The original Porta- Plane™

Carbon Falcon™

OWNERS MANUAL

The Portable Electric Powered
R/C Flying Wing ARF Slow Flyer

By

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Congratulations on your purchase of the amazing Carbon Falcon™ Porta-Plane™! We're sure you will simply love its performance, durability and portability!

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Carbon Falcon™ SPECS:

Span: 42 inches - Length: 16 inches
Disassembled size: 24 x 3 x 3 inches
Area: 360 square inches (2.5 sq ft)
RTF weight: 7.5 to 10 oz. (average 8-9 oz)
Wing loadings: 3 to 4 oz/sq. ft. (average - 3.5)
Brushed motors tested (**bold** = preferred gear):
GWS IPS "DX-A" w/ 9x7 SF & GWS IPS Dual "A" w/10x8 SF
Batteries: 6 or 7 cell 700mah NiMH AAAs (2.5 - 3 oz)
Receiver: - micro - GWS R4P or better
ESC - GWS IC-50 or GS-100 (w/brake) or CC Pixi-10
Brushless: PJS-300 SF or Nippy Black 0508 w/ 9x4.7 SF
CD-ROM post mount brushless outrunner w/ 8x4 to 9x5 GWS Direct Drive prop
Phoenix 10 ESC & 1100-1300 mAh ~2 to 2.5 oz 2S (2 cell - 7.4 vt) Lithium Polymer pack
Servos (included): >30 oz in torque
Radios used: Hitec Focus III FM, Eclipse 7, JR XP-652, Spektrum DX-6

Introduction:

We are very proud of this totally new concept in RC flight. The Carbon Falcon™ uses modern high performance hang glider technology for maintaining wing shape and stability. Instead of using inefficient weight shift or pull strings for control as some other powered kites or model hang gliders do, our Porta-Plane™ models use direct wing warping which simulates the reshaping done to a real hang glider wing when weight is shifted by the pilot. This wing twisting is how a bird rolls into a turn also. The advantage of this system is that the wing is not loose like a kite but retains its preset airfoil and shape for precise control and performance at all speeds and attitudes.

The Carbon Falcon™ electric aircraft will perform well with only an inexpensive stock GWS brand DX "A" drive and allow very slow and controlled flight. It will also move out quite well for a slow flyer allowing it to be flown outdoors in mild breezes. Due to its light wing loading however, it will suffer in any turbulence but can still be fully controlled better than most slow flyers in its class due to it's responsive wing warping control system.

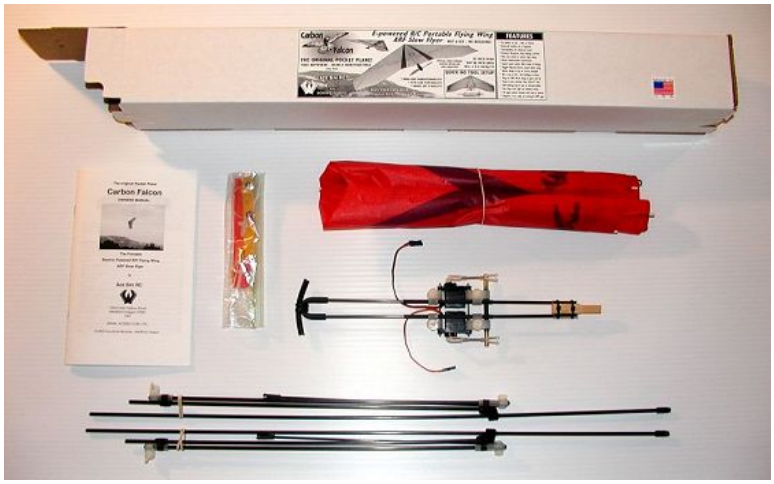
Even if you are an experienced RC pilot with plenty of time on R/E, A/E and even elevon flying wings, this aircraft has much to offer you. If you are a beginner with limited R/E experience, this wing is a stable platform for moving up to ailerons and/or flying wings. In still and smooth air it is hands off stable, even in turns! It will not stall under normal flight conditions or drop a wing from a "tip stall". The worst it will do is pitch up from a gust (or pilot input), yaw around and continue to fly off in another direction. This trick can be used as a great way to turn around in a limited area like when flying indoors and can be exciting when forced up into steep stall turns.

The Theory:

The exclusive Warperon™ control system works by simply twisting the wing tips. This allows the twist in the wing to change causing more or less washout (lower angle of attack of the wing tip compared to the root). Washout on a swept wing can act as the horizontal stabilizer on a conventional plane due to the tips being located behind the center of gravity.

A simplistic explanation is that since the tips are at the rear of the plane and are flying at a lower A of A, they hold the "tail" down to balance the weight up front. By varying this angle the plane will fly faster or slower sort of like having an all flying stabilizer on a conventional model.

The big advantage is that at slow speeds and as well as when turning, you are increasing the washout and thus stability of the wing more, even on the slower flying inside wing in a turn! On the other hand, when flying fast, you have less chance of stalling so having reduced washout allows less drag, higher speed, as well as more lift.



What's in the box:

Remove everything from the box and lay it out. You should have received the following:

Rolled up wing with preinstalled ribs & tension bands.
Center motor/gear frame.
Collapsed wing frames with control rods installed.
Spare parts bag.
These instructions. (NOTE: to reduce costs so not to have to raise the price of the plane, printed instructions are not included with the plane but are always available for download from our website.)

What else you'll need:

3-channel radio with delta or elevon mixing
(or separate mixer) and preferably programmable.
(2 channel with mixer is okay for light slope soaring)

Micro or lightweight (~.5 oz) receiver.

Small 3 amp or better ESC like GWS ICS-50 or GS-100 for small brushed motors.
(Must be able to handle the motor system you use.)

2) 30 + oz torque servos (pre-installed).
Metal Gear and/or BB preferred such as Hitec HS-81s

Brushed Motor: GWS DX-A drive or equivalent with 9x7 SF prop setup as a pusher as the minimum.
Brushless Motor (recommended): CD-Rom style post mount ~1 oz outrunner. (See end of manual for brushless details)

2 to 3 oz battery pack(s). 6 and 7 cell 700 Mah AAA NiMhs can be used for low-current brushed motors but any pack you normally use with your motor of choice should be fine.

For higher current motors and to keep weight down, 2 to 2.5 oz, 2 cell (2S) 7.4 volt pack of Li-Ion or Li-Polys are preferred.

Charger for your type battery packs.

Assembly:

The first time you assemble your CF, you'll be installing and setting up your radio, motor, and ESC. After that, you'll skip all of these steps.

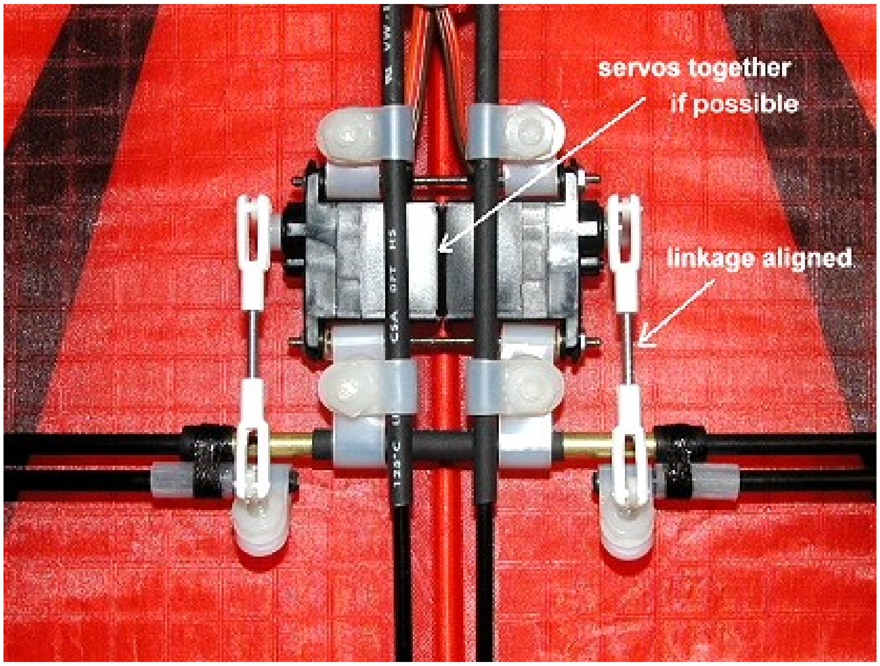
Note: Since your servos are pre-installed you can skip the Servo Installation section: Also note that current pictures of servo mounting are shown at end of manual.

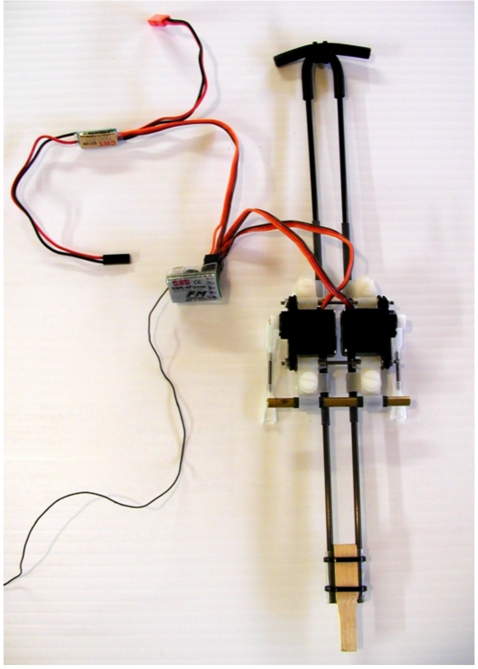
Servo Installation:

Position the motor frame facing away from you with the threaded rods across the top of the frame. Remove the nuts from these rods. Use the rubber grommets included with your servos as well as the brass eyelets inserted properly. Position the servos so that the control horn hubs are forward on the servo and facing outward. The servos then just slide on the rods and get secured with the nuts.

Note: If using longer servos than recommended, you need to relocate the forward threaded rod. Loosen the attachment clamps and move it forward on the frame tubes until the servos fit. Do not move the rear rod!

Tighten the nuts well but not enough to deform the grommet to the point it wants to squeeze out of the servo. Add a drop of lock-tight or CA to the nuts to prevent them from loosening if desired. The servo horns will lay vertically across the frame tubes as the servos end up on top with the horns sticking down. You'll want to leave the control horns unsecured until you do a bench check to find your centers as outlined next.





Setup Servos:

With the motor frame positioned with the servo horns sticking up (this is the bottom of the frame) connect your receiver to the servos. Program or switch your radio to allow delta or elevon mixing of the elevator and aileron channels. Don't use the V tail setting, as it is backward to what we want. With a receiver battery temporarily installed to test operations, move the stick around and see what the servos do.

