optional full-flow inlet and bypass ducting, then you have to make some preparations for the connections to the turbine. Cut the necessary holes in the upper an d lower bypass duct for the glow-plug and starter cables as shown. Make sure that the cables cannot chafe on the edges of the cutout, and it is preferable to fit a rubber grommet for protection. If you don't have a suitable rubber grom-

met, then split a piece of small silicone tube and glue it around the edges of the hole with thin CA.

Normally the fuel/air/gas tubes exit from the front of the turbine, and therefore must be installed through holes made in the inlet ducting. It is also important to protect these from damage where they pass thru' the inlet duct walls, either with grommets, or short sleeves made of a larger diameter tubing, and CA'd into place.

(above) Protect tubes and cables from chafing with Tygon tubing sleeves, or rubber grommets.

When the turbine is finally installed, and all the connections are made, fit the 2 small plywood wedges in position on the turbine mounting rails, to fill the space between them and the rear main bulkhead so that landing loads are transferred to the main structure of the model. These are made by gluing together the 4 square 20 x 20mm milled 3mm thick plywood blocks supplied, and securing them to the turbine mounting rails with 2.9mm Ø x 14mm sheetmetal screws. You will need to chamfer the back edge slightly so that they fit tightly into the slots.

(above) The 2 wedges are made from the milled plywood parts supplied, and secured to the mounting rails with sheetmetal screws.

If fitting the full-flow ducting option, the small aluminium angles on the front of the rear main bulkhead secure both the thrust tube and the top (bottom !) part of the bypass duct, using M3 bolts into captive nuts on the inside of the carbon bellmouth as described earlier.

When routing the tubing and services from the turbine (and the elevon extension leads and retract tubing) you will see that we have already milled suitable holes for these in the top of the plywood fuel tank support bulkheads.

Note: *Please call your turbine Manufacturer Rep. in your country if you need any additional help with the turbine installation.*

R/C and Gear installation

Finished in 5 - 6 hours

Everyone has their own favourite accessories, methods and options when fitting the R/C and gear, but the installation shown here can be used as a guide, and the set-up works fine as shown. Depending on the type and size of your receiver and turbine pumps and batteries etc, you will need to modify the installations accordingly..

Included in the standard kit are 2 generic ECU/Rx/Gear mounting plates, CNC milled from high-quality 3mm plywood, which can be fitted between the fixed strakes. One is designed for the normal 'pneumatic' retract and brake valves (ie:: CARF or Robart types) and the other has enough space for fitting the commonly used 'electronic' retract and wheel brake valves, for example the excellent 'jet-tronics' range.

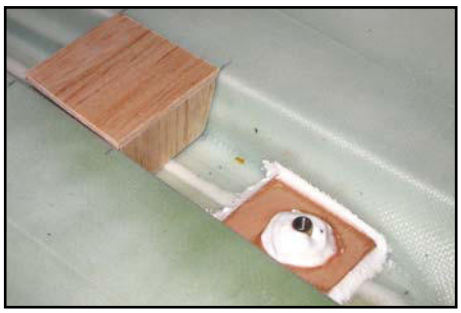
All the small parts that are required for standard installations are also included as milled plywood parts: Fuel pump mount, Hopper tank mount, pneumatic retract/brake valve mounts, servo adapters, air gauge mounts, I/O LED plate mounts, etc, etc.

We recommend that start the R/C installation from the back of the plane, beginning with the extension cable to the rudder servo. Protect the underside of the extension cable socket with the two pieces of 3mm milled balsa provided, CA'd into place to form a 'bridge', and run the extension cable up the side of the fuselage and then forwards. Cover the cable and balsa bridge with the supplied 2" wide aluminum tape to protect it from heat.

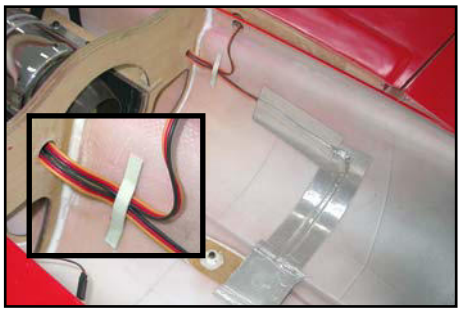
Drill the necessary holes in the wing root area of the fuselage for the retract tubes and elevon servo extension cables. Don't leave too much slack cable or tube here, or it could touch the hot exhaust in the fuselage. It's best to keep these holes as close to the rear main bulkhead as possible, and secure the cables in your favourite way - a length of rubber band CA'd to the fuselage works OK if you have nothing else handy!

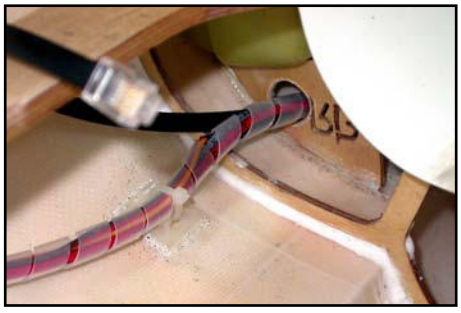
The retract and wheelbrake tubes need quick-disconnectors of some sort - we use Robart. See text in 'Wing' section for more details.

At this time you will have a real 'spaghetti junction' at the cockpit area of your plane, and it's a good idea to tape them out of the way now, keeping the ones for each side of the fuselage separated with some tape. If you are going to fit either of the air tanks above the fuel tanks, it should be done at this time. Likewise complete any remaining fuel



(above) 3mm balsa bridge made from milled parts supplied to cover the underside of the rudder extension cable socket.
(below) Rudder extension cable and bridge protected with the self-adhesive aluminium tape supplied.





(above) Extension cables, retract tubes & turbine feeds protected in spiral-wrap, go through the milled holes in fuel tank bulkheads. Spiral-wrap is secured with a cable-tie onto a plastic mount.
(below) Other side of the fuselage.

