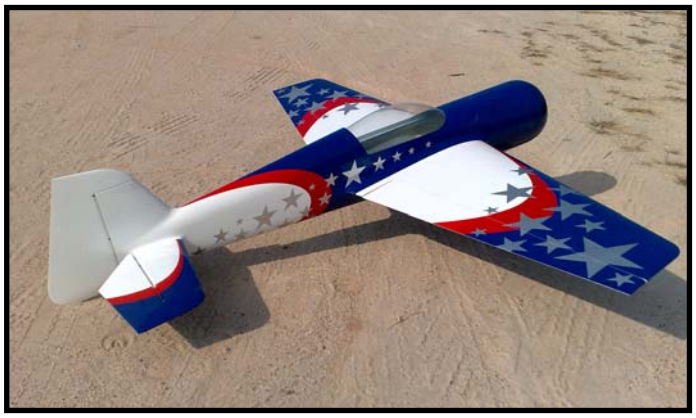


Instruction Manual

Composite-ARF Yak 55SP, 2.1m (83")

Instructions for Yak 55SP IMAC-Airplane

Thank you very much for purchasing our Composite-ARF Yak 55SP 2.1m (83" span) all composite aircraft, made with the revolutionary Total Area Vacuum Sandwich (TAVS) technology

If you want a full-color version of this manual, you can download it free of charge from our website, as an Adobe Acrobat .pdf file and print it. Just go to the Yak 2.1m page on our website, and click on the link named 'Download Instruction Manual' link above the top photo of the product.

NB: *Please* read all of the important information on pages 3 - 7 of this Instruction Manual carefully *before* starting the assembly of your Yak 55, especially if this is one of your first fully-composite ARF type aircraft.

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

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

Liability Exclusion and Damages

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

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

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

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

It is important to understand that 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.

Important Supplementary Notes

Pre-Assembly Checks:

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

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

1) Check that the plastic wing retaining bolts, and the front and back fibreglass rod anti-rotation dowels, are securely glued into the wing root ribs. Check that the fibreglass rod anti-rotation pins are securely glued into the front of the stabiliser root ribs.
2) Check that the fibreglass sleeves for the wing and stab spar tubes are securely glued into the fuselage.
3) Check that the alloy wing tube and carbon stab tubes are the correct lengths, as shown in the hardware list at the end of these instructions, not bent or damaged at all, and that they fit into the sleeves in the fuselage and wings/stabs without too much 'play'.
4) Check that the plywood landing gear support plates are securely glued to the top of the muffler tunnel and sides of the fuselage.

Pre-Flight Checks:

Before every session check that all the model's working systems function correctly, and be sure to carry out a range check. The first time you fly any new model aircraft we strongly recommend that you enlist the help of an experienced modeller to help you check the model and offer advice while you are flying. Be certain to keep to the recommended CG position & control surface travels. If adjustments are required, carry them out before operating the model. Be aware of any instructions & warnings of other manufacturers, whose product(s) you use to fly this aircraft.

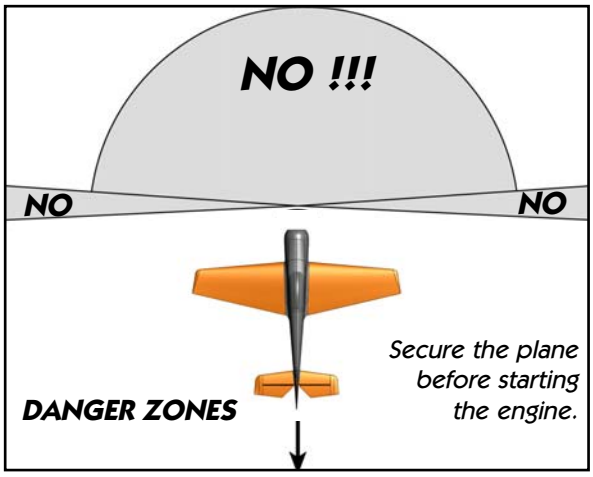
Make sure that your wing and stab spar tubes are not damaged. Check that the anti-rotation pins for the wings and stabiliser are not loose. Check that the plastic wing retaining nuts are tight, that the M3 bolts retaining the horizontal stabilisers onto the carbon tube are tight, and that the rudder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

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

Attention !

This IMAC-Aircraft is a high-end product & 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 Yak according to the laws and regulations governing model flying in the country of use.

The engine, servos and control surfaces have to be attached properly. Please use only the recommended engines, servos, propellers, and accessories. Make sure that the 'Centre of Gravity' is located in the recommended place. Use the nose heavy end of the CG range for your first flights. A tail heavy plane, especially during the first flight, can be an enormous danger for you and all spectators. Fix all heavy items, like batteries, very securely into the plane.



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

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

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

General Information about fully-composite aircraft structure

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

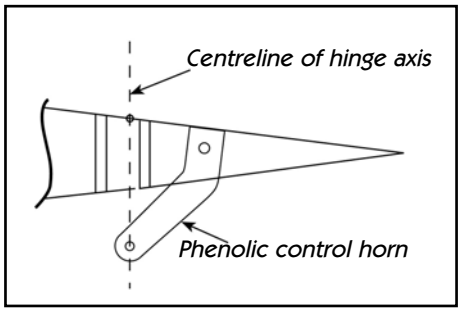
Description of Parts

The Wings:

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

The ailerons are elastic-hinged already for you - laminated in the mould and attached to the wing with a special nylon hinge-cloth, sandwiched between the outer skin and the foam. This nylon hinge is 100% safe and durable. You will never have to worry about breaking it, or wearing it out. There is no gap at all on the top wing surface, and there is a very narrow slot in the bottom surface, where the aileron slides under the main wing skin during down throw. This means that the hinge axis line is on the *top* surface of the

wing, *not* in the centre. This is NOT a disadvantage, if you program in about 10% NEGATIVE aileron differential in your transmitter. This means that the 'down' throw needs to be about 10% more than the up throw. Why? Because the axis of the hinge is not at the centreline of the aileron, so it moves slightly in and out when operated, and the aileron gets a little "smaller" in surface area when moving down.



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

The Fuselage:

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

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

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

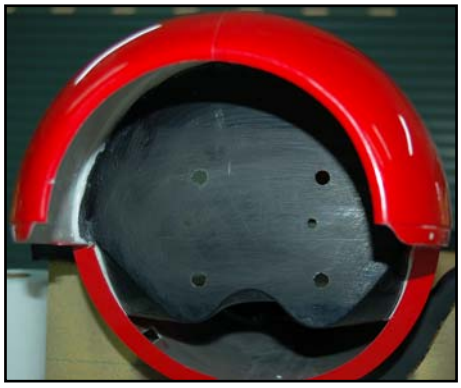
The Stabilisers:

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

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

Servo Screws:

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



Take Care:

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

Tools and Adhesives

Tools etc:

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

1. Sharp knife (X-Acto or similar)
2. Allen key set **(metric)** 2.5mm, 3mm and 4mm.
3. Sharp scissors
4. Pliers (various types)
5. Wrenches **(metric)**
6. Slotted and Phillips screwdrivers (various sizes)
7. M3 tapping tool **(metric)**
8. Drills of various sizes
9. Dremel tool (or Proxxon, or similar) with cutting discs, sanding tools and mills.
10. Sandpaper (various grits), and Permagrit sanding tools (high quality).
11. Carpet, bubble wrap or soft cloth to cover your work bench (most important !)
12. Clear Car wax polish (for protecting painted areas close to glue joints).
13. Denaturised alcohol, or similar (for cleaning joints before gluing)
14. An Incidence meter is helpful for engine thrustline alignment.

Adhesives:

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

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

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

When sanding areas on the inside of the composite sandwich parts to prepare the surface for gluing something onto it, do NOT sand through the layer of lightweight glasscloth on the inside foam sandwich. It is only necessary to rough up the surface, with 180/240 grit, and wipe off any dust with acetone or de-natured alcohol (or similar) before gluing to make a perfect joint. Of course, you should always prepare both parts to be joined before gluing for the highest quality joints. Don't use Acetone or paint 'thinners' for cleaning external, painted, surfaces as you will damage the paint.

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

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

At Composite-ARF we try our best to offer you a high quality kit, with outstanding value-for-money, and as complete as possible. However, if you feel that some additional or different hardware should be included, please feel free to let us know. We know that even good things can be made better ! Email us: feedback@composite-arf.com.

Accessories

This is a list of the things you may need to get your Composite-ARF YAK 55SP 2.1m (83") into the air. Some of them are mandatory, some of them can be chosen by you. What we list here are highly recommended parts, and have been thoroughly tested.

1. Power servos (min. 5). We highly recommend JR 8511/8611's or Futaba S9351's for the ailerons, elevators & rudder.
2. 3 metal servo output discs (1" or 25mm dia.) for aileron and rudder servos. We strongly recommend that you use metal discs instead of the standard plastic discs when using hi-torque digital servos.
3. 2 reinforced plastic or metal servo arms for elevators, length 30mm (1.25")
4. Throttle servo for gas/methanol motor. Any standard servo will do.
5. Aluminium Spinner 90 - 100 mm dia (3.5 - 4"), eg: Tru-Turn or Dave Brown.
6. Main wheels 100mm (4"). Dubro #400TL wheels are recommended.
7. Engine DA-50, or equivalent. The instructions show this engine, but you could use any other 50 - 60cc gas engine. Four 65mm long stand-offs are needed for the DA-50.
8. Muffler, minipipe or tuned pipe if using gas or methanol engine. C-ARF can supply option al headers, mini-pipes and MTW full-length tuned pipe for the DA-50 (see our website).
9. High quality servo extension cables, with gold connectors. High quality receiver and igni tion switches,. etc.
10. Receiver battery. Two 1200 -1800 mAH NiMH (or Li-Ion/Duralite) packs.
11. Fuel tank (500 - 700 ml) with gasoline stopper. Dubro #424 tank fits perfectly.
12. Propeller, to suit motor choice. A carbon 22 x 10 is most suited to the DA-50 in the Yak.
13. Powerbox Sensor switch, or similar.

A view of the complete Yak 55SP 2.1m (83") kit contents.
Star scheme Blue/White - Product #742000

About the Yak 55SP 2.1m (83")

The 2.1m Yak 55SP flies like a pattern plane, but on top of this it has enormous 3D-capabilities. It's bigger than one would think, and it feels much bigger than 2.1m span, which is due to the deep chord of the wing. This also requires a powerful engine, and we found that it is definitely a larger plane than the 2.1m Extra. But that's not bad news, that's great news. A plane, easy to store and transport, well powered with a 50cc engine, flying like its' 2.6m brothers. Just like it.

It tracks great and doesn't need any knife edge mixes. The control authority can be perfectly adjusted to everyones preference. It is the plane which can move you several classes up in the IMAC scene because of its' unbelievably smooth and neutral characteristics. It does what you want, not vice versa.

For 3D the large wing and the large control surfaces do the trick. The most impressive maneouvers can be flown very easily. It feels light and large, agile and responsive. There is nothing that the 2.1m Yak can't do. Moving batteries to shift the CG to your liking is easy because the plane is not CG critical at all. It balances well right out of the box.

Landing speed is very slow, and it feels like on rails during the approach. The high landing gear is not a disadvantage at all, it fits the touch down angle of attack perfecty and does not tend to bounce.

There is no better 2.1m plane on the planet. That's what we at CARF Models are convinced of, and we are ready to prove it to you and your fellow modellers....

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

Did you understand everything in this manual completely?

Then, and only then, let's start assembling your Composite-ARF Yak ...

Building Instructions

General Tips:
We recommend that you follow the order of construction shown in this manual for the fuselage, as it makes access to everything easier and saves time in the end. You can complete the assembly of the wings and stabs at any point.