With the nose of the frame pointed away from you and on it's back, both servo horns need to move back with back stick. If they don't, reverse the travel to both channels. Right stick needs to cause the servo on your left (planes right servo) to move back and the right one (planes left servo) to move forward. You may need to switch the connectors at the receiver to get them correctly arranged.

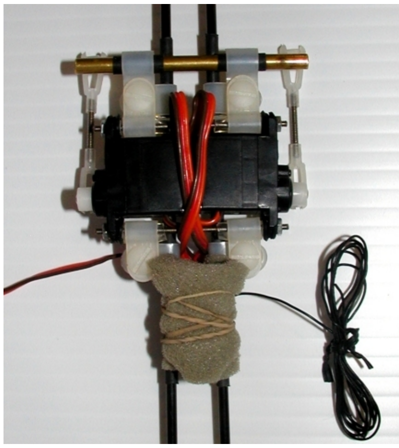
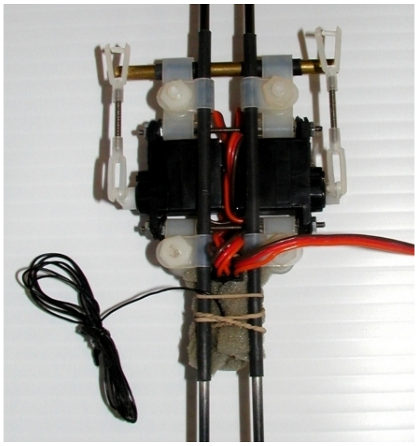
Once working properly, and if you have a programmable radio, set your travel for only about 50% on both channels to start. This way when giving full up and right for example, the mixed travel adds up to 100%. Note: These values assume you have a travel range up to 100%. My JR goes up to 125% so I have mine set to 60%. In any case you'll need less than 45° travel of the horn in each direction when applying up or down stick or left or right stick.

Also set your aileron differential to about 30% if available to reduce any adverse yaw. Test it and notice when you move the stick left and right that the horn moving back travels more than the one moving forward. You DONT want it the other way around. With the transmitter stick trims centered, both servos should have their horns centered and evenly matched. Test full up and down and be sure they stay even at both extremes.

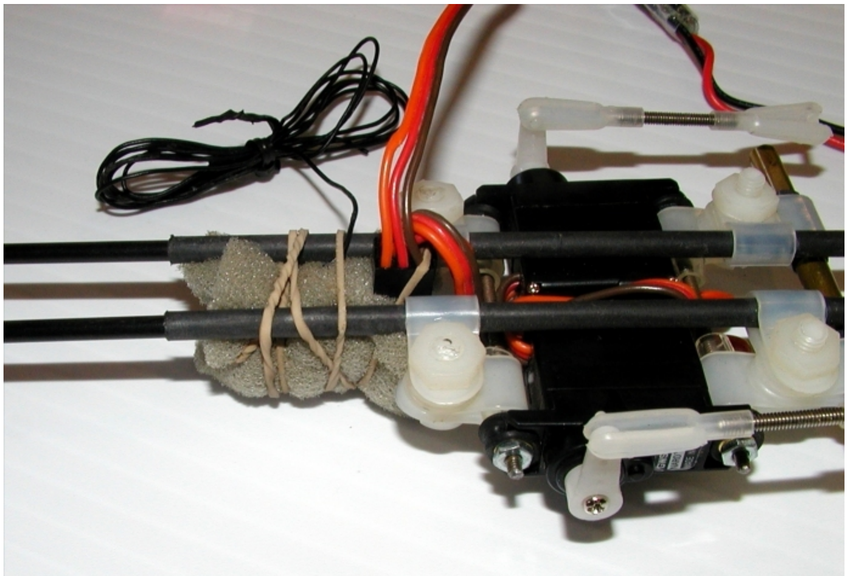
Note: If you don't have programming available you can add some mechanical differential by relocating the servo horns forward a little on the servos at center trim. Then extend the linkage the same amount so that the wing tips remain at the same angle.

Receiver Install:

Wrap your receiver with a thin layer of soft foam and put a light rubber band around it to hold it in place. Position the receiver under the frame on the same side as the servos in front of and as close to the servos as you can. If you have a receiver that has its connectors sticking straight up instead of out of the end, locate it so the connectors stick up (actually down in flight) through the frame tubes. Put another rubber band around the tubes and receiver to hold it in position.

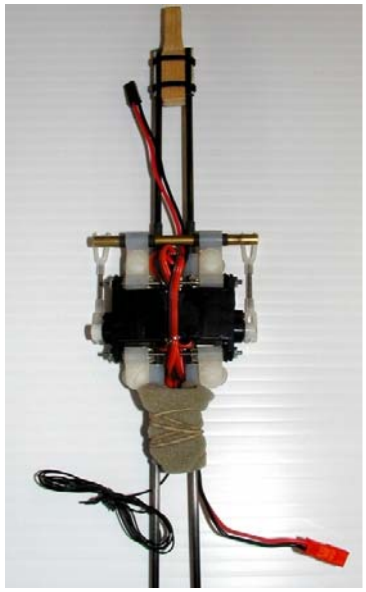



TOP **BOTTOM**

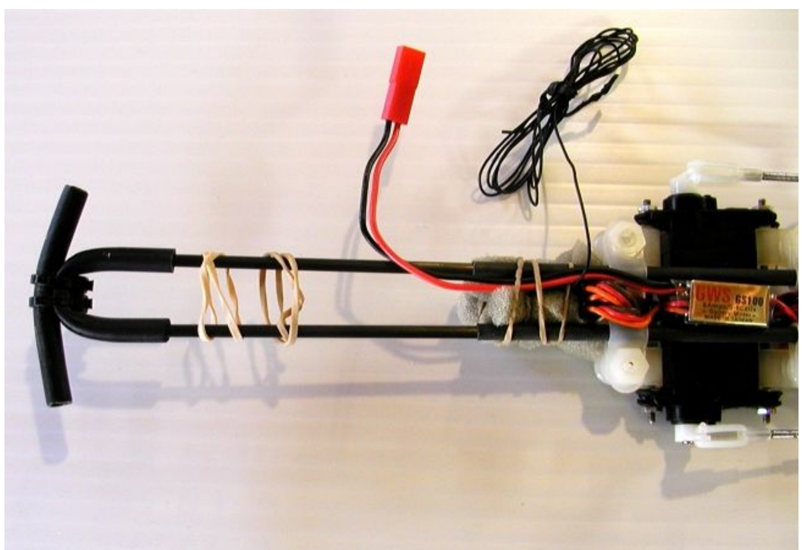


ESC Install:

The ESC should fit nicely between the tubes on the bottom of the frame under the servos for good cooling. If you are using oversized servos and don't have any room under them, locate the ESC back behind the servos between the frame tubes. Twist ties will go a long way to clean up a potential rats nest of wires. (What a drag!)

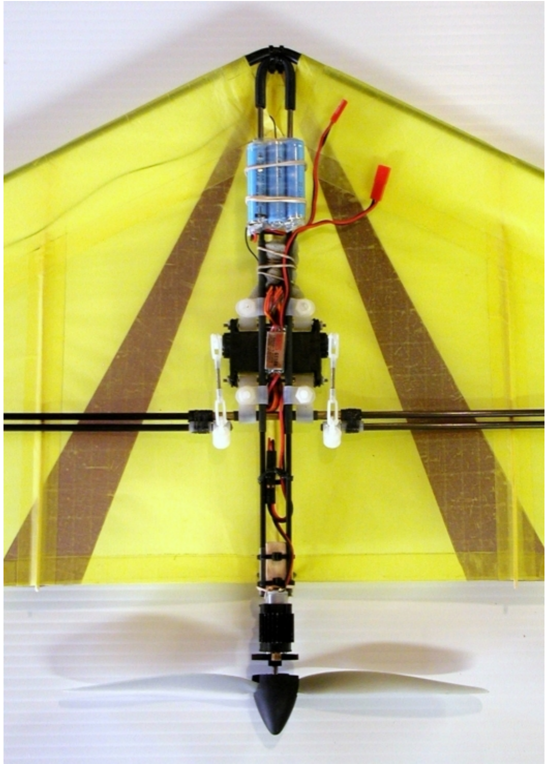


Add a couple doubled thin medium length rubber bands to hold your battery pack over the front of the frame at this time.



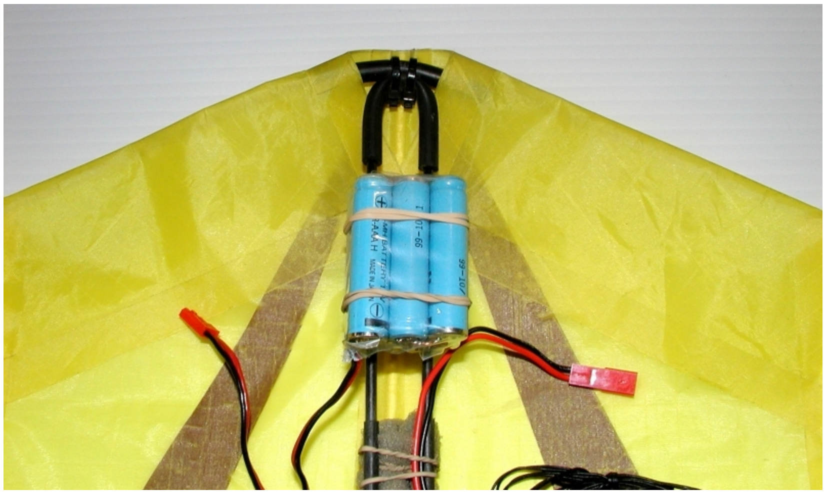
Portability:

The Porta- Plane™ concept is a simple one. Just assemble and disassemble it like a kite. Well, actually there is a little more to it but not much.



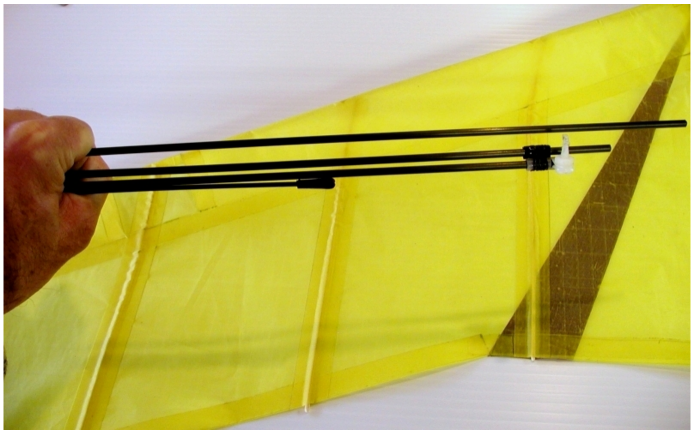
Assembly:

Unroll the sail and find its bottom. All seams are on the bottom of the sail. Lay it out with the bottom up and position the center frame also bottom up (servo horns up) in the center of the sail. The two LE sleeves on the frame nose get tucked into the LE sail pockets at the wing root.

