Hello, every one, this is rc-toy-shop, how are you!!
In order to make you all know very well about the helicopter, we send you for free this E-book. Hope you will like it.

This Helicopter eBook has emphasis on the Walkera Dragonfly #4 & #35.

I hope I enlighten you to the extent you expect. Meantime, one step at a time. Right now, let's get into some theory and understand what it is we got involved with.
Originally, these were going to be sections A through E. I know you want to get hovering soon.

Warning: Chapter 6 is potentially dangerous, wear safety glasses or don't attempt!

A) How the Bell-Hiller head operates
B) Collective pitch & Auto rotation
C) Tail function
D) Engine torque effects & inertia
E) Videos of things when done the WRONG way

1) Buy these tools...
1) Making a Pitch Gauge for a dollar

2) Proper charging and SAFETY with Li-Po batteries

3) Opening the box & what should be there
3) What/where/how to order parts & How much?

4) WALKERA Tx Switches and EXACT functions
4) Rx plugs and correspondence to Tx switches
4) Servo connections to the Rx
4) PLT & PZT? WARNING!!!

5) Head Balancing [for ALL helis]
5) Use of a gram scale
5) Flybar adjustments
5) Helicopter CG and battery placement

6) How to REALLY track the blades (Be CAREFUL!)

7) Tail rotor/gear & Main Drive adjustments
7) Gyro adjustments/placement & tailfin changes
7) Incorporating the "Lazy Susan"
7) Fitting the canopy and adding a switch

8) Preflight Checklist & choice (Carpet, concrete, grass) of environment
8) What to look for after a crash

9) Blade tip LEDs for tracking & night flight [How to]
9) All the gears you want... from Long Island for pennies!

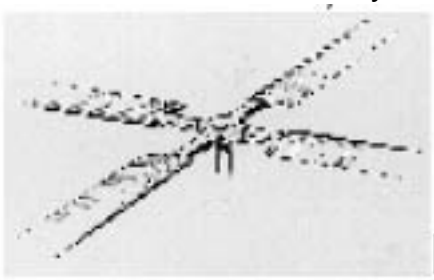
10) Dragonfly #4 and all fixed pitch chassis tweaking 11) Aerohawk XR-1 chassis tweaking

How the Helicopter Flies...

A Simplified Description of How Main Rotor Blades Work

Flight of a helicopter is governed by the pitch or angle of its rotor blades as they sweep through the air. For climbing and descending, the pitch of all the blades is changed at the same time and in the same degree. To climb, the angle or pitch of the blades is increased. To descend, the pitch of the blades is decreased. Because all blades are acting simultaneouly. or collectively, this is known as collective pitch. For forward, backward and sideways flight an additional change of pitch is povided. By this means the pitch of each blade increases at the same selected point in its circular pathway. This is known as cyclic pitch.

With these two controls in mind let us make an imaginary flight. With the engine warmed up and the rotor blades whirling above us in flat pitch, that is, with no angle or bite on the air, we are ready



Flat Pitch

We increase the collective pitch. The rotor blades bite into the air, each to the same degree, and lift the helicopter vertically.

Collective pitch

Now we decide to fly forward. We still have collective pitch so that as each blade passes over the tail of the helicopter, it has more bite on the air than when it passes over the nose. Naturally the helicopter travels forward.

Cyclic Pitch

Now we decide to stop and hover motionless so we put the cyclic pitch in neutral the rotor blades now have the same pitch throughout their cycle, and the collective pitch holds the helicopter suspended in space without moving in any direction.

In short, it is the cyclic and collective pitch which gives the helicopter its unique ability to fly forward, backward, sideways, rise and descend vertically and hover motionless in the air making it one of the most versatile vechicles known to man.

This is a very spendy hobby that will require lots of time, patience and money. The fact that you went with an electric helicopter shows that you are environmentally conscious and enjoy small precision machines. But I'll tell you now, it is not easy to fly. You have to sift through tons of BS and options before deciding on which items are best for you. You first learn to hover and then proceed to maneuvering flight, the latter of which is much easier! Transitioning back to a hover for landing is a nightmare!
On a lighter note, do not feel so down if you break $100 worth of parts.

Take some advice our book give to you and try it again and again, you will be a good pilot !

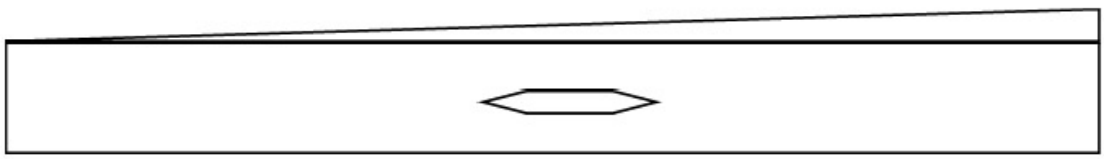
1) Buy these tools if you think you need.
(must haves are **bold)**

2) Loctite 242, or Permatex medium blue. Remember, it needs to be removable! $3.50

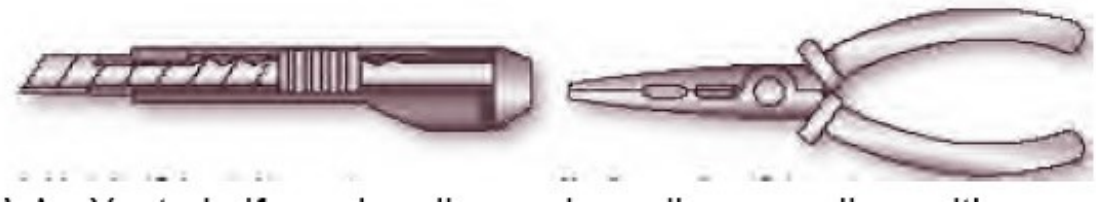
3)
RTV silicone sealant. VERY important! $3

c) A set of metric hex keys which include 1.5, 2 and 2.5mm. Get the best quality you can find. $6 Also, a 1/16” SAE hex, for stripped setscrews.
Note: While you're at it, grab 1.5 and 2mm setscrews, since you will find stripped screws pretty soon! 6-10 of each should do it. .25 each, may be hard to find.

d) A pitch gauge to set the slant/pitch of your blades. $15 - $25, depending on which and from whom. Once you know your settings, variable gauges are overkill. You can also make one by using a protractor. Draw a trapezoid like this:



The top angle needs to be 5° (beginner), this represents mid throttle on left Tx stick. When the blade is pitched 5°, the upper edge will sight LEVEL with the flybar. See prior photo. Now make one 8-9° to represent full throttle, and 0° to represent idle. Note the cutout in the middle so you can install it on the blade. If you make (2) of each angle, this goes much quicker. Also, gluing the paper onto cardboard and cutting with a straight edge and razor would be good. The angles given in the Walkera book are NOT for beginners, that's why this thing's so touchy in hover.



e) An Xacto knife and really good needle nose pliers with a cerated inner surface. We'll need these to remove jammed or stripped screws. Also, a small flat blade screwdriver.

f) A cheesy phillips screwdriver, because you can't over tighten anything with it.

g) A digital multimeter... see below! Note: eBay = $3 w/shipping!
h) A small SPST switch rated at 5 Amps with solder tabs on it, and a soldering gun.
i) Go to Home Depot and buy one of those wall mount lamp timers. You still need to watch the charger, but this way it will turn off after an hour! You should also use the multimeter to measure voltage and amperage on the battery. The only issue is... the battery discharges back into the charger, as the light turns green. This may indicate a fully charged battery, but since we have no documentation...

j) An Energizer Ni-Cad battery charger, with (8) AA cells. Charger only comes with 4. You'll use these in the transmitter. Every 2-3 days, you alternate the front 4 and the back 4 in the charger overnight. Let them cool down a bit before putting in the transmitter battery "brick". It has always been customary to use Ni-Cad rechargeables in the Tx, plus there is a power indicator up front which actually works. These charge to 1.4v each, use your meter and when they get down to 1.2, time to recharge!

k) A "lazy susan" turntable. You can clamp/duct tape the heli to this device and go CRAZY with all the controls and settings you try and nothing will get damaged. It will keep the machine on the ground, yet allow FULL tail control through all possible throttle/pitch/gyro settings. It will allow you to tune your heli to really hold the tail still for you and it is the way the factory *should* set it up. but sometimes we are very curious and move it by ourselves. An old turntable with the bubble balance from a 1960's stereo system would also be ideal.

l) If you want to make your own training kit, buy 2 tomato plant sticks in gardening at Home Depot and 4 foam balls at a craft store. Put balls on the end of the sticks, then criss-cross and twist tie them to the landing struts.

Flight Simulators:

This was worthy of it's own category and will get a dedicated chapter eventually. Remember, when running any simulator through your transmitter... unplug the crystal from the handheld to disable the RF output of the unit and extend the life of the AA batteries.
l) RealFlight Generation II RC Flight Simulator, comes with a controller that models a real radio. I am not making this mandatory, it's up to you whether to spend the money on parts, or a simulator. RC Helis are spendy, compare the shipping fees of a switch harness for a plane and one for a Heli from the same dealer on eBay. FMS is a freebie, It's amazing what you can get for FREE.
One of the user states:
My simulator works with cheap game pad controller, and with any USB RC Transmitter controller. In addition, most cheap "serial" cables can be used if you install a program, called PPJOY (do ggole serch to find where to download it) So, Walkera cable will most likelly works with ClearView by using PPJoy. On your last question, will it run on 98windows se, the best answer is to try it. The program generally requires OpanAL driver and 32mb 3d video card. The processor speed is less important than the video card. Any recent (<3) years video card will be fine.

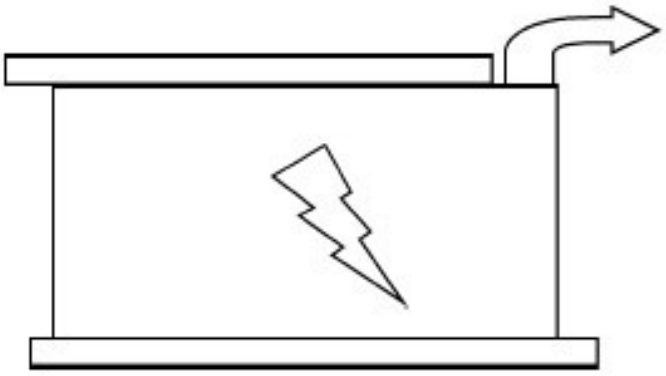
2) FACTS ABOUT LI-PO batteries

Li-Po batteries have an energy density which is four times higher than conventional Ni-Cd or Ni-MH batteries. These batteries are not as stable as Ni-Cd or Ni-MH batteries. ***When they become unstable there is a risk of explosion. When the voltage becomes too high or too low, a cell can ignite and cause the battery to explode.***

TRANSPORT & STORAGE
To avoid dangerous situations, always store and transport the Li-Ion or Li-Po batteries in a fire-proof case. When the batteries are outside the case, never leave them unattended. Always store the batteries fully charged in a secure area and avoid short-circuit. **[Most buy a strong box from Walmart.]**
MANIPULATING
• DO NOT store at temperatures above 45°C (113 F)
• DO NOT charge at temperatures above 45°C (113F)
• DO NOT expose to temperatures above 60°C (140F)
• DO NOT disassemble, crush, puncture or incinerate
• DO NOT short external contacts or reverse charge
• DO NOT immerse in water
• DO NOT drop or strike **[Causes internal polarity reversal, as per Hazmat.gov]**
• DO NOT place in microwave oven, standard oven or pressure container
• DO NOT eat the battery **[Did you want fries with that?]**
• DISPOSE OF AT AUTHORIZED BATTERY DISPOSAL SITES ONLY
• DO NOT over charge **[see charge parameters with volt/amp below]**
• Stop flying when the power starts to fade
• DO NOT expose to fire, heat
• DO NOT drill, cut, bend or crush
• Only use appropriate charger

• Never leave battery unattended while charging
• Only use the battery for the ZOOM 400 (see required battery)
• Not to be used without adult supervision
CHARGING OF LI-ION & LI-PO
• Always use an appropriate charger
• Check your charging parameters before each charging cycle
• Use a stabilized power supply to power your charger
• Never leave the battery unattended while charging
• Place the battery on a fire-proof surface while charging **[garden slate/cinder block on top]**
• Clear the area of flammable objects within a radius of 1.5 meters.

Battery Bunker



Battery Bunker
Place garden slate/slab on ground,
Cinder block on top of that,
Cover with another slab,
LiPo charges & stores inside. Arrow = wire out to charger
USE IN MODELS
• Never short-circuit **(Can happen if dropped, according to Hazmat.gov)**
• Never completely discharge the battery **(don't "cycle" them like Ni-cads.)**
• Stop flying before the power starts to fade
• Regularly check the battery temperature
• Let the battery cool down after flight, charge the battery when it is cool (to store or to fly again)
• When the power output of the charged battery is insufficient to lift the helicopter, dispose of the battery immediately.
Rules to follow:
If the pack is 11.1 volts, output of charger should be the same. 9.6v pack, also match this. If output current of charger is1000 mAH (1 Amp) these LiPo packs would be charged for this length of time:
1000 mAH pack @ 1 Amp with matched voltage = 1 hour
2000 mAH pack @ 1 Amp with matched voltage = 2 hours
1500 mAH pack @ 1 Amp with matched voltage = 1.5 hours, etc.

Go to Home Depot and buy one of those wall mount lamp timers. You still need to watch the thing, but this way the charger will turn off after an hour! You should also use a multimeter to measure voltage and amperage on the battery.
3) What's in the box?

one customer says:

It's about 3' long and 1' deep. Mine was wrapped in paper, but customs unwrapped it... probably due to the suspicious shape. So, expect the wrapping to be tampered with. Even has a carrying handle, ew!

Note: The box states (8) AAA batteries are needed, they're AA's!

The heli is twist-tied to the base and a foam block is used to hold the blades. Save it and trim it down because it will be good for regular transport to your flying site!

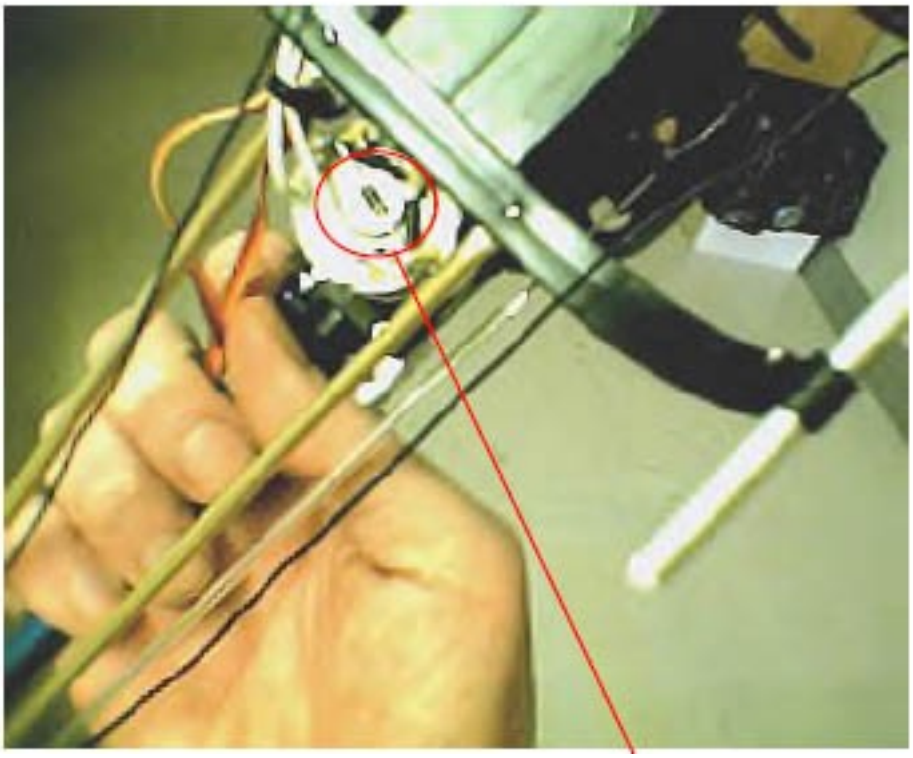
Remove the nose canopy from the right hand side of box.

After removing the canopy, lift out the packing plastic and you'll find the LiPo(s) TAPED to the underside.

WARNING: Sometimes these are shipped CHARGED already...

For example,The charger, GM-12W has an LED on it that is RED when it has a load, GREEN when it does not.
The LED does turn GREEN when the Li-PO is charged, whether it still draws current is unknown.
It is 12.6v @ 1 Amp output. Remember Ohm's Law? P= I x E, or Wattage = 1Amp x 12.6volts

Remove heli from box by undoing the twist ties at the base. Carefully remove foam blade retainer.



Looking from underneath, notice the (black) diode and 3 (beige) capacitors on the motor terminals: exposed wiring and cold solder joints! This should be resoldered to carry the current better.

Then, use your RTV to coat these exposed leads to prevent shorting that could lead to immediate power loss OR radio failure! Overnight dry time.

FYI: If the heli is in flight and loses radio signal from the transmitter, the receiver is pre-programmed to kill the motor after approx. 10 seconds. It will in effect fall out of the sky.

Also note, one technician says: " I have the receiver antenna extended to the rear tail fin, not wrapped around the landing skid with tape. Doing this effectively makes the antenna act like an RF choke, changing the reception frequency or the range". Also, never cut the antenna, which also inhibits range and may
change reception frequency!

Remove the transmitter from the box. Note: The antenna does NOT go in easily.

Remove any spare blades/parts you may have ordered. Note the inside of these “foamy” blades.

Two plastic rods run the length of it, giving it strength and inertia during spin. Otherwise, these would flex wildly. The colored tape on the blades (red/blue) is NOT placed correctly. Remove them carefully and start from the trailing thin edge of the blade, go around the thicker front and back to the trailing edge on the opposite side. Cut off the excess with your Xacto knife and CA glue at the ends. This mod is to keep the aerodynamic shape of the airfoil intact and also the air

pressure will ensure the tape is always pressed to the blade, since now the seam is at the

rear.

HM035-015 is the correct part to order, the rear bevel gear! This is the one that gets trashed
when the tail strikes the ground, I would order 6-8 of these with the machine, along with 3 sets of tail blades (HM035-016) because on a tail strike, usually one of the 2 will survive. Main Blades (HM035-042) 4-5 sets. This is your only chance to get parts under the original shipping fee.

4) The Walkera Transmitter

For the price paid, this unit is pretty decent since it's a Futaba knockoff. It is unfortunate it does not have exponential control for the right stick. What this does is make your forward/aft & right/left controls (on the swashplate) move very slowly with less deflection near the center point, but with more deflection out near the end of the stick's limits. This would have been a great aid in helping you learn to hover. I have another fix for this however, which will be made on the helicopter at the servos.

Shake the transmitter! My gimbal springs were sprung inside from the aileron stick, so shaking will reveal any issues rattling around inside. Go around the radio, tighten all hex screws and phillips head screws on the case. The retail on this is $40, so don't expect much.

This radio has detents on the left stick throttle control, which allow you a fixed number of speed positions instead of just linear control throughout. It may happen that your ideal throttle speed for hovering without rising or falling is right between two detents. The only way to eliminate this is to remove the metal clip inside the transmitter that accomplishes this.

I was going to include a guide to this modification, but the Walkera throttle stick literally falls to idle when the transmitter is held upright. It seems to have no binding except for the detent clip itself. With that in mind, we're movin' on! I will give you the mod if you are going to buy a transmitter tray. This will hang the radio at your waist flat and level. It will allow you to fly with your fingers instead of your thumbs, which would be needed to fly acrobatics. There is just not enough dexterity in the thumb to be able to fly well enough for it.