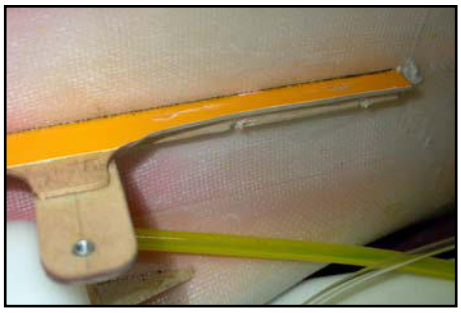
tubing up until the cockpit now.

Before going further with the gear installation, fit the small strakes either side of the cockpit if you wish. We have included a 1.5mm thick plywood plate for these, milled to shape full-width, but in the '*Eurosport*' you only need to install the outer 35mm (1.5") of this, on 6 x 6mm balsa sticks glued to the side of the fuselage. The strakes should project inside the fuselage by about 12mm (1/2") on both sides. Cut off the outer sections, sand them smooth and coat in your favourite laminating epoxy. When cured, sand smooth again and paint in your choice of colour. Here we have matched the fuselage colour, and small tins of all the plain colours used on your Eurosport are available from C-ARF if required.

(above) Robart quick-disconnectors used for the retract and wheel brake tubes.
(below) Finished Strakes, painted to match fuselage.

Mark the slots in both sides of the fuselage, on the moulded-in lines, and cut them with a Dremel and cutting disc. Adjust and smooth with a small file. Slide the Strakes into position through the fuselage, scuff up mating areas and glue them in with a couple of drops of thick CA. Make sure that they are both horizontal, then glue two 6 x 6mm balsa sticks under them, as reinforcement, with 30 minute epoxy and micro-balloons mix.

When dry you will find the milled plywood ECU/Rx/Gear plate sits on top of these strakes, which project inside the fuselage like 2 small 'shelves'.

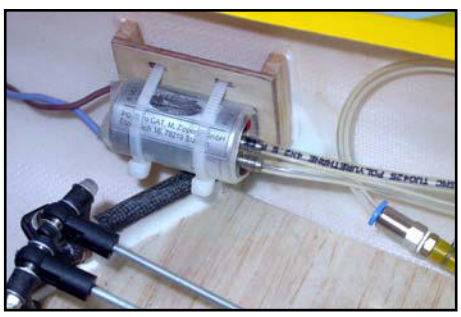


(above) Leave about 10 - 12mm of the plywood strakes projecting inside the fuselage, like small shelves. One of the plates for fixing the ECU plate, with the M3 blind nut under it, is also shown here.
(below) We recommend installing the fuel pump in a position where it is easily accessible, but at least 15cms from the ECU and receiver.

Now make up your choice of ECU/Rx/Gear plate from one of the 2 supplied. 8 slots have been milled for fixing the ECU and Receiver to plate with Velcro, but you could also use cable-ties if you wish. Make sure to mount both these sensitive items on foam pads about 6mm thick.

If using Jetcat solenoid valves you will need to glue the ply part (16 x 35mm) from the centre of one of the retract servo cut-outs under the ends of the 2 valves as shown. Mark the 4 mounting holes, drill 2.2mm Ø, tap M3 through the plywood, add a drop of thin CA to the holes to harden the wood, retap M3, and secure the valves with M3 x 20 bolts.

We have milled a hole for a standard JR switch in front of the Rx position, although you may chose to fit the switch mid-way between the Rx and the receiver to reduce cable length and connections. The plywood part removed from the cable hole in front of the Rx position is used to mount an optional manual 'Festo' fuel shut-off valve, if you chose.



The 4 small plywood parts for making the LED I/O board mount are in the middle of the back hopper tank bulkhead. There are also 2 plywood adapters that you can use to raise the servo height if you fit mini-servos for controlling

the pneumatic retract and brake valves. You will find that we have milled cable connection holes for you in the plate next to most items, and so all the 'untidy' cables etc can be hidden underneath the plate, secured tidily.

The photos here should make the rest of the assembly easy to understand.

The finished ECU plate is supported on the 2 small 'shelves' of the Strakes that project inside the fuselage, but it must be secured also. The easiest way is to glue 2 small plywood tabs under the 'shelves', with M3 blind nuts and secure it with two M3 bolts (supplied), as shown. Use a ball-ended allen wrench to tighten the bolts.

After assembling the ECU plate to suit your gear, remove all the items and give it a sand and a light coat of laminating epoxy or G4 or paint to seal it.

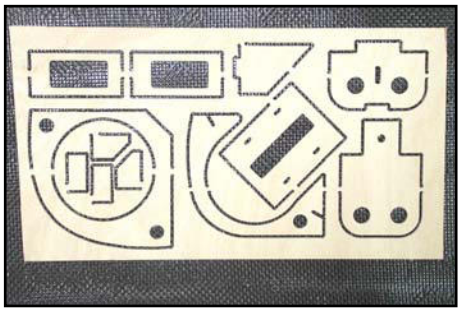
You will find that it is easiest to install most of the items on the ECU plate outside the model, and it *is possible* to insert the plate into the fuselage with almost everything on it - except for the pneumatic retract valves at the back, and the optional air gauge plate at the front. Turn the plate thru' 90°, push it backwards over the inlet ducts as far as possible, then tilt it and turn it thru' 90° again, and lift it up and forwards onto the shelves formed by the Strakes. Round the 4 corners of the ECU plate a little to make this easier.

The milled plywood fuel pump mount will need suitable shaped balsa glued to the ends of it, shaped to fit the fuselage in the position of your choice. Chamfer the 2 long edges of the cut-out inside it so that the pump sits firmly, and secure with 2 cable-ties. Glue in place with minimum 30 minute epoxy and micro-balloons mix. The exact location of the pump is your choice, normally determined by Centre of Gravity and easy access, which is why we like to install it where it is easily visible.