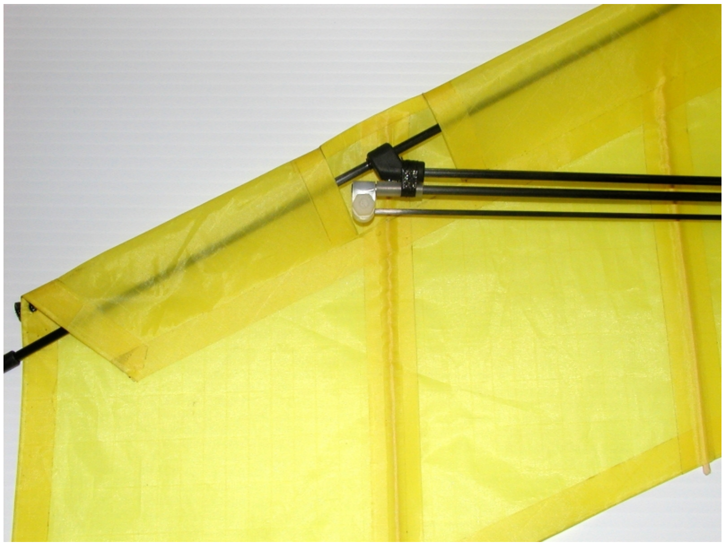


Spread open the wing frames and note the different tubes and attachments. The longest tube is the LE with the next longest being the spar. The tube with the nylon fittings on it is the control torque tube and the small rod attached at the end is the wingtip control rod. This rod folds in along the torque tube for storage.

Note the attachments of the wingtip control rod. One side has a little nylon cylinder that the rod fits through and the other side has a nut holding it all together. You want this attachment nut down in flight so since the plane is being assembled bottom up, lay out the frames with these nuts facing up. The control horn will also be pointed up. Make a mental note of this position of which wing frame is for which side of the plane.

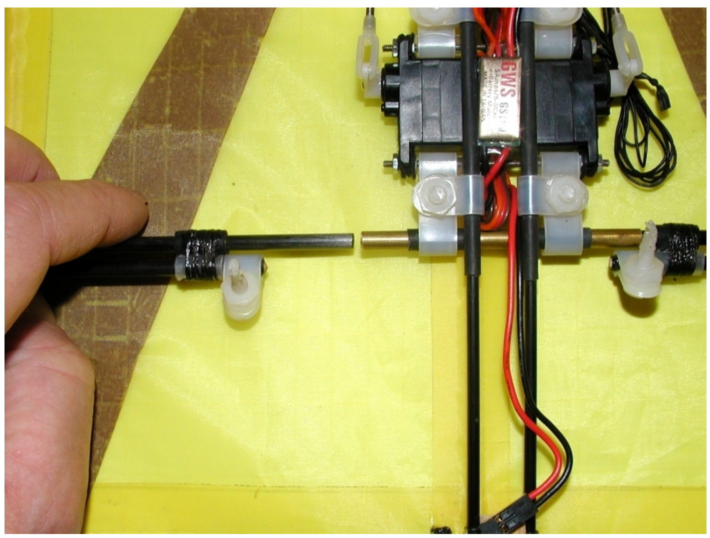


Now take one frame and while holding it compressed flat with the tip rod folded in, insert all these tubes held together from their root end into its wing LE pocket from the tip. As you get it started, allow all the tubes except the longer LE tube to come out of the attachment hole in the pocket. Keep them compressed however to reduce stress on the LE pocket.

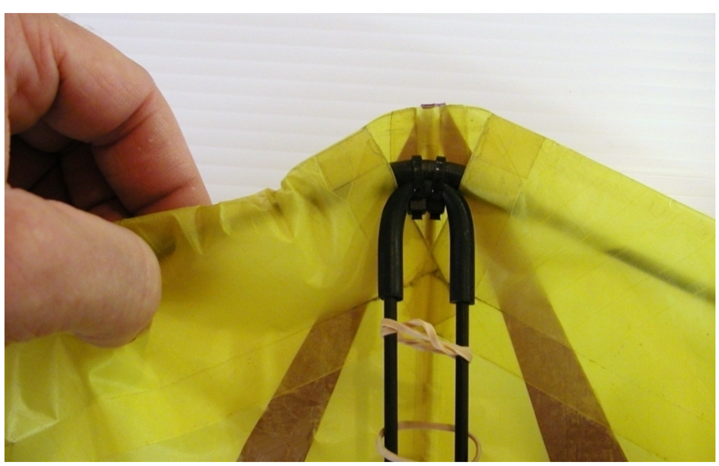


Once the rubber spar fitting on the LE is through the hole, start the spar end in its brass sleeve on the center frame but don’t insert it fully.

Note: fittings and connector types may vary in appearance from current production model.



Next get the LE tube started into its nose sleeve on the frame front. You have to do this “blind” inside the pocket and once both LE and spar are started in their sleeves then work them both all the way in as far as they can go.

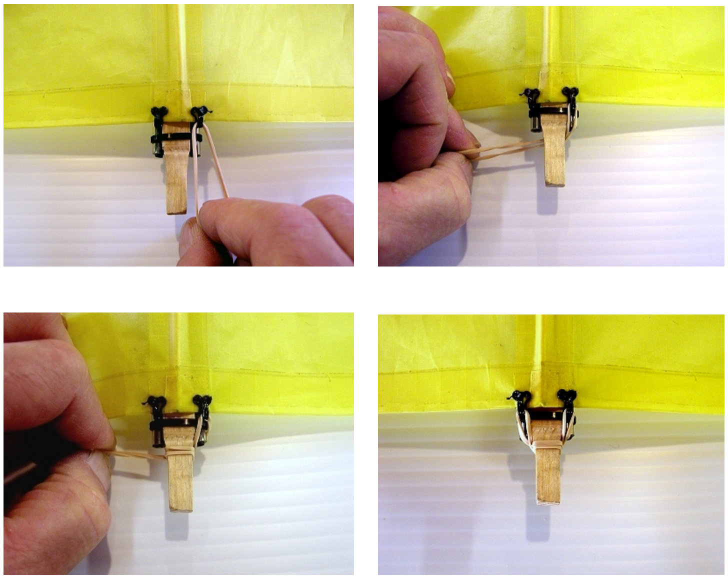


No need to force anything, as both are slip fit connectors. If they do not seem to want to go then they are binding due to the angle you are inserting them at. Just work each a little at a time. Now do the other wing the same way.

Swing out the tip rods until they match the location of the sail TE tip corners and tighten their attachment nut snuggly by hand. Don't try to tighten them until the clamps close flush, as the clamps are undersized and won't allow it without putting excess strain on the bolts. This nylon hardware can be stripped easily so don't over tighten any of it.

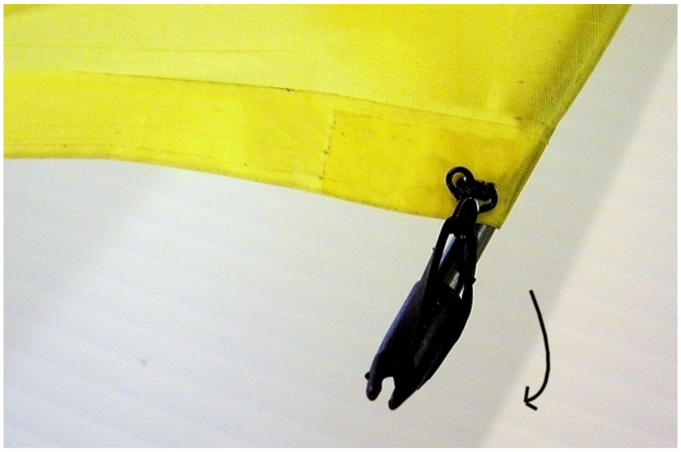
Connect Sail to Frame:

On the wing root TE are two hooks to rubber band it to the center frame. You want the sail pulled snug backward as well as downward. Hook each of the small included bands over the motor mount. If you run out of these, use a light weight, medium sized band. Hook one end on and while pulling back gently on it, wrap it once behind the wire ties on the motor block then on to the other hook. You don't want it real tight as the sail needs to shift a little back and forth in flight, but you want it tight enough that it won't lift up any in flight.

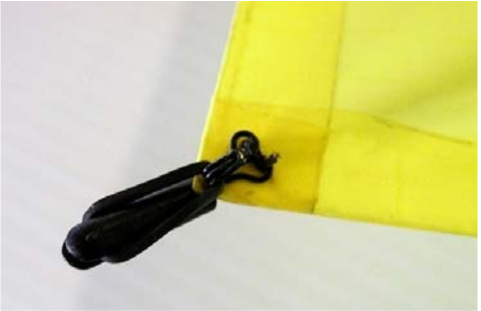


Next connect the bands at the wing tip LE hooks to the LE frame tube ends. Rotate the band as shown to help pull the LE of the sail in the correct direction to keep some shape at the tip. (Viewed from top of wing)

This step is only done the first time you assemble the plane. After that you'll leave the center frame attached to the sail and just pull off the motor or prop to fit it all back in the box.



Finally, attach the wing tip TE bands to the control rods the same way. Note that the little hooks we use securely lock the special bands in place so if disconnected they won't fly off and get lost. NOTE: If you need to use larger bands, just double them to get the correct tension.

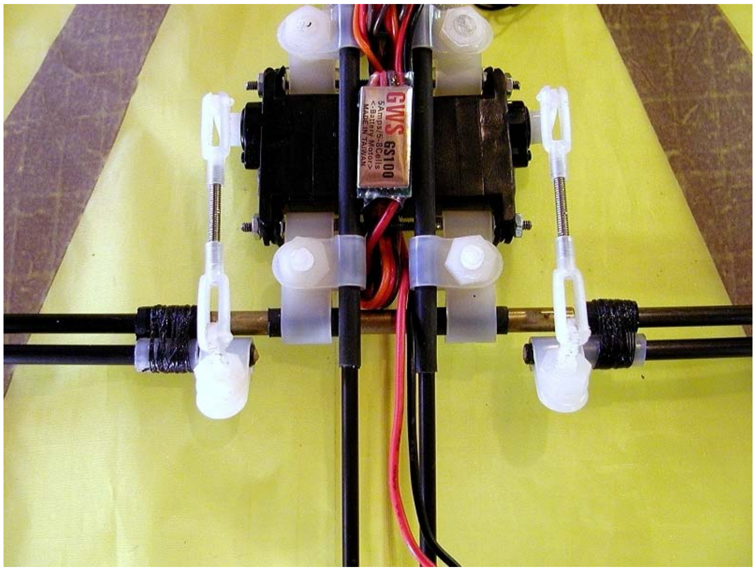


Sail tension is very important to both flight and control performance. Too tight and you might stall a servo and reduce control range, too loose and you'll lose performance as well as throw off the CG. Don't try to stretch out all the wrinkles either as they will go away after awhile from being tensioned.