These are the default (USA) factory settings for the rear dip switch bank on the transmitter:
[left=off & right=on for all 10.]
1. Elevator [left] (reverses channel #1) (servo)
2. Aileron [left] (reverses channel #2) (servo)
3. Throttle [left] (reverses channel #3) (Note: paralleled to the ESC output to motor)
4. Rudder **[right]** (reverses channel #4) (servo)
5. Heli/Acro **[right]** (Tail rotor compensator: on increases tail pitch w/throttle, off leaves tail alone)
6. Tail C [left] (Compensator reverse, not associated w/gyro but is the reverse switch for Heli/Acro)
7. CCPM/Normal [left] (changes swashplate trim & throttle mixing)**[This is NOT a CCPM heli!]**
8. Unlock/Lock **[right]** (Puts PLT & PZT knob settings into memory & deactivates knobs)
9. Pit **[right]** (Pitch reverse, channel #6) (servo)[You may use this if head spun counterclockwise]
10. Gear [left] (reverse, channel #5)[Landing Gear switch for retracts is at upper left of Tx]
ESC: electronic speed control
CCPM: This is a collective pitch system which moves the whole swashplate up/down the shaft like a Honeybee. This machine is a clone of the Schluter Heliboy/Miniboy/ Superior from the 80's... it too had a rod up the mainshaft! This is a VERY versatile radio... just fix that damned Rx antenna!
These are the settings for Mode 1, 35MHz in Europe:

1. [left]
2. [left]
3. [left]
4. [right]
5. [left]
6. [right]
7. [right]
8. [right]
9. [left]
10. [left]

Here's the Mode 1 35MHz settings for Europe. The frequency crystal on the right with the channel number on it can be removed while running a flight simulator. This turns off the RF output section of the radio and makes your batteries last much longer!

Warning: the RX-602 antenna wire is made from solid wire instead

of #26 multi-strand wire. Notice in the right photo that they put the antenna through a plastic tube to protect it. Always range check your radio as vibration will cause this wire to break at some point down the road.

Range Check: Place the transmitter and model on a table at your flying site. Check that you have clearance or the tag for your radio frequeuncy and nobody is on it. Unplug/turn off the motor and Plug in the battery. This is the one time you can do this in reverse order, but the motor **MUST** be deactivated! If the servos are moving, someone's on your channel, do **NOT** turn on your transmitter, I've seen this cause scary crashes!

If the servos are calm, turn on the handheld. Do NOT pull the antenna up, inducing a shortened range. Now take a walk with your helicopter, keeping an eye on the LED of the receiver. As soon as it loses signal, it starts blinking and the servos will chatter at the fringe of it's range. Battery power in the Tx will affect the range also. Mine went beyond anywhere I could see to fly the little thing, about 150 feet!

This was in a long hallway, under flourescent lighting besides, they wipe out AM/FM radios!

If the antenna wire does snap, a short range check will be your first heads up, don't fly!

PLT: This is used to adjust overall throw of your blade pitch. Setting this fully counterclockwise will inhibit all pitch *changes*. It is set to 0 due to factory settings pre-programmed into the transmitter. The settings have been “locked” into memory, deactivating this knob altogether. Leave it off.
“The throttle curve controls the speed of the motor so as you increase throttle (raise the stick), the pitch of the main blades changes (due to the pitch curve setup) and the pitch of the tail changes (to counter react the increased drag of the spinning rotor blades).” ~David Day

PZT: This is used to adjust blade pitch. Also set to 0 out of the box. Setting is pre-programmed into the transmitter also and locked via dipswitch #8. For now, set it fully counterclockwise.

FLIGHT MODE switch! **WARNING:**
If flipped down to “1”, this causes the engine to
power up to full throttle and remain there no matter what you do! You will only be controlling the blade pitch on the throttle stick. This allows the inverted flight and acrobatics, which need a high head speed to create a gyroscopic effect from the main rotor. It may take years, you may NEVER be ready for this stage.
Many people have been hurt or lost the whole heli due to lack of documentation and attention to this switch. Make sure it is pushed UP or to “N” ALWAYS!!! We will *temporarily* disable this to avoid accidents. Note: “N” as in normal mode.

Don't even THINK about not doing this: Using some RTV or Loctite (see chapter 1) lock this switch in the **UP** “N” position. It can be removed later when your skills have progressed. Leaving it alone guarantees accidents, damage and massive part replacement expense if the whole system is powered up while the heli is on the ground and switch is in the DOWN “1” position!
I was writing down dipswitch settings for this eBook and it must have rubbed against my leg and gotten flipped downward. Luckily I had the whole head removed for photos to the next chapter. The motor opened up full bore, I lost the tail rotor pitch arms (35-022) and the main rotor pitch arms (35-028). The crap flew clear across the room right past my head. If the head/blades were on at the time... I would have been slapped in the chest! The main drive gear and clutch would have been TRASHED! Lock this switch... only a few people can use it anyway!

The motor just QUITS w/o warning and the S.O.B. falls right into the ground. I was tracking blades for a buyer, and the thing died in my hand. It reset itself at idle and I could continue.
1) Pull/reseat the crystal on the Rx and cover with masking tape.

2) If HOT, turn the whole Rx over to expose the Regulator chips to cool air and use heavy style rubber bands (like used for R/C airplane wings) and band it down with the chips upward. Keep rubber away from the 2 chips of course.

This is a Walkera, the 3-in-1 receivers are notorious for dying in the DF4... this Rx is the same thing... basically!
3) Change the receiver antenna to #26 multi-strand wire. Also known as “R/C hookup wire”.
4) Important: If you replace the plastic tail gears with a metal set... make sure to keep your antenna wire *away* from that area now, as you will have metal-to-metal RF radio noise which *will* now interfere with the radio control system. The only way around this would be to seal the gearbox and fill it with conductive lithium grease... not an easy modification.

5) Head Dynamics and CG

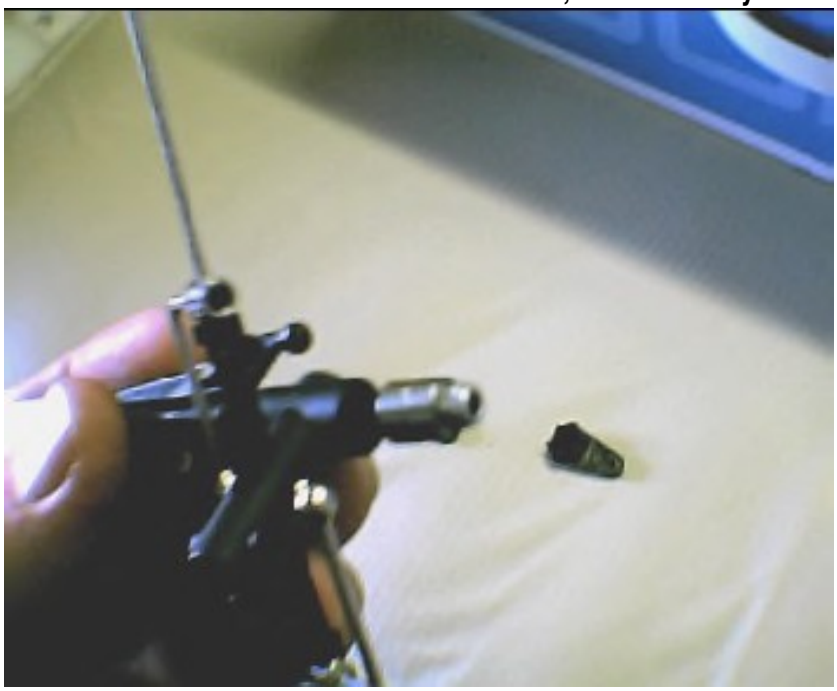
Prepare to remove the head by unlocking the pitch ball links (leading edge of blades)from the blade holders and these 2 swashplate rods. Do NOT use tools if you don'thave ball link pliers. Actually, you can use an ordinary fork! Put the tine right on the plastic ring and push the ball out with the side of a flat blade screwdriver.

Remove the rotor “Jesus” bolt and nut, again no Loctite! Hold the frame down and pull head straight up.

Tighten these 2 small screws if loose, right at the flybar seesaw pivot.
Note: No Loctite here, it has petroleum distillates and will melt the plastic.
You could use White-Out. Any loosening will crack White-Out and will be obvious at a glance.

Addendum: Tested this... Loctite didn't harm the plastic and is harmless to the carbon/glass material, use it sparingly on the thread of the screws. Watch & test, use judgment. I have read that coating a stripped out hole with CA glue and allowing to dry is effective.

Remove the blade and 2 blade holder screws, ONE side only!



Now you see 2 ball bearings and a hex nut on the end holding it all together. With a nut driver, tighten this a bit as it probably was loose or marginal. Don't over tighten, we just want to see metal past the nylon! Re-attach the blade holder with 2 screws (very tight!),then reinstall the blade, paying attention that it will spin clockwise and the little ball link is to the front. The blade should be just tight enough to not sag downward from horizontal. Use the other side as a reference. Now repeat this on the other side. For a fixed pitch machine, you sock down the blades pretty tight!

The “L” control arms (HM035-020) MUST be parallel to the flybar. If not, bend slightly by hand. Mine was bent at least 10 degrees out of the box!

Mine were so far off, this is the difference in length between the 2 sides. This will cause vibration and “hunting” or “walking” during flight. Maybe that's why it's called a Walkera?

A properly balanced flybar will look like this. Hold the 2 blade holders with their balls down and rest your thumb on the center hub to point it vertical. Flip a paddle down and let it seesaw back & forth. It should land level or near it. If you set it to level and one side falls down all the way, this guarantees the "shakes" and an unflyable machine. We need this flybar to balance as in the photo.

The "L" control arms are held by a setscrew, probably stripped like mine and void of Loctite! To get it out, try SAE sized wrench, like a 1/16". These can NOT have slippage,must be LOCKED/Loctited to the shaft. (Addendum: "L" is still movable on shaft even after Loctite!) You will have to work with BOTH "L" arms to get a level balance...

but make sure the paddle retainers (35-023) are all the way on and sock these setscrews down with Loctite. Mine was not Loctited. These have been reported flying off and penetrating drywall! While you are doing this, you must get the 2 paddles on the same plane as each other. In other words... in line and parallel. The plastic paddle is not threaded, nor is the retainer. Once the retainers are locked, you should be able to turn a paddle to get them both in line. If not, rotate the retainer and relock the setscrew.Note that the "L" control arms MUST also be in line with the paddles and each other. All 4 of these items, both sides of the center hub... must ALL be at 0° to each other.

Is there any plastic flash or "bumps" on the paddles? Trim it off now with your Xacto. Go back to the "L" arms and tweak them back & forth along the length of the flybar until you get balance. This process can take an hour or so but is necessary and mine was not balanced out of the box. It could fly, just not well! Note: This process is true for every heli ever made back to the 70's, it's never changed!

Using the vertical edge of a door frame, sight your 2 flybar paddles and see that they're in-line with each other. Ditto the “L” control arms. It works!

Using 2 identical books, set the head freely between them with the paddles themselves out past the top of the books. This way, it rolls freely on the flybar without any obstruction. Flip one blade down and let the whole sucker seesaw to a stop...

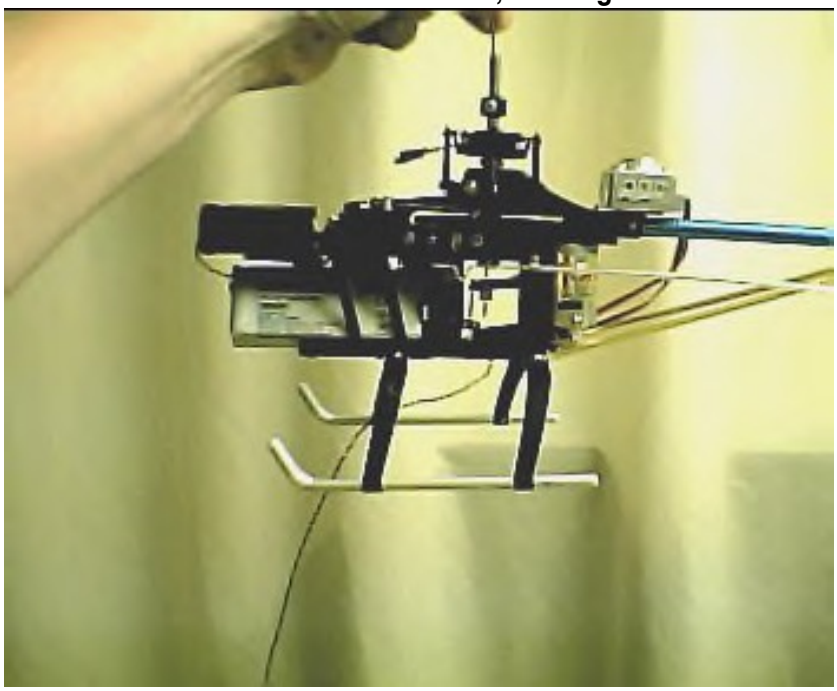
This is what you want to see! If one blade is lower than the other even by a little bit, the head's not balanced. With wood or carbon blades, you can sand the end a bit but these are hollow foam. Lay some clear tape around the leading edge of blade. When it balances out, take the little pieces of tape off, lay them on a tabletop end to end and measure. Now cut a new piece of tape that length and adhere it firmly to the front leading edge of the light blade and centered also. This is where the use of a gram scale comes into play. It allows you to lay each blade on it and weigh them individually down to a tenth of a gram deviation.

The red/blue tape on the blades is NOT applied correctly and is wrapped from the middle of the blade. It also is not adhered to the surface smoothly. Remove both pieces and redo it from top trailing edge around the front to the bottom trailing edge. Then trim off the excess with an Xacto knife. This also insures that any air pressure will keep them on since the edges are at the rear of the blades. The best technique is to mask/spray paint the tips with gold/chrome and track that!

Turn it 90 degrees and do the same for the flybar. There is not as much weight or inertia here, so even if you can set them to level and they're able to stay there... that's reasonable. So

long as one does not consistently fall to the floor, you're in range.Ideally, you want to see this seesaw back to level. You may need to tweak the balance with clear tape on the leading edge of the light paddle to add weight. Since these are not as long as the main blades, a slightly imperfect balance should not be horrendous in flight.

However: The better balanced all this is, the longer the machine will hover without stick inputs!



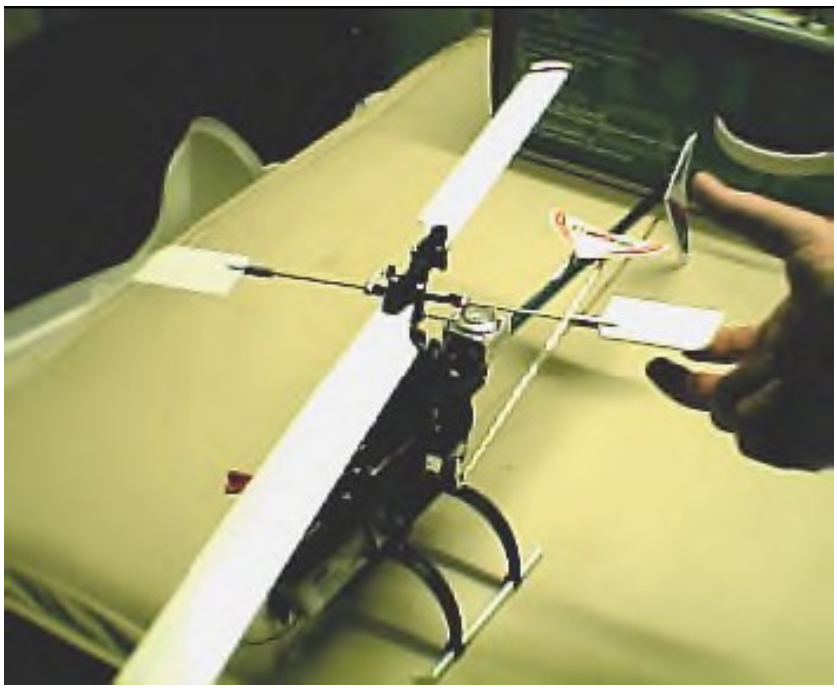
This is the ideal time to check the CG (center of gravity) by suspending the whole machine with a 1.5mm hex key inserted through the "Jesus bolt" shaft hole. Slight tail down, this battery can be shifted forward or I can use a bigger one. This is a 1600 mAH, a 1900 is just right. NOTE: See how I moved the gyro forward all the way on the tail tube? The way it was out of the box, you can NOT get this thing to balance. Your heli MUST ABSOLUTELY balance either level or a little nose down to make the machine stable and easier to both hover or fly around. With the canopy on, this will be fine.

Relocating the gyro down here is okay, but requires other mods to be done. Read chapter 7 first! You can velcro the gyro here or RTV. If it falls off, instant spin so don't rely on the original sticky tape. This is now at

the mainshaft, the gyro will sense turn quicker. Strap your battery in with a 1” wide velcro strap. It needs to be removed for charging anyway,the LiPOs are too unstable to charge in the machine and it would be foolish to do so. I think he can salvage the tailfin!

Mega Note: If you relocate the gyro... turn switch #4 off and reverse your tail blade holders so that the ball links are at the leading edge of the blades instead of trailing behind. Quite simply, right rudder on the stick makes it spin to the right. Turning the machine to the left (while held in your hand) makes the rudder servo arm move forward now instead of backward. I made this mod for CG issues to balance the helicopter, this may be too confusing for most to do. You can use putty in the nose of the canopy just as uccessfully. More in chapter 7 on the reasons for doing this mod to begin with.
The tail tube must be 0° with the top of the main drive gear, as this gear is always 90° to the main rotor shaft. Use a long straight edge or even sewing thread (end of chapter)to sight this. The DF35 tails all sag, due to those gold support tubes pulling it down.Also notice the rear of the landing skids are off from 0°, guaranteeing more tail blade strikes and more gear replacements. Get that tail OFF the floor!

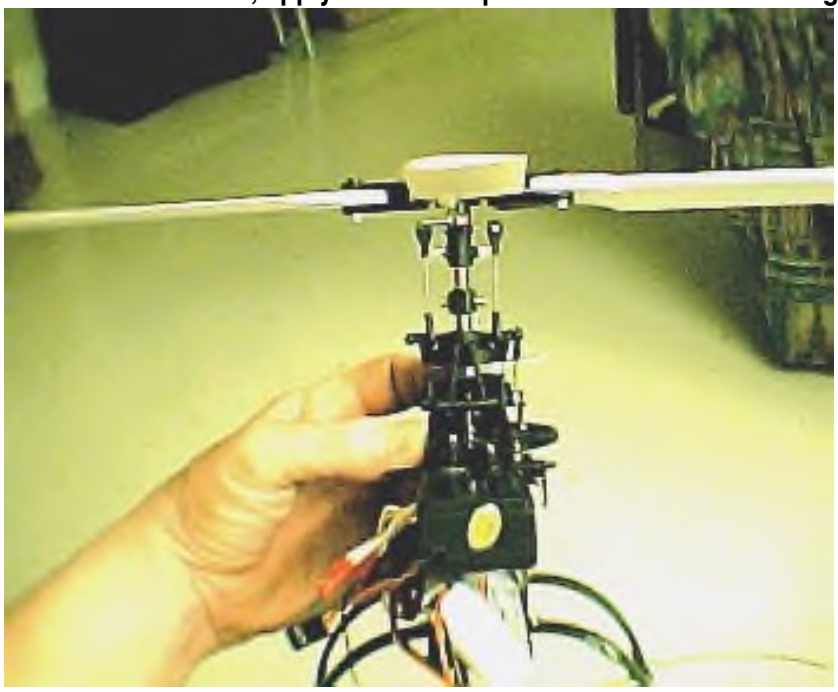
Simply turning the landing struts around so they flare back instead of forward made the tailfin over an inch higher! This way, it will walk away from you instead of back at you when breaking ground. With a triangle or folded piece of looseleaf, set it on the surface and sight the mainshaft now vertical.



Put the head atop the machine, do not reconnect anything. Flip the paddle up...

Flip it down... see where it winds up after seesaw. Somewhere around level? This would be good.

Reinstall Jesus bolt, apply Loctite to tip of screw or hex nut and tighten.