Extension leads etc:

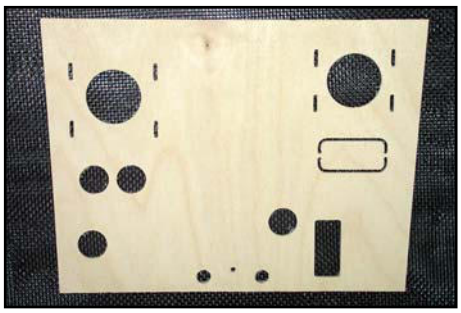
Please make sure that you use good quality extension leads, of heavy gauge wire with gold-plated connectors, especially to the Elevon and Rudder servos, and a high-quality receiver switch. Certainly we recommend that all servo leads and extensions longer than about 30cms (12") are fitted with ceramic chokes (ferrite rings) to prevent RF noise, at the receiver end - within 100mm (4") of the receiver. Wrap the extension cable through them at least 3 complete turns.

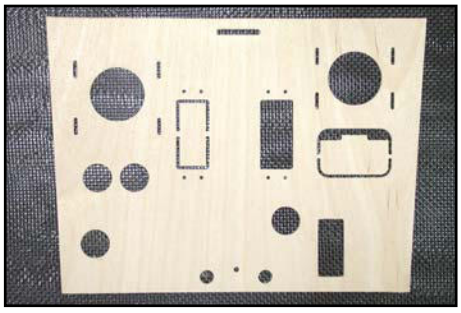
If following the installation shown here, you will need 3 long extension leads of about 1300mm (4') for the rudder and elevon servos, and short extension of 300mm (12") for the



(above) 3mm milled plywood accessory plate includes many parts for the standard R/C and gear installation shown in this manual.

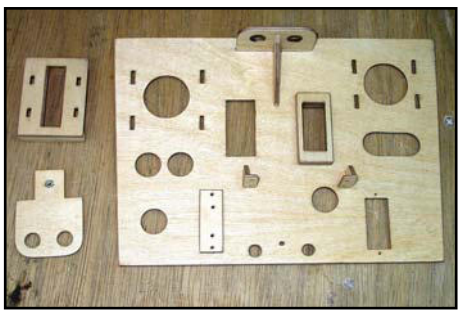
(below) 3mm milled plywood ECU/Rx/Gear plate for Electronic retract/brake valves, or special installations.





(above) 3mm milled plywood ECU/Rx/Gear plate for pneumatic retract/brake valves.

(below) Completed pneumatic ECU plate with mounts for solenoid valves, retract valves & I/O board glued in place.



nosegear steering servo.

To make sure that important connectors can come apart in flight, you can use 'safety clips', like the yellow ones shown in the photo.

Batteries:
The capacity, weight and type of batteries will depend on the type of R/C and turbine you are fitting, and your personal choice. However, normally both batteries need to be installed in the nose of a Eurosport to obtain the correct Centre of Gravity. However, we do recommend that you use *at least* a 4-cell 1800mAH Nicad for the receiver battery, and preferably a 5-cell pack with a voltage regulator, especially if you have fitted the recommended high power digital servos as they can draw a lot of current during the aerobatic and '3D' manoeuvres that the ES is capable of. The choice of using a single, or dual Nicad or NiMH packs and a 'battery-backer' system is up to you, but please use high quality equipment and check that your make of R/C is suitable for 5 cell packs if that is what you choose.

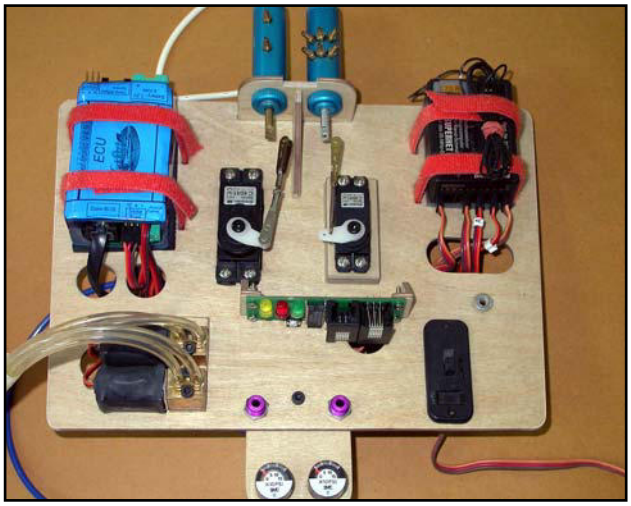
Of course the Nicad/NiMH/Duralite batteries, and all heavy items, must be fixed very securely in the model. We wrap the battery packs in 6mm of foam rubber, and tie-wrap them to plywood plates that are glued into the fuselage with 30 minute epoxy, and reinforced with some short lengths of 1' glassfibre tape.

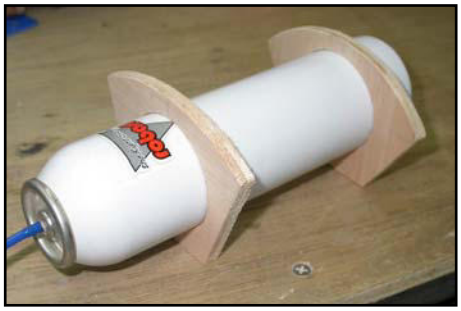
On-Board Gas Tank:
If fitting an electric-start turbine, which has a small on-board gas tank, for starting, make sure that the tank is installed in an accessible position for filling, and as vertical as possible - with the outlet at the top. Here we have fitted the JetCat starting-gas tank in 2 small plywood 'U' shapes, retained by a rubber band, for easy removal if needed.

Landing Gear:
Pressurise the air tanks for your landing gear, and check the operation. Check carefully for leaks, both with the gear 'up' and 'down'. Make sure that your pneumatic system has enough air pressure to operate the gear at least 3 times, and keeps this pressure for at least 30 minutes before you fly. Check the landing gear operation at the start of every flying day for proper operation.

