



Instruction Manual

Composite-ARF IMPACT



Instructions for IMPACT F3A-type Airplane

Thank you very much for purchasing our Composite-ARF IMPACT 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: feedback@composite-arf.com
or techsupport@composite-arf.com
telephone: Phone your C-ARF Rep!!! He will be there for you.
website: <http://www.composite-arf.com>

Liability Exclusion and Damages

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

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

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

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

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

Supplementary Safety Notes

Pre-flight checking:

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

The first time you fly any new model aircraft we strongly recommend that you enlist the help of an experienced modeller to help you check the model and offer advice while you are flying.

He should be capable of detecting potential weak points and errors. Be certain to keep to the recommended CG position and control surface travels. If adjustments are required, carry them out before operating the model. Be aware of any instructions and warnings of other manufacturers, whose product(s) you use to fly this particular aircraft, especially engines & R/C 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.

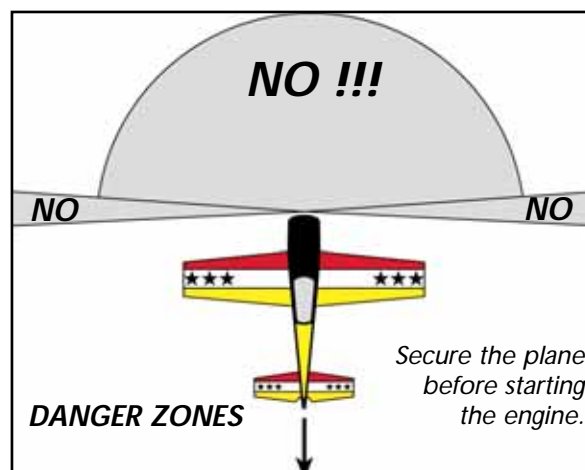
Attention !

This F3A/Pattern type aircraft is a high-end product and can create an enormous risk for both pilot and spectators, if not handled with care, and used according to the instructions. Make sure that you operate your Impact according to the AMA rules, or those laws and regulations governing model flying in the country of use.

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

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

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



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

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 and that the M3 bolts retaining the horizontal stabilisers onto the carbon tube are tight.

General information about fully-composite aircraft structure and design

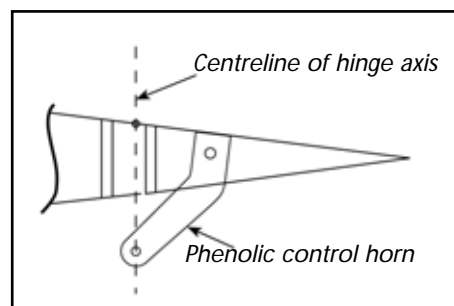
All the parts are produced in negative molds, manufactured using vacuum-bagged sandwich construction technology. All parts are painted in the moulds, either single colour or designer colour schemes. A new production method, called TAVS (Total Area Vacuum Sandwich), enables us to present this aircraft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

Description of Parts

The Wings

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

The ailerons are hinged already for you - laminated in the mould and attached to the wing with a special nylon hinge-cloth, sandwiched between the outer skin and the foam. This nylon hinge is 100% safe and durable. You will never have to worry about breaking it, or wearing it out. There is no gap at all on the top wing surface, and there is a very narrow slot in the bottom surface, where the aileron slides under the main wing skin during down throw. This means that the hinge axis line is on the *top* surface of the wing, *not* in the centre. This is NOT a disadvantage, if you program in about 10% NEGATIVE aileron differential in your transmitter. This means that the 'down' throw needs to be about 10% more than the up throw. Why? Because the axis of the hinge is not at the centreline of the aileron, so it moves slightly in and out when operated, and the aileron gets a little "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 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. It is extremely lightweight, yet more than strong enough for the recommended motors and use.

The 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 landing gear is a fairly flexible design, which works very much like shock absorbers. This plane is not made for crashing, but the landing gear will take some hard landings without problems. Do not change or modify it, as the results would only be negative. We had plenty of time and experience to engineer the strength needed in this area - and we did !

The Stabilisers

The stabiliser parts are also vacuum bagged sandwich construction. The elevator control surfaces are elastic-hinged, and the rudder is hinged with a Robart Pin-Hinges.

The rudder & elevator design gives at least 40 degrees throw. The horizontal stabs are mounted on a 10mm carbon tube and one 6mm Ø carbon anti-rotation pin each, and controlled by a pair of digital mini-servos installed in each stab half. Please remember during assembly of the plane to save every gram of weight in the tail area. The rudder is adequately powered by a single JR8411 servo, or similar, in the fuselage with a closed-loop system.



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 during transport, 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.

A couple of views inside the factory, showing a small part of the Finishing area, the vacuum/oven tables and the Quality Control/Assembly areas.



The 'Paint Job'

Occasionally customers see 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 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.

Paint flaws

If a plane is painted in the moulds, you save a lot of weight. At least 300 grams and that's worth saving !

A 'negative' paint job is very complicated to make. The painter 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, 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. 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 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 cowling 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 might decide to have a single colour version and have it painted by yourself or your 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) One of our 2.6m Extra's, in the popular 'Fantasy red/yellow' paint scheme ... all painted in the moulds.
(below) The prototype of a future-paint scheme for the Impact.



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. Incidence Meter
2. Steel straight edges, 90° squares and rulers for alignment.
3. Sharp knife (X-Acto or similar)
4. Allen key set (**metric**) 2.5mm and 3mm.
5. Sharp scissors
6. Pliers (various types)
7. Wrenches (**metric**)
8. Slotted and Phillips screwdrivers (various sizes)
9. M3 and M4 tapping tools (**metric**)
10. Drills of various sizes
11. Dremel tool (or Proxxon, or similar) with cutting discs, sanding tools and mills.
12. Sandpaper (various grits), or Permagrit sanding tools (high quality).
13. Carpet, bubble wrap or soft cloth to cover your work bench (most important !)
14. Car wax polish (clear)
15. Paper and clear tape
16. Denaturised alcohol, 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.

Note: Especially with the sandwich laminates the use of CA adhesives requires extreme caution. The sandwich foam will soak off any excess CA, and inside the foam this will start to cure, creating heat, which can deform the outside of the composite part. Use CA only for 'tacking' things into position, and preferably *thick* CA, without using any 'Kicker', and then glue permanently with slow epoxy resin, mixed with either milled fibre (for strong joints) or Micro-balloons for lightweight fillets.

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.

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

Accessories

This is a list of the things you may need to get your Composite-ARF IMPACT in the air. Some of them are mandatory, some of them can be chosen by you. We know that F3A and Pattern fliers have their own favourite hardware and equipment, and what we list here are recommended parts, and have been thoroughly tested.

1. Servos (5). We recommend JR8411's for ailerons & rudder & JR3281 for elevators. Alternatively, Futaba 9151 for Aileron/Rudder, 9650 for elevators and 9602 for throttle.
2. Throttle servo for gas/glow motor. Any standard servo will do (eg: JR/Graupner 4041)
3. Spinner 90mm dia (3.5"), eg: Optional moulded carbon spinner from C-ARF, or Tru-Turn.
4. Main wheels 60 - 65mm (2.25 - 2.65"). Kavan Light or Dubro Light wheels recommended.
5. Engine. Any F3A engine with a clean record (eg: OS140, YS140/160DZ, Mintor 3M 140/170 etc.) Also possible is one of the new small gas engines, like the ZDZ40. Electric motors recommended are the Hacker C50 (geared) or the Plettenberg Xtra 25-13.
6. Exhaust system, muffler or tuned pipes if using gas or glow engine.
7. Speed Controller and Flight Batteries if using Electric power
8. High quality servo extension cables, switches, etc with gold connectors.
9. Receiver battery.
10. Fuel tank (500 - 700 ml) for gas or glow motor. We use Dubro 16/20/24 ounce.
11. Propeller, to suit motor choice.

**Did you read the Hints and warnings above carefully ?
Do you understand everything in this manual completely?
Then, and only then, let's start the assembly of your Impact!**

About the IMPACT

The new Composite-ARF IMPACT is not really an 'ARF', like our other 'planes. It is not a beginners model, and not a trainer. We expect some experience in building and flying with this type of contest plane, but you do not need experience of fully composite structures - as it is very simple and you will learn a lot following this instruction manual.

We have tried to approach the professional pattern flier, as well as the ones that want to enter this exciting class of competition flying - and at the same time give you as many choices as possible to use your individual techniques, accessories and hardware. We know that most modellers in this class have their own favourite hardware and products, and this kit will allow you to follow your preferences. However, we have included the main hardware for the flying surfaces and landing gear, and it is all well proven and tested. Use it if you wish.

Likewise there is no motor mounting hardware included in the standard kit, but we have included the main firewall and nose ring, in case you wish to use these. There are many optional items available from us for this fine kit, including a standard engine mount for glow engines, a carbon spinner, an 'Electric Flight' option pack, and you can find these detailed on our website on the Impact page, under 'Related Parts'.

As technology advances and customer requirements change Composite-ARF will continue to design and manufacture new aircraft and follow our customers wishes and the latest trends.

We hope you will enjoy building and flying your Impact and look forward to feedback on the different power units used in this unique aircraft.

Building Instructions

General Tips

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

The first thing to do is protect the finished paint on the outside of the model from scratches and dents during assembly - 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% completely before applying any 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 with alcohol, before gluing *any* parts to it. Epoxy glues will **not** stick properly to any surface that has not been scuffed up and cleaned.

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

Cowling

It is easiest to complete the chin cowling first, as access to glue in the carbon pins and tubes is more difficult when the landing gear mount is installed. Please use the hardware supplied.

Note: Be careful not to deform the fuselage in this area later when fitting the bulkheads for your choice of motor/power unit. No bulkheads should be a tight fit in the fuselage, sand as needed to make them a gentle sliding fit.

The cowl is secured to the fuselage with 2 carbon pins (6mm Ø) that fit into 2 short lengths of 8mm carbon tube at the back edge, and a pair of plastic M4 bolts that fit into 'keyhole' shaped slots in the fuselage flanges. The cowl is retained with a single M3 bolt into a blind nut at the front edge.