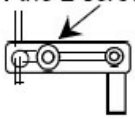


Level

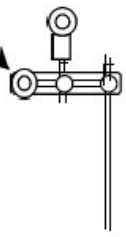
swashplate, both rods made the same length before install, “L” control arms at 90°, and flybar paddles also level. It'll fly smoothly. Now with the swashplate level, blade pitch at about 3-4°, the pitch control mixing arms (35-028) should be level also. Move the throttle to where the pitch block on the mainshaft is centered in the middle of the up/down channel in the shaft. The two lower arms will be level, while the 2 upper arms on the flybar will be either level or slightly downward...depending on how the linkage rods were Z-bended. With the swashplate perfectly level, just make sure you have

identical angles all over. **Note:** the 2 screws loosen up readily.

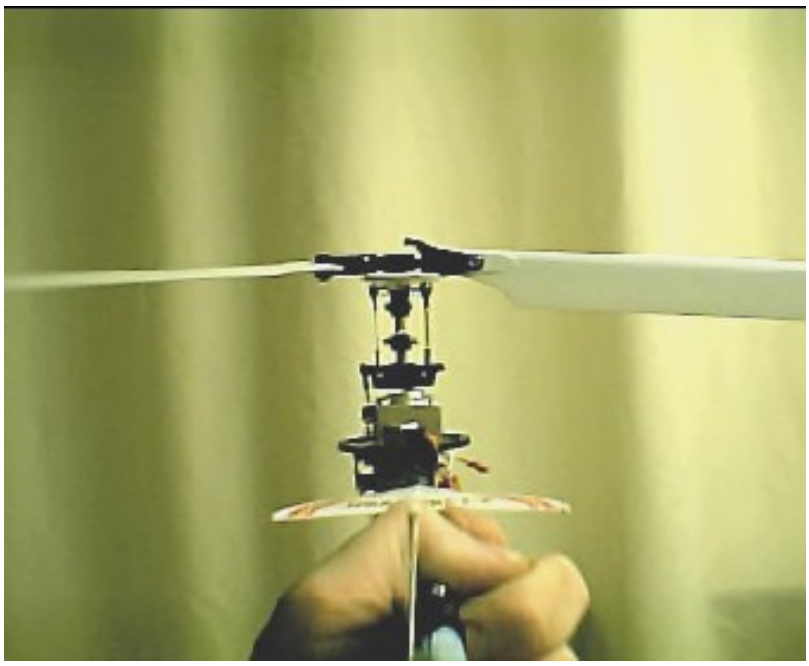
Lower



Upper

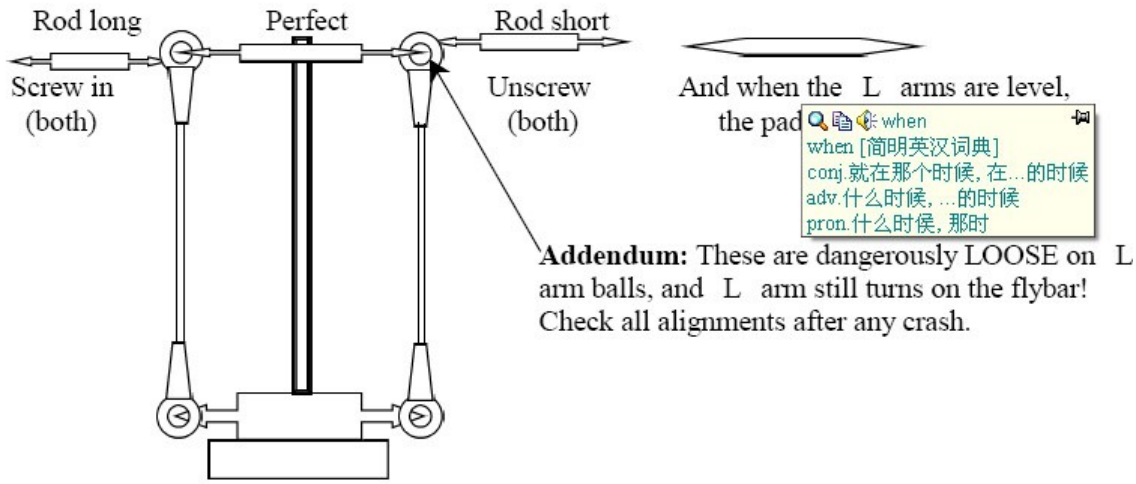


Clearer?

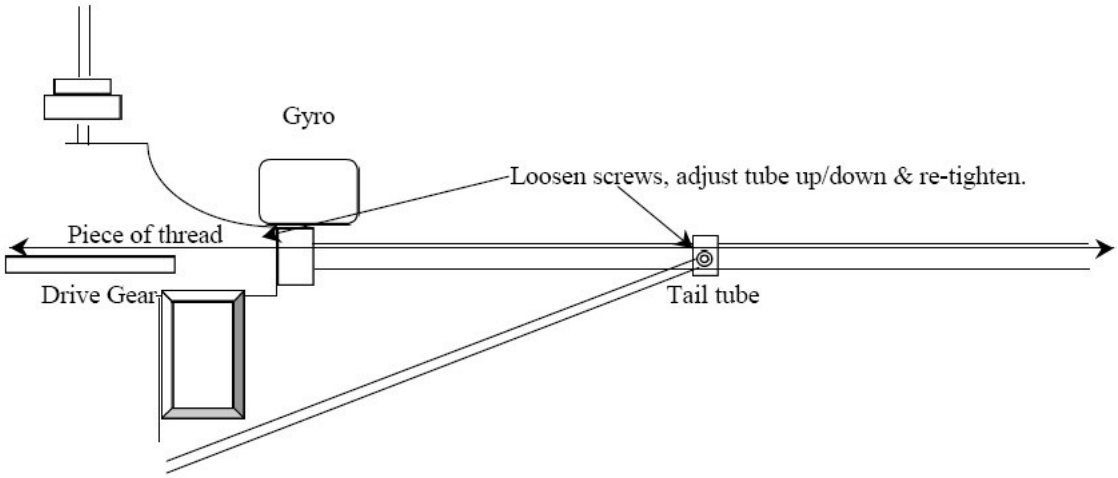


Notice how the flybar paddle goes right through the center of the 2 swashplate control od balls? That's 0° for sure. Check the other one. Note: When these rods are installed ack onto the "L" arms, they should neither push up nor pull down in any way. If short,unscrew both rods a turn each and re-fit. If long, screw both rods down a turn and re-fit.

Notice the head design here. The paddles are below the blades, making it suitable for crobatics and inversion. Also notice the blades go straight out with no dihedral (up wept) at all, which would make this thing right itself during hover instead of wandering.



Start with both rods fully screwed in. Put the swashplate control rods onto the washplate ball links (lower). These "arrow boxes" represent the "L" control arms(upper). If the rods are the right length, the balls will line up with the rod holes. Make engths adjustments to BOTH rods in equal increments. If you have to unscrew anything -5 turns to make it longer and you see thread showing... DANGER! Don't attempt flight ith that. This applies to ANY threaded rod on this or an other heli for that matter!

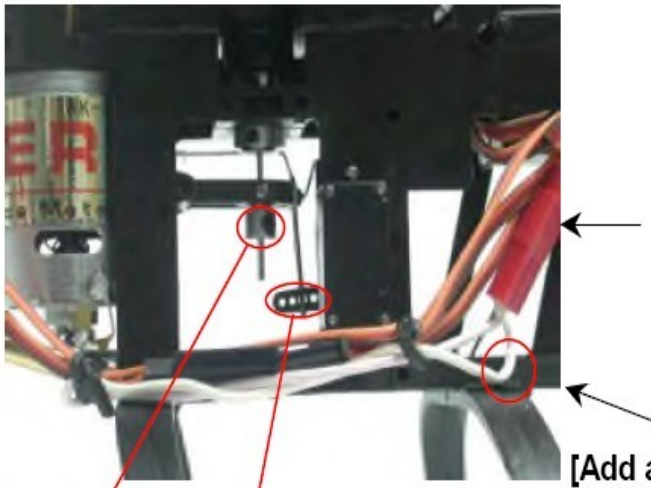


Jesus Bolt: The part that holds the main rotor on a helicopter. If you lose this, you're seeing Jesus!

6) How to REALLY track the blades:

You need to tighten ALL setscrews using Loctite around the mainshaft and drive gear. This means they all have to be taken out, Loctite applied and replaced. See the little bottle icon and where to apply. The one-way clutch bearing on mine kept loosening due to the maker not putting Loctite there on both the setscrews. Also on page 21 of the Walkera manual,every setscrew on the mainshaft on left side of the page needs Loctite. Also see bottom of page 15. As it states, you cannot have any up/down play in the shaft as all pitch/roll/yaw in the blades will shift immediately.

Do not Loctite the 4 screws on the tailtube behind the motor, just tighten them.



[Add a motor switch here]

Unplug the motor (red plug). Right below the plug is where you'd add a 5 Amp SPST switch. You could mount it right there on the chassis. Turn on the Transmitter (N switch!), throttle & antenna lowered. Plug in the heli battery. Make the servo arm level using your throttle stick. Adjust that setscrew on the pitch lever until it (35-027) too is

level with the servo arm, tighten up with Loctite. If it was close to level, just Loctite and tighten. I also made all my setscrews face the same way this bottom one does so I get a look at all of them when hand turning the shaft via the drive gear. Also, the lock ring just under the swashplate is supposed to be down against the black plastic, not up inside the swashplate.

Switch 8 Consideration: Another way is to just tighten it where it is and skip the Loctite for now. Moving that little collar will throw off the factory preset, remembering of course the preset is

NOT for a beginner. You can set mid throttle, then set 5° into the main blades using the ball links on the blade holders in the next section. Keep this paragraph in mind for later, just know that the factory settings are not for learning on. If you turn switch 8 OFF, you use the PZT knob to DIAL in the 5° at mid throttle instead of
ripping up the plastic clips on the rods. Turning a knob is easier. Then, PLT is brought up from off to select how much CHANGE (pitch curve) you want it to have BOTH sides of that mid-throttle 5°. You could leave PLT completely OFF, and you're basically flying a larger version of the Dragonfly #4! Get it? If this doesn't make sense, you better email me!

"Pseudo-Hover ing"

If you do NOT feel comfortable with the next procedure, please don't do it!

Instead, put a couple of heavy plates or narrow bricks (covered with an old sock) on the landing skids and do the blade tracking portion of it. Do a quick visual on ALL rods from servos to bellcranks, all the way up to swashplate, mixer arms and then the blades.Everything on? Do your servos work the swashplate and move the flybar? If you rotatethe right stick clockwise, can you make the rotor slowly turn clockwise? Does right stick make the swash tilt right? Forward makes it dip forward? Up on the throttle makes the
rod in the previous photo go UP? (switch 9)

On page 16 in Walkera's manual, remove the tail rotor blades (b). Experienced pilots don't remove them but I want you to now! We haven't "gone over" the tail yet for safety.Now check your main blades, are they SECURE and is the screw showing past the fibre lock ring? There must be for you to proceed. Is the "Jesus bolt" in place with Loctite from the prior chapter? Batteries CHARGED properly? If the battery's not fully
charged, your settings will not be accurate.

Place the machine on a table or your bed and sit in front of it with a chair, head and eyes above the blades. Put on glasses if you have 'em. Note: This is NOT for a 14 yr.old to do! Making SURE you're at idle on the throttle and the "N" switch is set... plug in the motor, then battery.

Bring the throttle up a little bit until you hear the beep. Get it up to where it's spinning slowly.
Grab the tailboom with your LEFT hand at the vertical fin with a firm grip on the tube itself. Please make sure there is clearance for the blades to swing without hitting you in the arm! You can tilt the tail up a little but not so much the blades hit the table or bed.Your chair should also be distanced so you have to extend your arm outward.

NOTE: If you're not using foam blades or they have HIT anything (furniture)... do NOT do this at all! Use safety glasses also, I got smacked in the eye once!

Relax your arm, but not the grip on the tube. Bring the throttle up slowly, is there any shaking you see or feel in your hand? If so, the blades are not tracking. Shutdown and make adjustments. Now start again, bring the throttle up more to the point where it lifts off the surface. Note WHERE on the throttle this occurs. You can count the detent "clicks" up from idle instead of looking, but you must know where on the throttle liftoff occurs. By default, they set it way above half throttle. It's too sensitive there to hover, so we want to increase the pitch on the blades at the blade holders. (or PZT if you decide to turn #8 off)

Unscrew BOTH blade holder ball links a half turn and reconnect. If the tracking was low on the blue blade, raise (unscrew) that one a half turn more. Remember that your link is to the leading edge of the blade holder, so make sure you're turning the correct ball link with reference to the correct blade. At this point though, you should have them well tracked. Notice that one will look a touch higher, like a speedbump (arrow) almost, but it is tracked. When it isn't tracked though, you really will see 2 lines distinctly outlined around the outer circumference. This is easier to do in sunlight by the way.

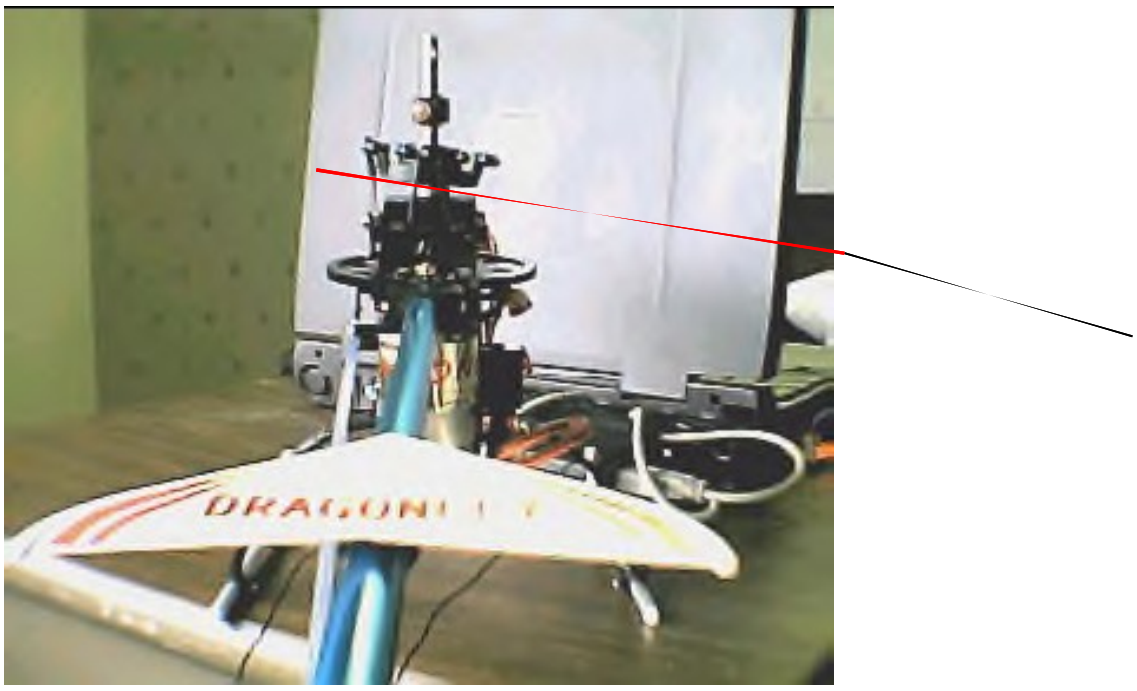

Also, bright spray paint using masking tape makes tracking real nice. Do one only.Eliminates “vibes” from the head when one of the tapes start lifting. Note there are 2 holes drilled into the bottom of the DF35 foam blades. When removed and painted, the machine whistles! Intentional, or perhaps to compensate for pressure/temperature differences around the world?

Now from here, just work with BOTH blades (equal turns) to get the liftoff at close to half throttle. Recheck this with a freshly charged pack, as I am not confident a brushed motor and less than a 2k pack can achieve this. Advantages are that the head spins slower, you burn the battery pack slower and the whole machine will be more docile.Only issue is the motor may run warmer due to more drag. This also immediately changes your tail rotor trim settings. The other option is... with a pitch gauge, find out what they set the pitch at for full throttle, half throttle and idle before turning off switch 8.That way, it can always be duplicated. Motor disconnected, measure it in “N” and “1”.Lock that Flight Mode switch again afterwards!

If you feel comfortable with this, try “flying” it with the right stick only. Hand on the tube of course. See how it tilts left/right and fore/aft. Just little movements, we have not reset the servos yet. That's the next step. But try this “false flying” without the tail blades for say... 4-5 15 min. flights. Let it get BORING cause you did it so many times! You are effectively balancing a broom on your right hand, true hovering is like balancing a broom on each hand. Note the HEAT of the engine every few “landings” by touching it after the blades stop spinning. This is a really good way to learn the feel of your machine! You're also breaking in the motor!

When finished, set throttle to idle. Pull the battery plug... then turn off the Tx in that order. Hey, we didn't break anything! Don't forget to recharge the battery, they have to be stored charged also!

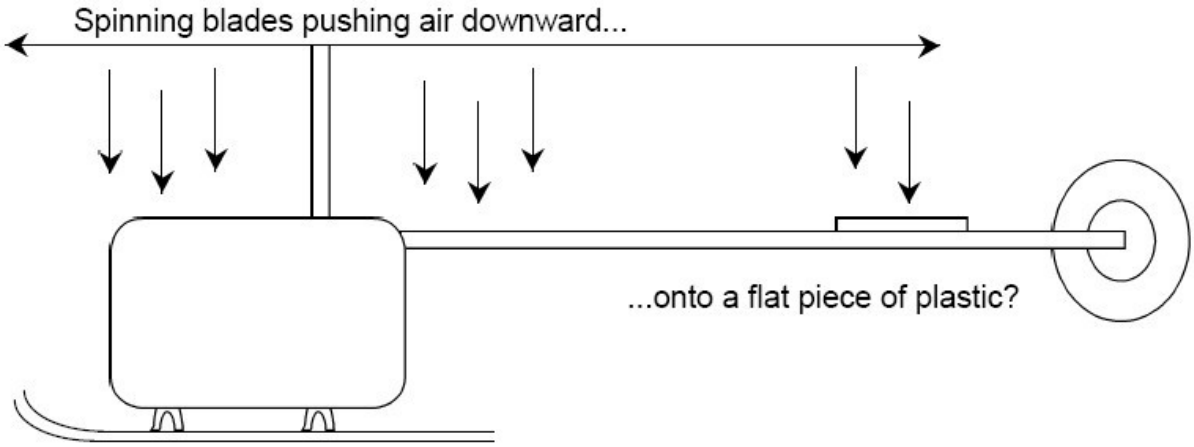
You probably notice how sensitive that right stick is. The 2 top servos at the front of the machine are of course the swashplate servos. Without mixing the two of them up...remove the servo arms by removing the little phillips head screw on each. Using a tiny drill bit or a fine Xacto blade, open up the NEXT hole toward the center on each. Get the wire Z bend through this new hole and replace with screw onto the servo. When you put them back on, have everything ON with the motor disconnected (or 5Amp switch!). Set the stick trimtabs to center. When you put on the Aileron (side to side)servo arm, make sure it is tilted to the right (looking from the tail) about 3-5°.



Due to gyroscopic precession and the torque of the engine, when a heli is in hover and the swashplate is level... it will naturally roll to the left. We are compensating for this by adjusting the position of the servo arm on the spline to naturally be tilted to the right,thus tilting the whole head to the right. If the head spun counterclockwise, we would tilt it the opposite direction. When you replace the Elevator (fore/aft) servo arm, have it
either level or slightly tilted forward with the stick and trim centered. Maybe 2-3°. If you did change the landing struts as in the prior chapter and the whole machine is tipped a little nose down, make the elevator servo perfectly level... this is one of those things you have to use judgment.