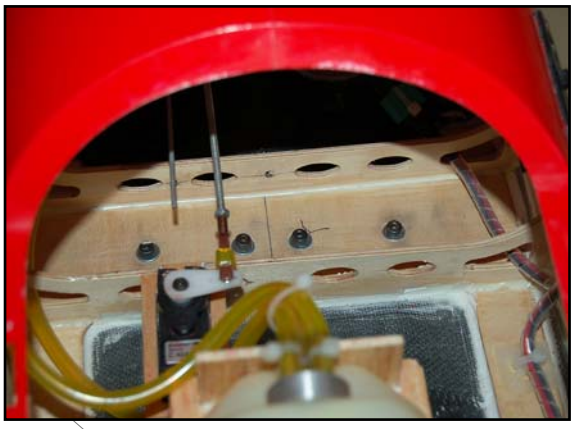
The first thing to do is protect the finished paint on the outside of the model from scratches and dents during building - so cover your work table with a piece of soft carpet, cloth or bubble-plastic. The best way to stop small spots of glue getting stuck to the outside painted surfaces is to give the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

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

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

Landing Gear

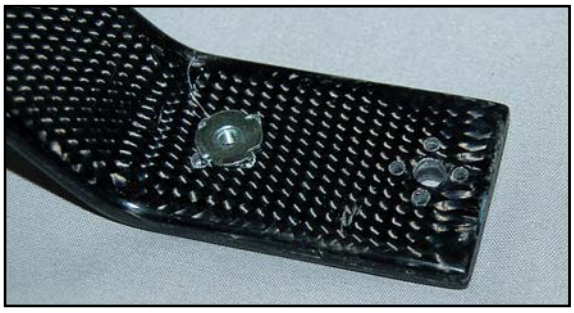
The 1st job is to fit the landing gear legs and you can leave these in place to protect the bottom of the fuselage during the rest of the assembly.

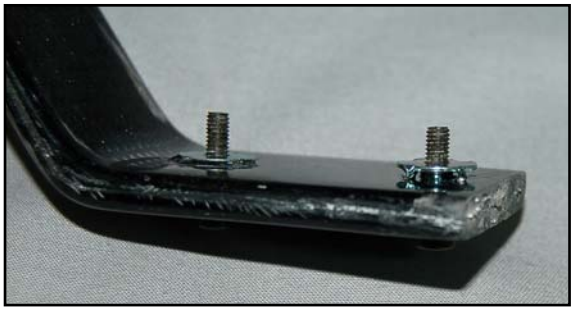


The landing gear legs consist of 45° laminated fibreglass and carbon cloth with a huge number of carbon tows inside, all made in negative molds and heat-cured. However it is still lightweight, and is flexible enough to take the shock of any landings that are less-than-perfect!

The plywood supports for the landing gear are already factory-installed on top of the integral exhaust tunnel. Please double-check now that this is properly glued in. If you wish to reinforce it against any really poor landings, you can add a layer of heavy weight (8 oz/200 gram) fibreglass cloth to join the vertical plywood supports to the sides of the fuselage, laminated on with slow epoxy - but this is absolutely *not* necessary for normal landings.

Both main legs are identical. Drill through the two molded in dimples in the top of each leg, with a sharp 5.5mm diameter bit. Using the M4 T-nuts to check the position, drill four Ø 2mm holes around each Ø 5.5 hole for the spikes of the T-nut to fit into. Using one of the M4 bolts and a washer, pull the T-nuts into the carbon legs a little, and secure them with one small drop of thick CA. Trial fit both carbon legs to the fuselage now, passing them thru' the factory milled slots in the fuselage, and bolting them to the *underside* of the black fibreglass exhaust tunnel using the M4 x 16mm bolts and washers from inside the fuselage. When the alignment is correct, secure the T-nuts to the legs permanently using 30 minute epoxy on each T-nut.





Drill 4mm Ø thru' the molded dimple in the bottom of the carbon legs, and then fit the carbon legs into the molded recess on the back of each wheel pant and drill 4mm thru' the wheelpant also, using the hole in the leg to ensure correct alignment.

The wheelpants are designed for 4" wheels, and we used the Dubro 400TL, which fit perfectly and are durable enough for operation from hard surfaces also.

The wheels are installed using the supplied M4 x 45mm allen bolts as the axles, with the head of the bolt on the outside of the wheel, and you will need some spacers between the wheel and the plywood inner plate of the wheelpant to give about 3 - 4mm clearance.

If using the Dubro 400TL the sequence of parts on the axle bolt should be: Bolt head, M4 washer, wheel hub, 1 or 2 washers, wheelcollar, M4 nut (with Loctite), washer, wheelpant, carbon leg, washer and finally the M4 Locknut provided. If using different wheels you may need to change the

number of washers and wheel collars required to give the correct clearance between the wheel and the wheelpant. For safety add a drop of Loctite to the lock-nut on the inside of the carbon leg also.

C-ARF can supply an optional tailwheel assembly for this Yak 2.1m, or use any 25mm/1" Ø lightweight wheel assembly from a hobby store. Shown here is the Graupner 1" tailwheel assembly, available from C-ARF as product #801002. You will need to use a sanding block to create a small flat surface on the bottom of the fuselage for the tailwheel bracket to sit on.

You do not need to make the tailwheel steerable unless you fly from a hard runway - on grass a simple fixed, or castoring action, is fine. A 3mm plywood plate (15mm x 60mm) is already factory-installed in the bottom of the fuselage in front of the fin post to secure the tailwheel assembly to.

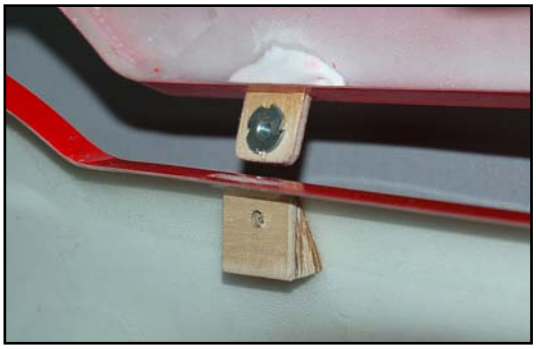
Any standard lightweight tailwheel assembly will do. Notice also the tape on the bottom of the rudder to prevent the hinge wire sliding out in flight.

Cockpit Canopy

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

There are many methods of securing the canopy frame to the fuselage. However we highly recommend that you use the method shown here, using 4 plywood tongues secured with M4 bolts and T-nuts, as it is rattle-free, resistant to vibration and improves the torsional stiffness of the fuselage - compared to using hatch-catches etc.

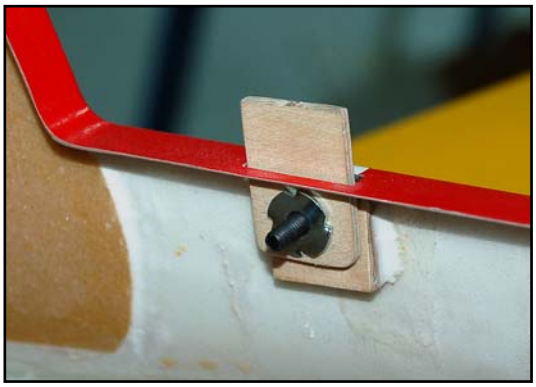
(above) 3mm thick ply blocks for rear canopy fixings - secured with thick microballoons mixture.
(below) Front blocks are 6mm thick, tapered to match fuselage shape.

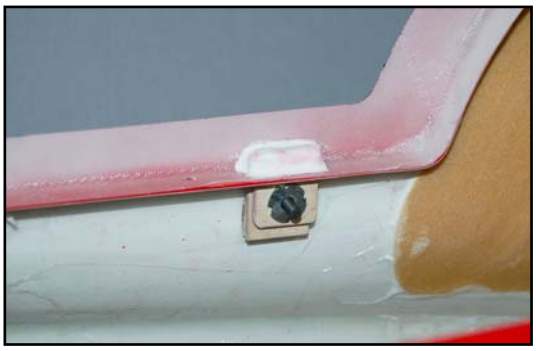


Lightly sand (or scrape with the edge of a sharp knife) the joint seams on both the fuselage and the canopy frame that could prevent it sitting perfectly flush, and check the fit to the fuselage. Tape the frame firmly in position to the fuselage all around, and check alignment carefully.

Using a small flat file, make the 4 slots thru' the flange in the bottom flange of the canopy frame and the fuselage flange. Each slot should be 3mm wide and 20 - 21 mm long. The outside edge of the slots should only be 3 - 4mm inside the outer surface of the canopy frame. Position the slots about 50mm (2") from the front and back of the canopy frame. Now remove the canopy frame, and enlarge *only* the slots in the fuselage flange to 4.5mm width, 1.5mm extra towards the inside of

the fuselage to account for the thickness of the T-nuts. Make up the 4 blocks that will be glued in the fuselage using the milled 3mm plywood squares (20 x 20mm) supplied, exactly underneath each slot a shown. It is important that the inside surface of the blocks is perpendicular to the fuselage flanges. The back two blocks only need a little sanding to achieve this, but for the front two you will need to use double thickness plywood squares, and sand the outer surface to an angle to match the fuselage shape. The inner surface of each ply square should be exactly flush with the outer edge of each slot in the fuselage flange. Tack glue in place with thick CA, and then secure afterwards with a thick mixture of 30 minute epoxy and micro-balloons.





Drill a Ø 4mm hole thru' the centre of each square, and the fuselage side. Open up the Ø 4mm hole in the 4 milled plywood tongues provided (20 x 30mm) to Ø 5.5mm, and secure the M4 T-nuts into the holes with a little thin CA. Carefully wax the area around the slots on both the canopy frame and fuselage flange, in case some epoxy gets on there in the next steps.

Bolt the 4 tongues in place in the fuselage with the M4 x 16mm bolts, so that they project up through the slots in the fuselage flange as shown in the photo (right). Refit the canopy frame onto the fuselage, taping it in place exactly, so that the 4 tongues stick up thru' the slots you filed in it. Check canopy frame alignment carefully and then glue the tongues in the frame using just a *little very* thick 30 minute epoxy and micro-balloons mixture. Be careful that the epoxy doesn't seep thru' the slots and glue the frame to the fuselage ! When cured, remove the canopy frame and reinforce all the joints with some more epoxy/micro-balloons mixture.

Finally you can counterbore the Ø 4mm holes in the outside surface of the fuselage a little, so that the boltheads sit almost flush with the surface.

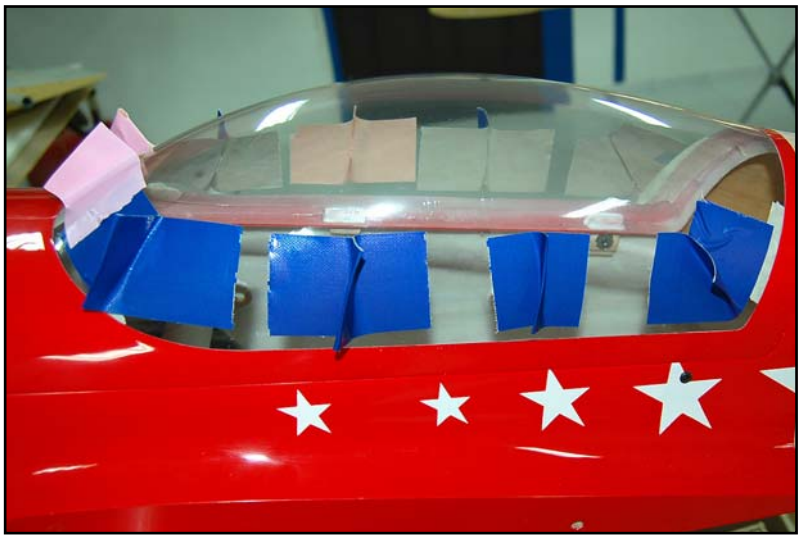
To make sure that the sides of the canopy match perfectly with the fuselage shape you can add 2 additional small plywood or phenolic sheet tabs in the middle of each canopy flange, as shown, and file matching slots in the fuselage lip (phenolic strip is included in the hardware bag).

Now glue in the clear canopy. Sand the inside edges of the canopy frame carefully with 120 grit sandpaper, especially the fibreglass joining tapes, to ensure a perfect fit of the canopy. Fit the canopy frame onto the fuselage. Lay the canopy on top of the frame, view from the front to check that it is centred and symettrically positioned, and then mark the approx. shape with a felt pen or wax crayon. Trim the canopy approximately to size so that it is about 6 mm bigger than the edges of the frame. When the canopy fits inside the frame, tape it into position temporarily, check that it is aligned properly, and accurately mark the edge of the frame on the clear canopy. Remove the canopy and trim exactly to shape, leaving about 6 - 7mm overlap outside the line all around. Unless you are in a warm room, we recommend that the canopy is slightly warmed up with a hair dryer to prevent cracking - but be careful not to melt or deform it!

Make some 'handles' from strong tape (see photo) to allow you to 'pull' the canopy in position while you fix it into position. With the canopy frame bolted to the fuselage, tack the canopy into position with a couple of *very* small drops of 'odourless' CA, at the back and front lower corners - making sure that the canopy is firmly pulled up into position while doing this.

(above) Completed canopy frame, also showing optional central alignment tabs.
(below) Strong tape 'handles' are used to pull the clear canopy into position whilst 'tacking' in place.