Control Linkage:

Stand the plane up on its nose and grasp the control horns and while moving them up and down, assure that the wings move freely. Now place the center of the plane over a corner of a table on its back with the wings hanging off the sides.

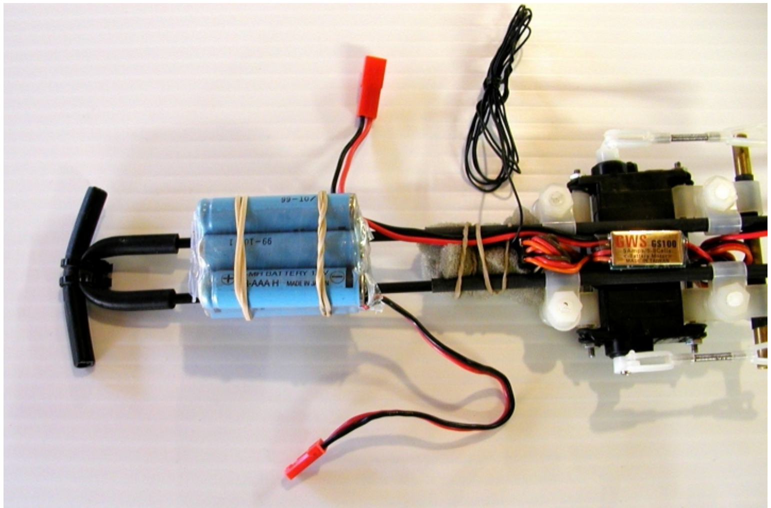
Connect the linkage clevises from the outer holes on the servo horns to their respective control horns on the torque tubes.



Battery Packs:

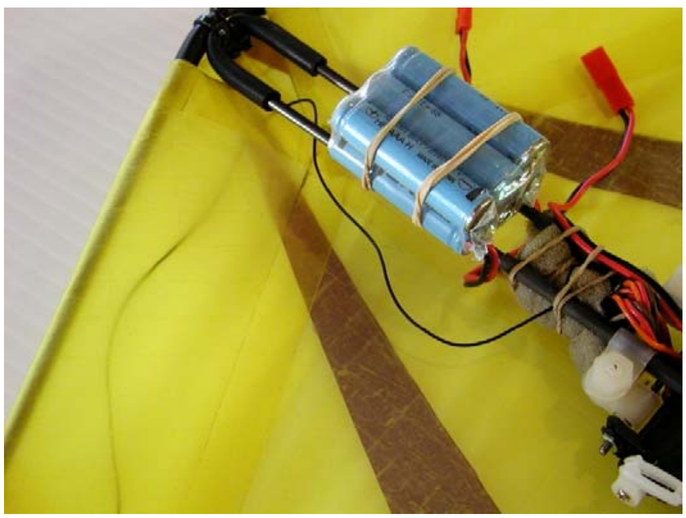
A folded or hump pack allows more room for CG adjustment but other styles should still fit okay and allow proper balance. The following picture shows the approximate location for a 2.5 ounce pack to obtain the correct CG at the factory settings.

(See end of manual for best way to mount LiPo packs)



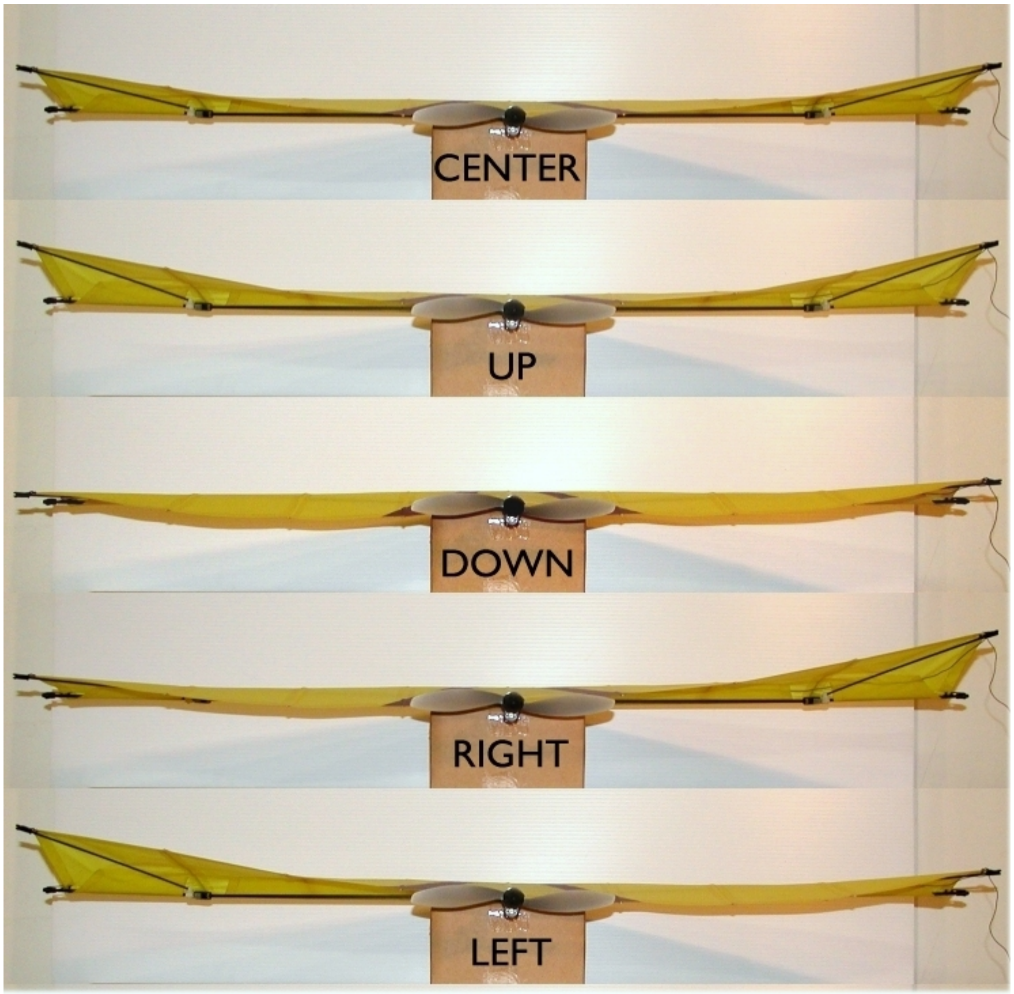
Antenna Placement:

Run the antenna wire into a LE pocket and out the tip. You can slip it under the tip rod band to further secure it if you wish.



Bench Check:

Since the wings twist for control, you need the wings unsupported for this test. With the plane facing away from you sitting supported in the center on a small box for example with the servo linkages unobstructed, test the controls. (Note: it's safer to leave the motor lead disconnected when bench testing.)



Back stick should raise both wing tips.
Forward stick should lower them.
Right stick should raise the right tip and lower the left.
Left stick should raise the left tip and lower the right.

Now flip the wing over and view the servos. Depending on the radio you have and the travel settings, check to be sure the servos are not over driving the linkages in the mixed stick positions. Test these at:

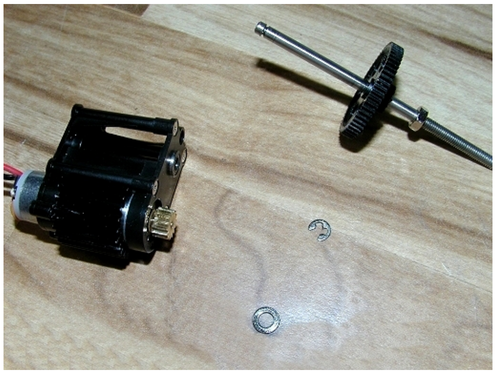
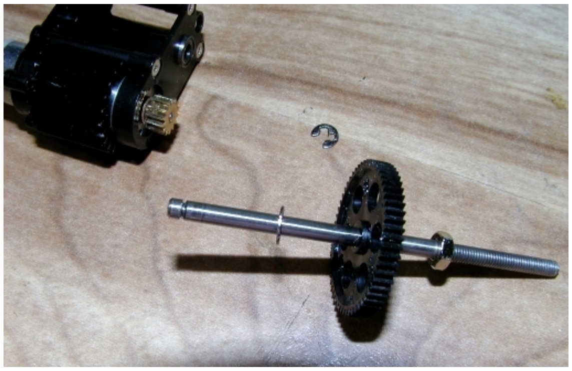
Full up plus right and full up plus left
Full down plus right and full down plus left

If it appears they are over rotating or binding at the extremes, reduce the servo travels in your transmitter. If you don't have a programmable radio then you can lower the linkage clevises on the servo horns and test again until freedom of motion is achieved.

Normally the full down plus right and left positions won't give you any trouble since this motion loosens the sail. The full up plus right and left positions are a different story. If you see the servos moving but the wing tip isn't going up, then it is trying to go too far. You'll need to reduce your servo travel or move the clevises at the servos in further on the horns.

Motor Installation:

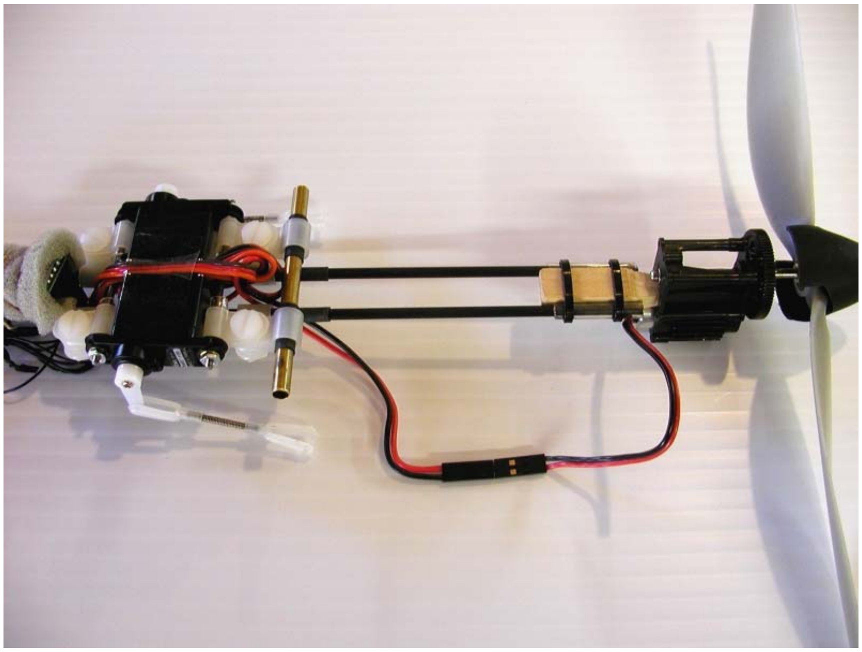
To modify the GWS DXA motor for pusher use it is recommended that the thrust washer at the rear end of the prop shaft be relocated to the front end of the shaft behind the main gear. It will work without this mod but this will increase drive shaft bearing life and reduce friction for more efficiency.