The 1 piece cowling is already cut and trimmed at the factory. Cut out the area in the bottom of the fuselage for the engine bay, depending on what type of power unit you have chosen. At the



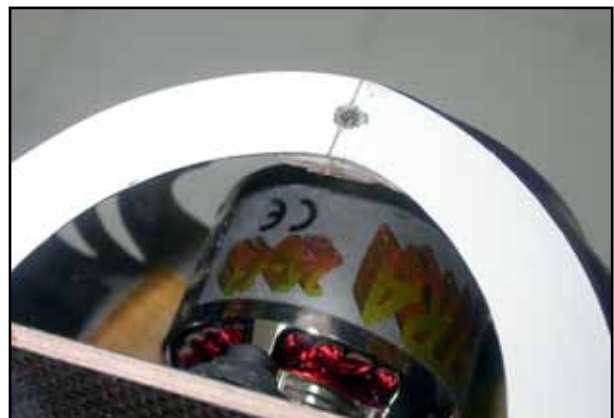
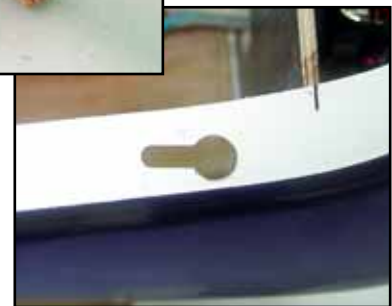
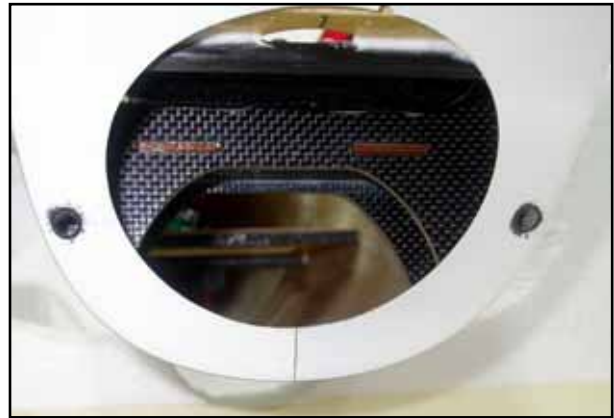
same time you can open the air inlet hole in the front of the cowling, as shown. Sand any seams on the fuselage and cowling that might prevent it sitting perfectly flush, and tape in position. Now carefully wax all around the mating surfaces of the fuselage and cowling in case you should get some glue on there during the next steps.

With a Dremel, or similar, you can drill 2 pilot holes for the carbon pins and tubes from inside the fuselage - as long as you do this *before* the landing gear mount is fitted. Remove the cowl and enlarge the holes in the fuselage to 8mmØ and the holes in the cowl to 6mmØ. Glue the pins into the cowl with a little 30min. epoxy and micro-balloons, and then wax them carefully. Wax the inside of the short 8mm tubes carefully, and slide them onto the pins and tape the cowl in position again. Glue the tubes into the fuselage with the same epoxy/micro mix.

Glue the 2 small milled 3mm plywood squares (15 x 15mm) inside the cowl flanges, about 75mm from the front. Drill thru' the centre of the ply squares 3.2mm, and tap M4. Fit the plastic bolts, and mark the position of the heads of the bolts on the fuselage flanges. Reposition these marks about 10mm forward and drill 2 holes of 9mmØ to accept the boltheads. Then mill and file two 4mm wide slots backwards, about 10mm long as shown. Check the fit of the cowl and adjust as needed. When the fit is OK, glue the 2 phenolic 'U' shaped plates onto the inside of the fuselage flange with a little CA. Adjust the length of the bolts to make the cowling a snug fit, that cannot vibrate. Glue the bolts in their final position with a little 5 min epoxy.

Note: Do *NOT* use CA on any plastic parts as it makes most plastics brittle, and they might fracture or split.

Finally fit an M3 blind nut into a small ply plate (20mm x 20mm) and glue under the front flange of the fuselage, in the centre. Drill thru' and use a single M3 bolt to secure the cowl, accessed thru' the air inlet hole. If fitting a glow engine with a front carburettor, please check to see that the carb and this securing bolt don't interfere. If so, then you can use 2 bolts about 20mm either side of the centreline.



Landing Gear

Fit the landing gear bulkheads and main landing gear legs now, and leave these in place to protect the bottom of the fuselage during the rest of the assembly.

Assemble the landing gear support from the 3 pieces of 3mm carbon/ply composite supplied as shown, and tack together with thin CA. Adjust the length of the landing gear mounts so that the bend is about 3- 4mm outside the ends of the plate, if necessary. Hold the 2 carbon landing gear legs in position and mark thru' the 4 milled holes in the carbon/ply part for drilling the holes in the landing legs (3mm Ø). Fit the 4 x M3 blind nuts to the bottom of the plate and glue in position. Finally glue the 3 pieces together properly with a little 30min. epoxy and microballoons, with minimum radius fillets.

For good access to glue the landing gear support structure into the fuselage is easiest to open up the large hole in the engine bay which will accept your tuned pipe or muffler if you are going to use a gas or glow engine, but for some electric power installations this will need to be closed later for correct cooling - and you can use some thin balsa sheet or foam-board for this. Cut out the 2 rectangular holes in the sides of the fuselage for the legs. You can rely on the marks in the fuselage for these positions.

Trial fit the landing gear support assembly in the fuselage and sand if necessary to have nice fit - it should not be too tight or it can deform the fuselage easily. Prepare the inside surface of the fuselage properly, wipe with alcohol, and glue in position with slow epoxy and micro-balloons. Bolt the landing gear in place with four M3 x 16 bolts during cure to make sure it cannot move.

Drill 4mm holes thru' the bottom of each leg in the moulded dimples, for the M4 x 40mm axle bolts. It is easiest if you drill a 7mm Ø hole in the outside of the wheelpant to fit the head of the M4 bolt, for access when fitting the wheels. Fit your wheels (65mm/2.5" diameter) onto the axle bolts, with a washer on the outside and a wheel collar on the inside to retain the wheel, then an M4 nut against the inside of the wheelpant, then the carbon gear leg, and finally another M4 washer and an M4 Locknut. Use a little Loctite on the thread to prevent any embarrassing moments!



Fit your choice of tailwheel, along with any plywood plate that might be necessary inside the rear fuselage. Any 1" or 1.25" lightweight pattern style will do, such as Kato, IMK or similar.

To set the correct angle of the wheelpants in relation to the ground, set the fuselage on a level surface with your choice of tailwheel in place. Eye through both wheelpants so that they are level, and secure with a small sheetmetal screw through the carbon leg into a small scrap plywood plate inside each wheel pant. See photo.



Remember - keep it lightweight at the tail end!

Canopy

A moulded fibreglass canopy is provided in the kit. Fitting is simple, and with a little care the fit will be perfect.

Sand any seams on the fuselage and canopy that prevent it sitting perfectly flush. The front of the canopy is secured in the same way as the sides of the cowling, with a single plastic bolt in the canopy, and a 'keyhole' shaped slot in the fuselage. Glue the 15 x15mm ply plate inside the canopy flange, and drill and tap M4 as before. Fit the plastic bolt, and transfer the position to the flange on the fuselage. Mark a centre point 9mm back, and drill 9mm Ø. File the slot 9mm forward, and adjust the bolt length for a snug fit. Finally secure the bolt with a drop of epoxy inside the canopy. Glue one of the 'U' shaped phenolic plates underneath and adjust with a needle file for a perfectly snug fit.

Mill and file the slot on the fuselage centreline behind the canopy for the handle of Hatch Catch. The slot should be 2.5mm wide x 15mm long, and the front of the slot is about 21mm behind the edge of the fuselage moulding. Drill a 3mm hole in the fuselage flange for the catch pin. Scuff up the outside surface of the hatch catch and glue in place with a little 30min epoxy and microballoons. Oil the catch pin first to stop it all getting stuck together!

Fit the canopy and tape tightly in place. Push the hatch catch forward to leave a small mark on the back of the canopy. Remove canopy and drill the



hole 3.5mm Ø. Scuff up inside the canopy around the hole and apply a blob of very thick 30minute epoxy/microballoons. Oil or wax the Hatch Catch pin again and hold it back, tape the canopy tightly in position and then push the catch forward into place. Wait for cure.



The sides of the canopy are retained to, and aligned with, the fuselage using the 2 phenolic canopy hooks and 'U' shaped plates supplied in the kit. Mill 2 slots in the flanges of the canopy to fit the hooks tightly, position as shown in the photos, and glue in with a very thick epoxy/micro-balloon mix. The space between the hook and the canopy flange should be about 2.2mm (3/32"), and the front of the hook should be angled a little downwards. Transfer the positions to the fuselage flanges and mark carefully. File the slots until the canopy fits correctly.



Then glue only 1 'U' shaped phenolic plate under the fuselage flange, at the front of the slots, positioned so that it is *just* not quite possible to slide the canopy right to the front in it's correct position - because the hook is binding on the phenolic plate. With a needle file chamfer the back bottom edge of the phenolic 'U' until the canopy fits perfectly. Then do the same for the other hook and 'U' plate.

Result - a perfectly fitting canopy that will not rattle, and definitely cannot come off in flight when you fit it as described above. Paint the canopy as you like.

Wing and Stab Alignment

For your Impact to fly straight and true it is very important that the alignment of the stabilisers and wings is accurate, as well as having the correct incidences. This step is critical, and it helps to have an extra person and pair of hands to complete it. All the care and accuracy taken in this stage will pay off when you fly your plane, so please take your time to double-check before gluing anything in place.



Carefully mill out the 30mm Ø holes for the wing spar, the 10mm Ø holes for the carbon wing anti-rotation tube and stab spar, and the 6mm holes for the stab anti-rotation pins - all exactly in the positions marked on the fuselage. You can use an old 3mm drill in a Dremel for this, and then a fine round file. Make all holes a tight fit on the spars and tubes at this stage.