When the canopy is tacked into the frame, and it cannot twist any more, you can carefully remove the compete canopy frame and secure the inside edge of the clear canopy with a small bead of slow epoxy and microballoons. Alternatively you can use a specialist canopy glue that dries clear and bonds well the the clear plastic. We have used the ZAP 'Formula 560' canopy glue with good success, and any drips or drops can be cleaned up with water before it cures.



Whichever method you chose, *make sure* to bolt the canopy frame in it's final position on the fuselage while the canopy glue dries to ensure that it cannot deform.

Cowling

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

The cowl is secured with four M3 x 12mm bolts, washers and T-nuts.

The cowl is secured to the fuselage with four M3 x 12mm bolts, and four T-nuts that are glued to the inside of the horizontal flange on the fuselage. Additionally you should add 2 small phenolic tongues at the back lower corners of the fuselage lip to maintain alignment, and prevent any rubbing or damage due to vibration (see photo). A small strip of phenolic sheet (15 x 40mm) is

included in the hardware bag.

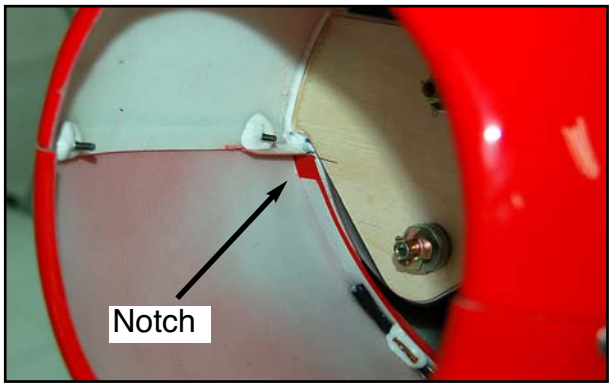
Sand or scrape any seams on the fuselage and cowling that might prevent it sitting perfectly flush. File notches in the back flange of the cowling to allow it to fit over the flange on the fuselage (arrowed in the photo right). Sand the inside surface of the flanges on the fuselage. Now carefully wax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

Tape the cowling firmly into position on the fuselage in the correct position. Drill 4 holes of Ø 3mm through the cowling and flanges of the fuselage as shown. Space the holes about 25mm (1") from the back and front, and 6mm (1/4") from the edge of the cowling.

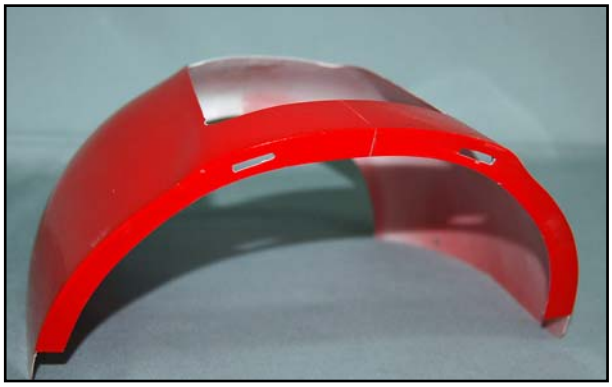
Apply some wax or thin oil to the M3 bolts and push them into the 3mm holes. Reach thru' the front of the cowling and screw the T-nuts into position against the flange, with the flat side against the fibreglass flange. Apply one drop of thick CA to each T-nut to hold in position, then remove the cowl carefully and secure properly with some 30 min. epoxy and micro-balloons mixture. You can grind or cut off the lower edges of the T-nuts that project below the fuselage flange after the glue has cured.

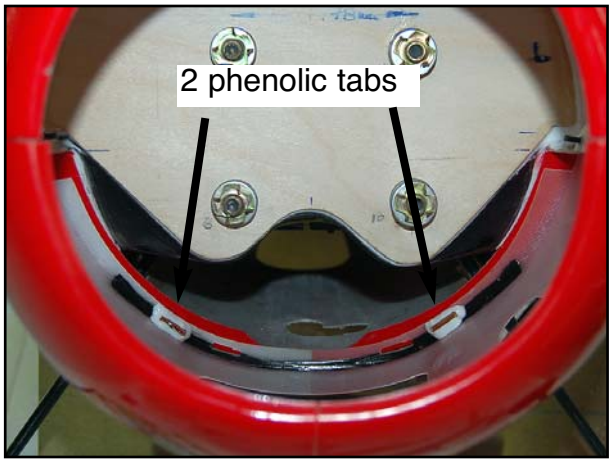
Using epoxy, glue the 2 small phenolic tabs, as mentioned above, at the lower back corners of the cowl and file matching slots in the fuselage to ensure correct alignment.

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

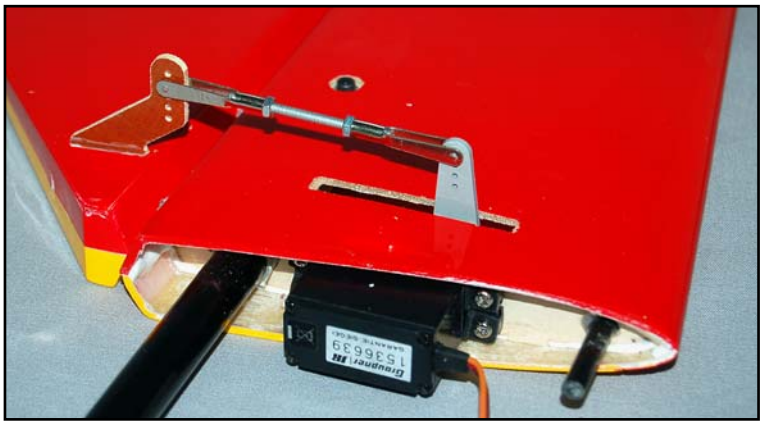


(above) T-nuts are fitted reversed, with the spikes pointing inwards, and secured with microballoons/epoxy mixture.
(below) Lower edge of cowl is secured with 2 small phenolic tabs, glued into the cowl, that fit into slots filed in the fuselage flange.





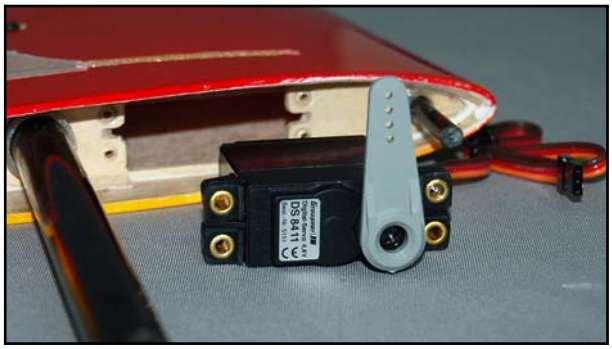
Horizontal Stabs



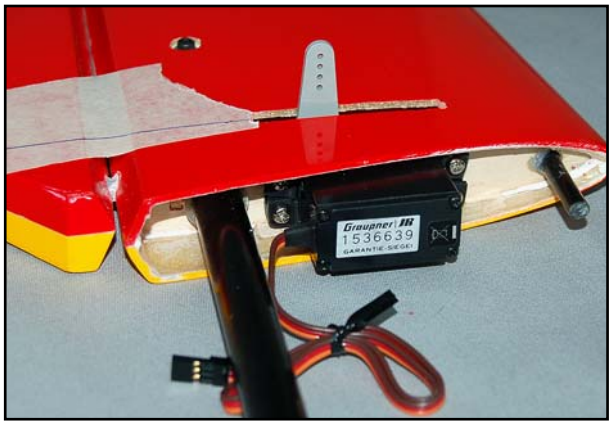
(above) Completed stab servo & linkage, also showing the position of the M3 stab securing bolt, recessed into the bottom of the stab. Note positions of clevises on the horns for the maximum mechanical advantage.
(below) You should use a 30mm long high-quality reinforced plastic or metal servo arm on powerful digital servos.

The stabs are 95% factory-finished and the hinging is completed, using 4 large Robert hinge-points in each elevator - so you only need to install servos, horns and linkages. The fibreglass tube inside the fuselage that accepts the carbon stab spar, and the holes for the anti-rotation pins are also jig-installed at the factory, so the alignment and incidences are already perfectly set. Please double-check now that the 6mm fibreglass anti-rotation pins are securely glued into the root ribs.

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



Due to manufacturing tolerances it is possible that the carbon tube may be a little tight, or loose in the fibreglass tube in the fuselage. If it is a slightly tight you can sand the outside of the carbon with 600 grit - and if it is a little loose you can either spray a few coats of clear coat on it, or even cover it in one layer of clear tape.



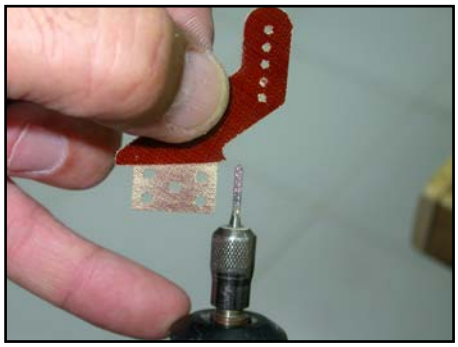
Servos: The elevators can travel more than 45 degrees, and if you are going to use the maximum throw for 3D manoeuvres, we strongly recommend hi-torque digital servos like JR8411/8511/8611 or Futaba S9351. It is not just that the torque of a standard servo is not enough - it is also the play in the gears which could cause problems centering, and it might result in high speed flutter.

IMPORTANT - Servo Output arms:
To obtain large elevator throws of around 45° you will need to use servo arms of 30mm (1.25") length, and it is very important that these are capable of handling the stresses placed on the splines by high-power digital servos, which can strip the plastic splines out of low quality/soft plastic arms - resulting in flutter.

We highly recommend that you use full metal arms, but high-quality rigid reinforced plastic arms (like the grey Dubro types shown here) can also be used with care.

The elevator servos are installed, inverted, in the plywood root rib as shown - with the servo output shaft towards the leading edge of the stabs. The cutouts in the root ribs are milled for stan-

dard sized servos.



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

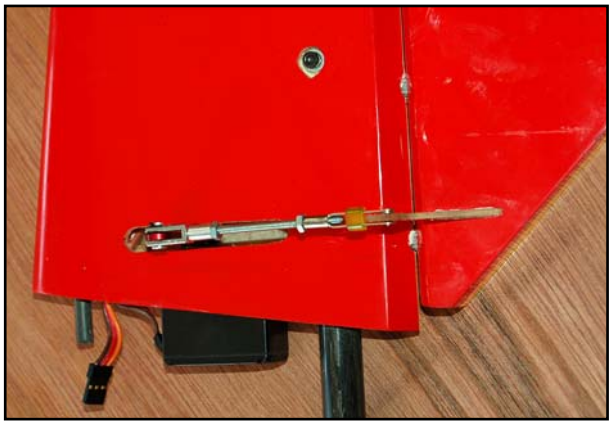
The slots for the supplied phenolic elevator horns are already partly milled in the elevators, but you will need mill them deeper - to at least 13mm (1/2") depth so that the phenolic horn fits into the balsa block in the elevators right up to the small shoulders on the horn.

It is important that both horns are in identical positions in relation to the hinge axis to give equal elevator movements. It is also important that the horns are directly in line with the servo arm, so that there are are no twisting forces on the phenolic arms. Depending on what type of servos and arms you chose to install, you may need to add thin plywood shims to the inside surface of the root rib to position the servo exactly in line with the elevator horns.

Do ***NOT*** use single-sided ball-links on the plastic servo arms or phenolic control-surface horns to obtain the correct alignment, because they will twist the arms & cause flutter. This is a solid experience and you should consider it a ***FACT***.

(above) Use waxed parcel tape to protect the painted elevator surface while gluing in the control horns.
(below) Adust the position of the servo or the slots slightly if necessary to make sure that the linkages are directly in line.

Adjust the position of *just one* of the slots slightly, forward or backward as necessary, so that the clevise holes in the horn are exactly perpendicular to the hinge axis when the elevator is in the neutral position. When horn fits fully into the slot, put a layer of plastic parcel tape over the area of the milled slot, wax it, and then cut through the tape with a sharp knife to allow the horn to be glued into the slot. This stops excess glue getting on the surface of the elevator, and makes the clean-up easy and quick! Rough up the gluing surface of the horn, and glue it into the slot with 30 minute epoxy and microballoons.



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

Make up the elevator linkages from the 60mm long M3 threaded rods, with 2 clevises and 2 x

M3 nuts for each stab, as shown in the photos. The clevise should be positioned in the servo arm hole about 25mm from the servo centre, and on the elevator horn it should be on the *4th or 5th hole out* from the elevator surface - to maximise the mechanical advantage and reduce any chance of flutter. With your transmitter throws set at maximum (125%) this will still allow even the hi-rate/3D throws mentioned at the end of the manual.