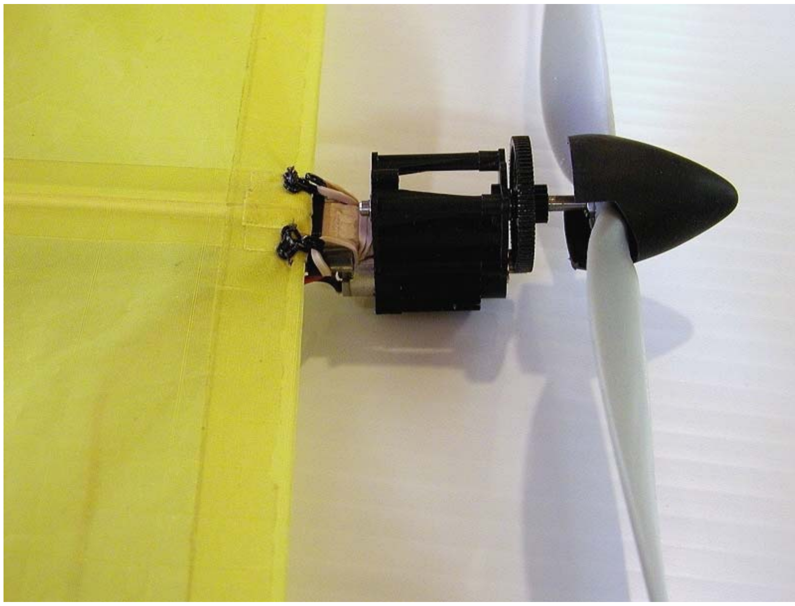
Be VERY careful when removing the cir-clip as it will want to shoot across the room and may never be found.

The GWS motor drive just gets inserted snugly on the motor mount with the prop shaft being positioned ABOVE the wing. You need to wire it BACKWARDS to the ESC for reverse operation as a pusher. (red to black, black to red when you plug in the connector)

The prop mounts on to the motor backward also so that the front of the prop is facing the drive gear. You can usually tell which side of the prop is the front from the lettering stamped on it. I say usually since not all props do this. Basically you need to be sure that the prop is facing the same way in relation to the plane as it would be if mounted as a tractor on the front. Since you run the motor backward and it is mounted backward, the direction of rotation ends up the same. It should turn clockwise if viewed from the rear.



If you get either of these wrong, your first flight will go nowhere fast. (Voice of experience!) The prop nut needs to be VERY tight since in the pusher position it wants to loosen on the shaft instead of tighten as it does being used as a puller.



This is a big advantage however if you accidentally drive the prop into the ground under power. It will usually just unscrew itself instead of breaking! If it does look like you're "going in" be sure you immediately cut the throttle to prevent damage to your electronics. (prop-saver used for brushless motors shown at end of manual)

Note: If you are using a motor used as a puller that has a lot of mileage on it, you may suffer from reduced power due to the fact that it was broken in running the opposite direction. You can easily test this by running it in one direction, listening to the RPM sound and then running it the opposite way and comparing the sound. (Switch both the leads and prop position.) If there is a noticeable increase in RPM (higher pitched tone) then you may want to save that motor for use in its original direction.

MOTOR MOUNTS - Note that your motor might fit very snuggly at first on the mount. As it is used it will loosen up or you can light sand it for a better fit. We've noticed some variation in the motors we've tested and elected to leave it on the tight side instead of having it start out possibly too loose. If used when too tight, be careful to work the motor off the mount while holding the mount tightly by pinching the tubes together at the wire ties instead of just pulling it straight off as the mount itself could pull out of the frame. If it ever does loosen up on you, a light coat of thick CA or wood glue allowed to dry will snug it back up.

Disassembly:

Just do the reverse of the assembly except leave the center frame attached to the sail. When rolling up the sail, don't try to make it too tight since if the ribs get compressed they may want to flatten out and lose their shape. This would mess up your airfoil.

MUST READ - Preflight:

With portability comes responsibility. You'll need to do a quick visual preflight and "walk-around" to assure everything is in order. Check for all of the following prior to flight and especially after a "crash":

- All nuts are finger tightened snugly especially at the tip rod attachment. (don't try to tighten this one all the way flat, just snug)
- The motor is pushed onto its mount tightly.
- The prop is secure and installed correctly.
- All the sail tension bands are connected properly.
- The control linkage is connected.
- The ribs are all upright and seated fully in their pockets. (The center rib inserts from the front of the sail by the way.)
- The LEs and spars are fully seated in their attachment sleeves.

Voice of experience:

I've had all of the above problems happened to me at one time or another during the testing period. One example that really stumped me was the following:

After a severe impact during crash testing (yea, right...), I found that most of the rubber bands had either broken or popped off but no other damage was visible. I put new ones on and continued to fly. From then on the plane wanted to turn in one direction no matter how much trim I gave it. I examined it numerous times to determine why but found nothing wrong. Only after disassembling it at home did I find the reason for its unusual behavior. The impact was so severe that it had knocked the LE tube out of its connector sleeve at the nose! Since it stayed hidden within the sail pocket I didn't notice it at the field but this changed the tension on one side of the wing causing the turning. Obviously you can't do too good a preflight!

Know your model:

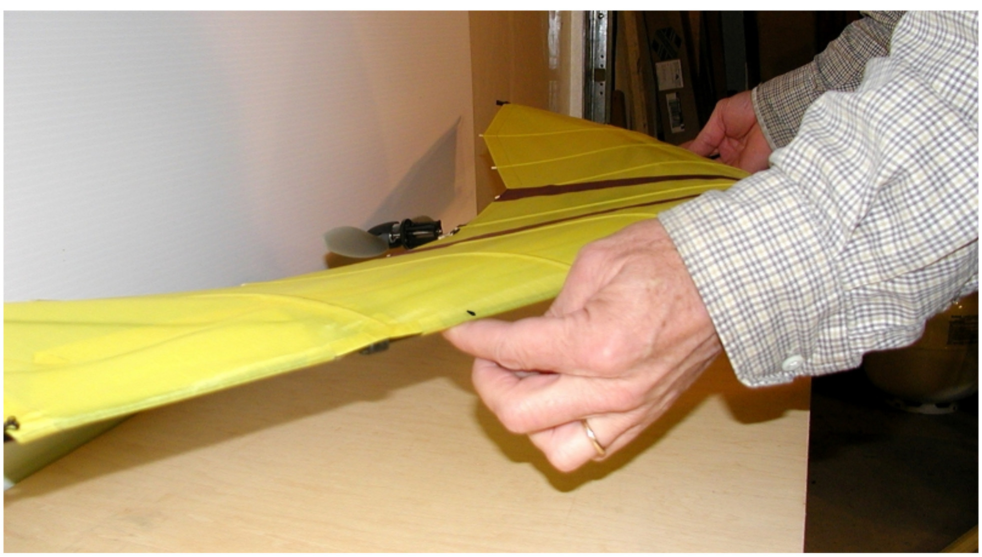
Memorize how the sail shape looks at center trim by eyeballing the TEs from the rear while sighting forward along the center frame. If the servos are centered and the wings are not symmetrical or the TE of the wing tips are not raised the proper amount, you've got a problem. Don't even think about flying until you find it and fix it.

The same goes for the CG. Even a soft landing can cause a battery pack to shift in its bands and change its position (a little Velcro helps here). If you don't get in the habit of checking it each flight then sooner or later it will take a hard nosedive on launch from being nose heavy, or pitch up (usually) out of control from being too tail heavy! If just marginally tail heavy, it may seem to fly okay at first until you add any pitch change and then it will start pitching up and down wildly and be VERY hard if not impossible to control. This is normal for any plane with a too rearward a CG location by the way.

CG:

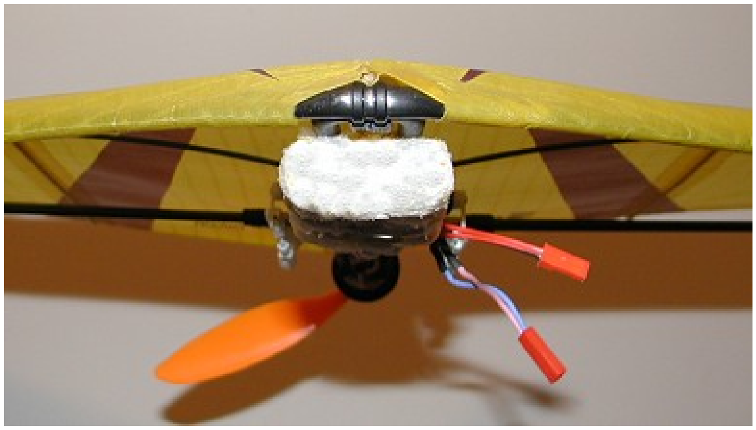
The proper CG of any plane is where it flies correctly no matter where the directions say. Keeping this in mind and the fact that the CG range for flying wings in general is very small, finding the correct location is important for the Carbon Falcon to fly at it's best.

Instead of trying to balance the plane from the center frame underneath which is awkward at best, we've put CG indicators out on the wings leading edges at 8.5 inches in from the sail tip. This allows a much more precise setting due to the wing sweep angle stretching out the range.



With the plane pointed toward you, balance it with just your fingertips at these locations on the tubes. If the nose droops, slide the battery pack back just a fraction of an inch and test again or move it forward if the tail sags. For use without the suspension rods (see end of manual) balance the wing at the nose about 1 inch raised from level. After test glides, mark the battery location on the frame for future reference and get in the habit of checking it often. The entire range of CG can be adjusted when balanced on the marks just by viewing the raised nose.

With the speed rods installed the CG will be more forward than without so start with the plane balanced about level on the marks with their use and trim the pack location for best glide prior to powering up.



This is about what you want to see when balanced properly viewed head-on at "flight level". (non-suspension rod use)

The most important step is having the CG set properly for a good long glide with full control. Once this is achieved, the rest is easy.

If your plane seems to trim out just fine under power but wants to pitch up once power is cut, then it is a little tail heavy.