Now do the "false flying" one more time and see the difference. Does it still feel sensitive? Yes, it is! For actual hovering indoors or without wind, you only need 10°maximum deflection on the swashplate. Out of the box, the swash was bottoming on the chassis, there was no way in hell you were gonna fly it if I couldn't! I recommend you get a new set of Walkera output arms. HM00-005

The horizontal tail fin or the "Dragonfly" sticker in the photo above can be REMOVED for hovering and learning:



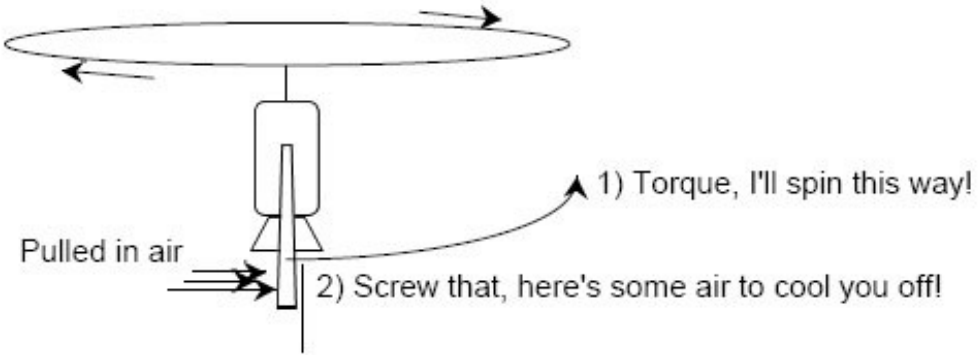
Ground effect: That wonderful bouncy feeling when a helicopter is near the ground, the air hits it and has to go somewhere... outward & upward. When the air hits the tailfin, it pushes the fin DOWN and the machine constantly drifts backward or rocks fore/aft. If you want to learn quicker, take the fin off temporarily. A trimmed machine should need NO stick correction in hover for 3-5 seconds.

Obviously, not a beginner's machine. But we're getting there and when you're ready...everything can be put back as you progress. Next... tweaking the tail gearbox, servo linkage and gyro!

Good PLT & PZT settings:

7) Tail rotor/gears & Gyro adjustments

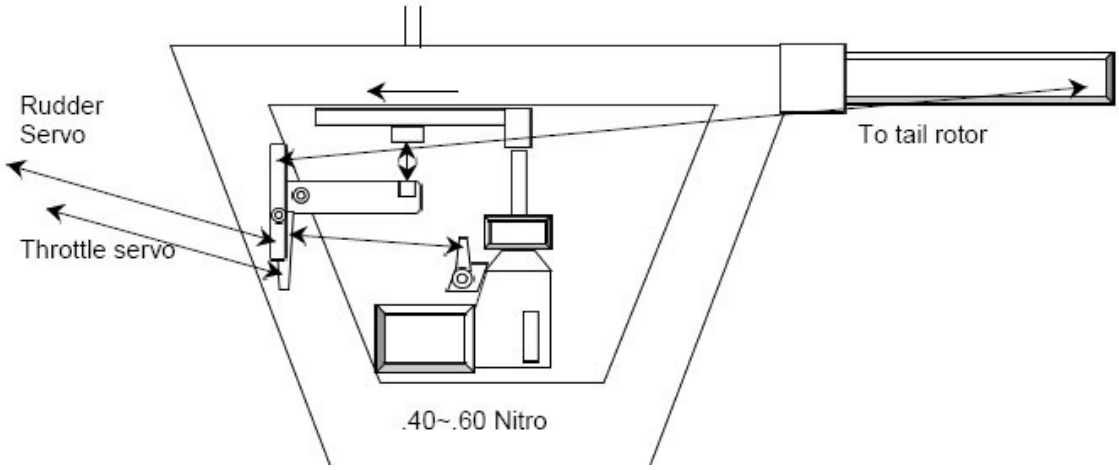
When I got into these back before gyros, we flew with full 4 channel control and fixed pitch. When everything is trimmed out properly, it really isn't that hard to do. We would hold right rudder (clockwise spinning main rotor) and bleed it off to neutral at mid-throttle liftoff. Remember: A *clockwise* spin on the main rotor looking down from above will cause a *counterclockwise* rotation of the machine itself. So to compensate for this, the tail blades must be *pushing air to your right*, thus *pushing the tail to your left*, or clockwise... and in turn counteracting the torque of the clockwise spinning main rotor! The little head wants to do the opposite of whatever the big head is doing.



Action = equal & opposite reaction.

With this radio, you have a built in Tail Compensator, switch 5. This is the Heli/Acro switch, **ON** will increase the pitch (left clockwise pull) of the tail rotor as you raise the throttle. Only problem is, it's not adjustable... thus the need for a gyro. Remember that all switches are actually **ON** when they are to the **RIGHT**. But the labeling next to the switch bank is backwards, another nice Asian feature! Chinese folks read right to left, if memory serves me. One eBook buyer refers to the manual grammar as “Chinglish”. Eventually, mechanical tail mixing levers were introduced by Schluter, your throttle went to a lower fork arm and the upper part went to the carburetor. On that near the middle was a pivoting arm... rudder servo went to the lower part, upper arm went to the tail rotor. So as the throttle was raised, the whole fork would move and the rudder arm

angle would change in sync. It was locked with a screw & nut into a 1” long channel. You could loosen the screw and move the whole damned thing up/down the channel and create more/less compensation on the rudder with respect to throttle changes. Add collective pitch into this mess and torque effect also changes (oh yeah! You forgot that, didn't ya?) what a time we had setting up that sucker! The pitch rod at the bottom of the mainshaft went into the end of the fork, not a servo!



Rudder
Servo To tail rotor
Throttle servo
.40~.60 Nitro

See how as the throttle was raised, the pitch rod was pushed up and the carb was opened? The angle of the tail mixer would turn slightly clockwise and lengthen the rod to the tail.

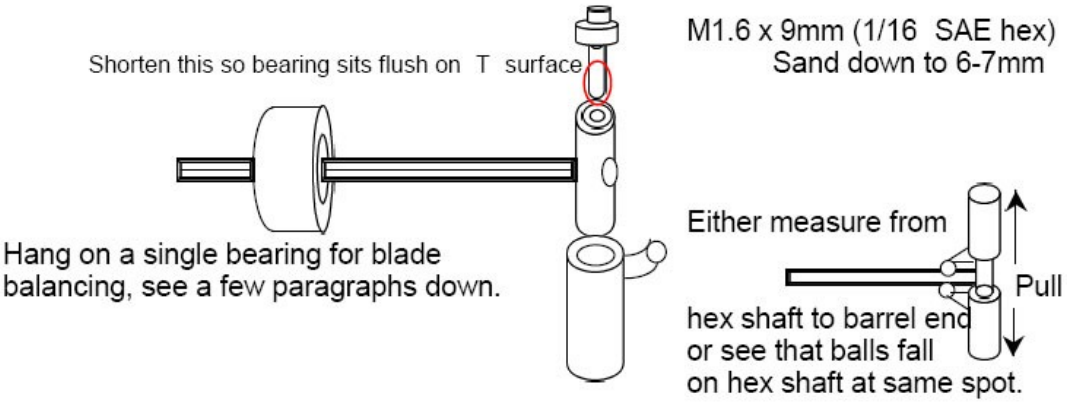
When Futaba came out with a decent helicopter radio, you could add a 5th servo for pitch and link it to throttle electronically, or enter the “Aerobatics Mode” by flipping the ”Invert switch”. The switch would set your carb to your chosen preset, lock it and continue controlling the 5th servo to the blades. With that, it also increased the total throw on that pitch servo to not just -2° and +8°, but -10° and +10°! To do that with an electric, you're going to need a very ballsy motor and at least 3-4 Amps of battery! With that added weight, you'll need a more robust machine with a larger main head, etc... etc... etc.

A Futaba gyro was introduced ($75) that was fully electronic and very good. But, you didn't need it if tail comp was setup correctly. The compensator moved off the metal fork and onto the radio. You dialed in the % of change you wanted via a rear access panel on the Tx. Depending on how much pitch change (PLT) you setup for the main rotor, that would determine the way you setup tail compensation. All this stuff is basically interrelated, and very critical. What we are doing by automating the controls at the Tx or mechanically is in essence simulating the presence of a pilot in the thing.

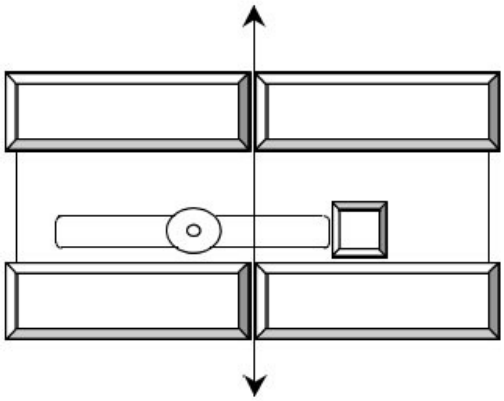
Gearbox

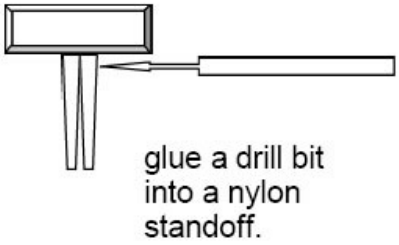
Well, we all know that this area of the machine is a weak spot. I have thought it might make sense to completely swap out the whole mess for a motor, but the stock radio is not geared for it. You might be able to use a Piccoboard, but none of the people who have them can say whether it's compatible with a 6 channel Walkera. I am working on

this, because I have an XR-1 all balanced which I'd like to fly with the Tx/Rx I already have.
Here's what you order to build an entire tail gearbox (no bearings) with blades:
HM035-009 $5
HM035-012 $3
HM035-015 $5 The metal gearset will help, but should be used in
HM035-016 $5 conjunction with modification at the end of chapter.
HM035-021 $3
HM035-022 $3
Shipping $5
Gearbox = $29
This entire piece can be swapped out and you can repair the damaged one when the parts arrive. The other alternative is to buy this. Spendy! Might as well get a DF4 as a spare or a flight sim! Make sure the I.D. of that clamp is 9mm, to match the tailboom of the DF35 we are flying. How about just buying an ARF Z400? Then, you go buy a good Tx/Rx set with good exponential and tail comp on it! The best solution though is to find/fix your own parts, like my mentor (a machinist from Sperry-Univac) did. So let's begin from the inside out, as this area has always been a sore spot on all helis over the years and this tail rotor design is from the 70's. Assuming you've already trashed the tail rotor...

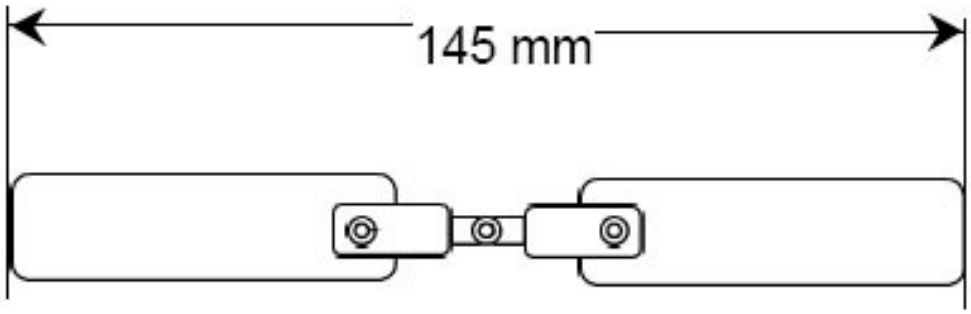


HM035-012: On a tail strike, this will get bent. If slightly, straighten with vise grip pliers. You can get it fairly decent. Use it until new part arrives. Note that the barrels on the bearings MUST spin free, no binding as that will kill the whole tail system.
The tiny screw is M1.6 size, 9mm and is too long, since it bottoms out in the “T” barrel and throws off the blade holders. Sand it on 200 grit in circular motions, the bearing has to be flush against the T. If stripped, use a 1/16” hexkey and use Loctite inside the hole to keep it away from the bearing. Pull the blade holders outward to get both locked on bearings.
Matter of fact, why don't we replace the tail blades with Master Airscrew propellers?





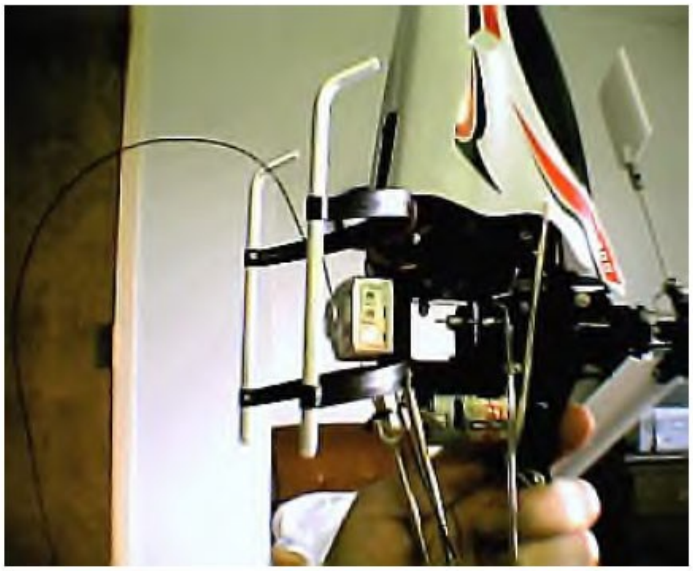
Build a box with side walls and a flat bottom. The middle has a slot for a razor saw. Lay your propeller in there and cut. Turn it around and cut again. The root side has to be drilled to accept the screw on the DF35. All this has to be jigged, so they come out the same, and the ends will need to be filed. It also needs to be balanced just like the main rotor head, and I would mask/spray the tips on these blades so we can track them just like the head. If you do track them, wear safety goggles and view from an angle.

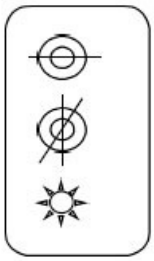


145 mm

When you have a tail strike, you should pull the gearbox apart and hang the hex shaft on 1 bearing only, since it will be bent. File the tips until it balances and reassemble the whole thing. Note that you need to do this with your Master Airscrew homebrewed units too. Do not exceed the original O.D. which is: 5.5” approx. I've found that when you pull the holders out, the plastic binds on the bearing, so try pushing them in and let them find their own place. Binding of the blade holders causes the whole tail to be uncontrollable. If the pitch control moves very freely, you can bet the gyro will work better and hovering

will be easier even with the original tail rod from the servo. Push & pull the servo rod to make sure it's free and if not, keep mucking with the ”T” bearings/holders until you get it nice. I got mine freed up today and the whole machine flies beautifully, the gyro works CLEAN and needs much less sensitivity/gain settings. Which brings me to a “can of worms” I'm sorry I opened...





The gyro is also much more efficient under the rotor shaft but those tail blade bearings better NOT bind at all! Here, the sensitivity can be 25-40%, gain can be at midpoint. To set the sensitivity and gain, use the lazy susan turntable or...

Run the throttle up to hover speed and down. Up and down. Do it slow, do it quick. Don't lift off, just watch the tail. If it's set right, at the very least you should be able to bring it to liftoff with no tail movement. If there's movement, bring sensitivity up a little or use the rudder trimtab. Eventually, this should just sit there with no yaw. Thus, I was able to snap the photo.

Mega Note: If you relocate the gyro... turn switch #4 **off** and reverse your tail blade holders so that the ball links are at the leading edge of the blades instead of trailing behind. Quite simply, right rudder on the stick makes it spin (right photo above) to the right. Turning the machine to the left (while held in your hand) makes the rudder servo arm move forward now instead of backward. I made this mod for CG issues to balance the helicopter, this may be too confusing for most to do. You can use putty in the nose of the canopy just as successfully.

The main reason to have the ball links at the leading edge of your main/tail blades is always the same as it's been for years now: So that the air pressure during spin causes the ball links to be pressed **on** the balls, not pushed **off** because they're trailing or behind the blades. So yes, it's also a safety issue and not just for CG balancing. Years back, nobody put their linkage to the rear of ANY blades!

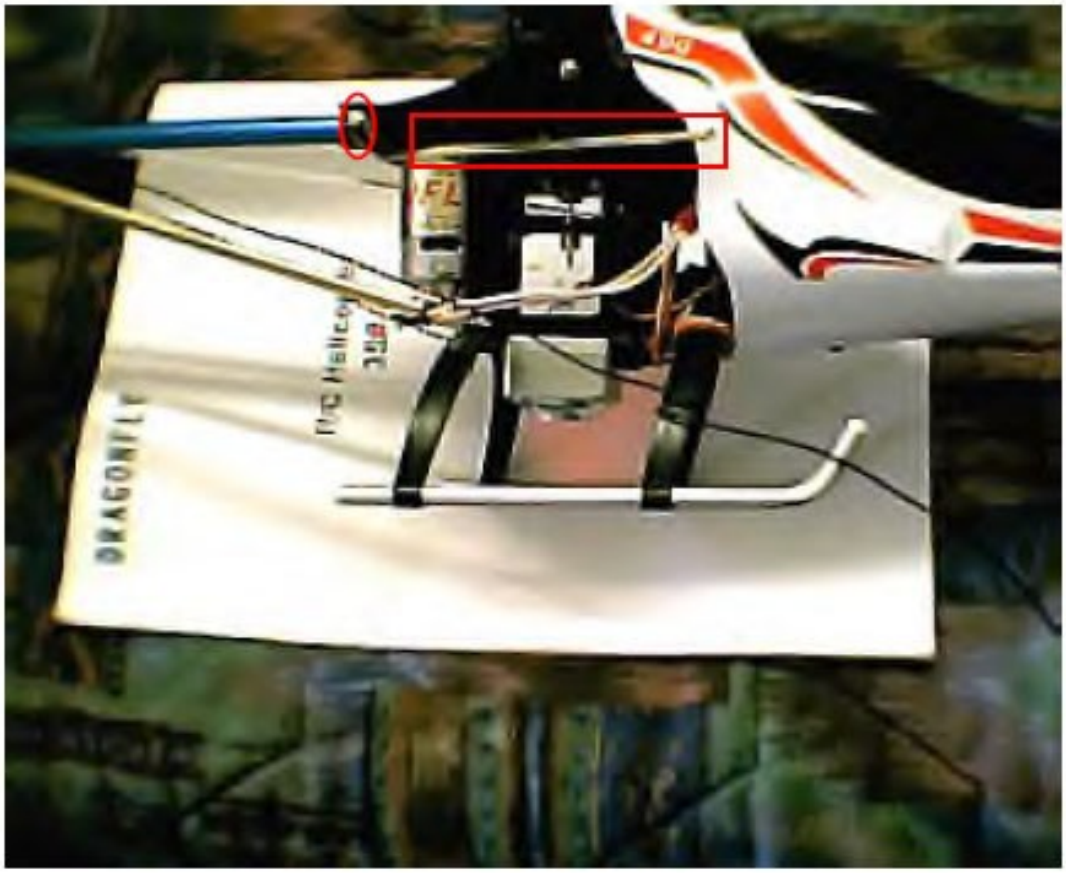
How do you know sensitivity is too high? Wiggle the tail to activate the gyro. If the servo

arm doesn't come back to the original starting point before wiggling, then it's too high. Also if the servo arm cocks all the way to the end of travel and stays there.

Another advantage to moving the gyro, check the shaft against that rear door frame! This is the blue 1900 mAH pack.

Time to get rid of that rats nest inside and run the servo leads around things like the landing strut, frame legs below receiver tray, etc.

Let's put this issue to bed now too, loop 2 rubber bands through the original holes (you can open them)...