(above) Make slots in the fuselage for the back of the servos. You can glue the socket on the end of the elevator extension lead into the fuselage as shown here.
(below) Location of the hole in the underside of the stabs for the spar securing bolts.

'Loctite' the quick-link and lock-nut on at least one end of all linkages. Add a couple of short lengths of silicone tube over all clevises to prevent them opening accidentally in flight.

Of course you will also need to cut out a corresponding rectangular shape in fuselage for the back of each servo as they will project into the fuselage by about 20mm (3/4"). See photo right.

The stabs are secured to the carbon tube using two M3 bolts, screwed thru' the bottom surface of the stabs, into T-nuts that you must glue inside the carbon tube. There is a small plywood reinforcing plate inside the stab that the bolts will pass thru', and the centre of this is 85mm from the root.

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

The stabs are secured onto the carbon tube spar using M3 bolts, into cut-down M3 T-nuts that are glued into the ends of the tube with epoxy and micro-balloons.

You will need to grind or file the sides of the T-nuts a little so that they will fit inside the carbon tube.

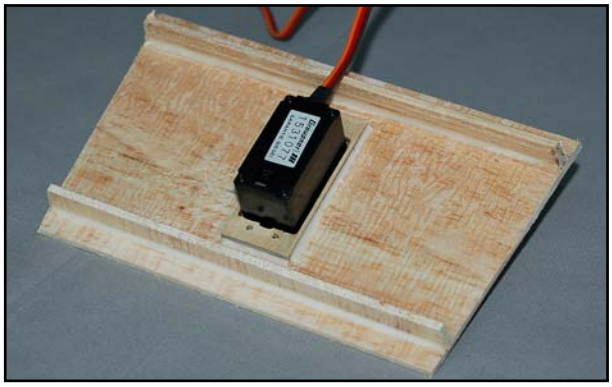
Fit both stabs tightly to the fuselage, and then drill the hole in the other stab and spar tube, thread and glue in the T-nut as before. Counterbore the holes in the bottom surface of the stabs for the boltheads so that they fit almost flush with the bottom surface of the stabs, and put a piece of clear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

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

Rudder

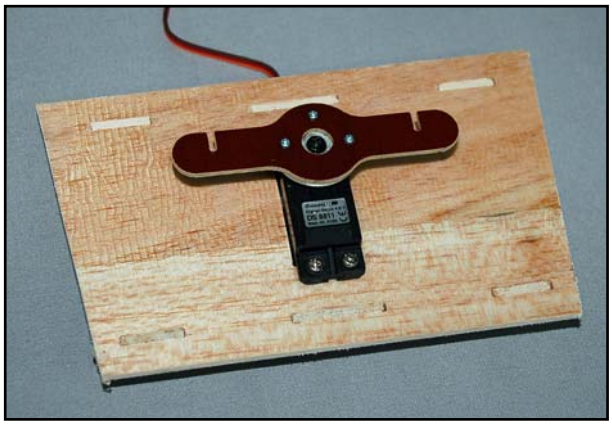
The rudder is hinged to the fin using the Ø 2mm wire (supplied) which passes thru' the 3 phenolic hinge posts that are factory-installed and aligned. File a point on one end of the wire, and a short 90° bend on the other end and push it through the tube in the rudder from the bottom, capturing the 3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

Trial fit the double-sided phenolic rudder horn in the slot that is already milled in the base of the rudder, and mark the part that will be glued in. Remove it, mask the parts that will be exposed, and scuff the centre part on both sides with coarse sandpaper. Cover the slot area on both sides of the rudder with waxed plastic parcel tape, as mentioned in the Stabiliser section above. Cut thru' the tape to expose the slots in the rudder. Glue in place with 30 min. or slow (*not* 5 minute !) epoxy and microballoons mix, making sure that it is centred in the rudder. The front edge of the phenolic horn should be flush against the back of the balsa false leading-edge inside the rudder. Remove the plastic tape from the rudder and horn when the glue is hard.



Servo: The rudder is a large surface on the Yak which definitely needs a hi-torque power servo of at least 12kg torque, and we recommend the digital JR/Graupner 8511/8611/8811, or Futaba S9351, for this very important control surface.

The servo is installed in a CNC milled composite mounting plate, which is then glued across the fuselage just behind the back end of the exhaust tunnel as shown here. Position the top surface of the mounting plate 35mm (1.6") above the bottom of the fuselage, so that the pull-pull wires pass underneath the rear fuselage bulkhead. If you are using a larger and heavier motor than the DA-50, you should install the rudder servo mount as far back as possible to help with setting the correct CG.



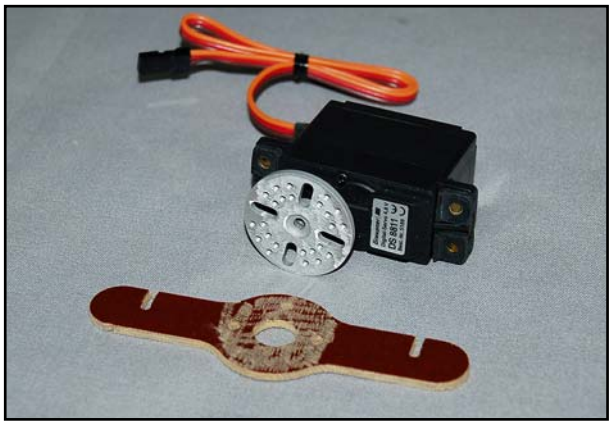
If using a full-length pipe, then you will need to cut and extend the muffler tunnel, and the rudder servo mount will need to be raised by approx. 80mm to clear it. In this case the position of the slots for the pull-pull cables to exit the fuselage will change from the ones shown here.

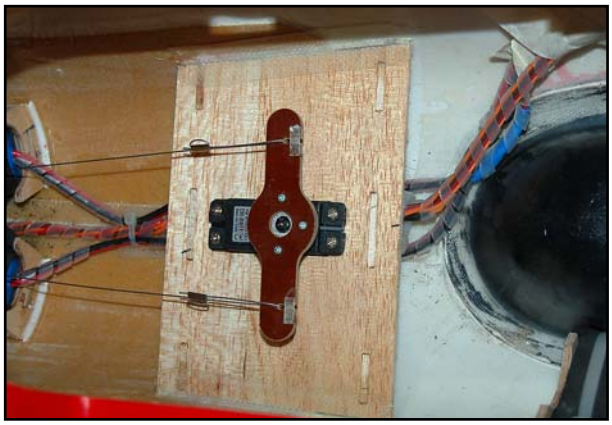
To prepare the mount, glue the ply plate to the bottom of the balsa with CA and mount the servo with the Ø 2.9 x 13mm screws provided, *not* the standard ones that come with the servo. The composite balsa stiffening rails are glued into the milled slots under the front and back of the plate with thin CA. Depending on the exact location of the servo mount you may need to sand

the ends a bit for a perfect fit.

Rough up the fuselage sides before gluing the complete assembly into place with 30 min. epoxy, and then reinforce these important joints with the glassfibre tape provided in the kit, and 24hr laminating epoxy (see photo).

Note: Fit the wings to the fuselage, and secure with the M6 pl;astic nuts, before gluing in the rudder servo mounting plate - so that you cannot accidentally deform the fuselage.

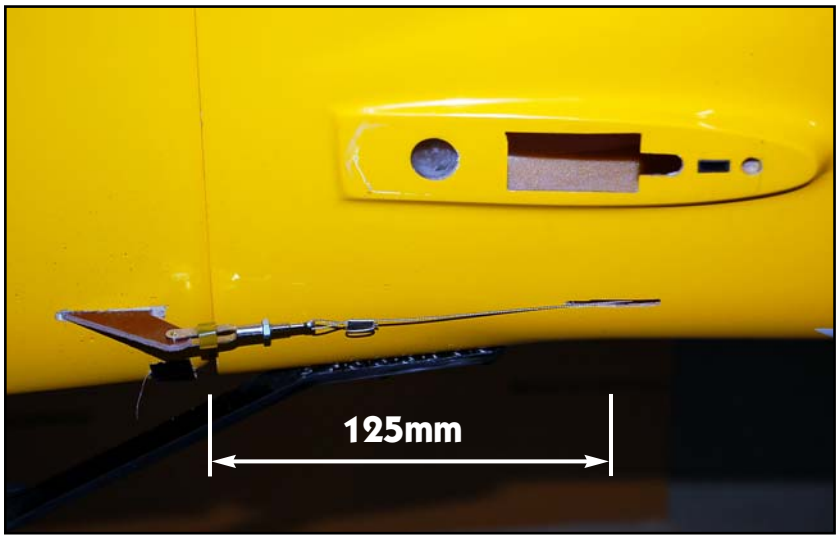




(above) Rudder servo mount positioned to suit heavy engine at top end of power range. Secure the plate to the fuselage sides with the glassfibre tape supplied, and slow epoxy. (Below) Pull-pull cable exit slots suit rudder servo positioned as above.

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

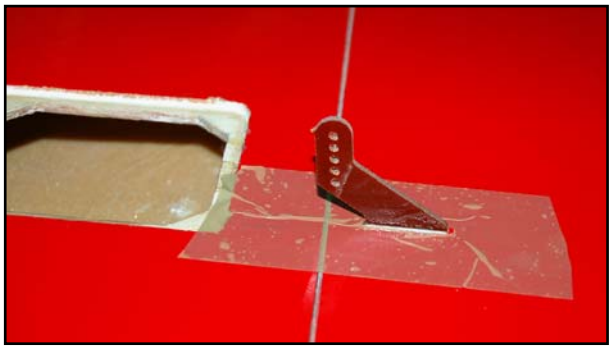
Make up the pull-pull wires for the rudder from the hardware supplied, with a loop at the front that goes over the hooks on the output arms, and a quick-link with turnbuckle and locknut at the rudder end. We cross the wires over in the fuselage, as then the exit slots are further back - and almost hidden under the stabs. For security pass the closed loop cable through the supplied 'crimping tubes' 2 times before squashing flat with large pliers. Make sure that the wires are tight, and check and re-tension them after the first few flights as the cables straighten out. Even a small amount of slop will prevent your Yak from perfect tracking.



With servo mounted in the position shown, and the cables crossed, the centre of the slots (30mm x 3mm) for the pull-pull cable exits need to be approx. 125mm (5") from the back of the fin and 25mm (1") above the bottom of the fuselage.

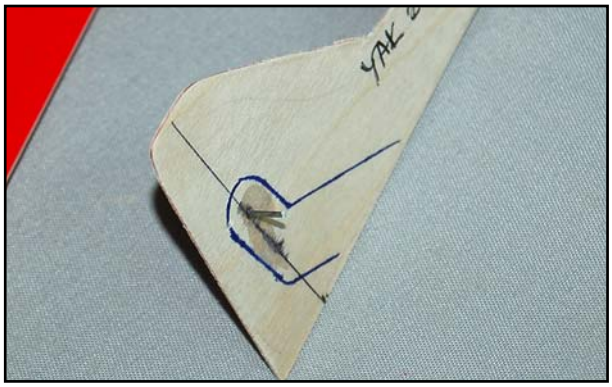
Wings

The wings are 95% finished at the factory, and have already been installed on your fuselage to check alignment. They fit on a Ø 30 x 790mm aluminium alloy spar tube, with 6mm Ø fibre-glass rod anti-rotation pins at the front and back, which are all completed for you. Each wing is secured to the fuselage with a large M6 plastic nut, that screws onto the factory-installed bolt in the wing root. All you need to do is mount the servos, glue in the aileron horns and make up the linkages using the included hardware.

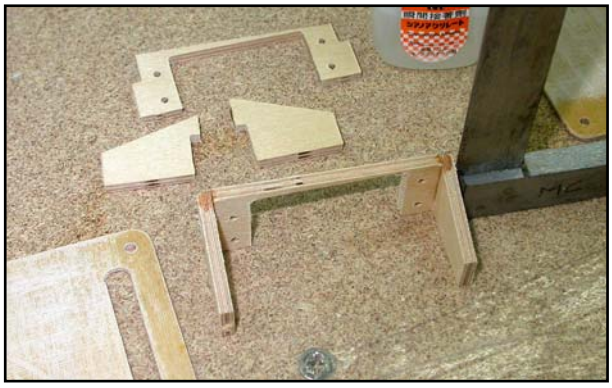


Please double-check now that the front and rear anti-rotation pins, and the M6 nylon wing bolt, are securely glued into the root ribs of the wings. You can also check the inside structure of the wings easily at this point, thru' the cutouts in the root ribs - to make sure that all critical components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

Mill the slots at least 13mm deep, and glue the phenolic aileron horns into the milled slots in the same way as the elevator horns, making sure that the clevise holes are perpendicular to the hinge axis, which is about 3mm behind the slot in the bottom of the wing skin. As before, we advise you to fit just *one* horn first, then make a template (see photo right) to ensure that the other horn is positioned the same. You can make the template from card or thin ply, with a 1.6mm drill or piece of wire thru' it to locate in the upper hole of the horn.