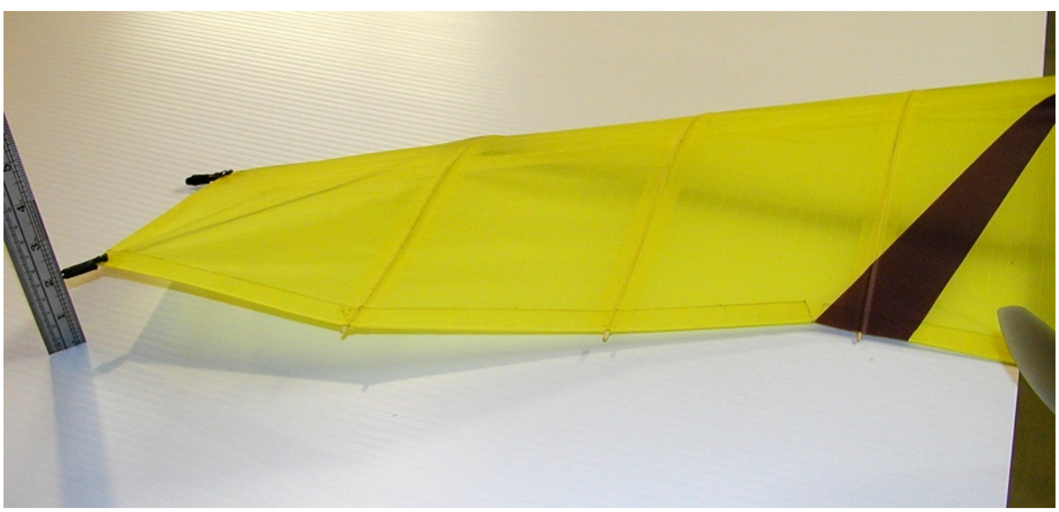
If it wants to nose over or dive once power is cut then it is nose heavy. This is because the prop has a stabilizing effect on the plane in flight.

If the CG is perfect it should just transition from level cruise under power to steady glide without any control changes needed.

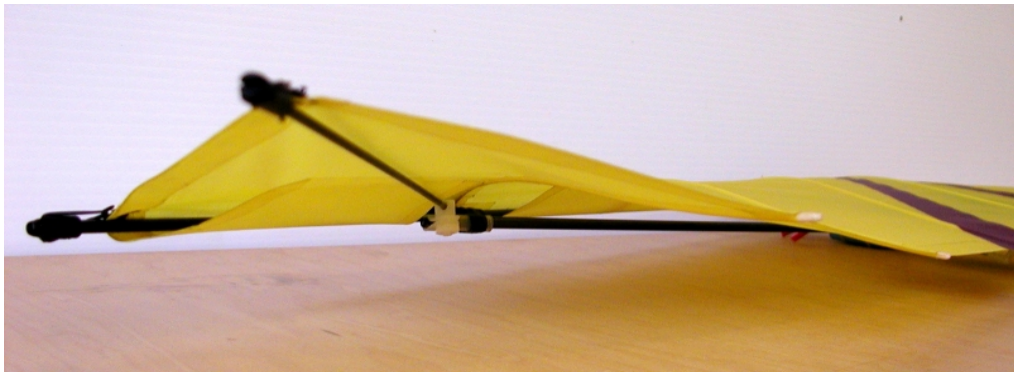
You may find that if you like to run on the tail heavy side of the CG, that as power is cut the nose rises, the plane slows, the nose bobs down a little etc. as it finds it's new balanced trim speed. This setting is good for soaring as you usually want to trim for your minimum sink speed then lower the nose as needed to penetrate to the next thermal. This is also a good setting for stunts as although not as stable, you'll have more control authority for maneuvers.

Trim Adjustment:

Ideally, you want the tip rod to be raised about 2.25 inches above a flat surface at the TE with that wings LE and spar tubes placed flat over the edge of a table. Don't sit it on the servo linkage, just up to it at the table edge. Measure it with the servos set at center trim on the transmitter. Have radio on when checking and motor disconnected for safety.



If your CF included servos, they have been factory adjusted within this range. However, our test equipment may not center the servos exactly the same as your radio does so it is important to check this prior to flight. We offset the servo horns a slight amount forward of the vertical position for control differential as previously recommended. If the tips are not raised enough you could end up with stability problems or if they are not equal on both sides you'll have some turn built in.



If for some reason your radio system center trim setting moves the servo horns from this slight forward position, then you'll need to either relocate the servo horns to re-center them on the servos or program the trims to center them from your radio.

You want to find the best setting allowing full trim range on your transmitter to be used. If the tips are set too high for example and you compensate with a slightly forward CG it will fly just fine but you may run out of up pitch range since the higher the tips go the tighter the sail gets. Again, test the control range in all stick and trim positions. Memorize what the sail looks like for later reference at the field when doing your preflight. Also note that unlike elevons, you never need the wing tip to lower much if at all below level since the wing camber by itself has all the down effect you'll ever need.

Tube Alignment:

Assure that the torque tubes and spars are in line with each other when viewed from the rear. It should be noted that they should also be lined up with each other if sighted along them viewed from the ends. The center frame tubes are not supposed to fit all the way forward into the nose rubber connector to allow some shock absorption in case of a nose-in. If these tubes do get pushed all the way forward say from an impact, then the wing spar assemblies will not be in-line anymore. This could cause binding of the linkages so this check should be added to your post-crash checklist.

The spar tubes are only a tight friction fit into the rubber LE connectors so it is possible but unlikely that they could get twisted and misalign the torque rods causing trim problems. They could be glued in but for service purposes we elected to trust that they stay in the proper position since we've never had a problem with them moving.

The LE tubes have a stop ring glued just outboard of the spar fitting. Since an impact will want to move the fitting outward on the LE, a stop on the other side of the fitting isn't needed. If you even notice that the fitting has moved away from the stop for some reason however, just push it back up against it.

Flying:

Your first flights should be in a big grassy field or park without any obstacles around to worry about. This includes spectators! You'll have plenty of chances to "show your stuff" once wired into the plane. In fact, it's hard not to draw a crowd wherever it's flown!

After your preflight and range test you are ready to launch.

Launch:

Hold the plane by the sides of the frame tubes just behind the spar. Keep the nose slightly raised and toss gently overhand.

CAUTION:

Since the prop swings down behind the plane, and your hand is in front of it to launch, DO NOT run the motor until it's well clear of your hand. It's best to do many glide tests (preferably without the prop installed) the very first time you try to fly it. If trimmed properly, it should glide a good ways out before a gentle touch down with a bit of back stick to flare.

First flights should be in little or no wind or a light steady breeze if you're familiar with wind drift. In this case, launch into the wind and make all turns into the wind until familiar with the handling characteristics. Always be aware of the attitude of the nose. Without a tail it is harder to reference. If you do slow it down too much, you'll find it will want to yaw one way or the other or waggle back and forth and try to keep flying. If you provoke a whip stall (or fall out of a failed loop), you may get into a very nose low attitude (like straight down). If so, immediately hold full back stick to pull out. If you get in trouble with wild pitching oscillations from over control, try letting go of the stick and let it fly itself. Or just bank it over and hold back stick and it will settle right down. In fact, you should be able to hold full up stick in a 45° bank turn almost indefinitely. The worst that will happen is that it will eventually degrade into mushy bobs and yaws as it wants to level itself out.

Control:

If you have prior flying wing elevon experience, you will feel fairly at home with the controls.

The Warperon™ responsiveness is somewhere between R/E and A/E control. If going fast they act more like ailerons. If going slow, more like a rudder with lots of lag time. If you haven't flown flying wings before, be aware that they are speed sensitive in that you will need to re-trim (or hold stick pressure) at different speeds to maintain level flight.

Don't over control. This is the most common cause of flight problems. This causes huge amounts of drag, degrades performance, and since the Carbon Falcon doesn't normally drop a wing and just yaws or mushes along when stalled, you'll just be ineffectively dragging it around the sky mostly out of control. Relax, let the bird fly itself and gently and smoothly guide it where you want. After you get used to its natural feel, you can then explore more severe bank and crank horsing around.

As is the nature of most flying wings and delta designs, You'll need lots of up pitch in tight turns as well as a little pitch down before rolling into a new heading. After a while you'll find yourself using stick stirs for rapid direction changes.

Be sure to keep your speed up for good control anytime you are going downwind. You're natural reaction to the high ground speed will want you to slow down but this is exactly what you don't want to do. More planes have ended in trees for this reason than anything else.

Slow Flight:

At first you'll probably fly it way too fast. This is okay since you'll have better control. Once you realize how stable it flies at all speeds, gradually raise the nose up and slow it way down, back off the throttle to prevent it from climbing and hang on the backside of the power curve. About 3/4 throttle should do it depending on the condition of your motor and batteries. Be very gentle on the controls so as not to upset the delicate balancing act you have going. Ease in a little turn and you'll find with a little practice that you can go anywhere you want while staying nice and slow, almost level, yet in complete control.

Stunts:

At very high angles of attack in a turn or when flying very slowly, if you try to quickly reverse direction without lowering the nose first, you'll find that the high wing just yaws back and the plane does a fast 180 or so and flies out. This is as close to a spin as I have achieved. Once mastered you can use this "trick" for stall turns, wingovers and the like.

With the minimal DX-A motor, loops can be done but have to be worked up to from a dive for speed and then are mostly flop-over at the top in nature. Inverted flight has been achieved but required full down stick to remain level.

I have not been able to perform any kind of decent roll myself with the DX-A drive. By starting very high and giving full down and left (to let torque help you) on entry I have managed to sort-of roll it but it exits most of the time at 90° from where it started, loses 50 feet of altitude, and isn't a pretty sight. With the addition of a brushless outrunner, decent rolls and inverted flight are no problem and loops are as large and round as you want.

This excess stability is credited to the wing shape and the washout which allow solid hands off flight even without any vertical surfaces. Normally flying wings in general are overly sensitive and prone to being unstable once they're pushed to their limits.

Note on Radio Interference:

There has been a lot of discussion on radio interference caused by carbon fiber tubing. After months of testing, I only ran into two situations where it gave me any trouble. One was where the wire strands were sticking out of the end of the antenna wire and intermittently brushing against the frame tubing. CF tubing is conductive so be sure the insulation is pulled fully over the end covering the strands and that there are no bare spots on your antenna wire.

The other instance of trouble was when on one early prototype a sleeve on a tube slipped out of position. This allowed direct tube-to-tube contact. Every time I moved the nearby servo, it caused the tubing to rub together causing a glitch. For a long time I kept thinking the servo was bad.

Additional Info:

Most owners will just assure the proper tip angle and CG and fly. Many pilots however want to learn more about the theory or how to tweak the most performance from their planes. The following addresses some details for a better understanding of how this unique design works.

Basics:

Assuming a planes "tail" angle is set properly (and other factors are constant), a slightly tail heavy CG will cause you to have to hold forward stick to fly level. If too nose heavy, you'll have to hold up elevator to keep it level.

Stability:

Most planes have a horizontal stabilizer at the back set at a slight negative angle to the wing to hold the nose up for stability (simplistic explanation). On the swept winged Carbon Falcon, the wing tips being behind the CG act as the tail. Since they are so close to the CG however, they must be at a much higher angle at the back to properly balance the plane. This is even more critical with an under-cambered wing which wants to pitch down severely. For level flight you need the tip rods at the TE to measure about 2.25 inches up from flat as mentioned. There is a direct relationship between this tip angle and the CG, as well as with the sail tension and airfoil shape.