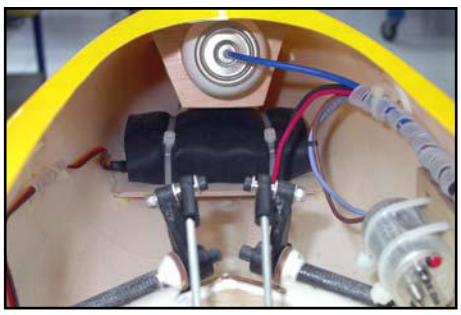
Make sure that the legs, steering cables and brake tubing cannot catch on anything, even if the legs have been bent backwards a little after a hard landing ! Tie-wrap the brake tubes to the outside of the main legs. Adjust the rubber

(below) A typical installation with JetCat ECU & solenoid valves, JR Rx, pneumatic retract & brake valves, switch/charging socket, LED I/O board, pneumatic fill valves, and mini-air gauges. The optional 'manual' fuel shut-off Festo valve is mounted on the plate over the retract valves.

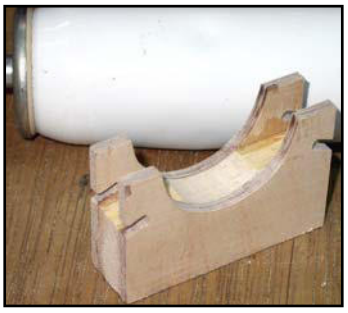




(above) Retract & brake air tank(s) can be mounted in the nose of the model, against the top surface. Make balsa supports to suit your tanks, with a sliding fit for easy removal, and glue in with a 30min epoxy & micro-balloons mix.
(below) Battery mounting plates are glued into the nose with 30 min. epoxy, and short lengths of 1" glassfibre tape. Make sure you can access the turbine battery connectors easily if your system does not have a separate charging socket.



bands on the nose-gear steering cables so that they are just tight enough to pull the cables to the sides when the gear retracts, but not so tight that they prevent it extending properly. Remember that the nose gear extends forwards, so it is a good idea to reduce your airspeed before selecting 'gear down', to make sure that it 'locks' properly against the air pressure.



(above) On-board starting gas tank installed vertically in 2 small plywood hoops, with rubber bands. (below) One possible location of the optional Festo manual fuel shut-off valve. This is an important safety feature & should be fitted.

It is often quite difficult to get the small air tubing onto the 'tee' fittings, especially in a cold place, and it is important that all tubes are fully seated to prevent leaks. Do *not* heat the ends of the tube to make it easier to fit them - as it can alter the physical property of the tubing and it may not shrink onto the barbs properly afterwards. One easy way to fit the tubing is to temporarily expand the ends of the tube with an old screwdriver, sanded to a nice taper. Push it into the tube about 5 - 6mm, remove it, and then quickly push the tube onto the fitting. After a few seconds it returns to its original size and grips the barb properly.

Linkages/Servos etc:
Check that all your linkages are secured, with locknuts against all clevises (so that they cannot turn), and add short length of heat-shrink tubing, or Tygon tubing, over all clevises to make sure they cannot open in flight.

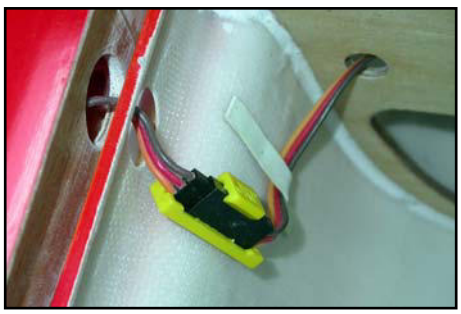
(above) Note the short length of Tygon tubing over the clevis to prevent it opening in flight. Use locknuts on the M3 bolts that hold the ball-links to the elevon horns, with a drop of Loctite to be sure ! (below) Please put safety clips, or similar, on the important elevon extension connections !

Check that all servos are securely fastened with the correct screws. We advise you to add one small drop of low-strength Loctite to all the servo horn securing bolts in digital servos, as the occasional 'buzzing' that you hear is actually high-frequency vibration and it can loosen the servo arm screws over time. We have seen this happen on several occasions - so be warned!

Fuel-proofing:
At CARF we highly recommend that you give all bare wood surfaces inside the model one thin coat of laminating epoxy (or G4) to seal all the surfaces in case of a fuel leak.

Centre of Gravity:
With the R/C gear installed as shown, with the JetCat P160, the CARF optional fuel tanks, the full-flow inlet/bypass duct set, and the Hopper tank full of fuel, the model as built needed only about 50 grams (about 2 ounces) of lead in the nose to achieve the correct Centre of Gravity balance.

This was using a 5 cell 1800 mAH Nicad (sub-C sized cells) for the Rx, and a standard JetCat 6 cell 1250mAH Nicad for the ECU & pump. All up (dry) weight was 12.2 kg (26.7 Lbs)



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 during aerobatic manoeuvres. Check the turbine, fuel system, wing, canard and vertical fin mounts carefully again.

- Are all extension leads, cables and fuel/retract tubes securely fixed to the fuselage so that they 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/Tygon tubing?
- Did you fit small Tygon or silicone tube pieces over all the clevises/quick-links?
- Did you tighten the M3 locknuts against all the clevises, and the clamp bolts and nuts on the moulded canard-arms ?
- Are the swage tubes crimped up tight on the nose steering 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.
- Did you flush out your fuel system, fit a fuel filter, and check for fuel/air leaks ?

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

The assembly of the model should be completed in about 28 - 36 hours, depending on the options installed.