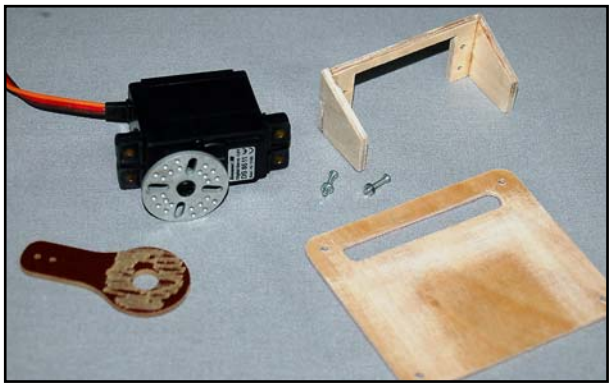
Servo choice: We highly recommend using a hi-torque digital servo (eg: JR/Graupner 8511/8611 or Futaba S9351) for each aileron as the surfaces are very large. We also *strongly* recommend that you secure the phenolic servo arm extensions to *metal* output discs on the servos, and *not* plastic discs. (see also page 19)



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

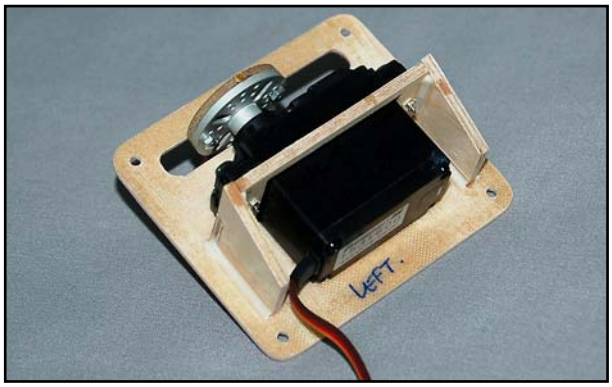
Assemble the servo mounts from the milled plywood parts for each servo, using thin CA and a

90° square. Fix the servos into the mounts with the Ø 2.9 x 13mm screws, and place them on the hatch covers to check that the servo arms are in the centre of the slots milled in the hatch covers, and aligned with the aileron horns. Don't forget to allow for the extra thickness of the phenolic servo horns that will be fixed onto the servo discs. You may need to make the slots in the servo hatch covers a little wider, by 1mm or so.



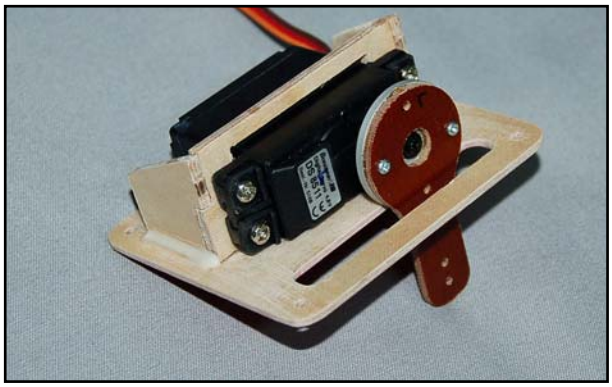
(above) Make sure you thoroughly sand and clean all the plywood parts before gluing the servo mounts onto the hatch covers, and make a nice fillet of epoxy on all joints.

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



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

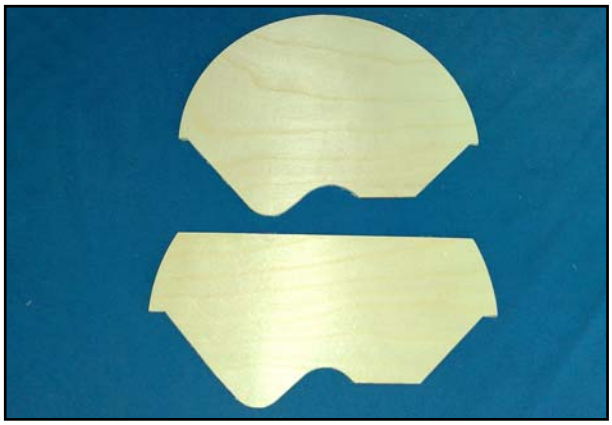
Finally make up the linkages from the M3 x 45mm threaded rods supplied, with 2 clevises and 2 x M3 locknuts for each.



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

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

Motor Installation



(above) The 2 firewalls are CNC milled from 3mm aircraft-grade plywood. The larger one is glued to the inside of the fibreglass firewall, and the smaller one is glued onto the front.

The new Composite-ARF Yak 2.1m design allows so many different choices of power unit that it's impossible to provide mounting bulkheads & hardware for all of them! Therefore, depending on your choice of gas engine you may need to modify the milled plywood parts we have included, or even make a few of your own.

The original prototype was flown with a DA-50, probably the top end of the power range that anyone could possibly want ... and it has *lots* of vertical performance! There are many other gas engines that would be suitable, and ready-to-fly weight with these will be in the range of 7 - 8kg (15.5 - 17.5 Lbs).

DA-50 (gas engine installation)

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

The integral black fibreglass firewall and exhaust tunnel is factory installed in the fuselage and jig aligned, so that the front face the front face of the firewall has, nominally, 0 degrees side thrust. However the manufacturing process does not allow us to set the up/down thrust exactly, and this could be as much as +/- 1 or 2 degrees from the wing incidence. The exact incidence of the front face of your firewall, after you have glued the plywood parts into the fuselage, is easily checked using an incidence meter to determine the angle in relation to the wing roots. Of course when you install the engine the thrustline required is easily adjusted by using a stack of washers between the back face of the motor stand-offs and the front of the plywood firewall.

The firewall consists of 2 milled 3mm plywood sheets. The larger one must be glued to the inside of the fibreglass firewall, and the smaller one onto the front face, with the black fibreglass part sandwiched in between. With the DA-50 and carbon Mejzlik 22 x 10 prop the correct thrust line is approx. 2 degrees right thrust, and 0.5 - 1.0 degrees 'down-thrust', but this can vary a little depending on your motor/prop combination.

We recommend that you accurately mark, and drill, the engine mounting holes in the 2 plywood firewalls *before* they are glued in to the fuselage. The dimensions shown here suit the DA-50.

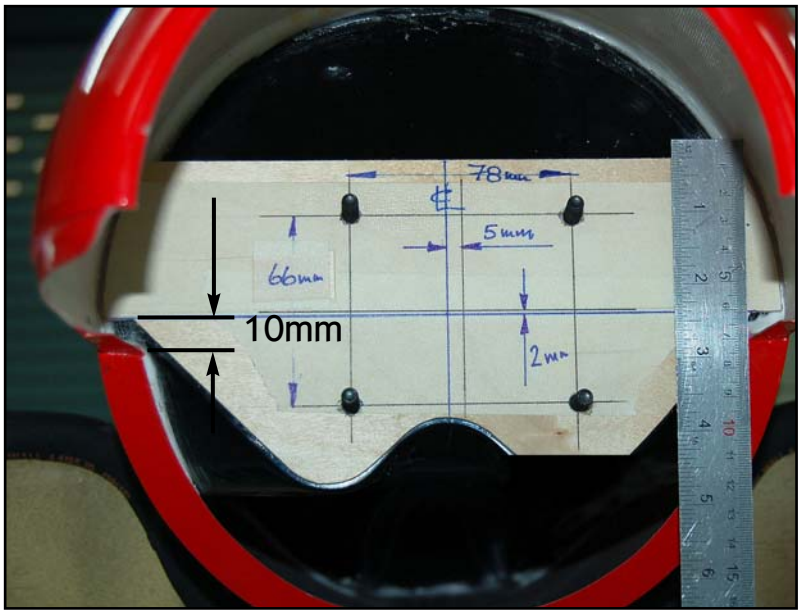
To give the correct side and down-thrust, and still have the spinner centred on the nose of the fuselage, the motor needs to be mounted offset from the centreline of the fuselage. Cover the front plywood firewall with masking tape and draw a horizontal line on it between the two short straight parts on the sides. Now mark a vertical centreline exactly bisecting the horizontal line at 90 degrees. Mark another horizontal line 2mm above the first one - this is the horizontal centre of the motor to allow for the 0.5 degree downthrust.

To account for the 1.5mm right thrust the centre of the motor needs to be offset 5mm to the (pilots) left side - so mark another vertical line 5mm to the right side of the first vertical centreline. Now mark the positions of the 4 mounting bolts equally spaced either side of the motor cen-

trelines; in the case of the DA-50 these are 66mm apart vertically and 78mm apart horizontally.

Temporarily clamp the 2 ply firewalls together, allowing an equal overlap of about 3mm all around (see photo page 22), as the inner plywood is bigger than the front one, and drill thru' all 4 mounting holes with a 6mm drill.

Position the front firewall (only) on the fibreglass firewall in the model - with the short straight parts on both sides exactly 10mm above the horizontal flanges and temporarily hold in position with 1 or 2 very small drops of CA. Using the 4 holes in the plywood as a template, drill all four Ø 6mm holes thru' the fibreglass also.



(above) The short straight edges on the sides of the front firewall should be 10mm above the flanges of the fuselage. Dimensions shown are for mounting a DA-50.
(below) The inner firewall is larger than the front one. Align symmetrically, to give an even overlap all around, when drilling the motor mounting bolt holes.

Tip: At this point it is wise to temporarily bolt your motor and stand-offs to the firewall, insert washers to set the sidethrust/upthrust and check that the spinner is centrally aligned with the cowling. Small adjustments to the alignment can be made easily now by slightly moving the position of the plywood firewalls on the fibreglass bulkhead, and redrilling the holes in it, without having to redrill the holes in the ply firewalls.

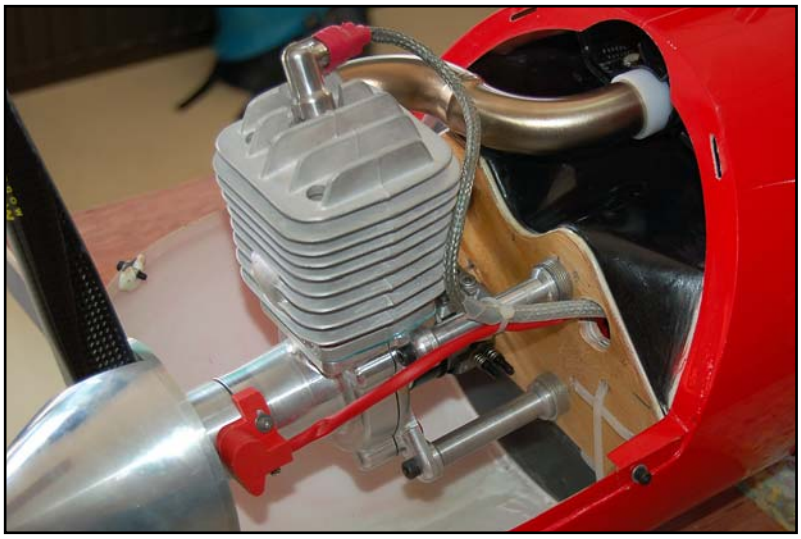
When satisfied, remove the front firewall from the fibreglass bulkhead and rough up and clean the gluing surfaces of both ply firewalls, and both surfaces of the black fibreglass.

Now glue both plywood firewalls into position and temporarily bolt them tightly together, with the fibreglass bulkhead sandwiched in between them, using the M6 bolts, washers and T-nuts included in the kit, while the glue cures. Wax or oil the bolts first so that you can get them out easily later! This method ensures that there are no air pockets in the firewall - especially where the stand-offs will be positioned. Use a slow (at least 30 minute) epoxy and microballoons mixture and make a nice smooth fillet all around as shown in the photos.

Secure firewalls with M6 bolts, washers & T-nuts provided while the epoxy cures.