Tweaking:

Starting with your bird trimmed for level flight with the tips set as recommended and at the correct CG, if you adjust the tips lower, you'll need up stick for level and if you raise the tips then down stick is required. Understanding this completely will do wonders at troubleshooting any trim problems you may encounter. Never change both the tip angle and CG at the same time or your reference is lost and the settings become meaningless. Only change one thing at a time and test it before changing something else.

If your sail is too tight your servos will have to work extra hard to raise the wing tips. This could stall a servo and cause you not to have enough up elevator just when you may need it the most.

The less tip angle you run the less stability you'll have but you'll gain a little more glide performance. Don't try to go too far with this or if the nose gets too low you'll get a tuck where no matter how much up you give it, it won't recover. The same goes for too rearward a CG location (balances farther out along the wing LE).

Due to the forgiving nature of the Carbon Falcon, experimenting like this is encouraged so that you better familiarize yourself with the planes stability envelope. Once you find the sweet spot, mark it and use it but in most cases the factory defined tip setting and CG should give you all around good performance with no bad habits. In any case, don't try to fly with anything less than 2 inches of tip rise. Using less than this and/or running with too tight a sail tension and you're just asking for trouble.

Construction Notes:

The torque tube attachments on each end have been glued to the correct angle on the tube to eliminate any unwanted rotation that would throw off the trim. In the unlikely event that one would get knocked loose from an extreme impact they are simply CAed in place. Use the opposite wings clamp position as a reference for the correct angle and don't get any glue on any other area. The pivot hinge tubes are directly next to these clamps and must stay free of anything that could restrict freedom of movement of the torque tube. Be sure that you don't slide the clamp so far on the tube that it eliminates the small amount of side-to-side free-play needed for a non-binding fit. Just a small drop applied to the outside ends of the clamps at the gap and allowed to bleed under them is all that is needed then quickly hit it with a little accelerator if available so it doesn't spread under the pivot sleeve or hold the end down to prevent running.

Replacement Parts:

Most of the fittings, nuts, bolts, etc. can be picked up at your local hardware store or hobby shop. The tubing is available from kite shops or on-line kite supply stores and replacement parts are available in the online store. There is a piece of clear ripstop repair tape included in the parts bag that is for any small tears or punctures you might get in the wing. Just cut to size, peal off the backing and stick in place.

Ribs:

In the freak chance that someone steps on your plane and breaks some ribs, you'll be happy to know that they are simply bamboo skewers available everywhere. You may wonder how they get shaped into an airfoil however. This is done by using a heat gun and holding them curved until you start to feel the bamboo "softening". Remove the heat and hold in position until cool. For the experimenters out there, you can even make different rib sets if you want to try out other airfoils.

In the field if you notice one rib has lost its shape, you can rub the area needing reshaping with your fingers and just when it heats up enough that your fingers start to burn, hold the curve in it and wait a few seconds.

The center rib is a 12 inch long heavy duty skewer that is inserted into place from the front of its pocket. Be sure it stays seated between the wire ties and resting on the front nose tube. If it gets pushed back too far it could drop down behind the LE and change the root airfoil shape. This will adversely effect flight and control performance.

See the "Owners Hanger" web page for a full size template if ever needed to make your own or check to see if they are holding their shape.

Airfoil:

The stock airfoil is an original 6CC-W4 which stands for 6 inch Coffee Can - Wrapped around 4 inches! If you need to make a replacement rib, just punch a hole the size of the skewer in the side of the can in one of its recesses. Drill it or use a small nail with a block inside the can to hammer on so you don't dent it. Next lean the nail over bending the hole elongated to hold the end of the stick flat against the can. Then soak a heavy duty bamboo skewer in hot water for 15 minutes.

Insert the stick just enough in the hole to catch it as you bow it gently around the can to hold it in place. Hold in this position as you heat it back and forth along the front half of the length. Once heated enough, you will feel it soften and start wrapping further around the can. When the stick is easily lying down on the can 4 inches away from the hole, remove the heat and hold it there for a few seconds for it to cool. Remove from the can and you have a "base" rib. It probably has too much camber and still needs trimming to length. A little reflex (upturned TE) needs to be added also if it is an outer rib. Note that each rib is a different length and slightly different shape.

Once cut to length, lightly sand the ends round to prevent slivers and allow easier entry into the sail pockets. To modify your base rib to the desired final shape, just bow the area where shape is needed gently by bowing and working it in your fingers over heat. For the reflex, just press the TE end down on a flat surface creating the up-turned bow, heat, hold and let cool.

Abbreviations and Terms:

A of A = Angle of Attack
A/E = Aileron Elevator
ARF = Almost Ready to Fly
BB = Ball Bearing
CA = Super Glue
CF = Carbon Falcon™ (also - Carbon Fiber)
CG = Center of Gravity
ESC = Electronic Speed Control
GWS = Grand Wing Servo brand
IPS = Indoor Power System
LE = Leading Edge
LiPo = Lithium Polymer - battery type
mAh = Milliamp hour
MG = Metal Gear
NiCad = Type of battery
NiMH = Type of battery
R/E = Rudder Elevator
RC = Radio Controlled
Root = center line of wing
RTF = Ready To Fly
SF = Slow Flyer
TE = Trailing Edge
Washout = Wing twist - tips at lower A of A than root

Conclusion:

Once mastered you'll be able to fly your CF comfortably in very confined spaces, catch the plane effortlessly and do maneuvers that spectators will swear need a rudder to perform. With the 700 mAh AAA NiMH cells we get over half hour durations with a little throttle management, and over 15 minutes at full throttle. 1200 mAh LiPolys are allowing close to hour long flights!

There is no doubt that this bird is different from other slow flyers. Once you've logged some time on it, you will be rewarded with an unusual, fun and exciting plane that can be ready to fly in a moment's notice almost anywhere you go. And instead of judging your planes lifespan by number of crashes as you would with so many other delicate slow flyers, you'll be counting the years it's still airworthy!

Designer's Note:

I personally love this plane a lot and fly it every chance I get. I'm sure you will too. To me it's a real "Zen" thing and a great way to unwind after all that tense stunt action!

Technical updates, tips, power mods, etc. will be posted on the "Owners Hanger" web page on a continuing basis so check in often: http://www.acesim.com/rc/p2/hanger.html

Keep wingin' it!

Sincerely,
Ken Hill - Ace Sim RC

8-04 Amended:

Since the Carbon Falcon was first introduced, many new advancements in electric flight have developed. Current Lithium Polymer batteries and small, light weight brushless motors allow longer flights at lighter weights with less noise and more power and with very low motor wear. It's a great time to be into electric powered RC!

Since we now carry complete brushless motor power systems as stock gear for the CF, the following has been added to instruct you in the proper installation of the components.

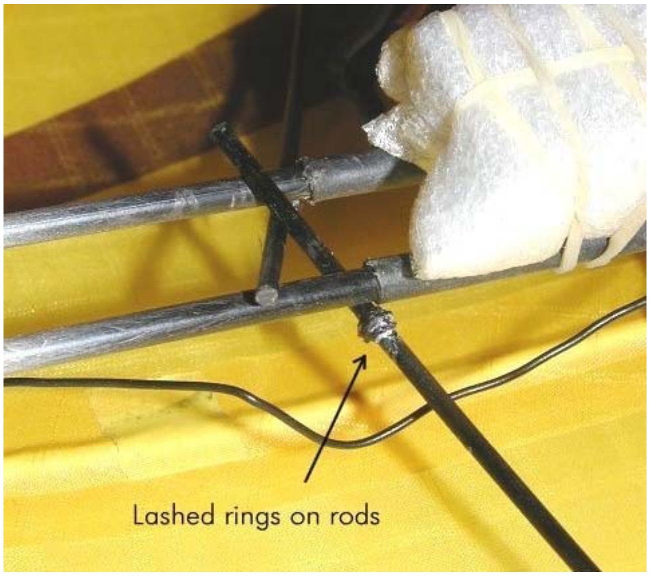
Suspension Rods (now included in all CFs):

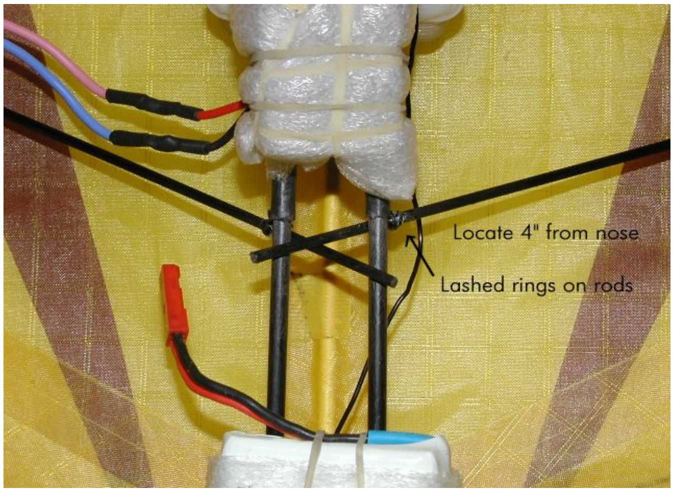
The Carbon Falcon is NOT a replacement for a high-speed foam combat wing so don't try to make it one. (That's coming later). It IS however a great slow flyer, light stunt wing, and with the addition of these rods, can handle higher weights, winds and speeds. If you just have to beef it up for more action and speed, please be sure to always use these suspension rods and limit yourself to a < 2 oz. motor with preferably a < 3 oz battery pack to keep it under 11 ozs total.

By adding these simple pitch suspension rods, the CF suddenly feels like a whole new plane; much more like a rigid wing with snappy and more precise control. The following pics should fully explain their installation.