Setting up your Aircraft

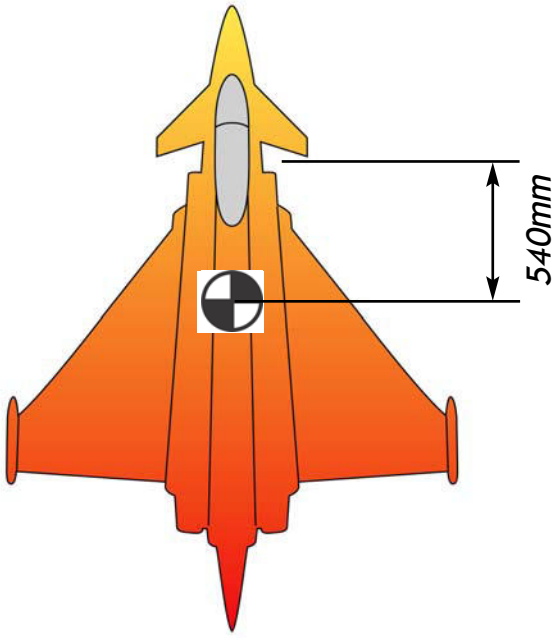
Centre of Gravity:
The Centre of Gravity should be set at 540mm backwards from the front of the inlet, with the main fuel tanks empty, and the 'Hopper' tank (if used) full of fuel.

This is a safe and stable position, and there is no need to move it further forward than this - even for the 1st flights. You will just find that it is more difficult to rotate for take-off.

After you are confident with the Eurosport at this position, you can move it backwards up to 20mm from this position, for '3D/Freestyle' flying if you wish. However we recommend that you do this in small steps and check for stability - particularly in the 'pitch' axis at high angles of attack and slow speeds.

Don't forget to balance the plane laterally, supporting it under the nose and in the centre of the rear fuselage moulding above the exhaust, and if needed add a small weight to the light wing tip to make it track correctly.

C of G: 540mm back from the front of the inlets, with <u>empty</u> fuel tanks.



CENTRE of GRAVITY

Control Throws:
Use a 'Delta' mix in your R/C transmitter for mixing the Aileron and Elevator functions, to create 'Elevons'. Don't forget to check very carefully that all controls move in the correct directions !

We recommend that you set about 25% Exponential for Elevator & Elevons for smooth flying, and this definitely helps to make it less sensitive around the neutral position.

(above) Centre of Gravity for 1st flights is 540mm back from the front of the inlets, with empty main fuel tanks.

For '3D' style flying later, with a slightly more rearwards C of G, you will need the largest control throws possible - so just set everything at the maximum throws that you can obtain without stalling any servos, but still keep at least 25% Exponential mixed in for the critical landing and take-off phases.

The centre position of the Elevons is 'neutral', and this can be checked at the wing tip. The Eurosport normally does not need any 'up' reflex for level flight if the Centre of Gravity has been set correctly, unless you have very large fuel tanks in front of the C of G.

Check carefully that both elevons move 'up' and 'down' exactly the same amount when using elevator only, otherwise you will have a roll effect when you apply elevator. Adjust all linkages carefully.

All control throw measurements should be made at the ***root/trailing edge*** position.

Elevators: 45mm ‘UP’ and 35mm ‘DOWN’.

Elevons: 30mm ‘UP’ and ‘DOWN’.

Rudder: 45 - 50 mm both sides.

Canards: 30mm Trailing edge ‘Down’ (mixed with ‘UP’ elevator), and 15mm Trailing edge ‘Up’, mixed with ‘DOWN’ elevator. For take-off, we recommend that you set the trailing edge 10mm ‘down’, using a 2 position flap switch, which makes the take-off distance much shorter, while still maintaining full control. You can also use this setting for landing, when it automatically creates a ‘nose-high’ angle-of-attack to slow the model for short landing approaches. Remember that you *must* keep plenty of power on if using this type of approach, as the drag is very high.

Nose steering: Approx. 20 degrees both sides.

And Finally ...

The CARF-Models *Eurosport* is really 2-planes-in-1. Flown at low/medium power it is an extremely stable and forgiving jet-model, and could almost be used as a jet-trainer. In fact we know of many of our customers who have built and flown the Eurosport as their 1st jet model.

With a more powerful turbine, increased control throws and some experience, it is transformed into an extraordinarily capable ‘3D/Freestyle’ performance machine which is capable of many incredible manoeuvres.

However, your new Eurosport has quite large control surfaces which really need high quality, high-torque digital servos to allow it to perform these manoeuvres safely, and we highly recommend that you choose the JR 8511/8611 servos - at least for the most critical elevon surfaces.

The Eurosport is a relatively slow flying plane, which has a huge induced drag when the angle of attack is increased, and in some circumstances this needs very large amounts of power to overcome the drag. But don’t worry, the airframe has been designed to take it, and come back for more ... !

We know that the fuselage is not quite symettrical in a few places, as our original moulds were made from a hand-made plug that was purchased some time ago. Therefore when you are checking the vertical fin, for example, you might find that the measurement from the top of it to each wing-tip differs slightly. However, there is no noticeable effect on this type of Delta model at the speeds it flies at.

However, even at these speeds, there are still considerable loads and stresses placed on every item inside the model, so please do yourself a favour and use the best quality accessories and equipment possible, and install them securely and carefully. Your reward will be many hundreds of exciting flights with a reliable and safe jet model.

Have Fun!

Feedback:

We hope that you enjoyed building your 'Eurosport'. This manual is one of the first of a new standard of CARF-Models instructions, and we plan to complete all our products with this style of Instructions in the future. Please let us know whether you like this all new instruction manual, and if you have any ideas to improve it ?

Also let us know, if you think that any hardware 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 appreciate your comments very much.
Email: info@carf-models.com

Thank you!

Your CARF-Models Team

The 'New EuroSport' looks good from all angles - and the 'Fantasy Red/Yellow' colour scheme shows up really well in flight. Watch out for more exciting new colour schemes later in the year.