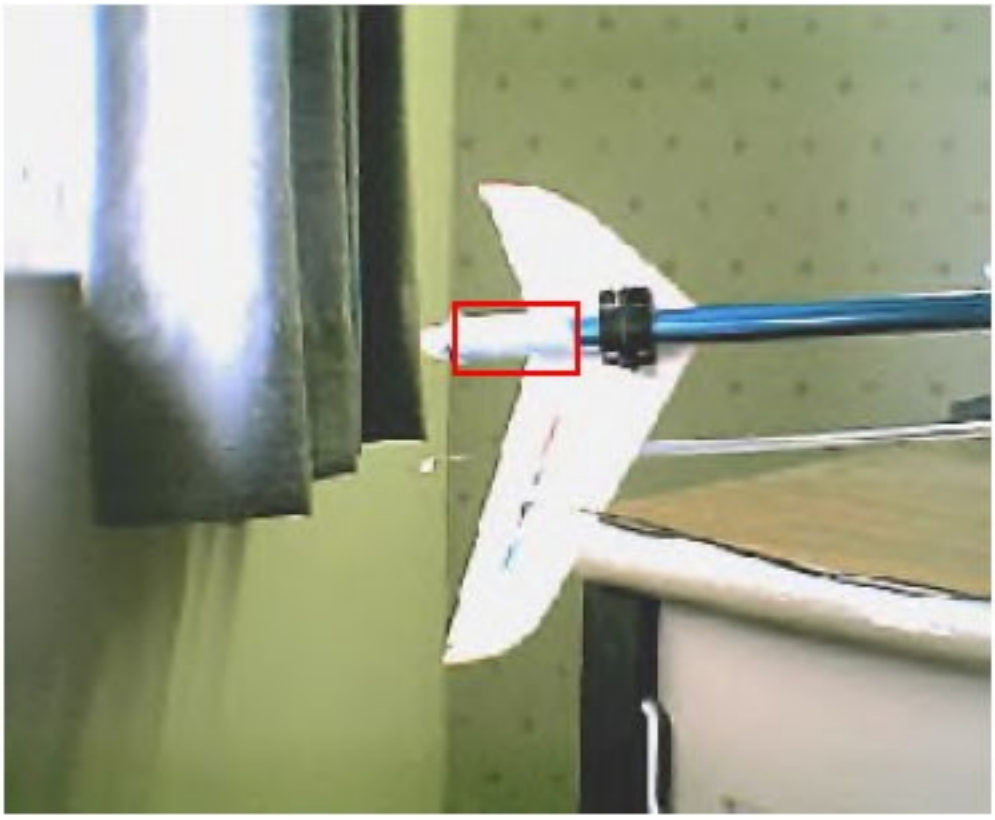


And anchor them to the opposite side screws of the gyro platform. Flown it this way, it works fine. Note the cleaner wiring this side also. All I did was reroute everything.

Which brings me to the SOLUTION for tail strikes and ALL this gear/parts BS:

Step-by-step to end of the chapter:

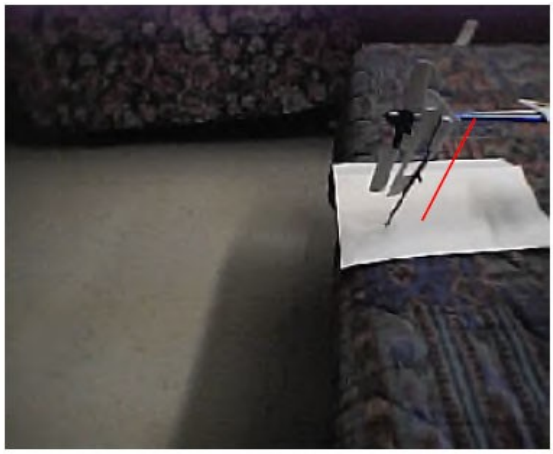
1) The tailrotor box is held in place with 2 weeny screws no bigger than a piece of a toothpick! Vibration and floor smacks knock the whole rear rotor out of 90° alignment. Lose those 2 little weeny screws that stick out the side of the tailrotor gearbox like cat whiskers. Next, locate the 4 tiny (!!!) black screws that clamp the front tube of the box onto the tailboom blue tube. Back them out enough for the 2 halves to seperate and pull the whole thing away from the tail tube. Using very THIN masking tape (white McKesson, which is used in hospitals) wrap the rear of the tube ONCE around... NO overlap. Now position the tailrotor gearbox back onto the rear of tailboom tube and reassemble/tighten the whole business back together... checking the 90 degree alignment and gear mesh as you proceed.



This setup will eliminate the slop that was there when the black box was clamped on smooth aluminum. Also, scribe the blue aluminum tube with an Xacto knife so you know where to put it again and not lose your trim settings! Any shift fore/aft of the gearbox will change the angle of the tail bellcrank and your trim.

2) That control wire with plastic tube (HM035-030) going to the tail is too flexible.

Replace the whole thing with a carbon kit for $10 or reroute it. If you have a hobby store nearby, there's no reason not to use an airplane part for this. Make sure there's NO binding and it moves freely. This is NOT optional, there must be smooth action on this rod and tail blades.



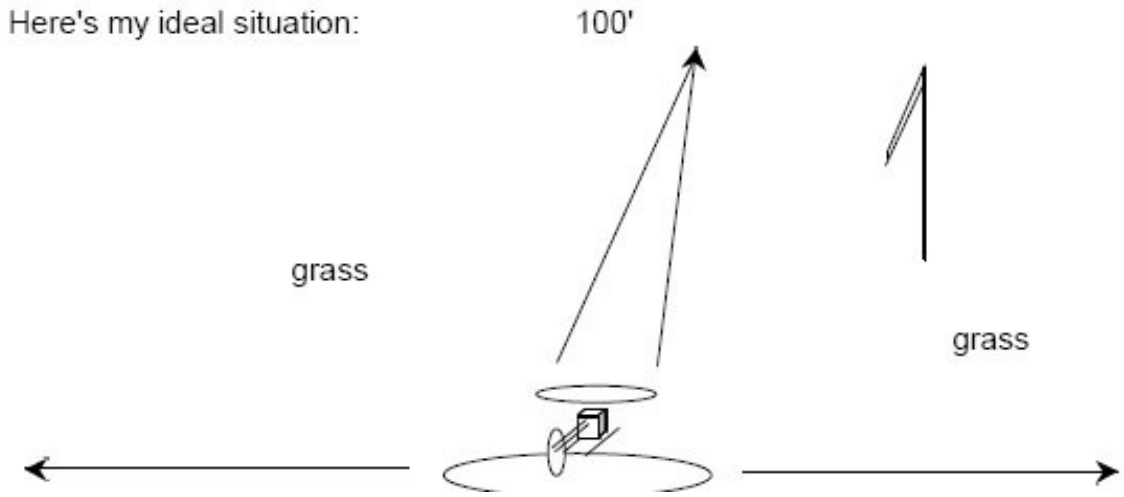
3) Take those cheesy stickers off the fins and now she doesn't wobble in hover. Also, your tail will be more efficient. Run your antenna through the horizontal fin and then forward. Strip the rest of the foam off a trashed blade, clip it and attach to the tailtube clamp with #6 sheet metal screws. Also note the clamp and fin are now on the right side of the tube, there should be no way to strip the gears now. You can add coins and caulking putty to the nose to maintain CG balancing.
If you touch down on grass, move it back to pavement or linoleum sheet, as it can't "hunt" in grass and it may spin after leaving the ground. Also note that your tail trim most likely will change after touching the tailfin, so you want to retrim on a smooth surface. That means to set the tail bellcrank to 90° at half throttle with the trimtab centered. This way, you have enough to play with in both directions.
This mod is working nicely on mine and I came up with it when I was down to ONE spare bevel gear.
This, coupled with the training kit I suggested you make (tomato plant sticks and foam balls) should get you going well!
Next chapter: Initial hovering and preflight checklist

Preflight & choice of location

You should cut & paste this checklist to another document and print it:
1. I'm in a good mood for flying, relaxed and have not had too much caffeine or any liquor.
2. I've eaten and am sated.
3. My Li-Po batteries are properly charged and ready to use.
4. My transmitter batteries are fresh/charged and good to go, the Tx light is green.
5. I have unplugged the motor.
6. I have plugged in the Li-Po battery.
7. My servos are NOT chattering while the Tx is off.
8. I have pulled the throttle all the way down, made sure **Flight Mode** is set to "**N**".
9. I have turned on the Tx, set it down and walked away with my model.
10. My radio check went well, the receiver light was solid for **xx** feet from the Tx.
11. There are no obstructions in my chosen location, I have 30' around and 15' above.
12. I am outdoors or in a high ceiling parking garage.

13. If it is nighttime, I am under bright lighting and it's windless.
14. If it is daytime, it is calm and I don't have glare from the sun in my eyes.
15. I'm not being attacked by bugs. (Many machines have been lost during a swat!)
16. The surface is flat and smooth, with no spectators, cars and power lines to interfere.
17. Inspection of the machine looks nominal. All linkages from servos to the controls are intact.
18. Spinning the swashplate stick (Mode 2) clockwise causes the whole head to rotate.
19. I have now plugged in my motor, with the throttle down & **Flight Mode** is set to "**N**".
20. I have brought the throttle to half throttle, without any abnormal shaking, tail spin, or uncontrollability. Left rudder turns it left, right turns it right, etc.
21. The blades are tracking well and the rudder is reasonably tame w/o stick inputs.
22. I have hovered/flown successfully... I am done for this flight.
23. With throttle all the way down, I have unplugged the battery.
24. I have removed the warm Li-Po and swapped it with a fresh one if I have one.
25. I have done a post-flight check, especially of the head linkages and flybar.
26. After cooldown, I have begun to recharge the used battery for safe storage.
Note: You should take your charger with you, because there is usually an outlet around to plug into. Bring a book, TV or some munchies too! I prefer Pat Metheny myself.

Location
A college parking lot with bright lighting is ideal, winds considered. Of course, this nighttime stuff doesn't apply to you if you're in a calm region of the world.
Where the heck would that be?
You don't want any powerlines above you as it can rise up into them. If you get in trouble during hovering, you want that space to climb up to and buy time anyway. Altitude is your friend!



NOT in a park with wild curious kids around! They'll be all over it!
With our little machine, you've got 100' depth, 50' on either side and maybe 50' behind you. This will allow you to fly around yourself in circles. And you have a little 6' bamboo pole with a streamer or windsock on it that shows wind direction. You want to be pointed into that dead on. The tailfin will weathervane and a constant breeze of like 5 mph is absolutely perfect for learning to hover. A little bit of breeze is a good thing for learning.
If you touch down on the grass, carry it back to the smooth pad again before lifting off.

Otherwise, it might swing on you and these gyros really are just “tail dampeners” in my opinion. Hopefully, you've added the tailskid I suggested in the prior chapter.

Initial hovering and trimming

In “no wind” conditions and on linoleum, you want to trim the swashplate so that it doesn't walk left/right or fore/aft to the point of liftoff. With a breeze, you'll add a few ticks forward trim. At liftoff point, you want the rudder trimmed so that little or no rudder input is required to hold it. I have found this difficult to do with this tail system and gyro. Every damn tail strike shifts the trim!

If these trims are achieved, you raise the machine to eye level and balance the “broom” on your right hand while keeping the tail at you. You are effectively balancing 2 brooms if you think about it. Keeping it near the ground is just making it more difficult, at least 3' would be okay for this size of machine. There is nothing from stopping your adjustment of the gyro, I would try sensitivty a bit higher if needed.

Advice for learning: Fly the thing with full thumb & forefinger on the sticks using either a Tx tray or sit down in a light folding chair. Thumb flying is difficult and this does not have the inertia of a gas machine with wooden blades either. Don't fly thumbs! Also, it will help to put the canopy on the front and “fly the nose”! Watch the nose or reference the front of the machine instead of the tail to keep yourself oriented.

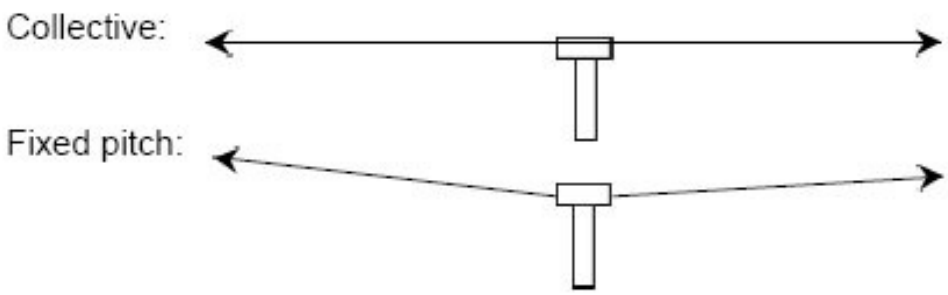
This happens to all heli pilots: Losing the tail. It's not instinct to do this, but the best thing to do is get altitude quick by hitting the throttle and get it over 6'. Lower the throttle and regain tail orientation. In a worst case scenario, hit forward cyclic and enter forward flight, you turn with left/right swashplate and a little bit of added rudder in the same direction.

The important thing to remember here is that if it turns nose-in at you, the swashplate stick is all reversed and you are going to crash it within seconds... unless you are incredibly talented. Generally, you just want to give it power to gain height and in turn TIME to reorient.

If you're able to hover it controllably by the first week, you're doing pretty well. Try walking it under control forward/back, left/right. Try different altitudes. With plenty of space around you, try a slow forward flight around yourself. Do this by just giving it little forward stick inputs and no left/right. You steer with the rudder, just tapping it as you walk it all around yourself about 10' out from you. You keep your whole body/stance oriented with the nose of the machine and the heli is to your right or left facing forward. Turn with the machine as you fly a large slow/sloppy circle around yourself. Let it be sloppy but maintain tail orientation! Turn the tail in toward you and set down.

You might want to try landing and lifting off targets on the ground. Like lime X's or some marker. Also, I did mention a simple training setup with tomato plant stakes and foam balls. Before you enter forward flight at an altitude though, I would like to see you able to land and take off from a good sized table. A picnic table, for instance.

This machine will be hard to learn because there's no dihedral in the head:



The DF35 has no upswept blades, the main bearing shaft is a solid rod from one blade

holder clear across to the other. With even a Schluter Superior, there were 2 seperate blocks, seperate bearings and pitch rods. They were cocked at 2° positive, giving a total of 4° dihedral. This machine will always want to walk or fly and will be extremely maneuverable. That's why it's a poor machine to learn on, but an excellent and easy machine to invert. Most gasser guys looking to go into acrobatics (3D) would do well to get their feet wet on this inexpensive machine. A good nitro helicopter is going to run around $1000 to $1500 afterall! One crash cost more in parts than this whole basic Df35.
Flight from carpet is ideal, but how big is your playroom? 8' high ceilings and 20' of clear floor space in all directions? If not, forget it until you know what you're doing. It will lob right into a lounge chair and you'll be waiting for Chinese blades for 2 weeks or paying $30 from California because you cannot wait to crash the thing again. You have to learn outside, this is a tad too skiddish for indoors. A gymnasium is perfect, with the smooth wooden floors!

What to look for after a crash

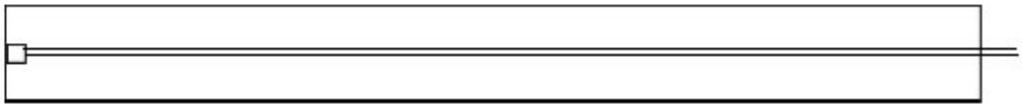
In the case of an expensive nitro machine: A second job!
From what we already know, start with the tail and work your way forward. By now, you should know where the tailrotor bellcrank should be on a trimmed DF35, has it shifted? Is the shaft bent, does it turn freely, do the tail blades move freely with the output arm pulled off the servo? Are the blades chipped or shaved? If so, you should take the whole gearbox apart and check everything. See how important that tailskid is now? How about the gear mesh and forward tail drive gear at the motor pinion? Partially stripped yet? They tend to go by the 4th tail strike. Has the tailboom shifted up or down and is it bowed or bent? That would cause tons of vibration.
Disconnect the head linkages, does the flybar still teeter totter back to level or is it shifted? Are the “L” arms still aligned as well as the flybar? Are the head linkages still straight? If bent, go to the hobby store and replace with decent rods. How are the main blades? They can fly with a minor knick, but are they crushed or compressed in any way from front to rear? Discard! How about the main blade bearings, and holders? That straight shaft could get bent if hit the right way. But if it's that far gone, so's the whole machine! Ditto the main shaft... if taken out (see Walkera manual) and rolled on a piece of window glass or a mirror, does it roll freely or wobble? If wobbling, it must be replaced and not toyed with. For $3.50, there's no point!
Is the chassis intact? Are all the screws in the frame secure? How about the screws retaining the head mixing levers above the swashplate, are they tight? If those holes strip out, you coat the I.D. with CA glue, let dry and re-anchor the levers with better screws from the store. SAE screws will always be slightly larger in the hole also.
If the crash was severe, did it go in nose first and damage a cell in the Li-Po, creating a potential bomb? Was the Li-Po inside the machine upon inspection, or seperated? That's a clue to be wary of that pack.

Special Projects

This size of helicopter lends itself well to making your own blades from rulers.
The article also goes into use of a gram scale.

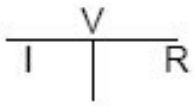
We used to buy all
our parts there after matching them up, especially the main drive gear. The tail rotor gears are a 2:1 ratio [21 teeth/10 teeth] and will need to be matched. I will add a matched set to this document when I find it, as there are many dimensions that need to

be correct.

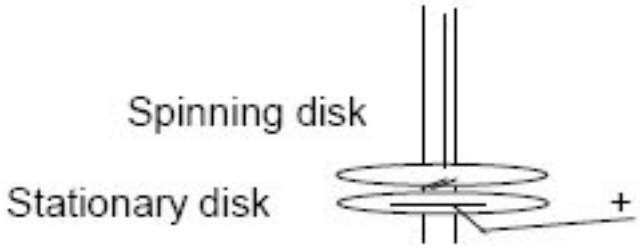


I would have soldered #30 gauge wire to a colored LED. Attach wire to end of a coat hanger and stick it through the tip of the hollow foam blade and to the root hub near main shaft. I'd epoxy or use one of those heat glue guns ($3.50) to anchor the LED at the tip. One wire goes to the mainshaft and is ground, the bottom of the shaft connects to your Li-Po negative lead through a dropping resistor. Assuming a draw of 10mA by the LED:

Resistance = 11.1v ÷ 10mA
1.1 K Ohms



The positive lead from the anode of the LED goes down the shaft circumference and to a brush mechanism at the pitch servo. Maybe the pitch rod could be used, if it's fairly insulated from the mainshaft. We are using it as ground already. It's something like the old fashioned rotating Christmas trees your grandparents had in the 40's and 50's:



Spinning disk
Stationary disk +
The top disk has the brush which is spring loaded, the bottom disk has a metal track near the O.D. The brush on the upper disk follows and maintains contact with the lower disk's metal track. The positive supply for battery power is connected to it. The LED voltage is strictly adjusted by the dropping resistor's value. The whole thing is ON or OFF.

Walkera Dragonfly #4 SUCCESS:

First, let me state that I am a true believer in the KISS principle: Keep it SIMPLE, stupid! There is nothing wrong with starting out on a Df4 as opposed to collective pitch units, as you will have your hands full just learning a controlled hover. Why add more expense, linkages and complicated trimming to an already challenging issue? 'Nuff said.

Note: With an electric helicopter, trims change as power runs down. With a fixed pitch machine, you'll have a little less to worry about. Collective pitch is just more to remember. The parts for a Df4 are all over the place!

The Df4 has been around for years and has sold thousands I am sure. Notice the

collective pitch machines are modified every 3 months, like a crappy release of Internet Explorer! This little machine goes unmodified from the manufacturer, but third party vendors offer some decent improvements. **Four** of which are noteworthy. **One** is essential, a higher capacity battery! The stock 8.4v, 700mAH pack barely breaks out of ground effect!

Note: Any modification below which is in **BOLD** text.... do it, no exceptions!
In mid July, I purchased one through an Aussie seller on eBay and have had tons 'o fun with the little bastard. Both indoors and out. With the exception of aligning the flybar paddles, it really did fly out of the box. Albeit poorly and underpowered. We're gonna fix that.

When opened, the radio and heli are sandwiched between two plastic halves which are taped. Cut the tape and remove everything to a cleared table. Locate your sim software and cable if these were offered with it, your battery and charger. Also find your training “kiddie skids” and any “crash kit” spare parts included.

Hopefully, this is the minimum you received. An exception would be extra main/tail blades instead of the “kiddie skids”. You really can't use the training rods anyway, they add weight and this sucker is underpowered!

The Dragonfly 22D, notice the absence of sim/cable, kiddie skids or spare blades! Seller doesn't appear to deal in them either. Note placement of motor, down low for stable hovering. Comes with a 9.6v, 1Amp battery.