Prepare the surfaces inside the fuselage around all these holes carefully with coarse sandpaper and wipe away the dust with alcohol. Prepare the outer surfaces of the carbon/ply wing tube reinforcement plates, and the carbon/ply washers for reinforcing the anti-rotation tubes and pins in the same way.

Carefully wax (2 times) the outer surfaces of the 30mm carbon wing spar, the 10mmØ carbon wing anti-rotation tube, the carbon stab spar and the two 6mm stab anti-rotation pins. Wax the

outside of the fuselage in the area of the wing and stab roots, and also the *inside* surfaces of the 2 short lengths of 12mm carbon tube that will be glued into the wing roots for alignment of the 10mm carbon anti-rotation tube. Also wax the inside surface of the 30mm fibreglass wing tube.

Fit the 30mm Ø fibreglass wing tube in the fuselage, slightly loose between the sides so it cannot deform it, with the 2 egg-shaped carbon/ply reinforcement rings over it. Fit the 12mm carbon tube inside the fuselage for the stab spar, again slightly loose between the fuselage sides, also with the 2 carbon/ply reinforcement rings over it. You can temporarily fit the milled balsa rudder post in the fin to make sure that the fuselage is not being deformed at the tail at all.

Do **NOT** glue anything at this stage!

Fit the carbon wing spar and a long, straight, 10mm tube thru' the stab spar tube, and eye from the front and back to make sure that they are both exactly in line, horizontally, and exactly at 90° to the centreline of the vertical fin. To check the 90° alignment of stabs to the vertical fin, make sure that exactly the same amount of tube projects from both sides of the fuselage, and then measure from the ends of the tube to the seam on the tip of the vertical fin. Adjust the holes a little if needed. Don't worry about wing and stab incidences at this point, and don't adjust the holes for the anti-rotation tube/pins.

Now fit the carbon wing anti-rotation tube, with its reinforcement rings, and install the wings on the fuselage. With a 2nd person to help, make accurate measurements with a steel tape measure to check that the wings are exactly at 90° to the centerline of the fuselage. Measure from both wing tips to the top centre of the vertical fin, and adjust the 30mmØ spar hole a little if needed. When correct tack the fibreglass tube inside the fuselage with 2 very small dots of 5 min. epoxy at each end. Remove wings and check again that the wing spar is still in line with the long 10mm tube thru' the carbon stab tube.

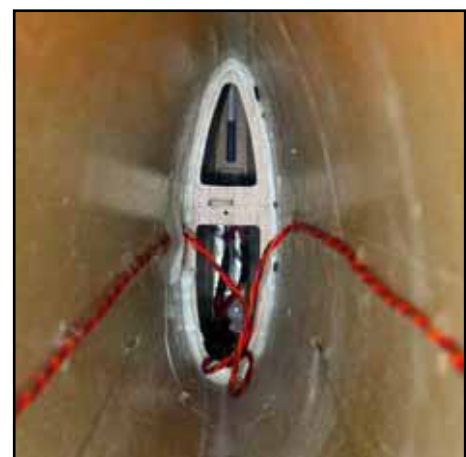
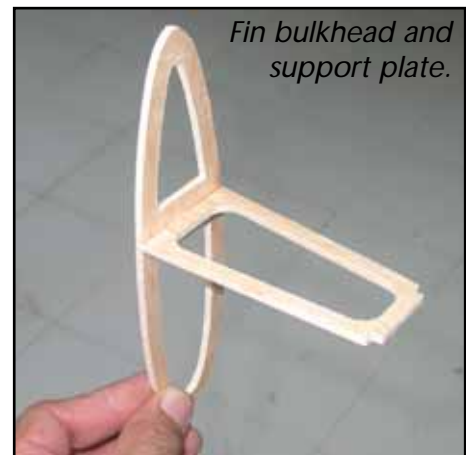
Scuff up one end of the two 6mm carbon anti-rotation pins and glue them in the carbon tubes in the back of the stabs with a little 30 min epoxy. When cured install the stabs on the 10mmØ carbon shaft in the fuselage. Measure accurately between the tips of the stabs and the seam at the centerline of the nose to check for 90° to the fuselage centreline. Adjust the holes as needed. Finally re-fit the wings and check between the tips of the stabs and wings. Before gluing anything check everything by eye, also with a friend to double-check your findings. Your eyes are much more precise than you would



Stab spar tube and reinforcement rings

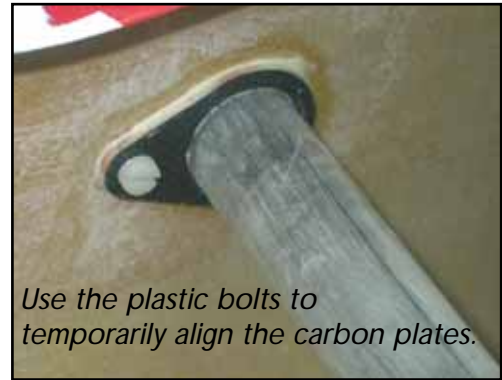


Fin bulkhead and support plate.



think, and will easily see even a 1mm difference.

When satisfied, permanently glue the short 12mm \varnothing carbon stab tube and reinforcing rings inside the fuselage with a thick epoxy and microballoons mix, and also the fibreglass wing tube and it's egg-shaped reinforcing rings. Make sure that the front edge of the carbon stab tube is properly glued to the edge of the horizontal 3mm balsa plate that projects backwards from the balsa bulkhead in front of the vertical fin. This is an important joint for the overall torsional stiffness of the tail.



Temporarily use the plastic wing bolts thru' the holes in the egg-shaped pieces, into the holes in the wing roots to keep them aligned. Tape the wings and stabs in position and double check all measurements before gluing. Leave in place until it has cured (at least 2 hrs if using 30 min. epoxy) before removing wings & stabs.



Now refit the wings and stabs and check the fit of the roots against the fuselage sides. If they need a little adjustment for a perfect fit, apply a layer of paper tape to the sides of the fuselage to protect it, and use a strip of 240 grit sandpaper between the fuse and roots for fine adjustment (see photo). Use the same technique for the stab roots if needed.



Incidences

The stab incidence is set by the pair of 6mm carbon pins which are glued into the T.E. of the stabs, and the wings by the 10mm carbon tube which is glued into the fuselage.

Support the fuselage firmly on your flat building table, with one stab exactly at 0° incidence, using an accurate incidence meter. Check that the other stab is also at 0°, and adjust the hole for the 6mm carbon pin if needed. Wax the two 6mm carbon pins again carefully, and glue the carbon/ply reinforcement washers inside the fuselage to finally set the stab incidences, using 30 min. epoxy and micro mix.



Fit one wing at a time and secure with the plastic bolts, with the heads inside the wing root rib and the threaded part projecting inside the fuselage thru' the 6mm hole in the back of each egg-shaped carbon/ply part. Glue the bolt heads to the inside of the ribs with thick epoxy and micro-balloons mixture, and fix wings in position on fuselage with the large knurled

plastic nuts until cured. Open up the milled holes in the back of the root ribs of both wings so that the short 12mmØ carbon tubes fit in easily. Wax both ends of the 10mm anti-rotation tube where it projects outside the fuselage, the inside surface of the 2 short 12mmØ carbon tubes, and the outside of the fuselage in this area. Sand the outer surface of the tubes to prepare for gluing.

With the fuselage still set with the stabs at exactly 0° check the incidence of the wings. If you milled to marked hole positions accurately on the marks set during manufacture you will find that the wings are between 0° and +0.5° incidence. Nominally the correct incidence should be about +0.25°. Adjust the position of the hole in the root rib until you get one wing set correctly, apply a very thick 30 min epoxy/microballoon mix to the outside of the 12mm carbon tube and push the wing fully into position. Secure with the plastic nut until completely cured (min. 2 hrs)

After both wing incidences are finally set correctly, remove the wings and check the glue joint around the carbon tubes. Apply more epoxy mix as needed to secure properly.

0° - 0° Datum line:

While C-ARF prefer and advise to use the above method for setting the incidences, as an alternative, you can use the horizontal 0° datum line of the fuselage to set the stab and wing incidences. This imaginary line is positioned from the **front** edge of the cowl to fuselage joint, to a dimension of exactly 37mm below the centreline of the 10 mmØ stab tube.

While the fuselage is set up with the stab at 0° you can also check the vertical front face of the fuselage for the downthrust angle which should be between -2° and -2.5°.

Now you can go on to complete the wing and stab servos and linkages as follows.

Horizontal Stabs

The stabs are 95% finished at the factory and are elastic-hinged during manufacture, so you only need to install servos, horns and linkages.

Glue a 20mm length of hardwood dowel into both ends of the carbon stab tube with epoxy and microballoons mix. Inside the stabs you will see a small plywood reinforcement plate between the carbon spar sleeve and the bottom surface of the stab. Mark the bottom of both stabs exactly in line with the centre of the carbon tube, and in this ply plate. Nominally the centre of the plate is 60mm from the root rib.

Install the carbon spar tube fully into 1 stab, and drill a 2.4mm hole through the stab, the plywood plate, sleeve and into the centre of carbon spar tube. You will need to drill 15mm deep. Do NOT drill right thru' the stab tube - only through one side of the tube into the hardwood dowel. Tap M3, and counterbore the hole in the underside of the stab so that the M3 x 12mm bolt fits flush with the surface and bears on the plywood plate - NOT on the composite stab structure.



Refit the stab and carbon spar to the fuselage, and then the other stab, making sure that both roots are tightly against the fuselage. Drill and tap for the M3 securing bolt in the 2nd stab in the same way. The bolts are secured with a small piece of clear tape for flight.

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

The stabs already have slots milled into the balsa blocks inside them for the phenolic elevator horns. It is important that the horns are both in identical positions in relation to the hinge axis - which is on the top surface of the stab - to be sure that you have equal elevator movements. Adjust the slots if needed. The CNC milled phenolic horns have steps in them to make sure that both are inserted into the control surfaces to exactly the same depth.

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

Servo choice: The elevators can travel more than 45 degrees, and if you are going to use the maximum throw for 3D manoeuvre, we definitely recommend hi-torque digital mini-servos like JR/Graupner DS3328, shown here.