Appendix (Parts list and Options)
'New' EuroSport

Packing List

Main Items

Art. #	*Quantity*	*Description*
34X101	1	Main fuselage
34X102	1	Bottom fuselage hatch
34X201	1	Right wing
34X202	1	Left wing
34X301	1	Canard right (with shaft)
34X302	1	Canard left (with shaft)
34X303	1	Vertical Fin
34X304	1	Rudder control surface
34X203	2	Servo hatches with slot (taped to wing)
34X204	2	Servo hatches without slot (taped to wing)
341108	1	Air intake lip
340104	2	Fibreglass exhaust nozzles
340105	1	Clear canopy
34X101	1	Fibreglass canopy frame
340106	1	Cockpit base, white plastic
340103	1	Air intake liner/retract cover, white plastic
340505	1	Stainless steel thrust tube
340502	1	Milled wood parts bag - 54 pieces (45 plywood, 7 balsa, 2 wood)
340503	1	Small parts & Hardware bag
900503	1	Carbon bellmouth for thrust tube
340504	1	Instruction book (English)

Hardware

Bag 1 **Rudder, Fin and Hatch**

Quantity	*Description*
2	Wood dowels, 6mm dia, 20mm long
2	Allen Screw M4 x 20 mm, for rear hatch mount
2	Blind nuts M4 for rear hatch mount
1	Carbon rod 10mm x 205mm
4	Robart pin hinges for rudder
2	Ball links complete M2
2	M2 steel threaded rods for rudder
2	Clevises M2
2	Bolts M2 x 20 mm
2	Double-sided phenolic control horns (for rudder)
2	Nuts M2
1	M6 x 50 allen bolt
1	Glassfibre tape 400 mm long

Bag 2 **Canards and Canopy**

Quantity	*Description*
4	M3 ball links
6	Bolts M3 x 20 mm
2	Nuts M3
5	M3 locknuts (for securing ball-links to canard arms and servo arm)
2	M3 all thread, 150 mm long
4	Sheet metal screws 2.2 x 10 mm (for sliding servo mount)
4	Sheet metal screws 2.9 x 14 mm (for servo)
1	Allen bolt M3 x 25 mm (to mount the M3 balls to the servo horn)
14	Washers 3.2mm
2	Wheel Collars 6 mm (for canard shaft spacers)
2	Canopy hooks (phenolic)
1	Hatch Latch (for canopy)
2	Moulded carbon Canard control-arms
2	Phenolic 'U' shaped plates
1	Brass tube 4 x 35mm long (for canopy)
4	6mm I.D. plastic washers
2	M3 Blind nuts (for ECU plate mounting)

Bag 3 **Wings and Elevons**

Quantity	*Description*
2	M3 all threads 120 mm long
4	M3 Clevises
2	M3 Ball-links
2	M3 x 16 allen bolts (for ball-links)
2	M3 lock nuts (to secure ball-links into double elevon horns)
4	M3 nut
8	Sheet metal screws 2.9 x 10 mm (for hatches)
8	Sheet metal screws 2.9 x 14 mm (for servos)
8	Sheet metal screws 2.2 x 10 mm (for CARF servo horns)
2	Allen head bolts M6 x 20 (for wing mounting)
2	Blind nuts M6 (for wing mounting)
2	Fibreglass rod 12 x 280 mm
2	Fibreglass rod 12 x 270 mm
4	Small control horns - phenolic
4	Big control horns - phenolic (for M3 ball-links)
4	CARF servo horns - phenolic

Bag 4 **Landing Gear and Turbine mount**

Quantity	*Description*
16	Blind nuts M4 (for mounting landing gear and turbine)
4	Allen bolts M4 x 20 mm to mount turbine
4	Crimp tubes, inside diameter 2mm (nosegear steering)
1	Steel cable 0.8mm x 1metre (nosegear steering)
12	Allen bolts M4 x 15 mm to mount landing gear
2	Small aluminium angles 12 x 12 x 15mm (for Thrust tube)
5	M3 Blind nuts (for mounting Thrust tube)
5	M3 x 12mm bolts (for mounting Thrust tube)
2	Sheet metal screws 2.9 x 14 mm (for mounting turbine wedges)
1	Aluminium self-adhesive tape (50 x 450mm)

Options and Accessories

Description

CARF Fuel Tank set (incls: 2 tanks, 2 x aluminium stopper hardware, 4 bulk heads & 2 spacers, 600mm glassfibre tape for reinforcement, 4 balsa blocks)

CARF 'Full-Flow' Inlet ducts and Bypass set (incls: 2 inlets, 1 bypass, wood parts, fibrgelass tape, Velcro)

'Economy' Landing gear set (includes: retracts, oleos, wheels/brakes, brake and retract air valves)

'High Performance' Landing Gear set (incls: retracts, oleos, wheels/brakes, retract valve, 3 colours air tubing, 6 quick-disconnectors, air tank, 3 x Tee's, air filler valve.)

Appendix II

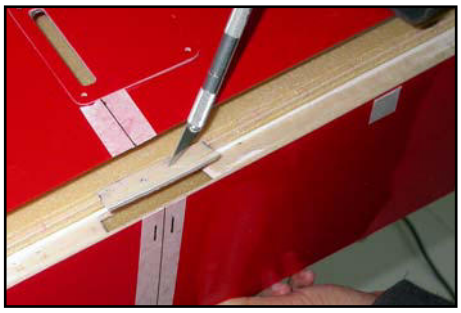
Below is some additional information to cover a few 'Frequently Asked Questions' and other points that CARF-Models think might assist our customers.

Control Horn Blocks

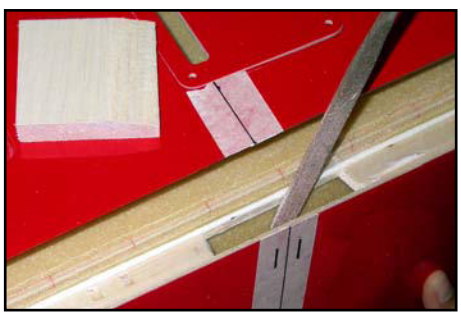
If you mill the slots for the elevon horns and find that the balsa block for gluing these into is not in exactly the correct position there is a quick and simple way to fix this. This method can also be used to insert a block for the outer horns if you chose to use 2 servos per wing.