For the DA-50 you will need 65mm long stand-offs, which are mounted to the firewall with the M6 bolts and large diameter washers provided -

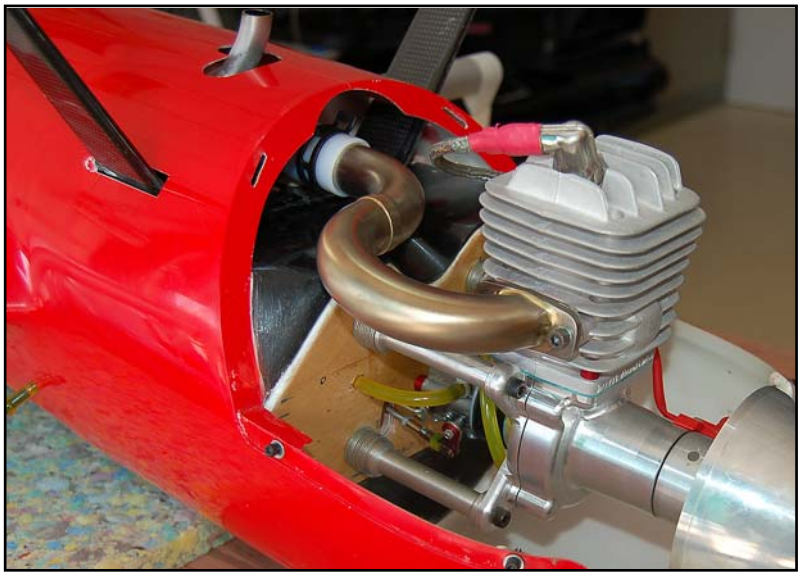
or whatever bolt size is needed for your stand-offs. Use an Incidence meter on the wing root, and against the prop-driver or spinner backplate of the motor to set the down-thrust to about 0.5 degrees for the first flight. Add washers behind the (pilots view) left side stand-offs and the front firewall to set the right thrust to approx. 1.5 degrees. The thrust-line can easily be adjusted slightly after trimming flights by adding or removing 1 or 2 washers.



Left and right side views of the completed installation. Note the HT ignition lead secured so that it cannot touch any other metal parts, especially the exhaust header. Tygon fuel line, throttle and choke linkages pass thru' holes in the fire-wall adjacent/behind the carb. Ignition unit is mounted on the inside of the firewall on a rubber isolation pad, and you can see the cable-ties used to secure it in the upper photo. Note also outlet of mini-pipe cut shorter for easy installation.

You will need to make a cut-out in the cowl bottom as the DA-50 cylinder head sticks out, but this gives excellent cooling and no internal baffles are needed in the cowling In any case make sure that the fibreglass cowling clears all hot parts by at least 6mm.

The header/manifold on the prototype also touched the cowling, and required a small cutout (seen here), but 'production' headers should fit completely inside the cowling.

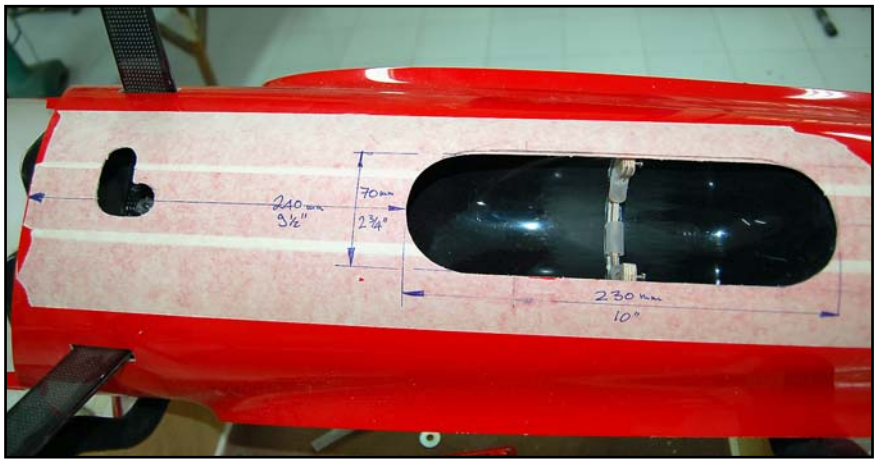


Mini-Pipe

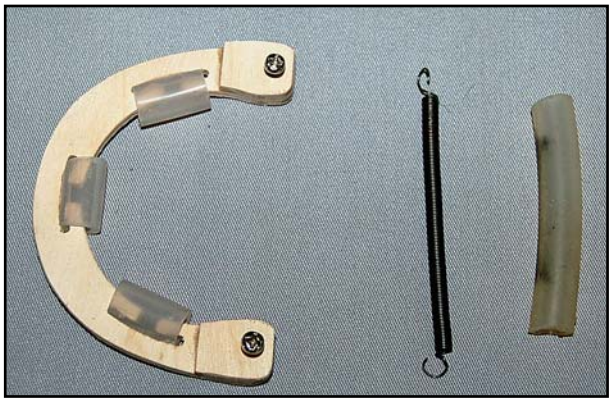
A TD75 mini-pipe (Ø55 x 355mm long) and specially manufactured header from MTW is shown fitted, and these are available as an optional set from Composite-ARF , as well as the DA-50. This combination gives the engine a nice throttle response, a perfect mid-range, and increases top end power slightly. (Now there is also a full-length MTW pipe available - see below)

Now mill the large cutout in the bottom of the fuselage for the pipe cooling air exit. Cover the bottom of the fuselage with masking tape and draw the shape on accurately to make the neatest job of this task. For the MTW TD75 mini-pipe the front of the cutout should be 240mm (9.4") from the front of the fuselage, the length of the cutout is 230mm (9.25"), and the width should

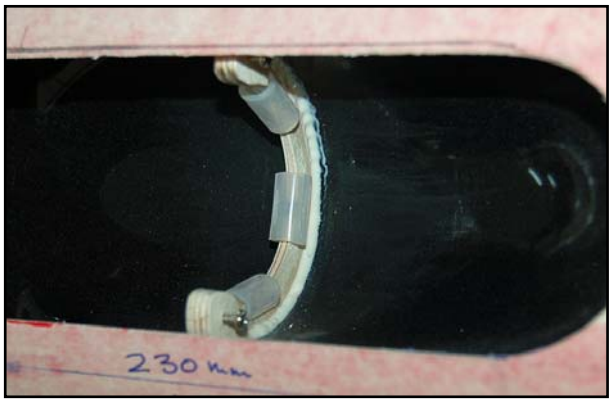
be 70mm (2.75"). Radius both ends of the cutout as shown. The dimensions of this slot can be adjusted to fit your chosen exhaust system as needed, within the overall size of the molded exhaust tunnel.



The mini-pipe is only supported in the exhaust tunnel in a 'U-shaped' milled plywood part which has 3 silicone buffers fitted into the slots in it, and no other support is necessary. Assemble the header and mini-pipe with the teflon joiner and clamps, and trial fit it into the fuselage. You will need to mill an 'L-shaped' hole in the fuselage as shown, between the LG legs for the pipe outlet - which can be cut a little shorter to ease installation without affecting the performance noticeably.



Cut three 15mm lengths of the hard Ø10mm clear silicone tube provided, and fit them into the slots in the rear pipe support as shown. The hard silicone tube 'isolation' buffers on the pipe supports give some flexibility for the pipe mounting, and also reduce the vibrations transferred to the airframe.



Glue the 2 small ply doublers to the ends of the pipe support, which will take the 2 sheetmetal screws for the spring that secures the pipe. Screw in the sheetmetal screws now, as it is more difficult when this part is finally glued into the pipe tunnel. You may need to sand the inside of the pipe support a little, in the area of the ply doublers, for a good fit of the TD75 pipe.

Trial fit the pipe support in the tunnel, positioned about 110mm (4.25") from the back of the cutout in the fuselage, and temporarily tack in place with a drop of CA. Test fit the header and mini-pipe and adjust the position of the pipe support if needed, checking carefully that the mini-pipe clears all fibreglass parts by at least 6mm to prevent scorching.

When the fit is Ok, sand and clean the gluing position inside the pipe tunnel carefully, and glue it permanently in place with slow epoxy. The pipe is secured to the support using a short length of Ø 4mm spring (included), covered in another length of the Ø 10mm hard silicone tube. Bend a small hook in each end of the spring, and

hook the spring over the sheetmetal screws - as shown in the photos.

Full-Length tuned pipe

A full length MTW tuned pipe and manifold for the DA-50 is available from C-ARF as an option. Please see the 'related products' link above each color scheme photo on our website for part numbers and prices.

To fit this you will need to cut the back off the molded exhaust tunnel inside the plane and extend it to match the pipe length. You could make this extension with thin plywood or fibre-glass sheet. For sufficient cooling you must make sure that the outlet area for the warm air to exit at the back of the pipe is at least as large as the inlet area to the pipe tunnel.

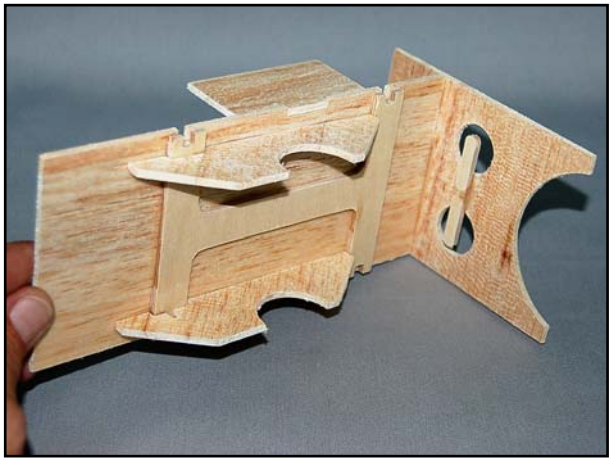
Cooling

Depending on your choice of motor and exhaust system, mini-pipe or muffler you must make provision for enough cooling to all these components during flight. Depending on your engine configuration you might even need to make a small balsa or ply baffle in the cowl to make sure that cooling air entering the cowl passes through the engine cylinder head cooling fins before entering the exhaust tunnel.

Fuel Tank Base

Included in the kit are CNC milled plywood and balsa/composite parts to make up the fuel-tank base, which also incorporates a receiver mount on the vertical back face. The photos show how the parts are assembled, and the completed unit is then glued on top of the fibreglass wing spar tube in the centre of the fuselage with epoxy and micro-balloons mix. Sand all the parts lightly first, assemble with thin CA - and then reinforce all joints with a good fillet of epoxy and micro-balloons mixture. It is also wise to seal all the bare balsa edges with a thin coating of epoxy - just in case of a fuel leak, especially if fitting a methanol fuelled motor.

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

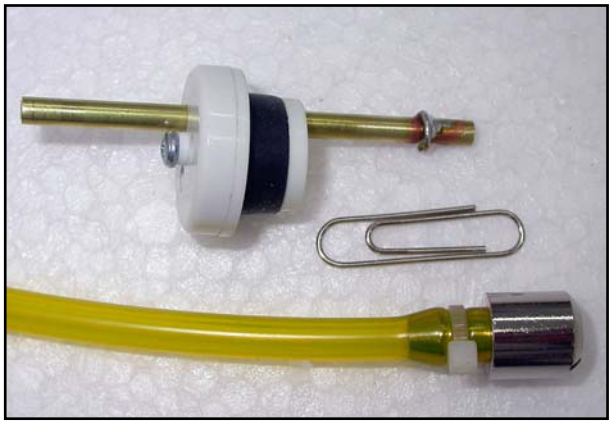


If you wish to mount your receiver on the vertical support at the back of the tank base, then glue the milled 3mm plywood stick to the inside surface, centred on the 2 large holes, wrap the receiver in thick foam and and fix it in place with 2 No.#80 rubber bands.

The fuel tank is held to the tank base with 3 cable-ties. Drill a hole in the motor firewall where necessary for the fuel feed tube from the tank to the carburettor, and protect it where it passes through the fibreglass using a rubber grommet or similar.

Fit the correct stopper to the fuel tank for the fuel type used. (If using Dubro tank the gasoline stopper has a small 'O' moulded in the top of it). We use the excellent 'Tygon' brand of fuel tubing for all our models. It is totally gasoline and kerosene-proof, and does not go hard and crack with age.