[Top Plate]
Noticeable improvements are a 3rd rudder servo linked directly to the tail rotor, and tailtube support struts. Negatives: look at that main drive gear... wobbles for sure!!!

I like how they routed the linkage though, straight back.

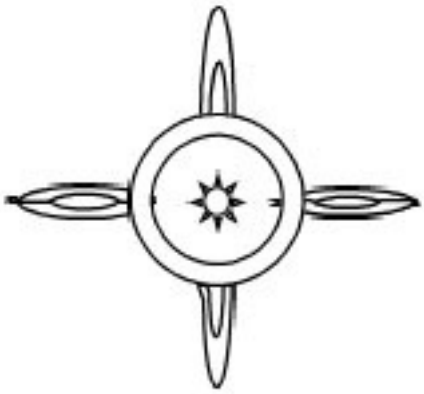
The motor has been replaced with a gearbox. Hopefully, those are metal gears! A weak spot here is that flexible plastic pitch link to the blade holders. They'll wear out in time. Do NOT bid this thing over $85 on eBay, not worth it!

Df4 chassis Prep:

First, start by removing the main rotor head. It is absolutely necessary anyway.

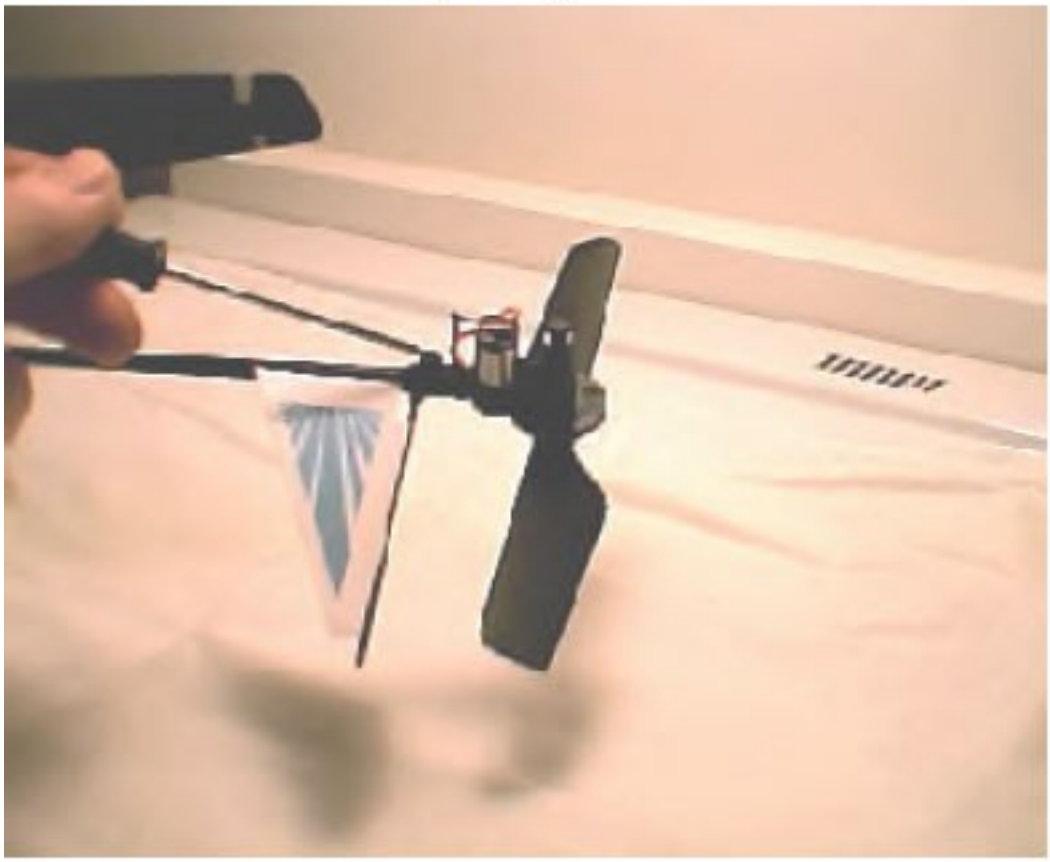
1) Poke out the “Jesus Pin”. 2) Disconnect the two upper swashplate links and just pull the head straight up!

Next, remove the tail rotor by pulling the orange tubing and hang it on a hex key or pin. Keep sanding the heavy blade until it levels. Reinstall. Loctite tail motor screws and **add a heatsink.** Don't have one? **Make it!**



The inner circle represents your tail motor and pinion gear. The outer one represents windings of solid copper wire. Wrap the wire around the motor about 5-6 times. In 4 or more spots, loop it up and away from the motor casing to form “fingers”. Solder it to the casing and sweat the solder

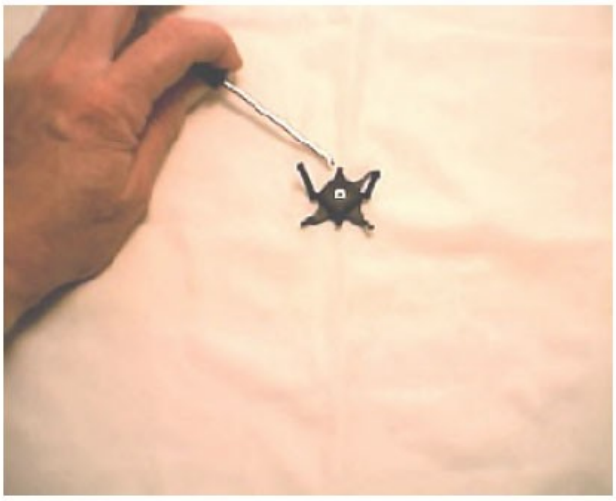
onto and between the copper windings. These “fingers” will tranfer excess heat away from the motor. The more “fingers”, the more heat transfer, just like a household radiator. This same technique works well for the main motor also. You can buy the heat transducing white grease at Radio Shack, although it might not be stocked. This is noteworthy mod #1: A beefier tail motor. They also have a brushless unit.



See the hole at the tip of the screwdriver?
That is where you **add a setscrew** to lock the tailrotor at 90° to the mainshaft. If this is not locked, it will shift every time the tailskid smacks the ground. You could also use a sheet metal screw, probably #6.

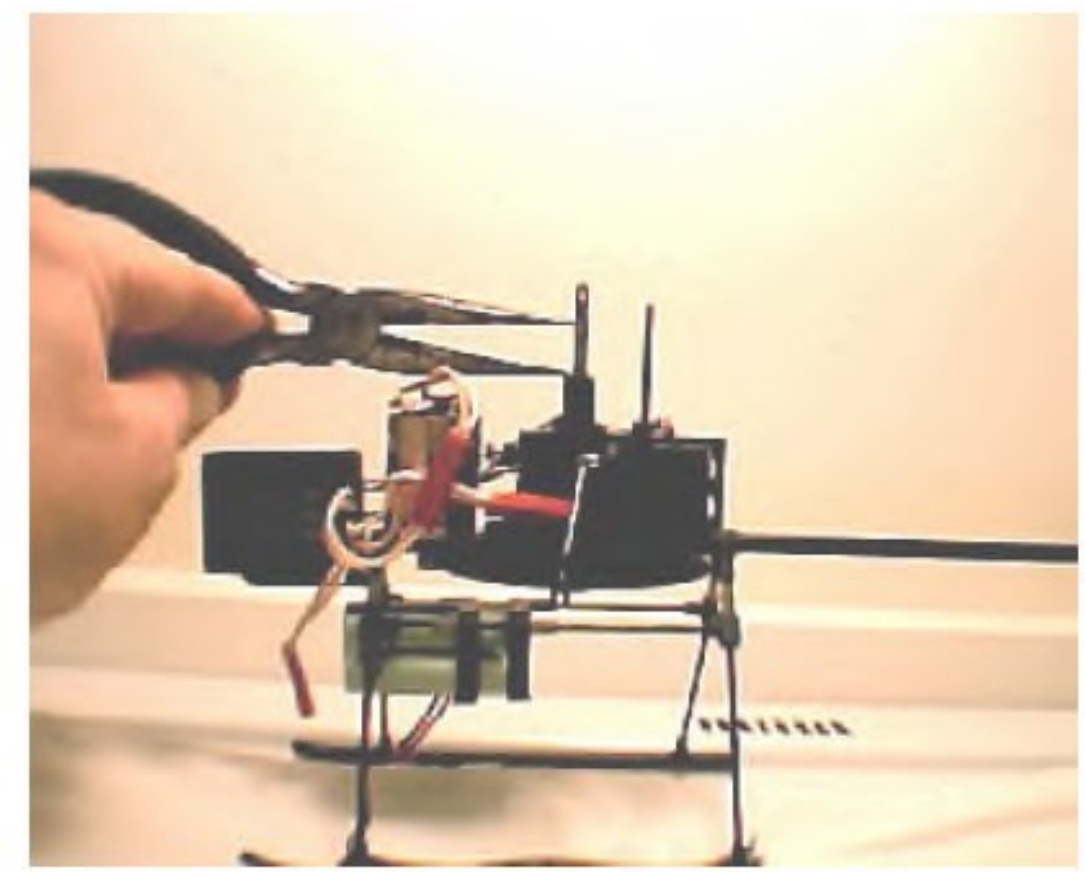
Add some 5 minute epoxy (or even Loctite!) at the V joint where the landing struts attach to the airframe, both front and rear. Vibration causes them to work themselves loose otherwise. Notice the head center hub in this photo...

The metal clip in the center is a head stiffener, it keeps the head from flexing too easily to make forward flight more controllable. Your unit may not have come with one. If not, order one here or make one. Every item is at Home Depot, the nuts and screws are 4-40. The plate can be made from delrin or lexan plastic and sits on the top plate. See [Top Plate] photo near the beginning of the chapter. This is noteworthy mod #2.

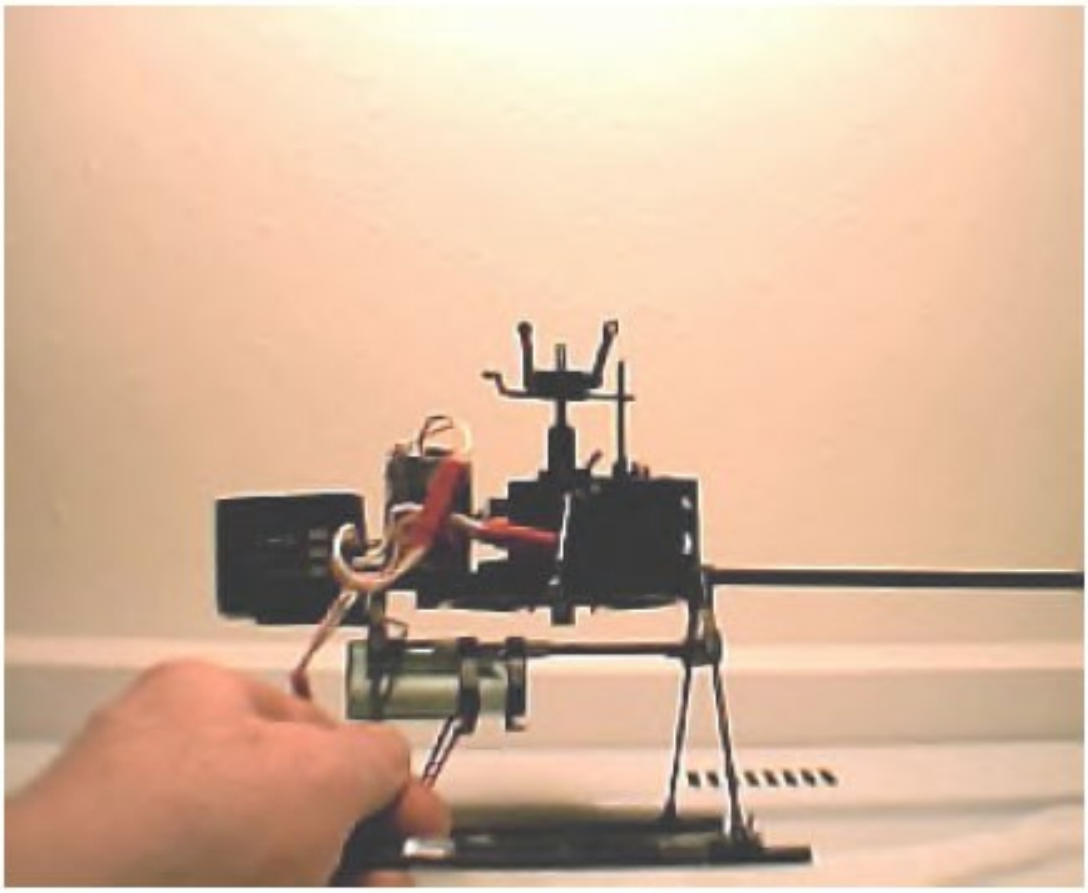


In as much as I asked you to remove the head long ago, the swashplate should be removed now and set aside. If yours has the brass ball in the center, you're golden! This is noteworthy mod #3 and is essential if you received some oddball older piece. The white ring seats into the I.D. permanently and

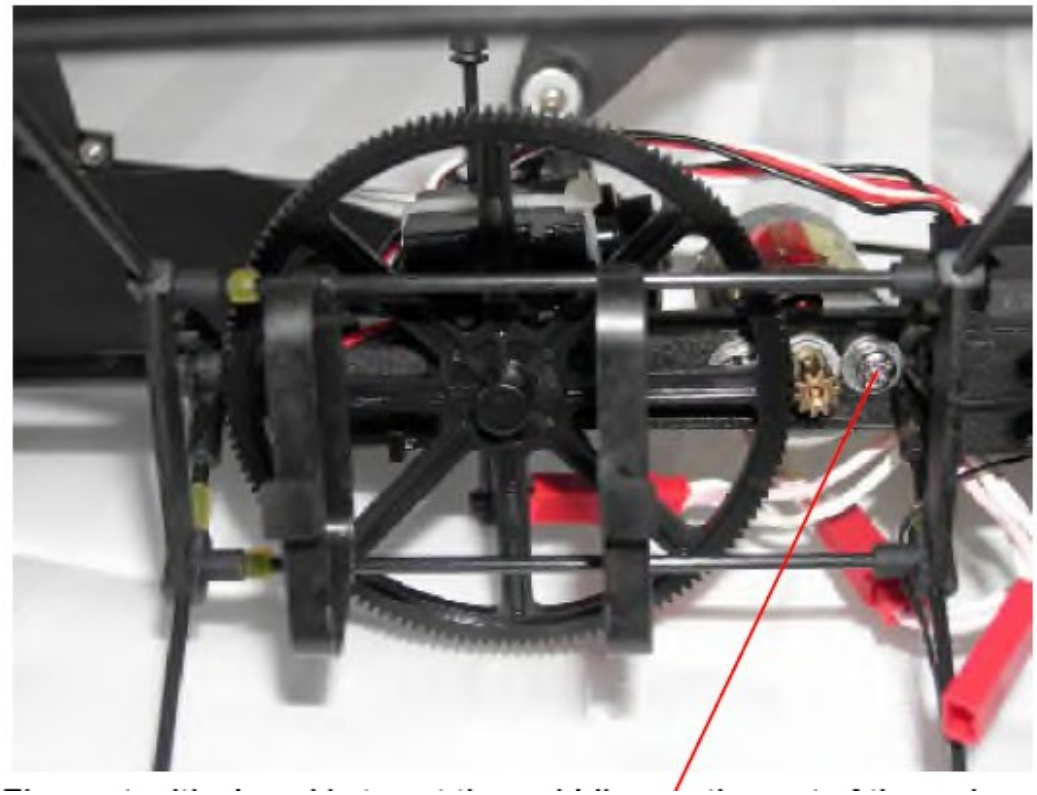
the ball swims around inside as the swashplate tilts during flight.
See the tip of the screwdriver? Okay, well the upper swashplate ring has FOUR linkage balls. Two short and two long. Use the shorter ones for learning and switch to the longer ones (right photo) for more sensitivity in flight. Don't use the longer ones until you're proficient or you'll just crash more easily. The longer ones will double the throw on your flybar paddles.



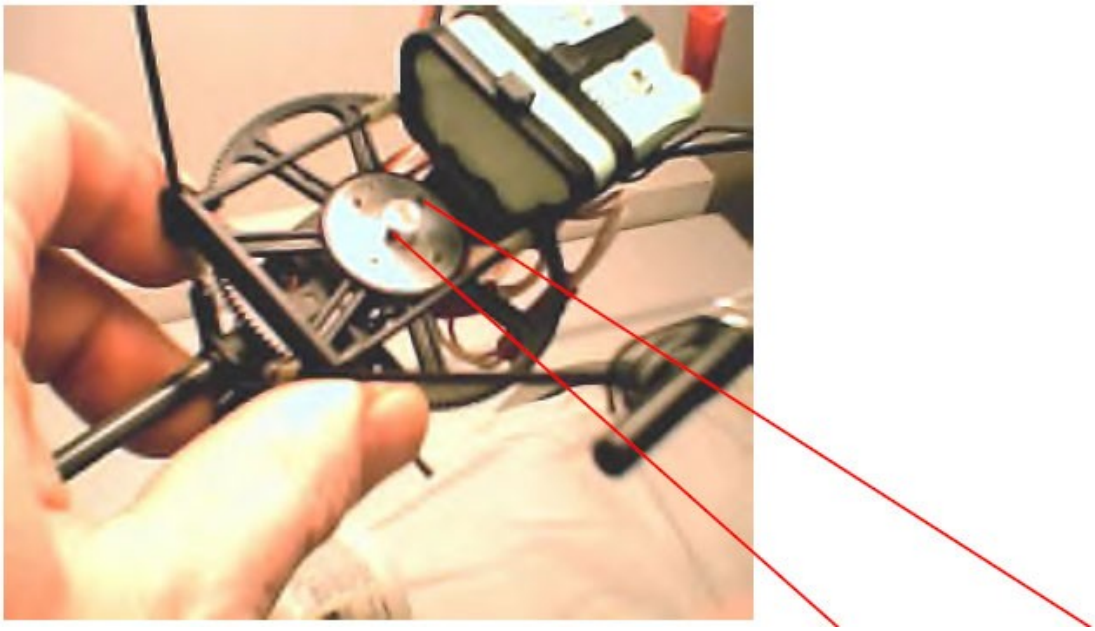
Make a spacer out of plastic, use a thick-walled straw of some kind or fuel tubing. It sits on the C locking ring and extends upward as the plier jaws depict. The length of mine is 9/16".



Replace the swashplate and it rests on top of it. Replacing the head now and pressing it downward onto the shaft, the lower end should butt against the swashplate ball and now there should be no up/down slop of the swashplate on the shaft. This mod with the brass ball is what gives you precise control and is essential, probably above any other in this chapter!