You have a choice of positions for the elevator servos. You can mount them inverted in the root ribs, which are milled for this, and cut 2 holes in the fuselage for the servos to project into, making sure that they don't touch each other.

Alternatively you can cut a small hatch in the bottom surface of the stabs, and mount the servos on a small plywood plate, glued to the top surface - which is the method shown in these photos. Make sure that the servo arm is exactly in line with the phenolic elevator horns to prevent any possibility of twisting. The hatch is simply secured in position with clear tape.



Make up the linkages to your choice - we have used M2.5 clevises and 2.5mm steel wire, with the clevis soldered onto one end, and a locknut on the other end to prevent accidental movement. However, if using a gas or glow motor with higher vibration levels, then we recommend that you use 3mm Ø hardware for the elevator linkages. A couple of short lengths of tube over the clevises to prevent them opening accidentally.



If using the supplied phenolic control horns (or plastic or phenolic servo arms) do **NOT** use single-sided ball-links for the linkage, because they can twist the horns/arms and cause flutter! You must *only* use single-sided ball-links when using metal horns and arms. This is a solid experience and you should consider it a **FACT**.

Tip: At this point we recommend that you install the extension cables for your elevator servos, as it is very difficult to secure them in place to the fuselage sides after the fin post and rudder are installed.

Wings

The wings are also 95% completed at the factory, and only need the aileron horns, servos and linkages installing.

Install the milled phenolic horns into the ailerons in exactly the same way as the elevator horns, described above. The servos are installed in the composite rib (with a plywood doubler on the back) that have already been milled to suit a standard size servo. Note that you will need a 400mm (16") long cross-head screwdriver to install the servos, which can easily be made by extending an old screwdriver shaft with a length of brass tube, either soldered or CA'd together. You should use 2.9mmØ screws to mount the servos into the milled ribs, not the standard screws supplied with most servos as they are too small. Our production process does not allow us to mill holes smaller than 2mm Ø in these CNC milled wood parts.



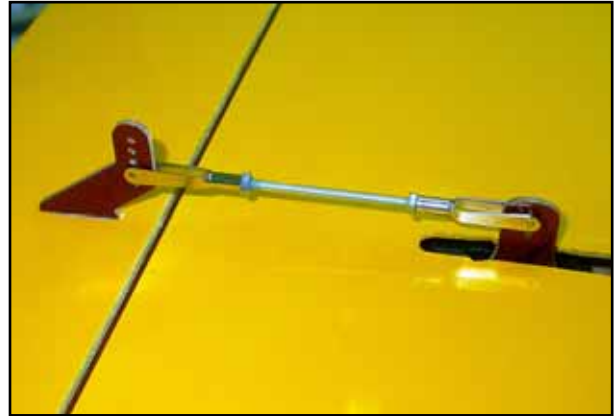
Servos: The large ailerons can travel more than 40 degrees, and if you are going to use the maximum throw for 3D manoeuvres, we definitely recommend hi-torque digital servos like JR8411, as used here.



Finally make up the linkages from your choice of hardware. We use M3 all-threaded rod with an M3 clevis and locknut at both ends. Don't forget to 'Loctite' the clevis and lock-nut on one end of each linkage, and fit short lengths of tube to prevent clevises from opening accidentally. You

may need long servo arms for the aileron linkage, and shown here are the C-ARF phenolic servo arms used on some of our other kits.

If using the supplied phenolic control horns, or plastic or phenolic servo arms do **NOT** use single-sided ball-links for the linkage, because they can twist the horns/arms and cause flutter! You must *only* use single-sided ball-links when using metal horns and arms. This is a solid experience and you should consider it a **FACT**.



Before final fitting of the servos, extend the cables so that they will reach your receiver. Drill the necessary holes for the extension cables in the fuselage sides, and protect the cables from damage with plastic tube or rubber grommets.

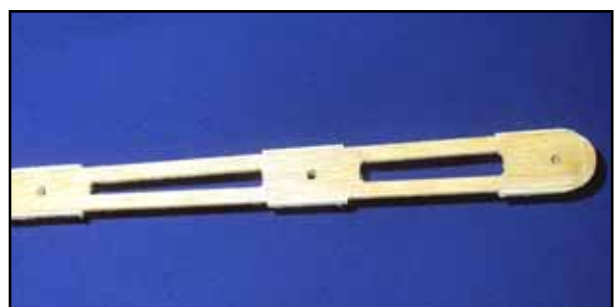
Rudder

The rudder is hinged to the fin with 4 large Robart pin-hinges, supplied in the kit. These are glued into the CNC milled fin post, with balsa doublers on the inside, and then the complete assembly is glued into the back edge of the vertical fin.

Cut the slots in the rudder with a Dremel and 2mm milling tool for the supplied phenolic Rudder horn. The slot should be 52mm (2") up from the bottom of the rudder. The front of the slot should be against the back edge of the balsa false leading edge, and the horn should be glued firmly against this balsa part. Glue with thick 30 minute epoxy and micro-balloon mix, using the same method as for the elevator and aileron horns. To get a really good glue joint you can drill a 5mm hole thru' the leading edge of the rudder and apply extra glue through this.

Note: Before gluing the complete assembly into the back of the fin, you must fit and glue in any reinforcement needed in the floor of the fuselage for your choice of tailwheel.

Glue the 4 milled balsa doublers onto the front face of the milled balsa fin post with CA. You can use a 4mm bolt to help align the holes. Trial fit the fin post into the fuselage and sand if needed to make sure that it does not deform the fuselage shape at all. If it is a little narrow, then add 4 short lengths of 1mm balsa to each side, at the location of the hinges, and sand for a smooth fit.



This also makes sure that you don't scrape all the epoxy/microballoons mix off when inserting the fin post into the fuselage. (See photo)

Hold the fin post against the rudder LE, mark through the holes to give you the hinge positions and drill 4.5mm Ø. Open up slots either side of the holes for the hinges with a round permagrit file, or similar, as shown.

Oil the hinge pins on the hinges so that they don't get stuck, and glue the hinges into the balsa L.E of the rudder with 30 minute epoxy and micro-balloons mix. Make sure that the hinge axis is exactly on the front edge of the false balsa L.E. for all 4 hinges. When cured push the hinges into the milled holes in the fin post (with about a 4mm gap between the rudder and fin post) and trial fit in the fuselage to check for enough movement. When correct, epoxy the hinges into the fin post.



Important Note:

The bottom rudder hinge, especially, is an **extremely important** glue joint, as there will be constant pressure on it when a pull-pull closed-loop system is used. Please make extra sure that this hinge is scuffed up, and glued into both the rudder and fin post in the fuselage properly. Do NOT use CA to glue the hinges into the rudder or fin post! If this hinge becomes loose and you have rudder flutter this can damage or destroy the back of the fuselage. The composite balsa/glass bulkhead, which is factory-installed in the fuselage, at the front of the vertical fin will help to prevent any serious damage if flutter should occur. If you have an early kit, without this bulkhead, we **highly recommend** that you make and install it. The paper pattern to make it is provided at the end of these instructions. Make from 3mm balsa, prepare inside surfaces of fuselage carefully, and glue in with 30 minute epoxy and micro-balloons.



Finally scuff up the inside surface of the fuselage, and epoxy the fin post into the fuselage, with a 1mm spacer on top of the fin (as shown) and tape the rudder into position until the glue has cured. Check the alignment of the rudder very carefully by eye, to make sure it is lined up with the centre of fin before the glue hardens.



Servo: We recommend a hi-torque digital servo, like the JR/Graupner 8411, for rudder control.

The rudder servo mount construction is up to you. We show the normal position, but it can be changed if you need due to Centre of Gravity



considerations. We have used a foam-board plate, reinforced underneath with a couple of balsa sticks, and glued to the fuselage sides with epoxy and micro-balloons. This plate also holds the Receiver and (optional) switch, and only weighs 22 grams - a stiff and lightweight solution.

Whatever mounting system you use we advise you to fit the wings to the fuselage before gluing in the rudder servo mount - so that you cannot accidentally deform the fuselage. Use your choice of servo arm on the rudder servo, preferably with the linkage hole centres at about 60mm (1.75") to match the hole centre spacing in the rudder horn. In these photos we used the phenolic C-ARF rudder servo arm from our 2 x 2 Extra kit. Linkage was by the usual closed loop pull-pull system.

Motor Installation

The new C-ARF Impact design allows so many different choices of power unit that it's impossible to provide mounting bulkheads for all of them, and it is our experience that many pattern fliers have their own preferences anyway. Therefore, depending on your choice of methanol/gas/electric engine you may need to modify the 'generic' milled parts we have included, or even make a few of your own.

No engine mounting hardware is included in the kit, because of the many different set-ups and engine choices.

Glow or Gas engine installation

Included in the kit is a generic composite carbon/plywood/carbon nose ring and firewall (see photo right). The firewall suits most typical motors, such as OS140/160, YS140, Webra 145, Mintor3M 140, etc, or even one of the new small gas engines. If using one of these typical motors we recommend using a 'Hyde' type mount, without a nose ring. Alternatively you can purchase our optional 'Engine soft mount', formerly designed for the Revolution Pro, which includes machined aluminium beams and all the other parts to build a lightweight beam mount with softmounts at the back and front. (see photos right and website).

If fitting a 'Hyde' mount, trial fit the firewall into the fuselage, at the correct distance from the nose to suit you motor and mount, and also at approx. the correct sidethrust and downthrust, and check carefully that it does not deform the fuselage sides at all. Sand the perimeter as necessary to make it a sliding fit. Trial fit the mount to the firewall, and the firewall in the fuselage at the correct distance from the front of the fuselage to give about 1.5 - 2mm clearance between the spinner backplate and the fibreglass. An



easy way to get this accurate is to tack glue equal thickness spacers onto the spinner backplate, bolted onto the shaft, and hold this firmly against the fuselage while tack gluing the firewall into position. This will give you the correct thrustline and centring. An extra pair of hands is very useful for this task! Remove the mount, prepare the surfaces for gluing with coarse sandpaper and clean with alcohol, and glue the firewall in with slow epoxy and milled fibre mixture.