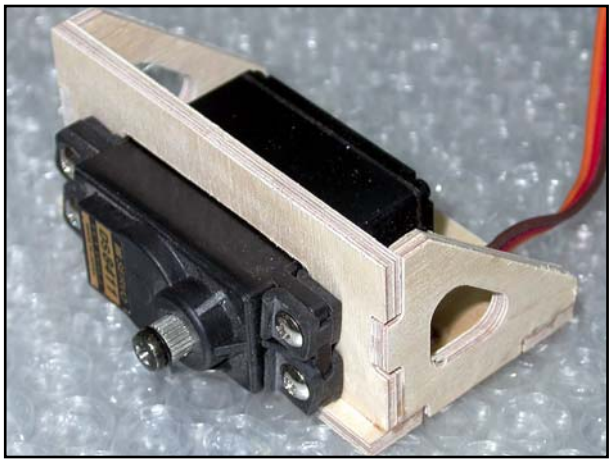
Secure the feed tube inside the tank to the clunk with a small cable tie. If the tube is even a little loose on the brass tubes though the stopper it will come off at just the wrong moment and your engine will quit. So solder some small rings onto both ends of the brass tubing (easily made from the soft wire of a paperclip wrapped around a small screwdriver) and secure with a fuel-line clamp or cable-tie. Don't miss this small detail - it could cost you your plane !



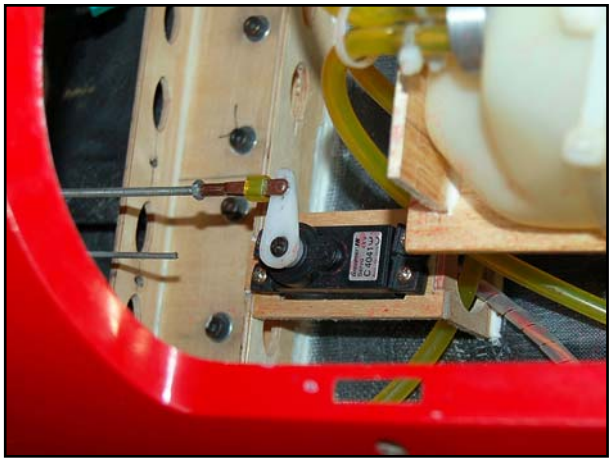
We use the normal 3-tube plumbing system, one from the clunk to feed the motor, one out of the bottom of the plane (vent/overflow - leave open) and one at the top for filling (close for flight).

Throttle servo

Included in the kit is a CNC milled plywood throttle servo mount, and you can fit this in any suitable position for your motor set-up. However, we strongly advise you *not* to mount it directly on the back of the firewall as engine vibrations can damage a servo quite quickly. We mounted it on top of the exhaust tunnel, directly in front of the fuel tank base - and glued securely to the rear of the landing gear mount as shown here. Included in the hardware are two M3 clevises and the M3 threaded rod to make up the linkage from the servo to the carburettor.



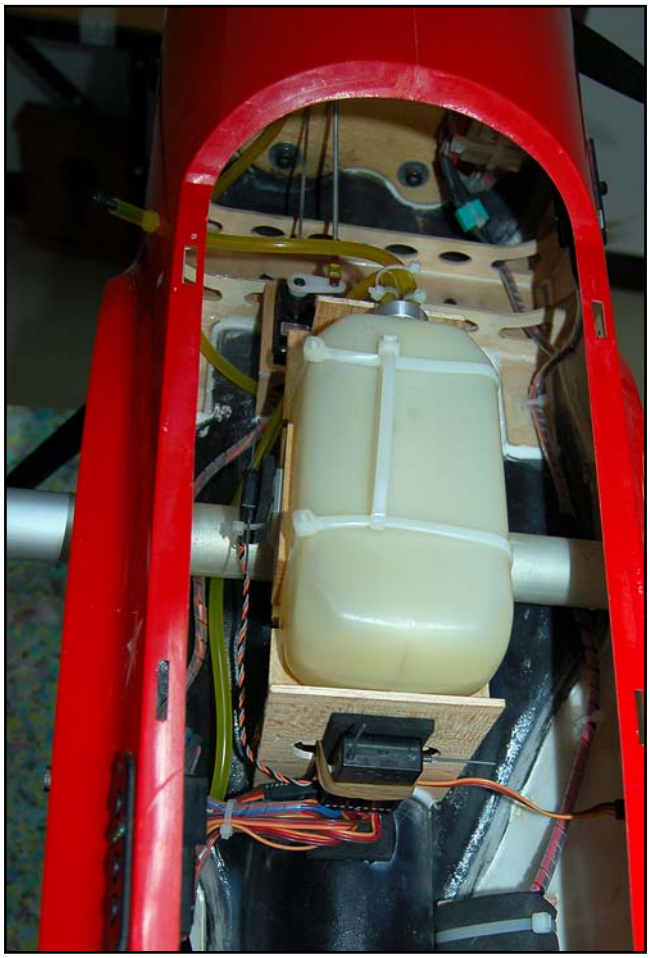
R/C & Gear Installation



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

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

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



Receiver and Antenna

The receiver can be fitted anywhere you like, but the position shown on the back of the tank base works well, and it is easily accessible.

Please protect it from vibration and shocks by mounting it on some foam rubber, and don't forget to secure the receiver crystal into the Rx with a piece of clear tape.

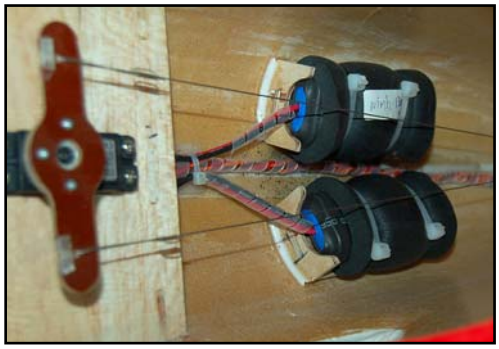
Run the antenna wire along the side of the fuselage in the cockpit area, taped in place, and then vertically through the top of the fuselage (in a piece of silicone tube) behind the cockpit and back towards the vertical stab. We often fit a short length of plastic tube, vertically behind the cockpit,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

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

Batteries and Switches

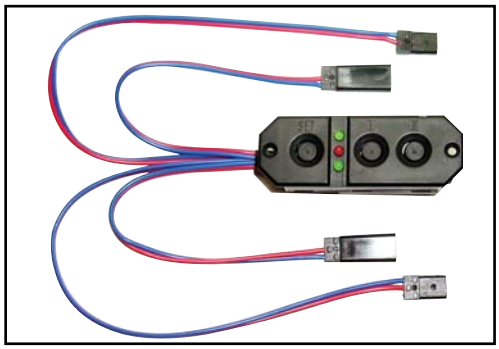
As this model has 5 or 6 powerful digital servos, we highly recommend that you fit dual Rx batteries, and here we have used 2 packs of 5 cells x 1400 mAH and a Powerbox Sensor switch. The sensor switch incorporates both dual battery inputs and outputs to the receiver, as well as a voltage regulator for 5-cell packs which regulates the voltage to 5.9 volts. You can use this switch with 1 or 2 battery packs. An excellent lightweight unit that is available from Composite-ARF as an option.

Wrap the batteries in foam, to protect the soldered joints from vibrations and shocks. The location of your batteries will depend on your motor choice and where they need to be for correct C of Gravity. The 2 receiver packs are 5-cell 1300 mAH NiMH, and these were installed immediately behind the rudder servo mount, as shown in the photo. Of course, if you need to add weight in the 'plane to achieve the correct Centre of Gravity, it is better to install a larger battery - rather then add lead. When using a gas engine we highly recommend a 'Powerswitch' for the ignition cut-off, which is also available from C-ARF.



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

NB: *Please double-check the manual for your R/C system if the use of 5-cell battery packs is recommended.*



PowerBox 'Sensor' switch

Motor ignition system

The ignition unit can be secured onto the back surface of the firewall, as previously mentioned, using 2 or 3 small cable-ties. We advise that you mount it either on a foam pad to protect from vibration. At C-ARF we recommend a 800 - 1200 NiCd pack for ignition, and we use a Powerswitch for the ignition cut-off. Add a very small cable tie around the plug/socket connectors from the motor pick-up to the ignition unit for extra security.

Servo extension leads etc.

We advise you to use good quality twisted-cable extension leads, of heavy gauge wire with gold-contact connectors. Secure all loose wires and extension leads - remember that when you are pulling those 10G manoeuvres everything in the plane has 10 times more force than usual! Be very careful to fix all your batteries securely.Make extra sure that no fuel tubes or cables can come in contact with hot exhausts.

Fuel proofing

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

(above) Motor ignition system is fastened to back of firewall with 3 cable-ties. Powerswitch for Ignition is on the right of fuselage, seen here.

Final check

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

- Are all extension leads, cables and fuel tubes securely fixed to the side of the fuselage ?
- Are all tubes/wires protected from chafing where they pass thru' the holes in fibreglass parts or bulkheads with rubber grommets, or short lengths of split silicone tubing?
- Make sure that no fuel tubing or wires can come into contact the hot exhaust.

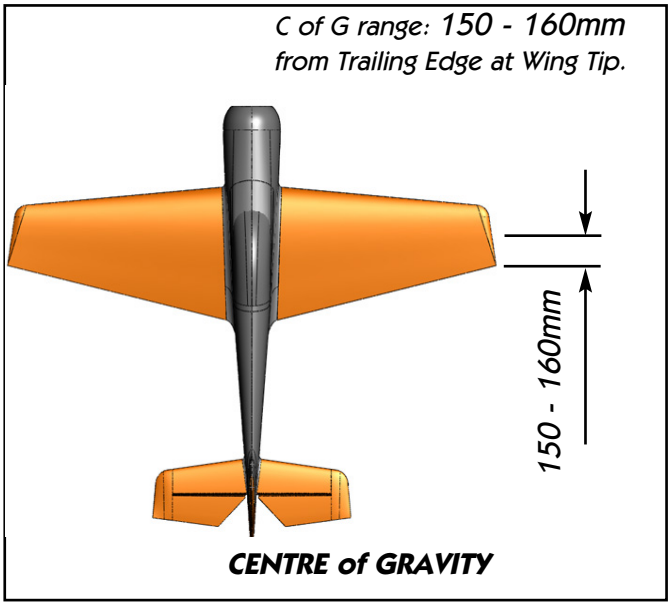
- Did you fit short Tygon or silicone tube pieces over all the clevises?
- Did you tighten the M3 locknuts against all the clevises?
- Are the crimp tubes crimped up nice and tight on the rudder cables?
- Have you put clear tape over the end of the rudder hinge wires and on the stab bolts ? Don't forget to tighten the large Plastic M6 wing retaining nuts before flying!
- For added security add one small drop of loctite/thread locking compound on all engine mounting bolts, and those that hold the servo arms to the servos, especially important with digital types.

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

Setting Up Your Aircraft

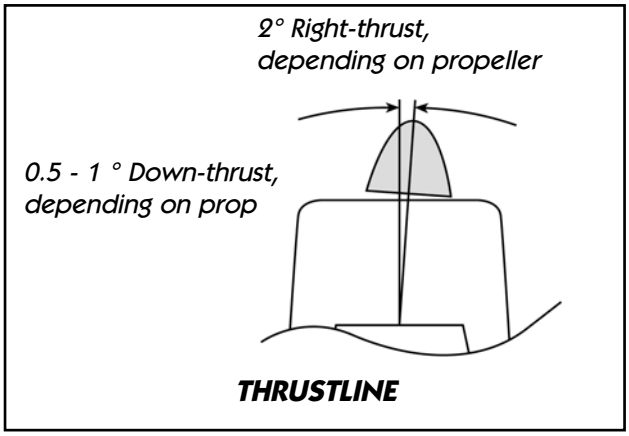
Centre of Gravity:
For the 1st flights set the Centre of Gravity at 150 - 160mm (6 - 6.4") from the ***trailing*** edge ***at the wing tip***. Hold it with a helper at both wing tips in this position and make sure the plane balances horizontally, or slightly nose-down. This is the 'pattern' CG position.

After you are confident with the plane, you can move it backwards up to 15mm, but this is definitely a '3D/Freestyle' CG setting and should not be used for the first flights. With this rearward CG you will need to use the high rate control throws and more exponential, as described below.



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

Engine Thrustline:
Down-thrust should initially be set at 0.5 - 1.0° degrees and right thrust 2 degrees, depending on the power system and propeller used. Of course, final settings can be fine-tuned to your liking after the first few flights, and will ultimately depend on your motor/propeller set up.