Open the elevon up fully, over the edge of the workbench (protected with bubble-plastic) and tape it securely in this position. Cut out a rectangular piece in the balsa leading edge of the elevon with a sharp knife, making the cuts at a slight angle so that the balsa piece that you will remove cannot fall inside the elevon - which also makes them easier to replace in exactly the same position. Cut a soft balsa block 50mm wide, 40mm deep and 10mm thick. You might need to chamfer the back edge slightly. Using a Permagrit file, or similar, scuff up the inside surface of the elevon on both top and bottom surfaces. Glue the block inside the elevon, sticking it to the *top* surface with a 30 min epoxy and micro-balloons mixture. When the glue is cured, fill the small space between the block and the bottom surface of the elevon with a thick mix of 30 min. epoxy and micro-balloons.

Replace the piece of the Leading Edge piece that you removed and glue in with CA, being very careful not to get any glue on the elastic hinge. Sand the surface smooth.



(above) Cut out a small piece of the balsa leading edge, at a slight angle, with a sharp knife.
(below) Rough up the inside surfaces of the elevon on both top and bottom. Glue in balsa block 40 x 50 x 10mm with 30 min epoxy and micro-balloons. Replace leading edge with CA, and sand smooth again. Be careful not to get glue on elastic hinge!



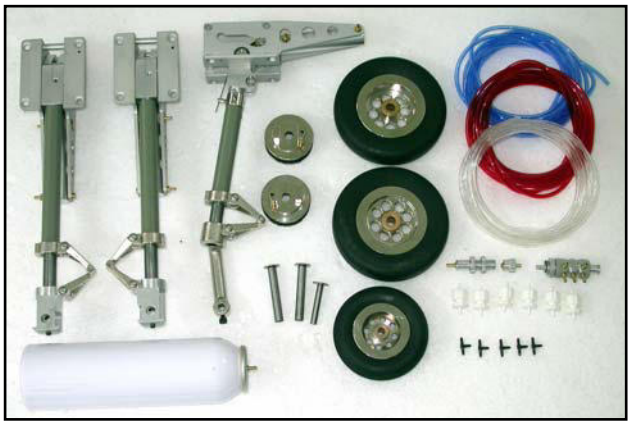
Landing Gear - Checking

CARF-Models now have 2 different landing gear sets available, an *'Economy'* set and a *'High Performance'* set.

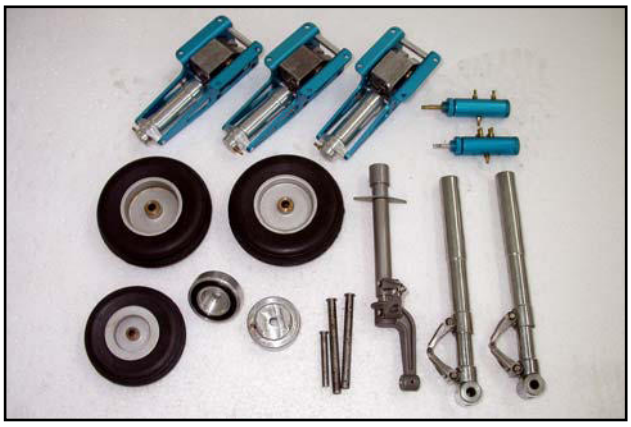
The new 'HP' set is very high quality, with investment cast 'scissors', chrome plated wheels and brake hubs, sintered bronze bushings, precision ground axles, and high-quality materials used throughout. They are manufactured to be a straight 'Drop-in' replacement for the existing 'Economy' gear, and are certain that you will be very pleased with them.

Particularly if you are installing the 'Economy' Landing gear (from Model Mechanics) supplied by CARF there are a few small things you can check before installing the gear that will improve reliability.

Please bear in mind that the 'Economy' retractable gear set includes retracts, oleos, wheels, brakes and operating valves and is extremely good 'value-for-money', at almost half of what you would pay for most other landing gear sets. However, with a little checking before fitting to your Eurosport you will find that it is quite serviceable.



(above) The new 'High Performance' landing gear set includes retracts, oleos, wheels/brakes, retract valve, 3 colours air tubing, 6 quick-disconnectors, air tank, 3 x Tee's, air filler valve.
(below) The 'Economy' Landing gear set includes retracts, oleos, wheels/brakes, brake and retract air valves.



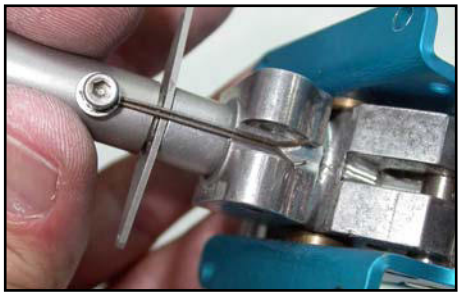
Main Gear: Check that all the bolts through the side-plates are tight. Check that the hex-headed pivot bolts are fully screwed flat to the outside face of the sideplates. Loctite as necessary. Dis-assemble the oleo legs and check that the springs are greased - if not add some grease to stop them binding.

Nosegear: Check that the top pivot bolt is Loctited.

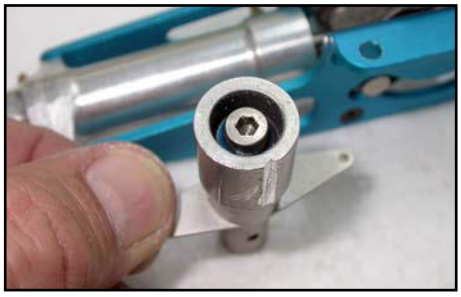
The spring that centres the leg when the wheel is retracted should be fitted on the *back* face of the leg, in the slot of the pivot block and trapped by the M4 pinch bolt, as shown in the photo. You will need to grind or file a small groove for the spring to sit in, otherwise it will be damaged when you tighten the M4 pinch-bolt.

Add a drop of Loctite to the M3 bolt that holds the spring to the leg, as it also holds the leg onto the strut.

Dis-assemble the oleo leg and check that the spring is greased - if not add some grease to stop it binding.



(above) The centering spring for the noseleg should be on the back of the leg. File slot as needed.
(below) Loctite the top bolt.