The front face of the fuselage is already moulded with between 2 - 2.5 degrees of downthrust and sidethrust, which will be close enough for trimming flights with typical motors and propellers. Final adjustment to thrustlines can be made after trim flights to suit your particular combination, if necessary.

A 90mmØ (3.5") lightweight moulded carbon, painted, spinner with CNC machined aluminium backplate is available as an option from Composite-ARF for this plane - see website for details.



Above we have shown a couple of typical glow engine installations, with a Mintor 3M 140 and an OS140RX. The photos of the Mintor 3M are taken in a Revolution Pro, not an Impact, but the principles are very similar.

Pipe installation

Install and fix the tuned-pipe according to the pipe manufacturers instructions. This is usually at 2 positions; just behind where the pipe connects to the header, and also towards the back end of the pipe - approximately where the inner cone begins. Make the pipe supports from scrap plywood, glued firmly to the inside of fuselage with epoxy, and allow for some flexibility to prevent the pipe fracturing.

Included in the kit is a CNC milled foam-board tuned-pipe floor and rear bulkhead, which can be used to construct th separate compartment for the exhaust system of your chosen motor. The balsa rails to support the pipe floor are already installed at the factory. Cut the pipe floor into 2 or 3 separate pieces to aid installation, and make at least the rear one removable with a few small screws for access to the pipe mounts. The front part can usually be glued in position permanently. It is important to note that the pipe floor should completely seal off the rest of the fuselage from air entering the cooling holes at the front of the cowl, and this prevents any overpressure inside the fuselage which could pop off the canopy etc. You must seal the space between the back of the cowl and the front of the landing gear support formers with thin balsa sheet, or similar, to complete the pipe compartment.

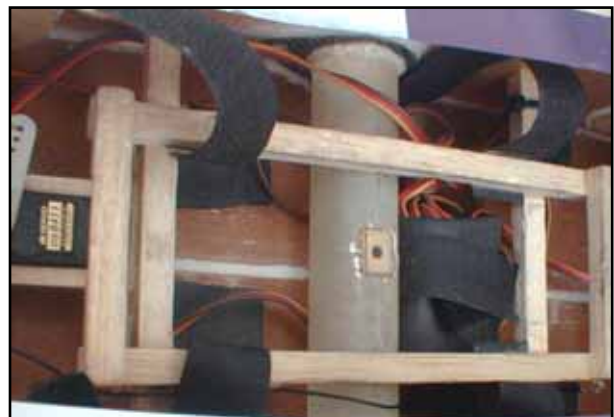
Cut a large enough exit hole in the bottom of the fuselage for the warm air to exit from the pipe compartment, and extend the outlet of your pipe with silicone tube to just outside the fuselage to make sure no hot gases and oil residue can damage the fuselage. Please make sure that the holes you cut have rounded corners so there is less chance of tearing the composite skin.

Note: Using a side-exhaust motor in this plane is not recommended. Not only does it make the engine installation much more complicated, but large cut-outs in the fuselage at the front could affect the strength and definitely will not look pretty!

Fuel Tank, Receiver & Battery Mounts

Basically the method of mounting these items and their position is your choice, and will be determined by the motor type used, and therefore where they need to be for correct Centre of Gravity. We have not supplied any wood or hardware parts for the installation of these items.

The Fuel tank should be mounted on the Centre of Gravity, and you can use the fibre-glass wing spar tube to help with the support for this lightweight balsa structure. Remember that you will need access to the wing securing plastic nuts, so either leave enough space at the side of the tank support for access - or make the whole assembly easily removable, and attach with Velcro strips or similar.



Do be extra careful that no fuel lines can rub on any carbon or fibreglass edges, as they will be damaged in one single flight. Use rubber grommets, or soft plastic tubes, to protect them where they pass through bulkheads and fuselage walls etc.

The batteries will have to be positioned to suit the Centre of Gravity, and are normally the last items to be installed. Don't forget that you might wish to alter the C of G position a little after the first few trimming flights, so try to allow for some adjustment. Normally a thin plywood, or thick balsa, plate can be glued into position, and the Nicads secured to it with cable-ties or Velcro straps.

Of course it is extremely important that both the fuel tank and batteries are mounted securely, as the forces on these heavy items are large during aerobatic manoeuvres - when you are pulling a 10G manoeuvre these items will, in effect, weigh 10 times their normal 'static' mass ! The receiver is a lightweight item and can be mounted on a foam rubber pad, and held in place with rubber bands or double-sided Velcro straps. Of course it must still be easily accessible, as you may have to connect your aileron (and elevator) servo extension cables each time you assemble the plane. Please make sure your receiver Crystal cannot accidentally come loose by securing it with a piece of clear tape, or similar. In the case of contests you might also have to change frequencies quite often, which also means that the receiver crystal should be in an accessible position.

Motor Ignition System

If you are fitting a gas engine, we advise that you keep the ignition unit as far away from the receiver and R/C equipment as possible. Generally you will be able to mount the ignition unit and battery right in the nose, close the back of the firewall.

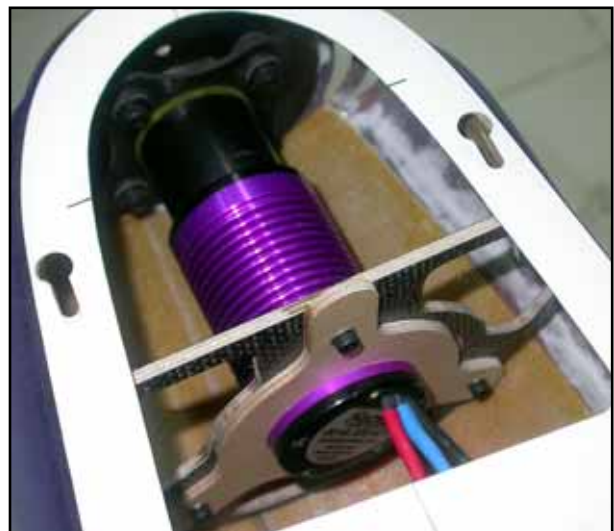
Fuel proofing

If fitting a gas or glow motor we highly recommend that you protect 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 grams (< 1 oz.) of epoxy to fuel proof all the wood in the whole area in the front of the plane.

Electric Power

We have done extensive testing with Electric power, as this is becoming a very popular choice in many countries now due to stricter noise regulations ... and we can tell you that the performance of our Impact with Electric power is absolutely stunning.

We have a special 'Electric option' pack available, which will be an extremely common option and this can be used for the Hacker C50 or Plettenberg 25-13, or modified for other similar units. This Option pack includes the main bulkheads and battery support parts required to install either the Plettenberg Xtra 25-13 motor, or the Hacker C50 geared unit, both powered by LiPo batteries. Considerable flight testing and demonstrations have been carried out with both motors, both by factory staff and C-ARF



Reps/Customers, with great success.

In addition C-ARF can supply both of these recommended motors, together with the correct Speed Controllers and a choice of LiPo Flight packs, and charger as options. Please see our website for full details.

Hacker C50 (Geared 6.7:1)

The Hacker C50, fitted with an APC E22 x12 propeller (as shown here) is a very powerful combination and will allow an unlimited 3D flight schedule. The Speed Controller used was Hacker's own Master 0-90-Acro unit, which performs very well and gives nice throttle response. The batteries are a pair of 'Thunder Power' 6000 mAH Lipo's, connected in series, which give 10 minutes duration.

Note: This complete motor/battery/speed controller combination weighs almost 2kg, and you have to be *extremely* careful with the assembly of the model to keep the ready-to-fly weight under the 5kg limit for contests.

C-ARF recommend that you use a separate battery for the Receiver, to prevent any chance of R/C interference which can occur when using a BEC system - or a voltage regulator to use current from the Flight pack for the receiver. In this case we used a 4 cell 600mAH Nicad, fixed under the Flight pack support, and this gave correct C of G with the set-up shown. Of course, a small LiPo pack for the Rx would even save a little more weight here.

The speed controller can be fixed directly behind the motor, in front of the LiPo's, and secured with double sided Velcro on a balsa plate. Make sure there is enough cooling airflow over the heatsink, which gets quite warm.

The photos show how the 2 bulkheads are installed. The front of the motor is mounted to the 2mm thick C-ARF carbon motor mount, with the standard fibreglass circular plate that is supplied with the motor sandwiched underneath it, using the four M3 bolts supplied with the motor.

The whole assembly is then fitted to the back face of the supplied carbon/ply nose ring with four M4 bolts, which pass through the plastic grommets with a 2mm thick carbon washer either side



(included in the Elec-option pack), into M4 blind nuts. Use the motor with the spinner backplate bolted onto it, with three 1.5mm spacers tacked onto the back of the spinner backplate, to centre the motor and set the side and down thrust exactly parallel to the front face of the nose. (see Gas and Glow engines section above for more detail).

Tack glue the nose ring to the inside of the fibreglass nose with a couple of drops of CA. A second person to help hold everything in the correct positions during this task is very useful!

Fit the plywood part with the 3 'ears' over the back of the motor, tightly, along with the rear carbon/ply bulkhead. Now position the rear bulkhead in the fuselage so that the plywood support with the 'ears' is flush against the back surface of it, and tack it in place. Check that the spinner backplate is still exactly parallel to the fibreglass nose, and then drill through the 3 'ears' into the rear former with a 3mm drill. Carefully remove the motor and open the holes in the carbon/ply bulkhead to 4.5mm for the M3 blind nuts, which are fitted to the front face of the rear bulkhead and glued in place with a little 5 min. epoxy.

Refit the motor and secure the back with M3 x 12 bolts. Check alignment again. When satisfied, remove the motor and glue both bulkheads in position properly with slow epoxy and milled fibre mixture. Slight thrust line changes can be made after trimming flights by adjusting the holes in the 3 plywood ears. The slight flexibility allowed by the plastic grommets used to mount the motor to the front bulkhead will allow about 0.5 - 1° thrustline adjustment.

Don't forget to add a drop of Loctite on all the front and rear engine mounting bolts !



Plettenberg Xtra 25-13.