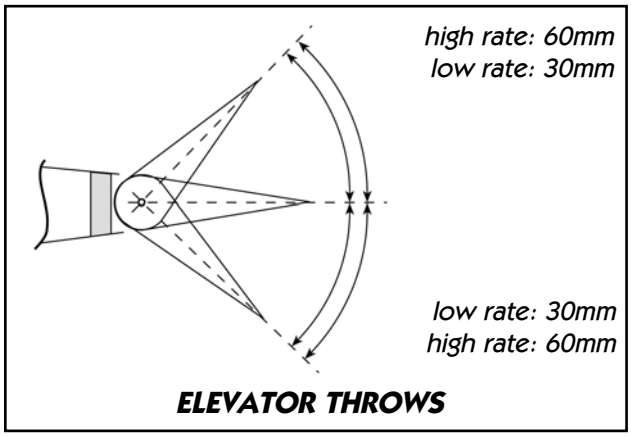


Control Throws:
All measurements are at the root/trailing edge position. All controls should be set with a dual rate switch, and we *highly recommend* that you make your first trimming flights using all of the low-rate settings listed below.

Elevator

Low rate should be no more than 30mm (1.25") both sides. This is the perfect throw for nice and crisp snaps. If you like you can add about 20% exponential to the low rate setting.

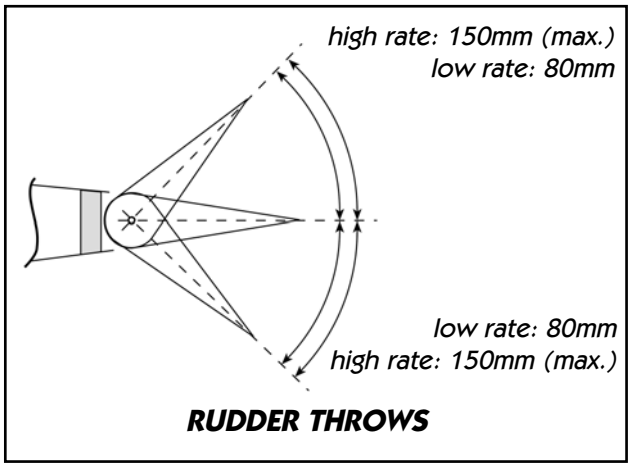
On high rate the elevator should be close to the maximum available, up to 45 degrees both sides, but in this case with at least 50% exponential, and this hi-rate setting is definitely for 3D only !



Rudder

Set the high rate to maximum throw (about 150mm) both sides, and at low rate reduced to about 80mm. The Yak needs quite a lot of rudder for nice stall turns, so you should at least add 25% exponential for smooth tracking corrections.

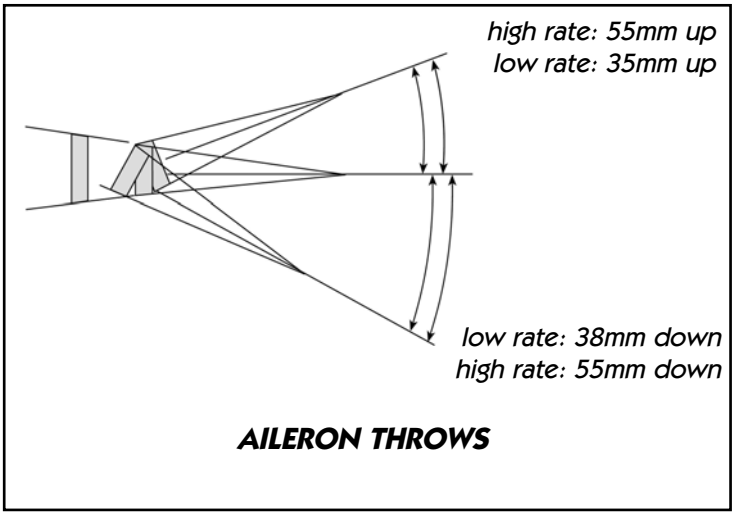
At the same time you should remember that the Yak rudder is very sensitive, and the plane starts shaking at high speed if the rudder linkage is not really rock solid, so check your closed-loop cables again and make sure that there is NO slop at all ! On the other hand these characteristics are also the reason for best rudder sensitivity at the slowest 3D speeds.



Ailerons

Aileron throw for high rate is 55mm up and down. Use at least 30% exponential for high rate. For low rate you should decrease the throw to the *top* to 35mm, and the bottom to 38mm.

Yes, this is a reversed differential due to the hinge line being in the top skin instead of on the centre line. You will have to finalise this differential figure during flight, as mentioned earlier in this instruction book. At high rate, for 3D manoeuvres, this doesn't effect the rolling too much, so you can maximize the throws to whatever is mechanically possible, even more up than down if you wish.



In General

Your Yak 55SP has very large control surfaces, which makes it very sensitive and reactive. It is always possible that these huge control surfaces can flutter at high speeds if the assembly, servo installation and linkages are not made perfectly. So please do yourself a favour, and make sure

that you only use the best servos available, and take the utmost care making your linkages. Check every linkage for slop, and set up all your linkages to give the maximum mechanical advantage and correct throws - rather than reducing the throws electronically in your transmitter.

We hope that you enjoyed building your Yak 55SP. Please let us know, if you think that any hardware is missing or inadequate. We have tried to make this airplane as complete as possible, and with good feedback from customers you will help us to continue making good things even better. We appreciate your comments very much.

Email: feedback@composite-arf.com

Appendix:

Kit Contents: Yak 55SP, 2.1m (83") Kit

Quantity	*Description*
1	Fuselage
1	Right wing (servo hatch taped to wing)
1	Left wing (servo hatch taped to wing)
1	Right stabiliser with elevator
1	Left stabiliser with elevator
1	Rudder
1	Cowling
1	Canopy Frame
1	Clear Canopy
1	Pair wheel pants
1	Pair landing gear legs, carbon
1	Aluminum Wing tube, Ø 30 x 1.4 x 790mm (wing spar)
1	Carbon Stab tube, Ø 14 x 1 x 275mm (stab spar)
1	Set of protection bags (wings, stabs and rudder)
1	Hardware bag
1	Milled wood parts bag
1	Instruction Manual (English)

Hardware Pack

Fuselage bag

Quantity	*Description*
4	T-nut M6 (engine mounting)
4	Allen bolt M6 x 30mm (engine mounting)
4	Washer M6 large (engine mounting)
6	Allen bolt M3 x 12mm (cowling mounting + 2 spare)
4	Washer M3 (cowling mounting)
4	T-nut M3 (cowling mounting)
2	Clevise M3, spring steel (throttle linkage)
2	Nut M3 (throttle linkage)
1	All-thread M3 x 150mm (throttle linkage)
2	Sheetmetal screw Ø 2.9 x 13mm (to attach spring for muffler mounting)
2	Bolts M4 x 45mm (wheel axles)
4	Bolts M4 x 16mm (attach carbon LG to fuselage)
4	T-Nuts M4 (attach carbon LG to fuselage)
12	Washers M4 (attach LG to fuselage, and wheel centering)
2	Stop Nuts M4 (to secure ends of axles)
2	Nuts M4 (wheel centering)

2	Wheel collars I.D. 4mm (wheel centering)
4	Allen bolt M4 x 16mm (to attach canopy frame)
4	T-nut M4 (to attach canopy frame)
1	Phenolic plate 15mm x 60mm (for canopy/cowling alignment tabs)
1	Spring, Ø 4mm x 70mm long (to secure muffler to rear mount)
1	Silicone tube Ø 10mm x 125mm (muffler mounting)

Wing bag

Quantity	*Description*
2	Aileron horns - phenolic (2mm thick)
2	Servo extension arms, small - phenolic (2mm thick)
2	All Thread M3 x 45mm (for aileron linkages)
4	Clevise M3, spring steel (for aileron linkages)
4	Nut M3 (for aileron linkages)
8	Sheetmetal screws Ø 2.9 x 13mm (for securing servos)
8	Sheetmetal screws Ø 2.9 x 10mm (for securing servo hatches)
4	Plastic nut M6 (to secure wings to fuselage + 2 spare)
4	Bolt, M2 x 10mm (to secure phenolic arms to metal servo discs)
4	Nuts, M2 (to secure phenolic arms to metal servo discs)

Stabiliser bag

Quantity	*Description*
2	Elevator horns - phenolic
2	M3 All-thread x 55mm (elevator linkages)
4	Clevise M3, spring steel (elevator linkages)
4	Nuts M3 (elevator linkages)
2	Allen Bolts M3 x 12mm (to secure stab tube into stabs)
2	T-nuts M3 (to secure stab tube into stabs)
2	M3 washers (for stab securing bolts)
8	Sheetmetal screws Ø 2.9 x13mm (to attach servos to plywood mounts)

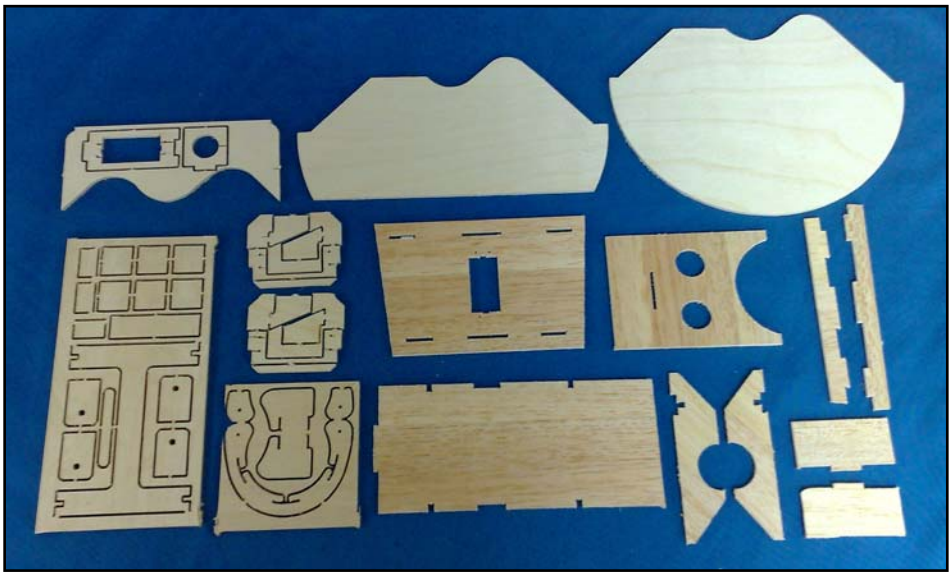
Rudder Bag

Quantity	*Description*
1	Rudder Horn - phenolic
1	Servo arm for Rudder servo - phenolic
1	Pull-Pull cable 0.8 mm Ø x 2.5 metres
4	Crimping tubes for cable
2	Cable adapters with eyes for cable, M3 (rudder linkage)
2	Nut M3 (rudder linkage)
2	Clevise M3, spring steel (rudder linkage)
1	Hinge wire Ø 2mm x 370mm (rudder hinge)
4	Sheetmetal screws Ø 2.9 x 13mm (to secure rudder servo to mount)
1	Fibreglass tape 20 x 200mm long (secure servo mount to fuselage)
3	Bolt, M2 x 10mm (to secure phenolic arms to metal servo discs)
3	Nuts, M2 (to secure phenolic arms to metal servo discs)

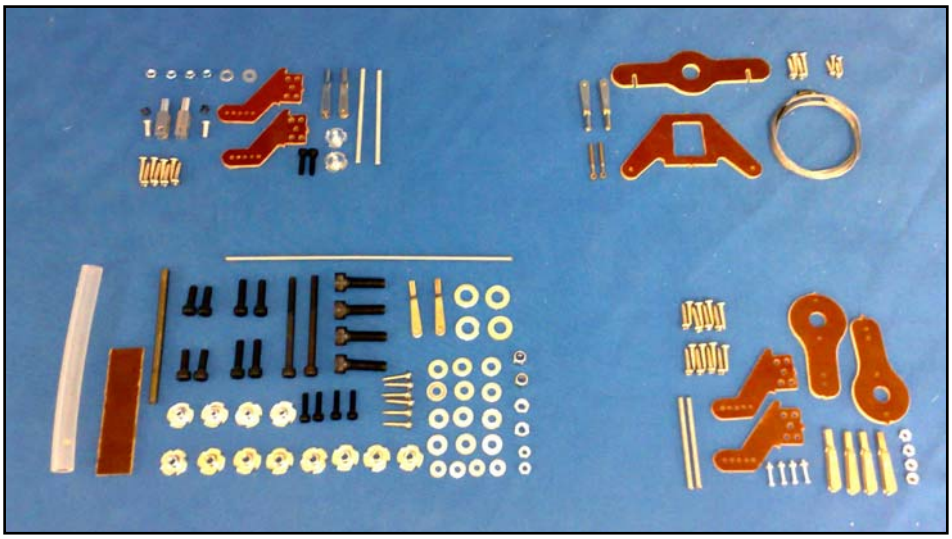
Available Accessories:

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

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



Standard Wood parts included in the kit



Standard Hardware included in the kit