Ball-Links - Tightening

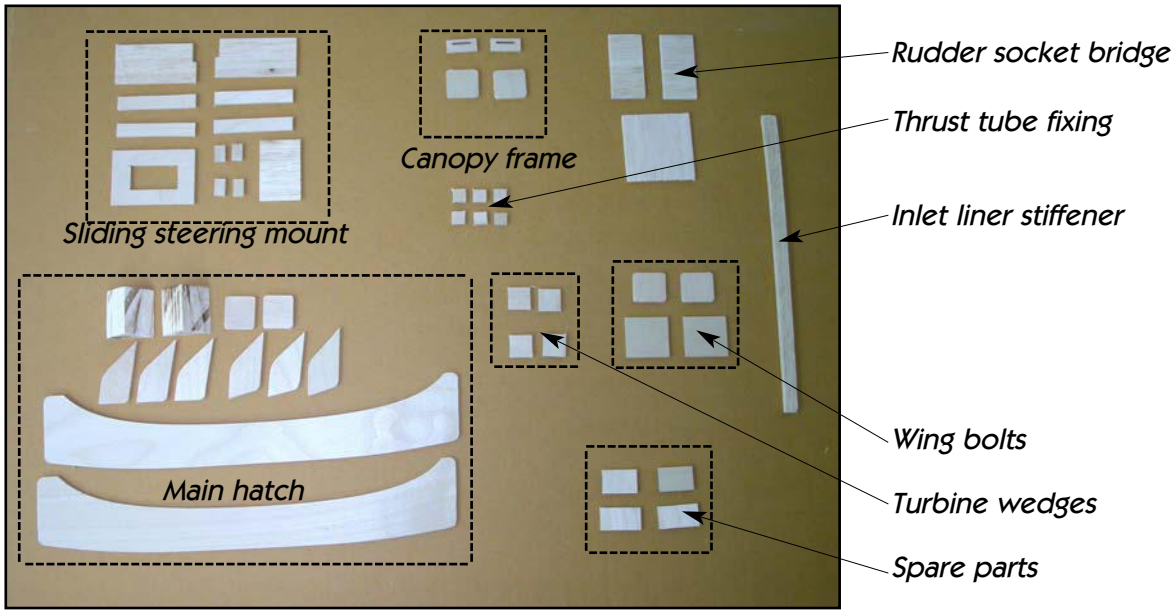
If you have any ‘play’ or ‘slop’ in the ball-links, so that the chromed metal ball is a bit loose in the plastic socket, they can easily be tightened up.

Put a long M3 bolt or length of threaded rod through the metal ball, as a ‘handle’, and then put one small drop of very thin CA (the ‘Pink’ ZAP works well) on the ball.

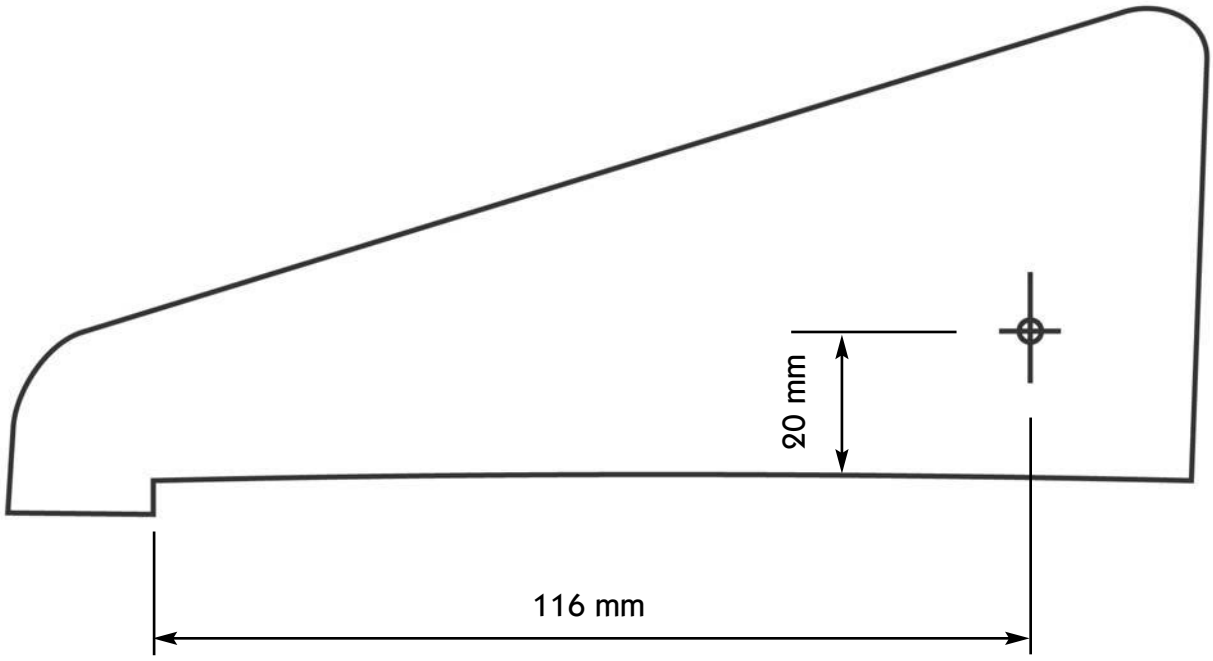
Keep moving the ball around with the bolt, and the CA will wick into the inside surface of the plastic socket and coat it with CA. Even if the ball ‘sticks’ after a few seconds, a sharp tap on the bolt frees it, and then you will find that the all ‘play’ has gone !

This method may sound a bit strange, but we have used this several times on our large aerobatic planes at CARF, with great success and it lasts for a long time.

(above) You can remove any ‘play’ in the ball-links by giving the inside of the plastic ‘socket’ a thin coat of very thin CA. Put a drop on the metal ball and move it around until the CA has cured onto the inside of the socket.



(above) Key to small milled wood parts.



Elevon Horn Template