The Plettenberg motor is mounted in a similar manner, except that there is no bulkhead in front of the motor - as the *outside* of the motor turns. This combination (Motor/LongGo cells and Future speed Controller) is about 300 grams lighter than the Hacker set-up, but also less powerful. Generally you should use the same methods as described above in the 'Hacker' installation, to set the correct sidethrust and upthrust etc, using the spinner backplate to centre the motor and set the thrustline.

The backplate of the Plettenberg motor is mounted onto a CNC milled 2mm carbon plate supplied in the Elec-option pack with three M4 x 6mm bolts. The complete assembly is then bolted to the carbon/ply bulkhead using 3 plastic grommets (with carbon washers on both sides) and an M4 bolt through the grommet, into M4 blind nuts on the back face of the bulkhead. Fit one carbon washer on the front of the grommets, and 2 washers on the back to give clear-



ance for the 3 bolts that secure the motor to the 2mm thick carbon plate. Don't forget to add a drop of Loctite on *all* these mounting bolts !

Small thrustline adjustments can be made after trimming flights by adding additional washers between the carbon washers and the bulkhead.

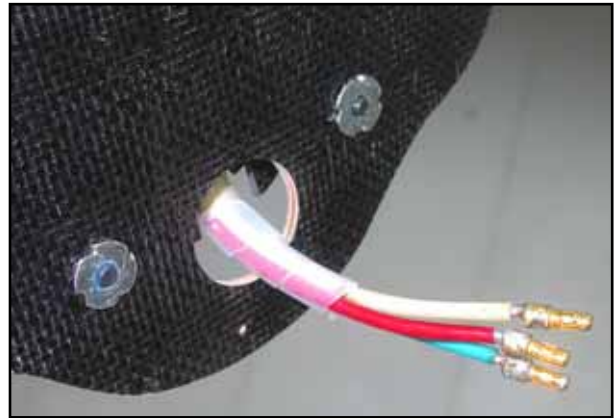
Note that the bulkhead supplied in the E-Option pack has been extended below the line of the cowling. This because the Plettenberg set-up is quite lightweight, and in some cases may need the Flight batteries to be positioned directly underneath the motor to achieve the correct Centre of Gravity, depending on what other equipment you install. You can use this bulkhead extension to support some carbon tubes for the battery mount if you need to position it here - otherwise just cut it off flush with the bottom of the fuselage and discard it. However, with the set-up shown here, the batteries could be fitted behind the motor without any C of G issues.

The Flight batteries (Emcotec LongGo LiPo's 10S2P 4000 mAH) were mounted in a similar way as for the Hacker, with a small piece of foam-board glued onto the carbon tubes, which are glued to the fuselage sides and reinforced with the milled carbon/ply rings supplied. The battery pack is retained with Velcro straps provided in the E-option pack.

The speed controller used with the Plettenberg was a Schulze 'Future 32.55', which is a very nice lightweight unit, but has short connecting wires to the batteries, and the motor wires must be plugged directly into it without extending them. Therefore it has to be mounted on a small foam-board plate immediately behind the motor, using Velcro. Make sure that sufficient cooling air is directed to the cooling plate (heat sink) of the speed controller in this location.

The connections to the LiPo cells are made at the front of the battery (access thru' the cowl). We made a simple external 'arming' system using a couple of 4mm gold connectors, so that the battery is not connected to anything until a short cable is used to join these 2 contacts on the outside of the plane.

We used a separate Rx Nicad (5 cells of 600mAH), positioned as needed for the Centre



of Gravity. In this set-up it was fixed next to the speed controller, and this gave a C of G at the nose-heavy end of the range - fine for first flights. The complete plane, ready-to-fly with the Plettenberg, LongGo flight pack, future speed controller & separate Rx Nicad weighed 4.7kg.

Plettenberg recommend a APC 18 x12E or 19 x12E prop for this motor, and this certainly performed fine with the set-up shown.

Flight Battery Support

The batteries are supported on a pair of 10mm Ø carbon tubes (included in the E-option pack), glued across the fuselage to suit your battery position. Make a platform on the carbon tubes from the supplied foam-board, with plenty of holes for cooling airflow, and access to the 4 landing gear bolts. Use the Velcro strips to retain the battery for flight. A few 10 x10mm balsa blocks glued to the foam-board locate the battery exactly and prevent it moving forward, backwards or sideways during flight.

Important: Don't forget to protect *all* bare carbon or fibreglass edges with a piece of silicone tube, split with a knife and glued in place with CA. This is *very important* as any wires or insulating material rubbing on the edges of composites will be cut thru' in 1 flight - which can cause a dangerous short circuit.

Cooling

Depending on your choice of motor, battery and speed controller you **must** make provision for enough cooling to all these components during flight. All 3 components will get warm during use, but must not get too hot to prevent damage and possible damage or fire.

This is **most important**, and if this is your 1st electric model we **strongly** recommend that you follow the advice of the manufacturers, and this instruction manual. Different power unit and battery combinations will operate at different temperatures in different ambient climates, so it is not possible to give you the exact areas and positions of the cooling required for every set-up. However, the cooling cut-outs and cowling baffle shown in the photos here, with the (65 x 50mm) air exit in the bottom of the fuselage, have worked well with the Plettenberg installation. For the Hacker/Thunder Power set-up you should allow a bit more exit area to prevent heat build-up as it does run a bit warmer than the Plettenberg.



You should go towards *more* cooling, rather than less, and pay particular attention that the area of the *exit* area for the cooling airflow is at least as big as the air entry area. Open up the cooling entrance in the lower front of the cowling as shown in the photos.

Cut out the full triangular shape in the front of the cowling and build a baffle from foam-board to direct the air over the speed-controller and battery, as shown. Make your 1st engine test-run, or flight, quite short, without using full power, and after landing check the temperature of the motor, LiPo battery and speed controller. If they are too warm, then you **must** increase the cooling airflow over these components - or they will be damaged and could even cause a fire in the plane in extreme cases.

Battery Handling

As battery technology advances at a rapid rate, the use of LiPo flight and receiver batteries is becoming quite common, but (like with all batteries) there are still dangers and it is **most important** that you exactly follow the battery manufacturers advice on storage and charging, and use the charger and charging rates that they recommend. Do **NOT** leave your LiPo batteries unattended during charging.



Important: When installing the battery(ies) in the model before a flight, make sure that no connectors can touch each other and cause a short circuit. To be safe apply a bit of masking tape to *all* connections while installing them in the plane, and glue a short length of clear silicone or plastic tube over each male and female connector (see photo) to make sure they cannot accidentally touch in flight.

So that you can make the final connection between your batteries and the motor just before your flight, after you have switched on your R/C system, we use a pair of the standard 4mm gold connector pins glued into the outside of the airframe and use a very short thick cable with opposing connectors to 'arm' the system without having to remove the canopy or cowling.

Please note:

The Electric-Flight scene, and it's technology, are advancing so rapidly that new Motors, Speed Controllers and Batteries become available all the time. At the time this manual was written the Hacker C50, Plettenberg 25-13 and other components mentioned here were top-of-the-line products suited to this aircraft. So don't be surprised when some of these parts are already outdated by the time you receive your Impact !

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, or speed controller heatsink.
- Did you fit short Tygon or silicone tube pieces over all the clevises?
- Did you tighten the locknuts against all the clevises?
- Are the swages crimped up nice and tight on the rudder cables?
- Have you put clear tape over the end of the rudder hinge wires and on the stab bolts ?
- 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.

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 between the back edge of the wing tube and up to 6mm (1/4") behind this position. After trimming flights you can adjust it a little by repositioning the battery (ies), if needed.

Don't forget to balance the plane laterally, 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:

Downthrust is, initially, set by the moulded nose of the fuselage, between 2 and 2.5° Downthrust, and this has been proved correct by many professional pattern fliers. Sidethrust is also set by the moulded nose, at about 2.5°, and this is fine for 1st trimming flights.

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, and this can easily be adjusted by packing your engine mount as needed.

Control Throws:

All measurements are at the root/trailing edge position.

Elevator

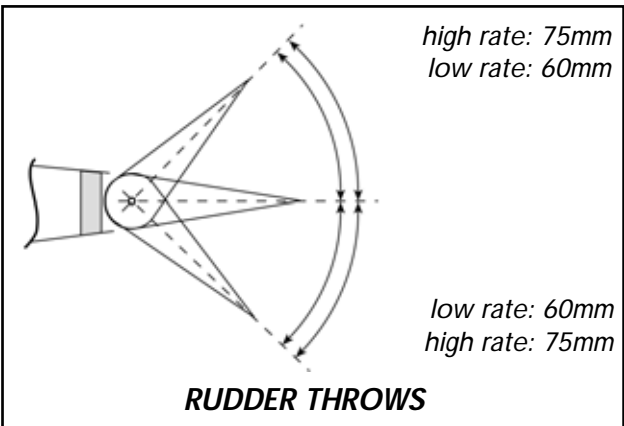
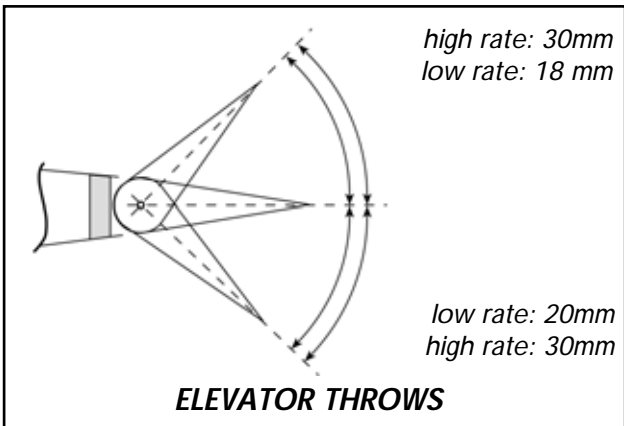
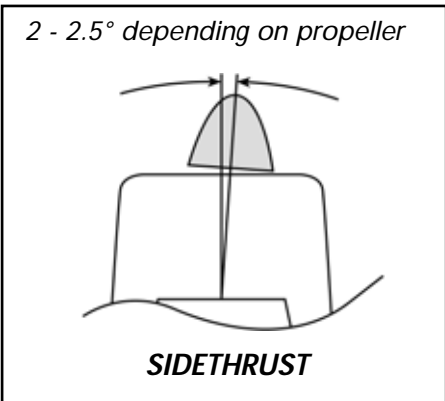
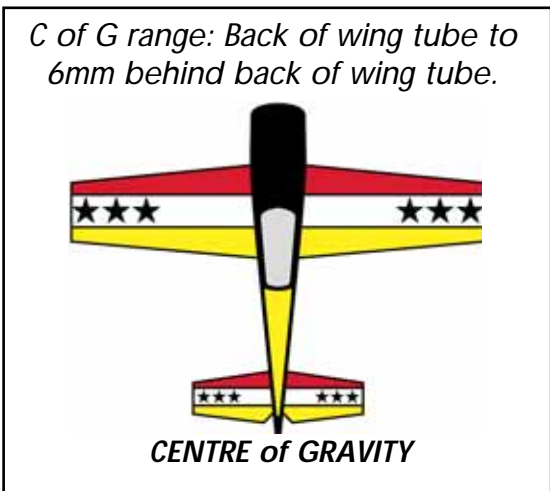
All controls should be set with a dual rate switch. On high rate the elevator should have about 30mm throw, up and down. Low rate should be 18mm (3/4") up and 20mm down. This gives a couple of mm negative differential, due to the top hinging. If you like you can add about 20% exponential to the low rate setting as well.