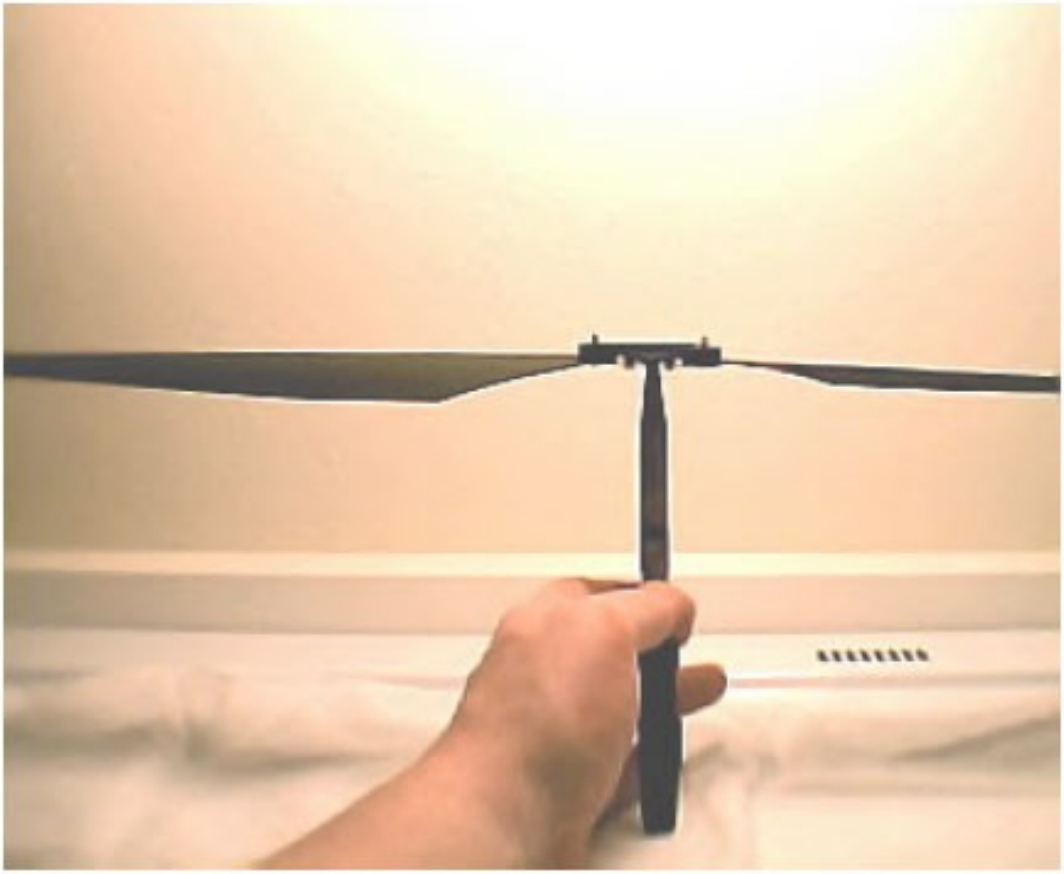


The next critical mod is to get the wobbling motion out of the main gear. Apply this for the 22D helicopter also. Make sure there's backlash between these two gears. Adjust the position of the motor and Loctite the motor mounting screws as you see here next to the motor pinion gear. There can be lots of backlash here.

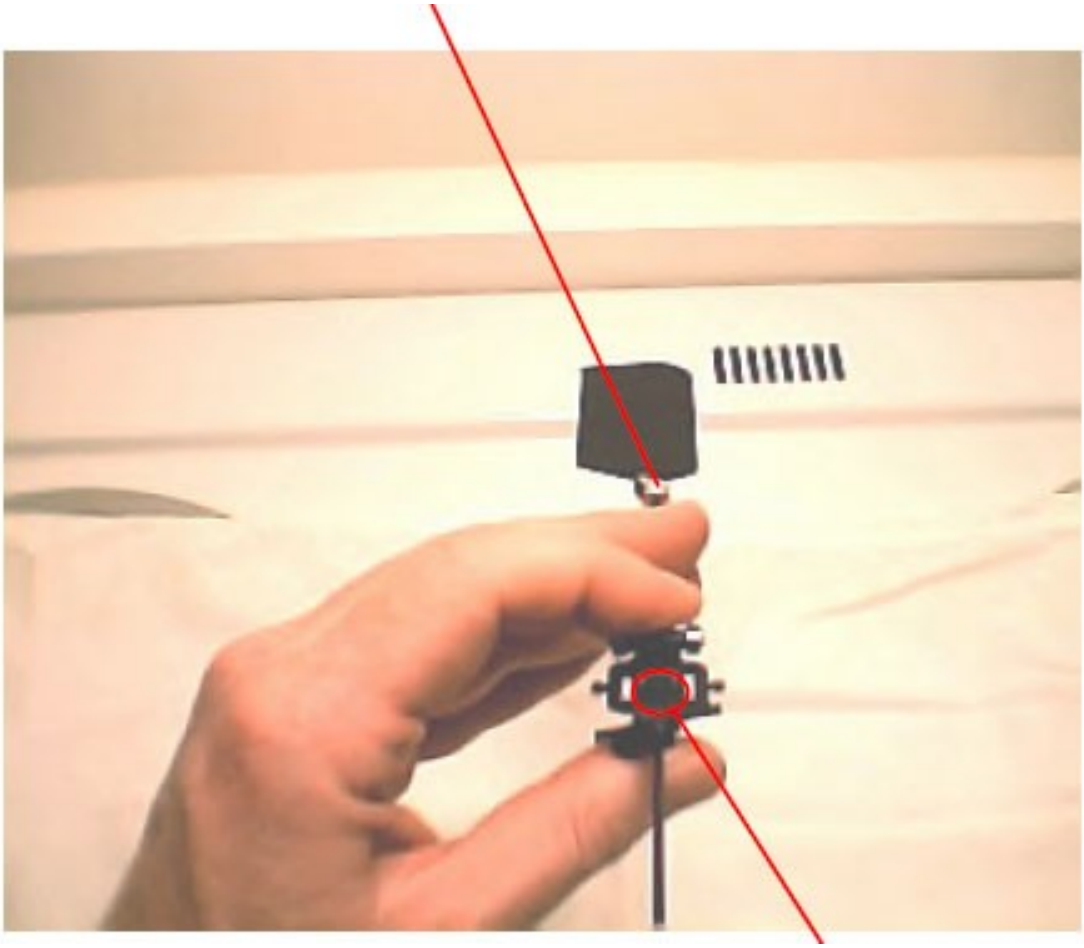


Remove battery and push clips out of the way. Remove the setscrew completely from bottom silver gear hub. Now pull the gear downwards and off the shaft. Next, remove the four screws from the top which seat the gear onto the hub. Apply Loctite to each and replace just to the point of being snug. Put the whole thing back on the shaft and replace botton setscrew with Loctite, tightened.

Replace the battery in the clips and plug into receiver. Turn on your transmitter with throttle at idle. Now raise the throttle just to the point of slow motor rotation. Watch the gear riding up and down on the motor pinion. Using judgment, adjust and tighten the four gear screws accordingly to get the gear to ride centered on the pinion without wobbling. It's not easy, but can be done and will improve power output of the motor and battery efficiency.



Most don't know this, but if you grab the top plate, it can be pulled and seperated from the upper shaft hub. It also pops back on. **Rest the two side balls on something (I used the tip of my pliers) and balance the head. You do this by trimming the main blades with a pair of good scissors. Trim a little plastic off the tip of the heavy blade until the whole thing balances level like this.** Or... you can put tape on the leading edge of the lighter blade to weight it down. The tape actually may save the blades in case they get smacked. Tape can also be used to salvage a blade that's cracked from the rear. Just recheck the head balancing. **Now check and adjust the balance of the flybar and paddles. Notice here how the two paddles are aligned to each other, this is essential. Also notice the center control frame is itself aligned with the two paddles. It has two setscrews in it (click on the line above) which can be loosened, then the whole rod can be slid left/right until the whole thing balances.** An alternate option is to adjust the two metal collars just inside of the paddles, but I prefer moving the whole flybar.



If the flybar cannot seesaw, due to binding...then it cannot even be balanced. Take the entire flybar off by removing a paddle and the locking collar with it. With both setcrews loose in the center control frame, pull the rod completely out.

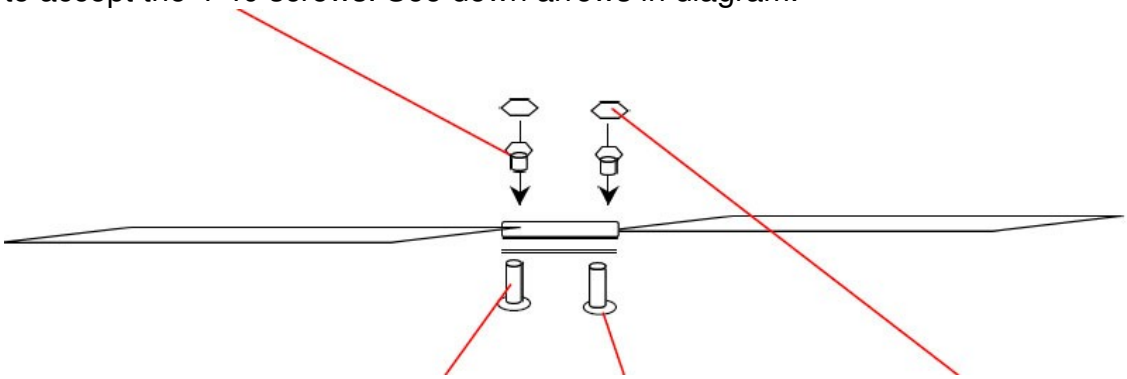
The flybar seesaw is binding on the inner walls of the hub and also the two brass bushings. With the hexkey that came with it, push each bushing out through the hole of the opposite one. Try not to butcher up the inner edges, work slowly as these are tight. Now, slide out the flybar seesaw. Sand both sides of this seesaw by rubbing it in circular motions on a flat piece of 400 to 600 sandpaper. With a small rat tail file, open the hole from both sides that the brass bushings enter. When all is reassembled, the ideal will be that it teeters freely and also your flybar with paddles will move freely. Some sewing machine oil can be added here as well. Note that this must not bind when you're finished. Work slowly.

Reassemble the entire head onto the shaft, replace the “Jesus pin” and track the blades. Note that if you do this in front of a television screen, you can see via the raster lines that the tips cone upwards! For this reason, the plastic blades are not suitable for regular flight. You will need wooden blades, but I would shop for a better price. For regular flight, this is noteworthy mod #4.
Noteworthy mod #5 is a decent capacity Li-Po battery and charger. You'll have to hunt this on eBay, but I would go for something well over 1000mAH at least. The little green stock Ni-MH batteries need to be charged to the point of being so hot, you cannot even hold it! I have a trick, throw it in the freezer after the charge and watch the current really flow when run cold! Even then, you get maybe 3 minutes of sufficient power to hover it properly and with good response. Without the power afterwards, it bounces around the ground and just damages your chassis even more! I have not yet tried two stock batteries in parallel.

You want a shakeless rock-stable helicopter? Read on and follow exactly:

buy (2) 4-40 1/2” long screws with matching hex nuts, also maybe some internal-tooth lockwashers and (4) matching flat washers.

Remember I mentioned that some DF4's come with a metal head stiffener? Drill out the (2) screw holes to accept the 4-40 screws. Take the original blade holding screws out of the Top Plate and remove the main blades. Now, remove those (2) plastic spacers as seen in [Top Plate] photo. Using a 1/8” drill, open the spacers to accept the 4-40 screws. See down arrows in diagram.



Replace the spacers into rotor hub. Now secure the blades onto rotor hub from the bottom using (2) 4-40 screws and flat washers. The hex shape at the top represents (2) 4-40 nuts. Use either Loctite here or (2) internal tooth lockwashers with flats against the spacers you just drilled out. Sock 'em down TIGHT! For even more stability, you can add this and it sits on the Top Plate.

What will this do? Okay, pull both blades straight out with your hands as hard as you can. Now turn everything on, set the heli on the floor and slowly run up the motor.
Notice what's different? No shaking or vibration if you did the mod right. Now, pick it up and track the blades. You do this by bending them to induce either more or less pitch. Once tracked well, try hovering. Next, you should notice it lifts off much sooner and easier on the throttle than before. Almost like you put a bigger battery in it. You should also note that although the trims have changed slightly (adjust them!) the whole machine is rock-stable and easy to fly!
After you hit something, check and retighten nuts as they may loosen. It is the overall

tightness that is giving you the stability and eliminating all shaking. Pulling the blades straight outward by hand is what sets the lead/lag ratio of the head. After doing this mod, it should be much more responsive, stable as a lamb... hell your grandma should be able to fly it! That's how much better mine improved!
Still wanna blow over 2 bills on a collective machine???

Remember, when running any simulator through your transmitter... unplug the crystal from the handheld to disable the RF output of the unit and extend the life of the AA batteries.

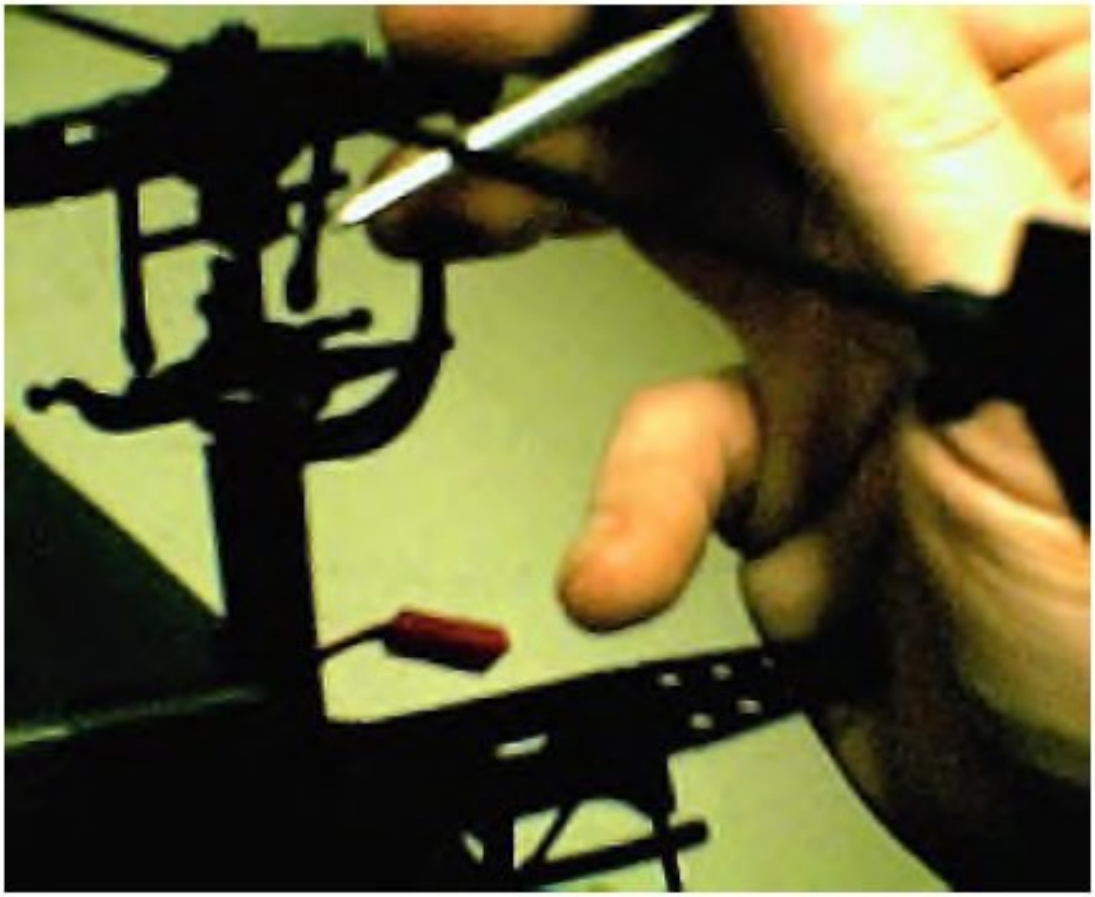
Aerohawk XR-1 chassis Prep:

Pretty simple, hang the tail rotor on a hex key or pin and keep sanding the heavy end until it levels. Reinstall. Loctite tail motor and **add a heatsink.**

Using a train transformer...

plugged into tail motor, run it up and see how it works.
Should be smooth if balanced. If not, check again. Check gear mesh

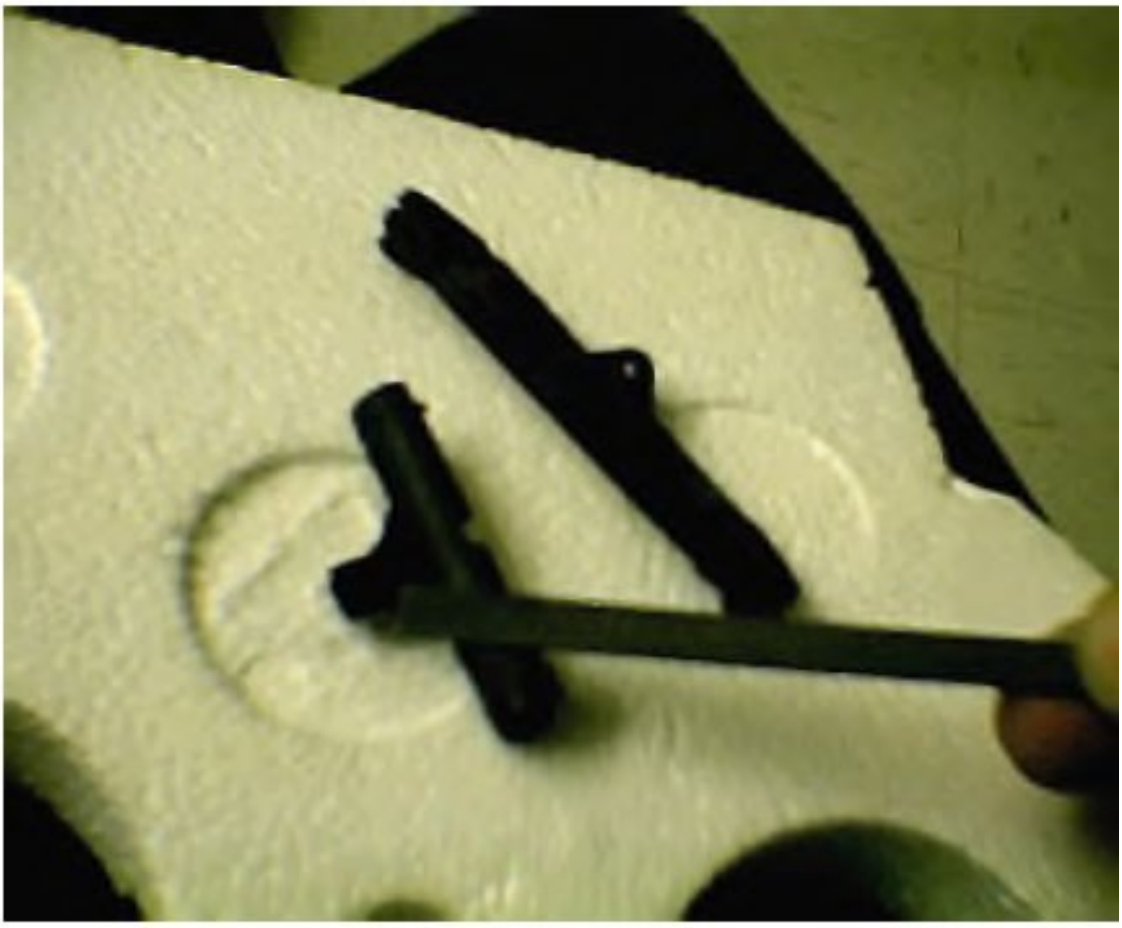
also. 3 Amps max, that one has meters. This also allows you to see how it operates/turns.



These have a “Jesus pin” poke it out & remove little swashplate linkages. Pull up & off!
Note that the short swashplate links are for hovering, the long ones are for flight.
If your swashplate doesn't have the center brass ball installed, see chapter 10 for the fix.

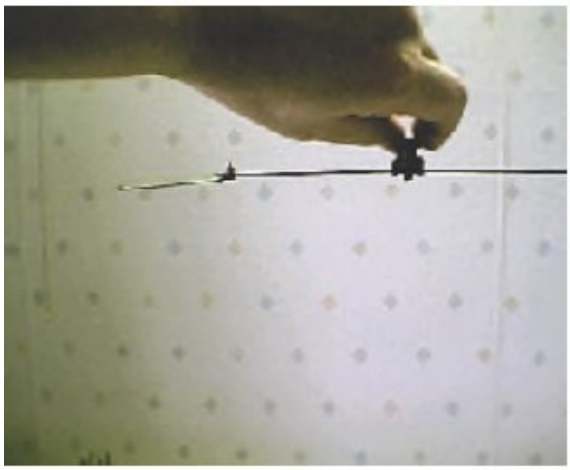
The flybar/stabilizer yoke must not bind like this.