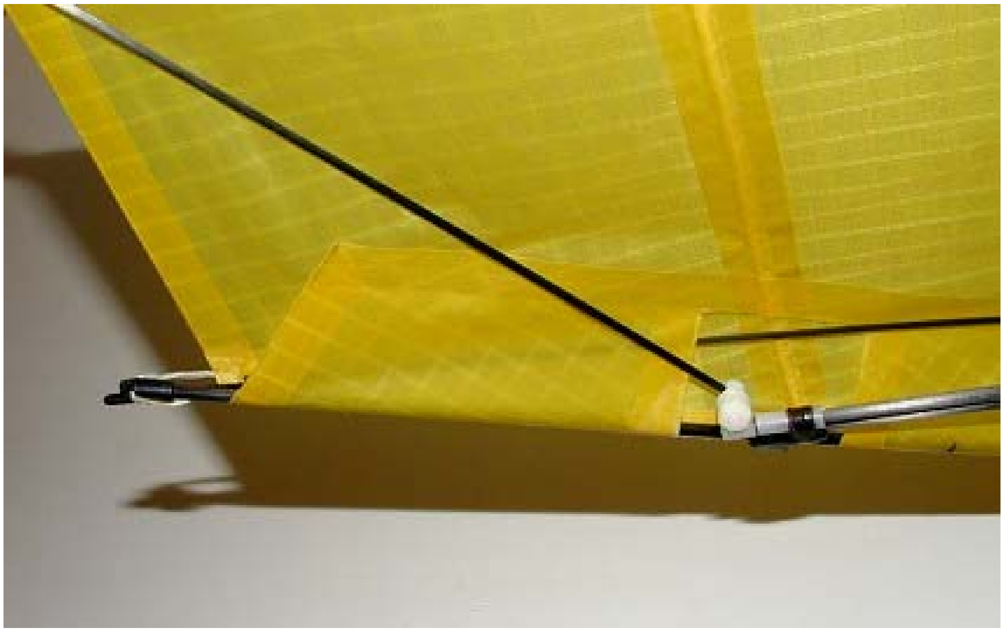
The rods attach and are held in the bowed position by inserting the ends with stops on them down through the center frame tubes (shown with plane on its back below).

The rods lay against the inside of the sail and their plain ends extend out through the tip extension bands on top the tip fitting. The angle that the root ends insert at between the center frame tubes tensions these bows holding the majority of the wing much more rigid. The rods should cross at about 4" from the nose. Depending on the gear you use this may vary some but you can lean the bow in the direction needed to keep it at about the1/4 chord sweep line near the root.





Rubber bands can be added around the center tubes and the X they form at the root to add additional assurance that they stay put if desired but ours hasn't moved under normal conditions.

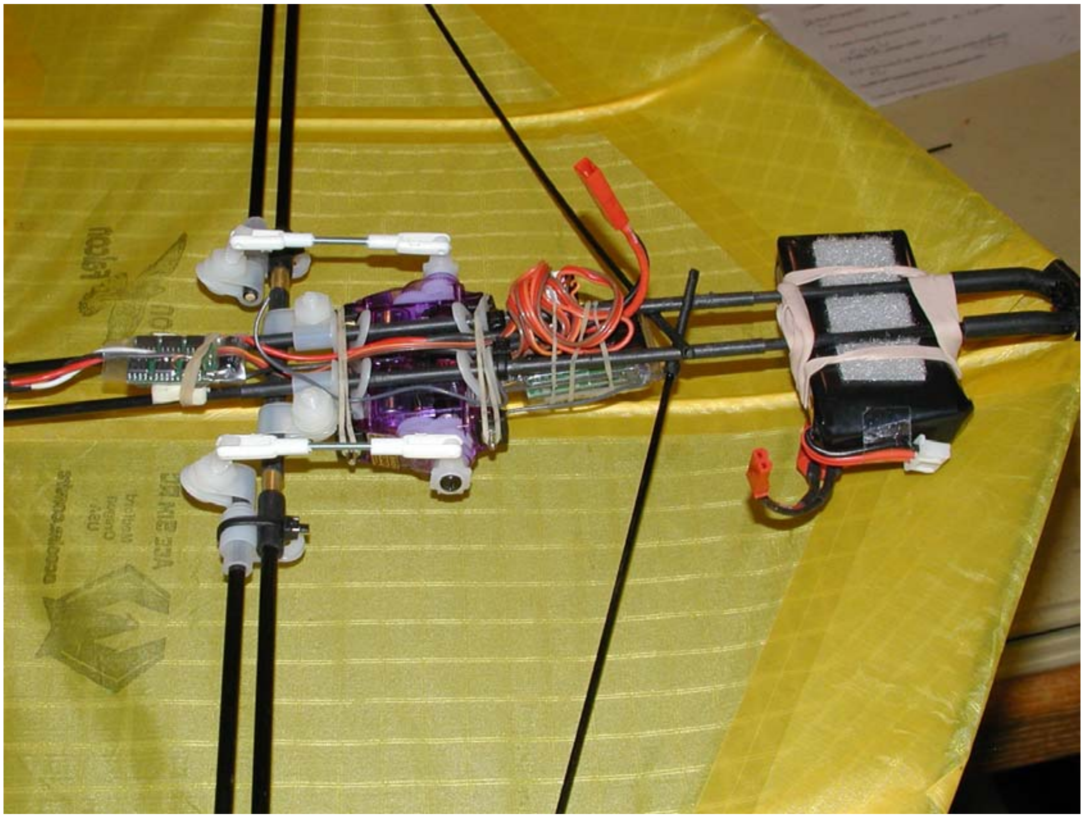


Insert rod through tip bands - (Viewed with plane on its back)

Due to possible radio interference from carbon fiber, it's a good idea to add heat-shrink over the rods at the root ends where they can rub on the center frame tubes (not shown above). Some can be added at the rod tips also or use rubber caps to clean them up.

Testing has been done with this addition from 8.3 oz up to 12.1 with excellent results. Maximum size motor tried to date is a Nippy Black 0808 turning a 10x8 SF prop with a Kokam 2S 1500 pack. Estimated about 12 oz thrust at about 10 oz RTF weight. Vertical climb wasn't quite vertical but almost and was unlimited. Due to the very sensitive nature of high speed flight with a flying wing, it is recommended that you use dual rates so you can have a reduced control travel setting for high speeds. More recent speed testing has been done with 1 oz outrunners with 8x4 prop and 3S 11.1vt LiPos with about 1.75:1 power to weight ratio with good results. Be sure to add some expo and/or dual rates for this level of speed performance as things can happen fast with a flying wing. ☺

Anyone with an old CF that shipped prior to the addition of the suspension rods who needs them but doesn't want to make their own (24" x .08 rod) can order a RTF set from the webstore.



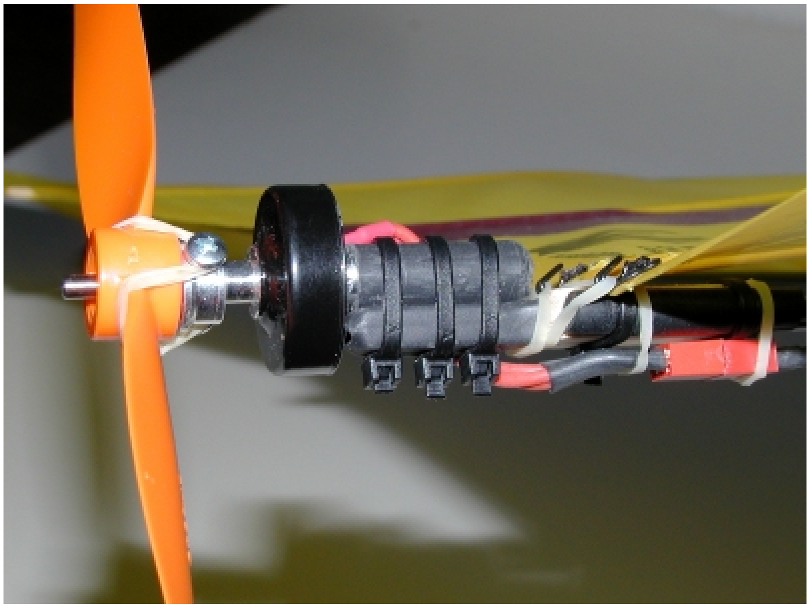
Note LiPo pack mount location well forward and above the center frame for protection.
Current servo mounting method is shown here also.

Brushless Motors:

With all the new mini brushless motors available these days, it's easy to upgrade to a lighter, much more powerful, longer lasting system.

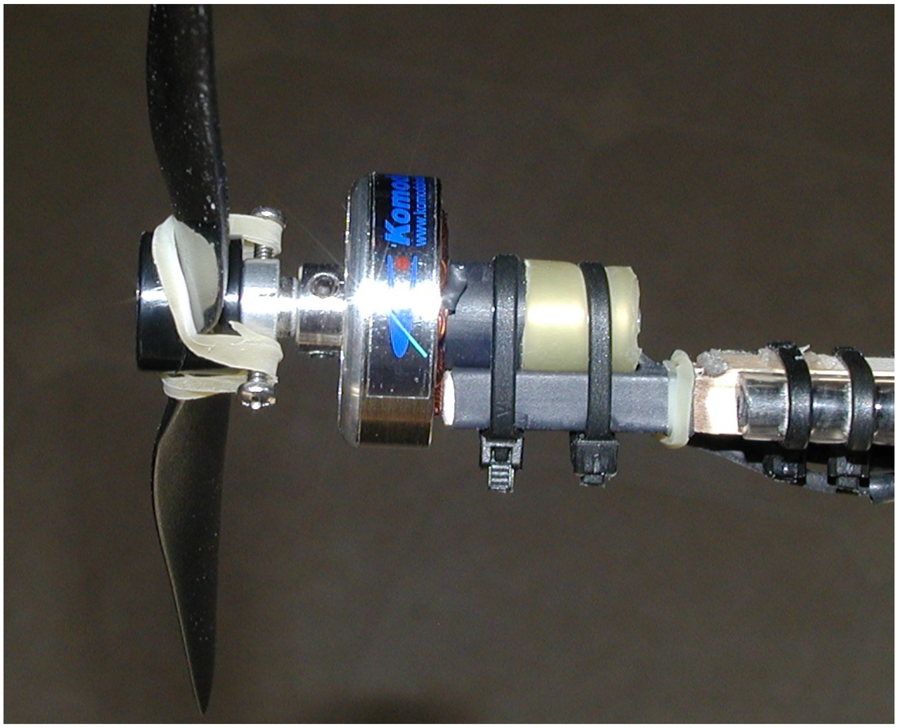
Some are just adding a 180 brushless inrunner to their IPS gear box and others like the outrunner style. CD-ROM motors at less than an ounce are everywhere it seems and even kits you can assemble yourself are available.

Here's an early typical post mount BL outrunner motor attached to the stock motor stick using some heat shrink and wire ties. Depending on the wind version of your motor, an 8x4 or 9x5 GWS direct drive prop should give you excellent performance.



The wire order to brushless motors doesn't matter by the way. If it runs in the wrong direction, just switch any two wires and be sure to locate the prop with its lettering forward for either mounting.

The following is our current motor with another mounting example. Note the use of a length of surgical tubing over the rear part of the motor post. This is to even out the stepped diameter post used on early version of these motors. This way a flat attachment to the mount stick can be made without any angle being placed on the motor that would throw off the thrustline.



Parts Dimensions:

- Leading edge tubes 24 x .157 inch
- Spar tubes 14 7/8 x .157 inch
- Torque tubes 14 1/2 x .157 inch
- Tip rods 9 3/4 x .098 inch
- Center frame tubes 11 1/8 x .125 inch
- Suspension rods 24 x .08 inch
- Threaded rod 2 1/8 inch 2-56 thread
- Nylon bolts & nuts 8-32 thread