Rudder

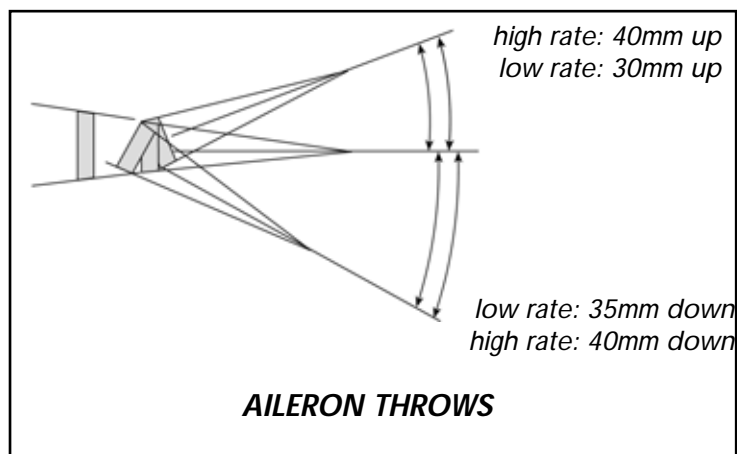
Set the high rate to about 75mm both sides, and at low rate reduced to about 60mm. You can add 25% exponential for smooth tracking corrections if you like. Check your closed-loop cables again and make sure that there is NO slop at all.

Ailerons

Aileron throw for high rate is 40mm up and down. Use at about 30% exponential for high



rate if you like. For low rate you should decrease the throw to the *top* to 30mm, and the *bottom* to 35mm. Yes, this is a reversed differential due to the hinge line being in the top skin instead of on the centre line. You will have to finalise this differential figure during flight, as mentioned earlier in this instruction book. At high rate, for 3D manoeuvres, this doesn't effect the rolling too much, so you can maximize the throws to whatever is mechanically possible, even more up than down if you wish.



Warning

Your Impact has large control surfaces, which makes it very sensitive and reactive. It is always possible that these 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 rather reduce the maximum throw than risking a high speed flutter due to sloppy servo gear or linkages.

We hope that you enjoyed building your Impact. 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

Thank you!

Your Composite-ARF Team

Flying and Trimming

During your first flight you should get a feel for the plane, and then set your control throws for your liking. The ones shown above will be fine for the first flights anyway. Get used to the flying characteristics, you will notice immediately how light the plane is, and that it might have to be flown a bit differently than other pattern planes you might be used to.

Setting-up a patternship correctly is a very complex procedure, and here is a description of the way we suggest you do it. Of course there will be other opinions around, and these might be useful as well, but for sure our suggestions will lead to a perfect flying pattern plane, and you can follow the actions step by step.

Basically there are several momentums in flight which influence the flying. First the 'CG', which is the Centre of Gravity. Secondly the 'CL', which is the Centre of Lift. Both points are not at the same place. Moving the CG forward or backwards, changes the distance between CG and CL. The Centre of Lift cannot be changed, the Centre of Gravity can.

Then there are the angles of attack (incidences) of both wings and horizontal stabs. Both need to be right, but most important is the difference of both between each other, rather than the single angle of attack.

Last but not least, there is another variable, this is the thrust-line of the engine. This is important, and should be measured in relation to the wing. It makes things easy, and we will refer in this section all angles of attack to the wing as a zero point.

Get the plane on your table, and first set the wing incidence to Zero. Then the stab should be negative (nose down) about 0.2 - 0.3 degree. You will need an incidence scale to measure this correctly. In relation to the wing, the engine down thrust should be -2° . And the CG should be then exactly at the back edge of the wing spar.

With these basic settings you can get on with your first serious trim flight. First setting adjustment will be down thrust (and right thrust at the same time). Take the plane to a high level, and push into a vertical down line, throttle AT IDLE. At exactly vertically downwards release all the sticks. The plane should now continue to dive exactly vertical. If the plane goes towards the belly, you need to uptrim, if it goes to the canopy, you will need down trim on the elevator. Do this manoeuvre several times, and set the trim so that the plane goes exactly vertically down.

Note: In this manoeuvre there is only the incidence difference of wing of stab influencing the flight. No thrust line is involved as engine is at idle, no centre of gravity in relation to centre of lift is involved, as there is a vertical downline without any momentums of both at all.

With the trim setting you found, the plane might dive or climb a little bit in horizontal flight, but please completely disregard this for this trim flight. The next step is, to fly vertical uplines with the SAME TRIM SETTING. At full throttle pull vertical up, and see if the plane goes to the belly or to the canopy. If it goes to the belly, you have to add upthrust, if it goes to the canopy, you have to add down thrust. It is that easy, and you cannot fool it. Do not change your trim setting at this time, land, and adjust the thrust line accordingly. After adjustment, make another test flight, to see if it improved. You should stop when the plane in vertical up AND down lines goes absolutely straight, without trim changes from your side. Then your down thrust (or up thrust) is set right. Of course at the same time you will find out about your right thrust, and you can correct at the same time, too, in exactly the same manner.

Now the effects of the thrust line are eliminated, and the angle of attack issues relative to the thrust line and relative to both wing and stab are eliminated, too. Now you can continue to find the right CG settings.

Fly horizontal, and NOW change your elevator trim so that the plane flies straight and level. If your CG is close, you should only need one or 2 clicks of up trim. If you need more, this is a hint for a nose heavy setup. Flip the plane inverted, and see if it now dives to the ground severely. If it does, your CG is definitely too far forward, and you should move it backwards.

Try the same manoeuvre again, after you moved your CG, and you will find an improvement already. Set it so that the plane only dives very little bit inverted, when it flies with the same setting absolutely straight when upright.

Regarding the momentums, your plane is now set and ready to go! Now you will have to test the snap capabilities, and the rolling capabilities, especially for rolling circles (of course, if you can do it...). In the snaps the plane will need a lot of aileron, and only little of elevator. Make sure that the snaps track nicely. If you do not get the plane to snap in line, if it "barrels" a lot, you might have gone too far back with your CG. You can then adjust it a little bit to the front. Also, if you slow the plane down, and you feel that you almost have to hold the plane with down elevator to stay flyable, this is another hint that you went too far back with your CG. Move it a bit forward then.

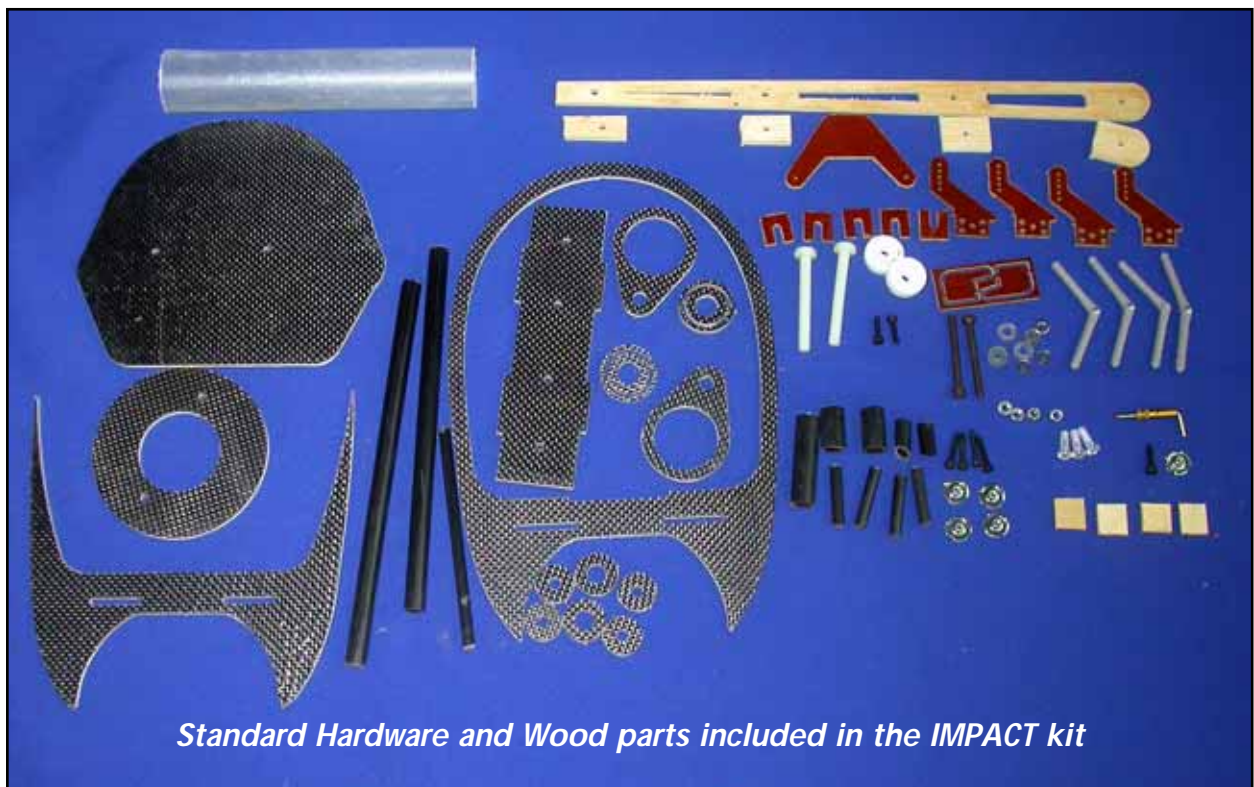
Do not worry if the elevators are not 100% neutral for all this testing. After you confirm every-

thing you have flown, and can confirm that the incidences, the thrust lines and the CG is 100% correct, THEN and ONLY THEN, you can go ahead and change the incidence on the stab (and only the stab) permanently. Measure the trim you needed for perfect level flight at the trailing edge of the elevator. Then remove the rear anti rotation pin from the plane, adjust the hole, and re-glue. You will have to change the trailing edge of the stab about the same amount as you needed trim in your flight testing. (e.g: if you had to trim 1.5 mm down for level flight, you will have to rotate the whole stab so that the trailing edge comes down this same amount of 1.5 mm, then set the trim to neutral and fly again, to verify. Usually it matches at the first attempt.)

Last but not least, you should test the balance around the rolling axis. First make sure that both right and left stab have the same angle of attack, and the deflections of your elevators are exactly the same on both sides. Then fly and pull up to a loop. Is the plane moving to the right during the pull, your right elevator might travel a bit more than the left one, or your right wing might be a little bit heavier than the left one. If it turns to the left, it is vice versa. Please try it many times, and confirm the direction to which the plane pulls. You might have forgotten even after your landing. Confirm it several times.

Then do the same thing inverted, and push up to a tight loop (negative loop). If one wing is heavier than the other, then the plane will now pull to the opposite direction than in the upright flight (positive loop). If it is indefinite, a slight adjustment on the elevator deflections might be necessary. If it is clearly pulling to the opposite direction, it will be most likely that both wings are not 100% balanced.

On a side note, it might be that 2 or more slight mistakes might eliminate each other, or add on to each other. To find out, you will have to make a lot of "dial in flights", and you might have to do the procedure over and over again. If you take your time, you will be granted with one of the best flying pattern planes of the world, which really is a big advantage in any contest flying.



Standard Hardware and Wood parts included in the IMPACT kit

Appendix:

Packing List - Impact Kit

Main Items

<i>Art.-Nr.</i>	<i>Quantity</i>	<i>Description English</i>
	1	Fuselage
	1	Right wing
	1	Left wing
	1	Right stabiliser
	1	Left stabiliser
	1	Rudder (attached to fuselage)
	1	Cowling (belly pan)
	1	Canopy
	1	Right wheel pant
	1	Left wheel pant
	1	Right landing gear, carbon
	1	Left landing gear, carbon
	1	Carbon Wing tube 30Ø x 600mm
	1	Hardware and Wood parts bag
	1	Set foam-board tuned pipe floor
	1	Instruction manual (English)

Hardware

<i>Art.-Nr.</i>	<i>Quantity</i>	<i>Description English</i>
	1	Glass tube for wing spar (30mm Ø x 160mm)
	1	Carbon tube for wing anti-rotation (10mm Ø x 186mm)
	2	Carbon tubes for wing anti-rotation (12mm Ø x 20mm)
	2	Carbon pins for chin cowl mounting (6mm Ø x 30mm)
	2	Carbon tubes for chin cowl mounting (8mm Ø x 20mm)
	1	Carbon tube for stab tube (12mm Ø x 45mm)
	1	Carbon tube stab spar (10mm Ø x 190mm)
	1	Anti-rotation rod (carbon rod) 6mm Ø x 100mm
	2	Anti-rotation pins (carbon rod) 6mm Ø x 30mm
	3	Plastic bolts (M4 x 12mm)
	5	'U' plates (phenolic)
	2	Canopy Hooks (phenolic)
	1	Hatch Latch
	4	Control surface horns for elevators and ailerons (phenolic)
	1	Rudder control horn (phenolic)
	2	Plastic bolts for wing mount M6 x 50mm
	2	Plastic knurled nuts M6 for wing bolts
	3	Bolts M3 x12mm for stab mounting/Cowl mount
	4	Robart hinges for Rudder
	5	Blind nut M3 for Landing gear/Cowl mount
	4	Bolts M3 x 16 for Landing gear
	4	Washer M3
	4	Washer M4
	2	Nut M4 for wheel axles
	2	Locknut M4 for wheel axles
	2	M4 x 40mm Bolts (axles)

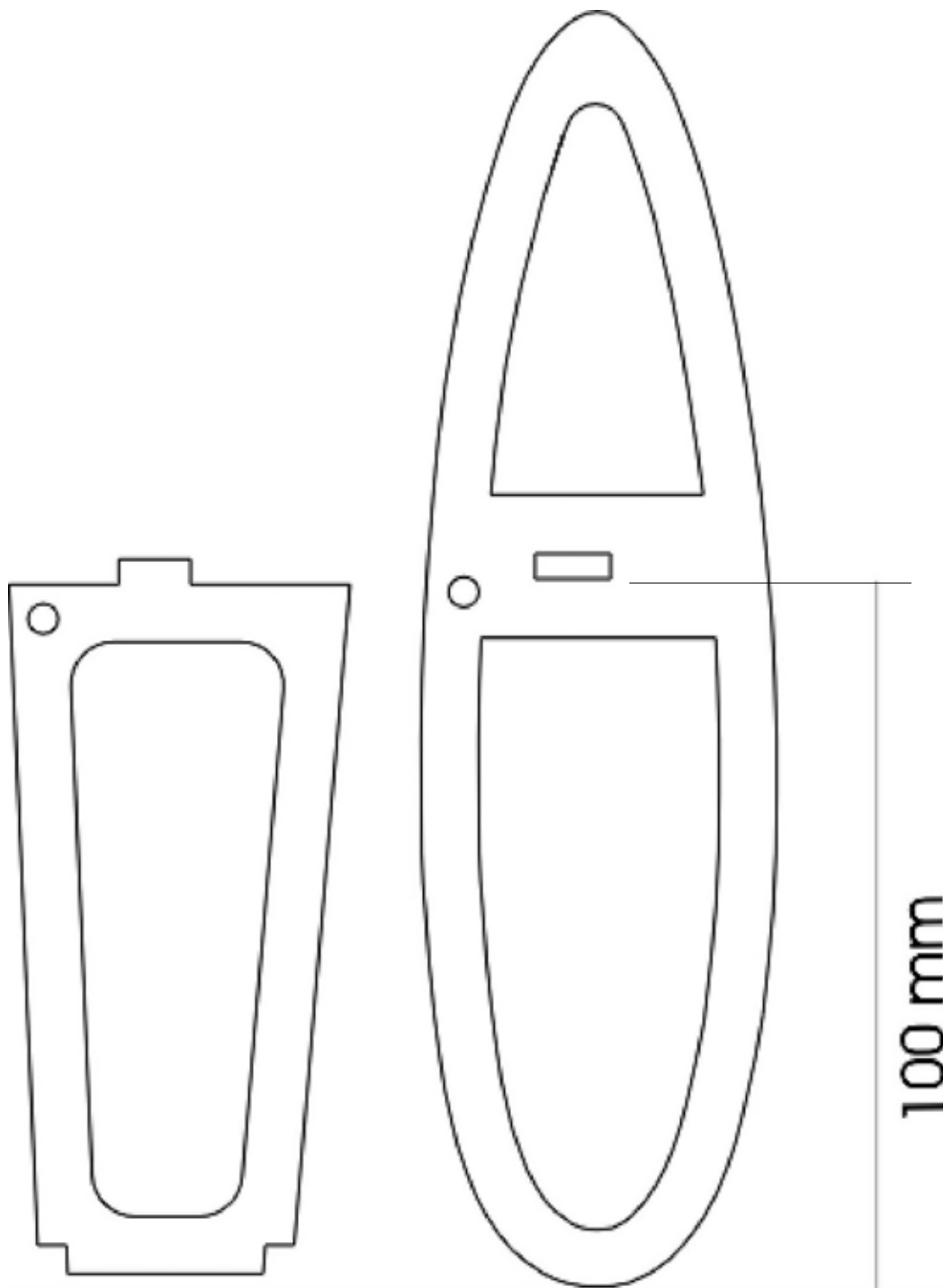
Wood Parts

<i>Art.-Nr.</i>	<i>Quantity</i>	<i>Description English</i>
	3	Landing Gear mount parts (carbon/ply/carbon)
	1	Firewall (carbon/ply/carbon)
	2	Reinforcement rings (carbon/ply/carbon) 10mm I.D.
	2	Reinforcement rings (carbon/ply/carbon) 12mm I.D.
	2	Reinforcement rings (carbon/ply/carbon) 6mm I.D.
	1	Nose Ring (carbon/ply/carbon)
	1	Fin post for Rudder (balsa/glass)
	4	Doublers for Fin Post (balsa/glass)
	4	Plywood squares (3mm x 15mm x 15mm)

Available Accessories:

- Spinner (moulded/painted carbon/aluminium)
- Engine Soft Mount (glow/gas engines)
- Electric Power option pack (bulkheads etc)
- Hacker C50 geared motor + Master 0-90-Acro Speed controller
- Plettenberg Xtra 25-13 motor + Schulze future 32.55 Speed controller
- Set 4mm Ø Gold connectors (10 each male/female)
- Thunder Power 5S3P 6100 mAH LiPo Flight pack
- Emcotec LongGo 10S2P 4000 mAH LiPo Flight pack
- Emcotec balancer set for LongGo LiPo cells (above)
- Orbit Microlader Pro (Charger for LiPo and NiCad/NiMH packs)
- Powerbox 'Sensor' switch with regulator a dual inputs/outputs
- Powerbox Power switch for Ignition or Receiver Nicads





Impact fuselage tail formers. Make from 3mm balsa.