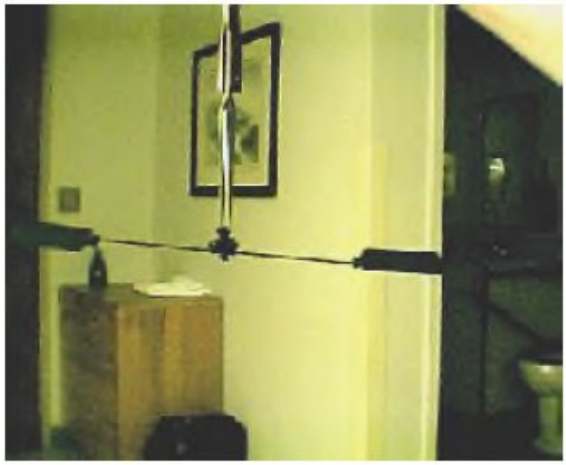
Take it apart...



and file/sand all the high spots that bind. Free up all movement on the 2 bearings.

You can see the 2 bearings here, center flybar and put paddles back on...



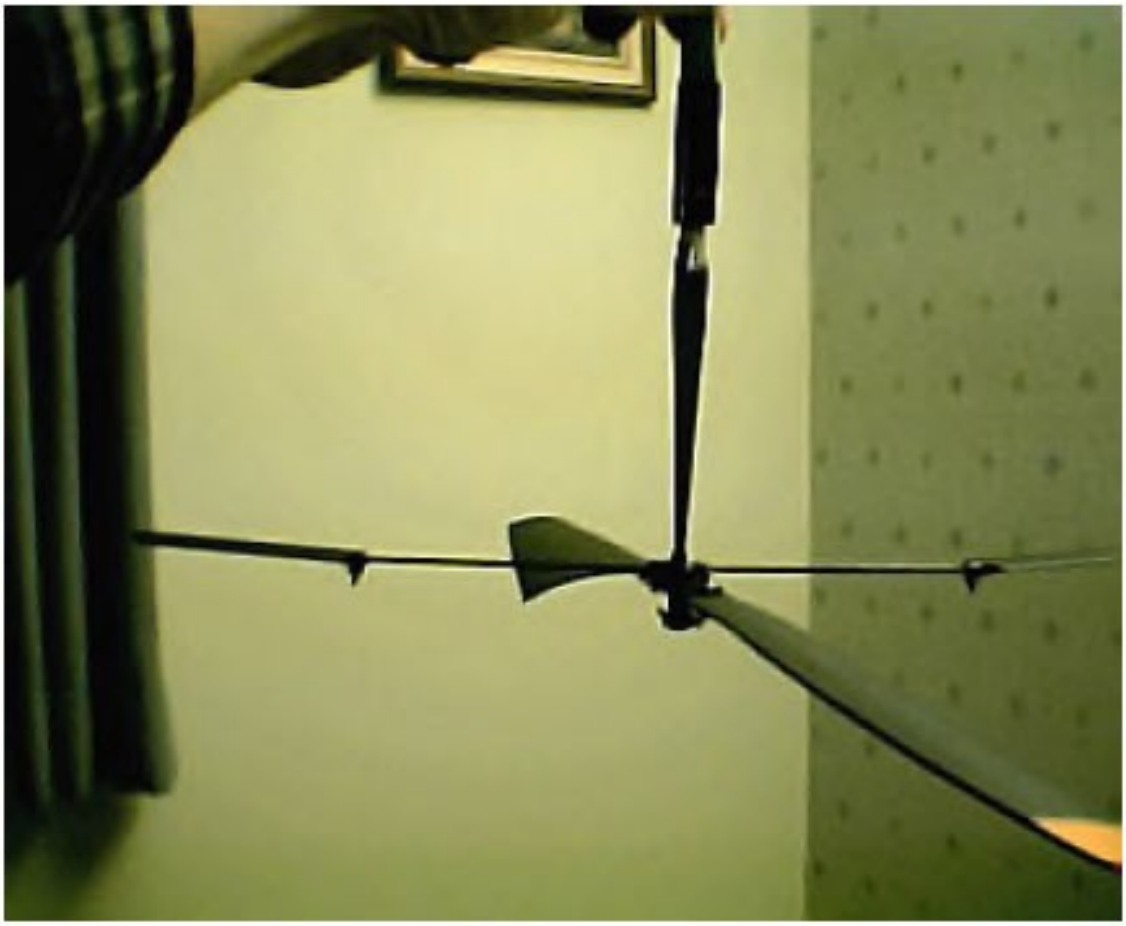


and make adjustments until you can balance it well.

Lock it's position with Loctite.

Sight them at 0° to each other and center seesaw, add some

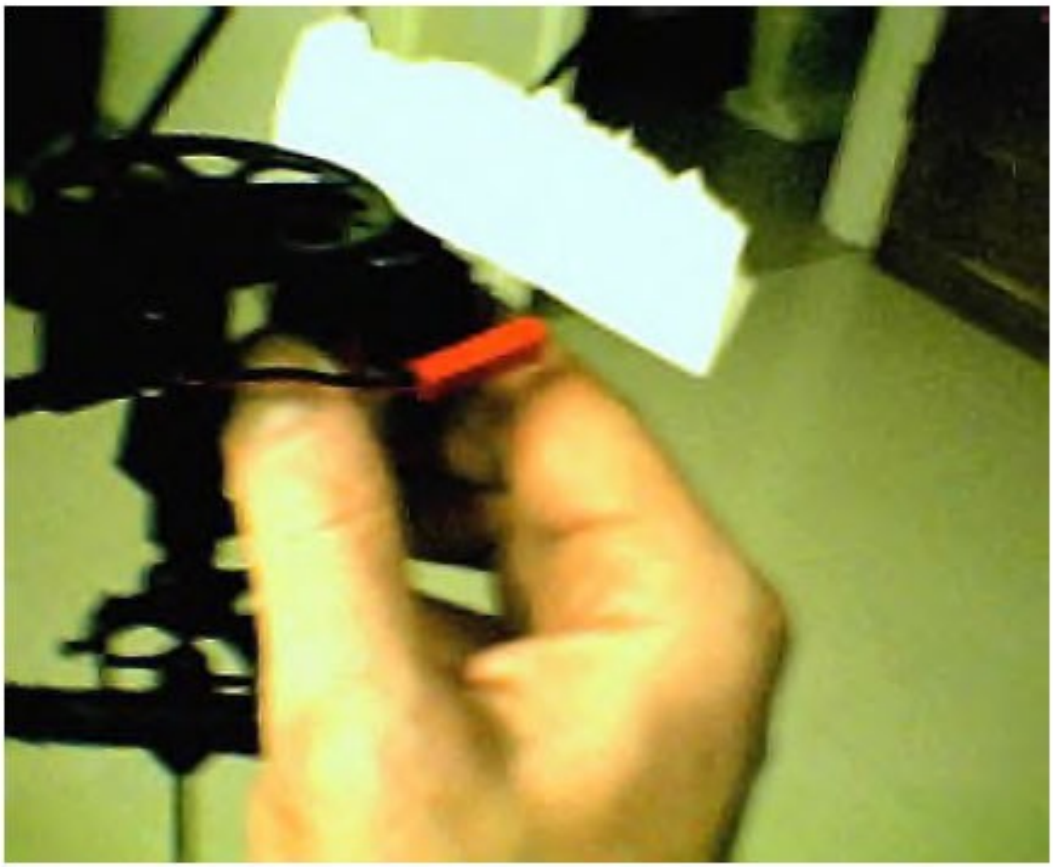
epoxy for safety and lock the crap outta these! They have been known to fly off and penetrate drywall! Buy some GOOD hardware at Home Depot. Rough filing the tips will help, but paddles should not slip. Stabilziers can be replaced with coat hanger wire after crash, that's what it is anyway!



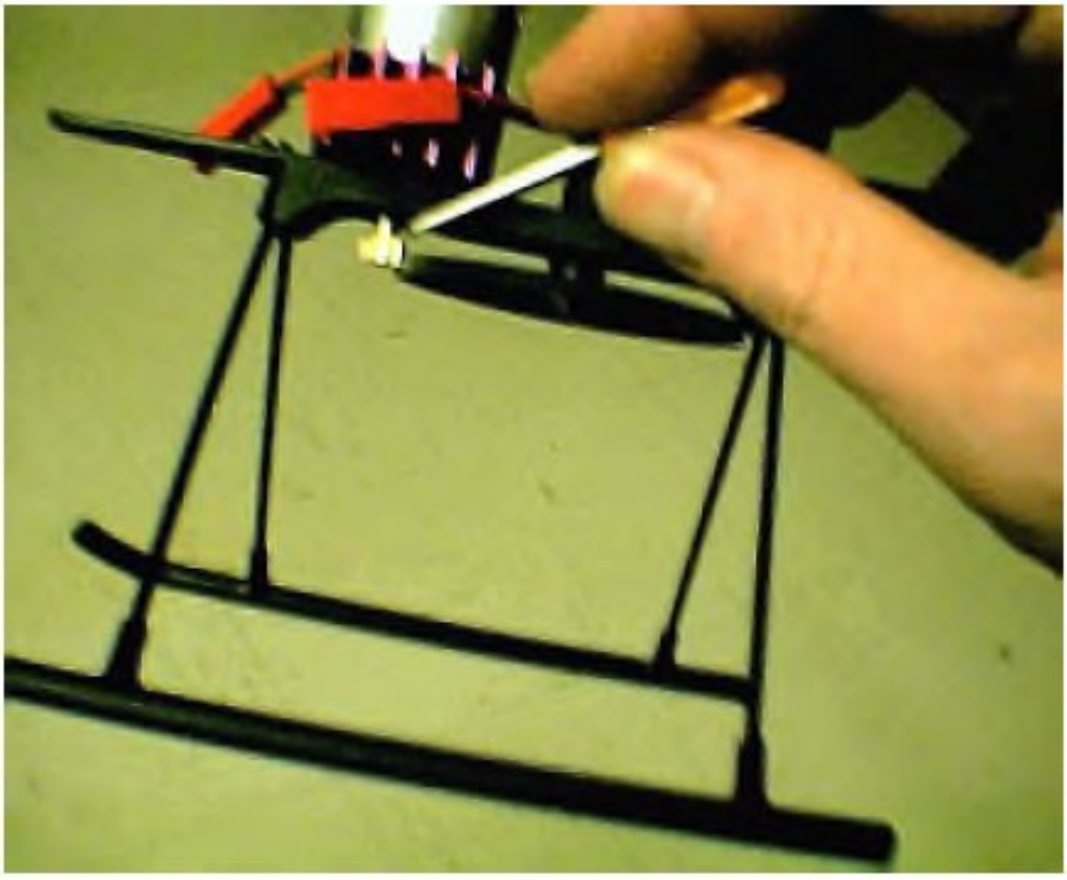
reinstall

Sand heavy end until balanced.

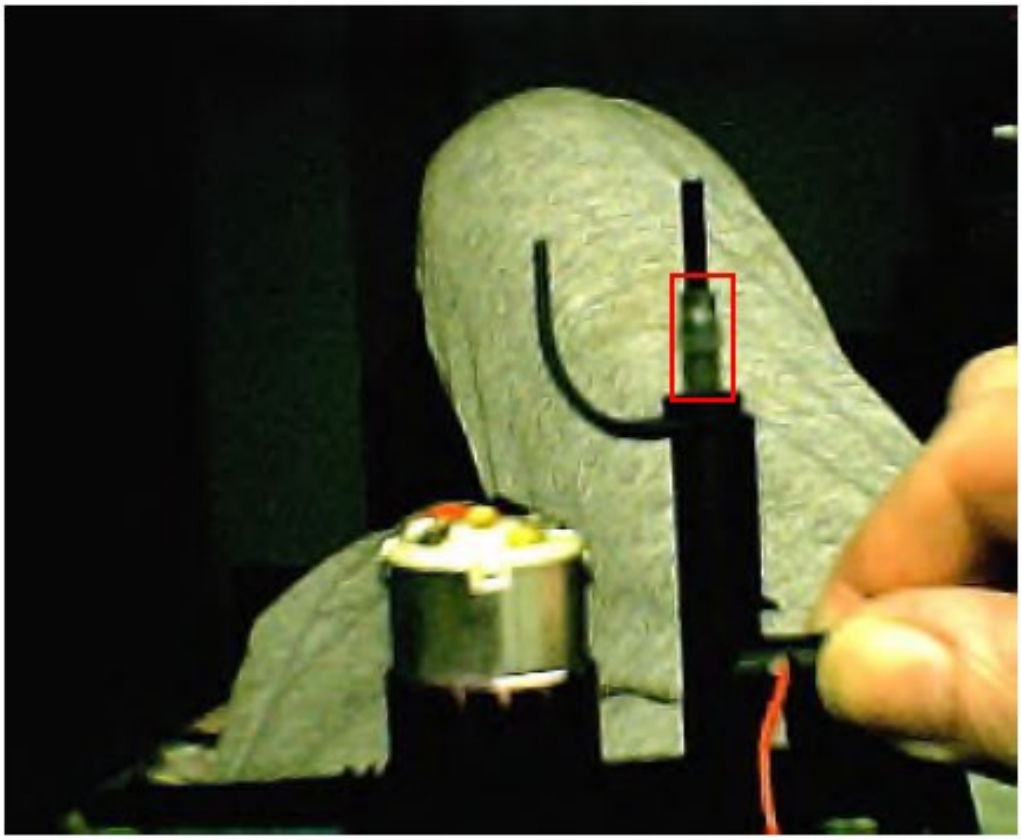
Lose the tape and spray paint one end after masking, reinstall.



Check mesh with a paper towel, lock motor screws with Loctite

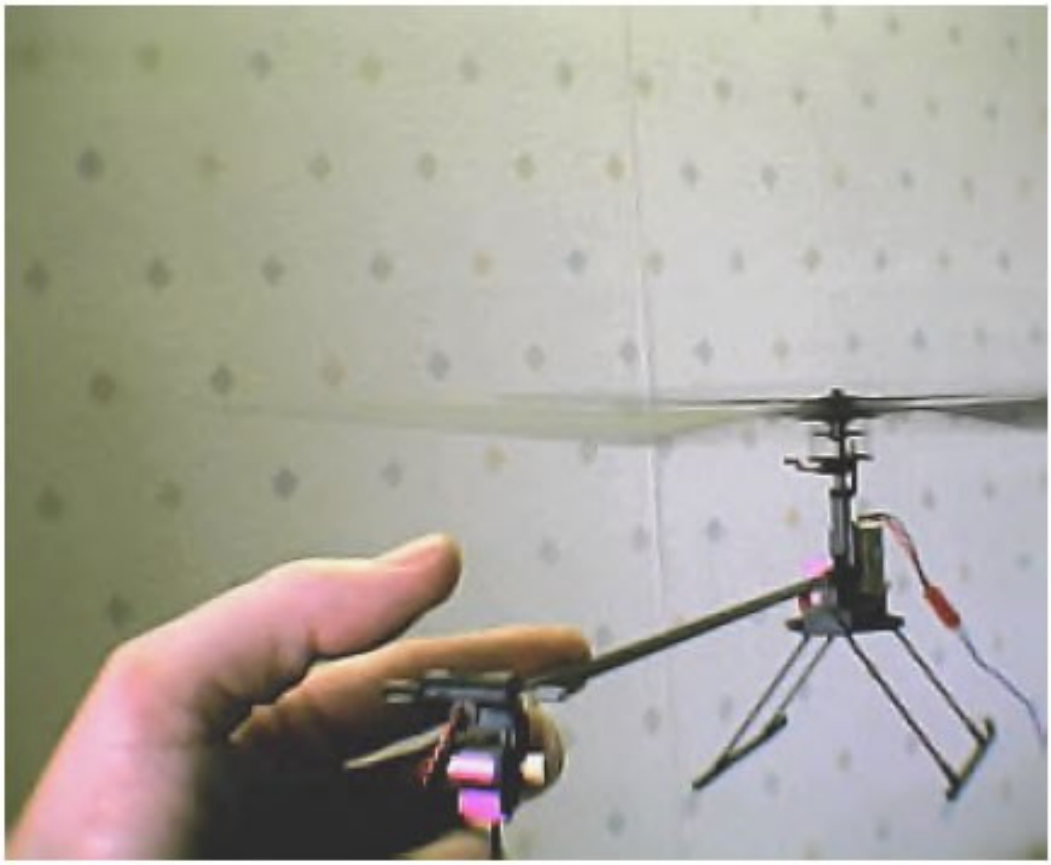


You can't have up/down slop in the mainshaft like this!



Put a piece of surgical tubing (RC fuel line) 1/2” to 9/16” long on shaft above bearing. Swashplate sits on top of it and compresses it down. If too long, trim with Xacto.

See how flybar paddles follow top surface of the swashplate, like styrofoam floating on water. If swashplate binds on that U shaped fork, file out channel a bit. Main blade screws can be tightened and you can PULL them straight out to set. After first run up, really sock 'em down!



Note how fine the outline is. They are tracked by BENDING! And keep bending until you get what you want.
Install radio, crash and repeat process!

DF4 specifics

Make sure your original unit (PHA-01) is OUTSIDE the cabin as these are notorious for burning out or even blowing up! Cut a rectangle in the canopy and RTV it there so the blades blast air down onto it. Or, leave the canopy off altogether. Do NOT put the thing in some kinda “saddle box” next to the mainshaft.
Make sure you read about the PHA-01
7/30/05: Found a BETTER manual for it .
And its NEW replacement, the PHA-300
Colco Thunderbird does not have the problems that Walkera does, as they use seperate components
The issue there is: by the time you get done upgrading, you've got more money into it than a collective pitch machine.

Flight

Flying a fixed pitch machine is very different also, in that during a turn it will drop in altitude and you have to wait for the head to spin up to compensate. If it rises too fast in

forward level flight, you have to jump off the throttle also. The easiest way to fly a fixed pitch machine is to put wheels on the thing and fly it like an autogyro.
See the videos in the Intro section and ”Dark Horse” with the Airwolf mod, he put wheels on one of his.
See Chapter 10 and incorporate the mods I implemented on the Df#4, because this sucker needs ALL of them! Since the two models are so similar, you'll find that chapter very useful.

Blade CP Basics

Here's a dedicated R/C forum for it:

tail rotor:

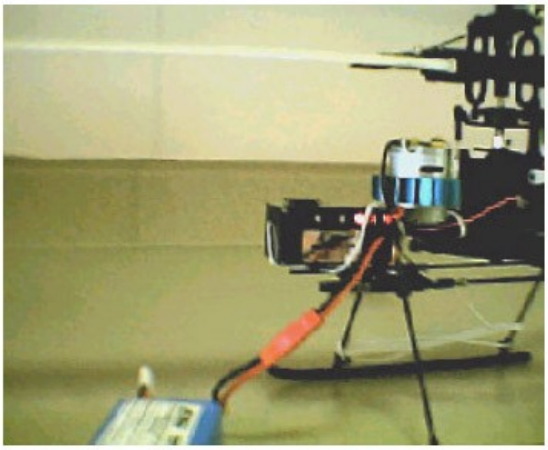
The Blade comes nicely packed. The stock 650mAH battery is at the lower left, the charger is to the right of the transmitter. Note the manual in the detent of the foam cover, it is identical to the .pdf download.

Look carefully at these pictures of the Blade's tail rotor:


I fooled you! Notice in the 2nd photo that I have the Blade [left] sitting next to my Walkera Dragonfly #4 [right]! The point is... the tail rotor is identical and the Walkera spur gear is actually a little thicker and stronger than the one used on the Blade! The different appearance of the DF#4 motor is the fact that I have a heat sink installed on it, see chapter 10.

Powering up

Be careful! The 4-in-1 receiver causes servo chatter if the transmitter is turned off, no exceptions! You *must* turn the Tx on first before even plugging in the flight battery! You must also unplug the flight battery before turning off the Tx, or you will still get chatter and the head/tail motors will spin up unexpectedly. Also, throttle trim must be all the way *down.*




The “idle up” aerobatics switch on the right top of the Tx *must* be set towards the *back*, not pulled forward. Unlike Walkera however, if it is set wrong... the main motor will not
power up. The LED on the Rx will not change from red to green (ready) if you power up in aerobatics mode. The motors also will not come on without the LED showing green. You can only transition to aerobatics from a running/spinning rotor scenario. This is a good safety feature Wakera should move on.

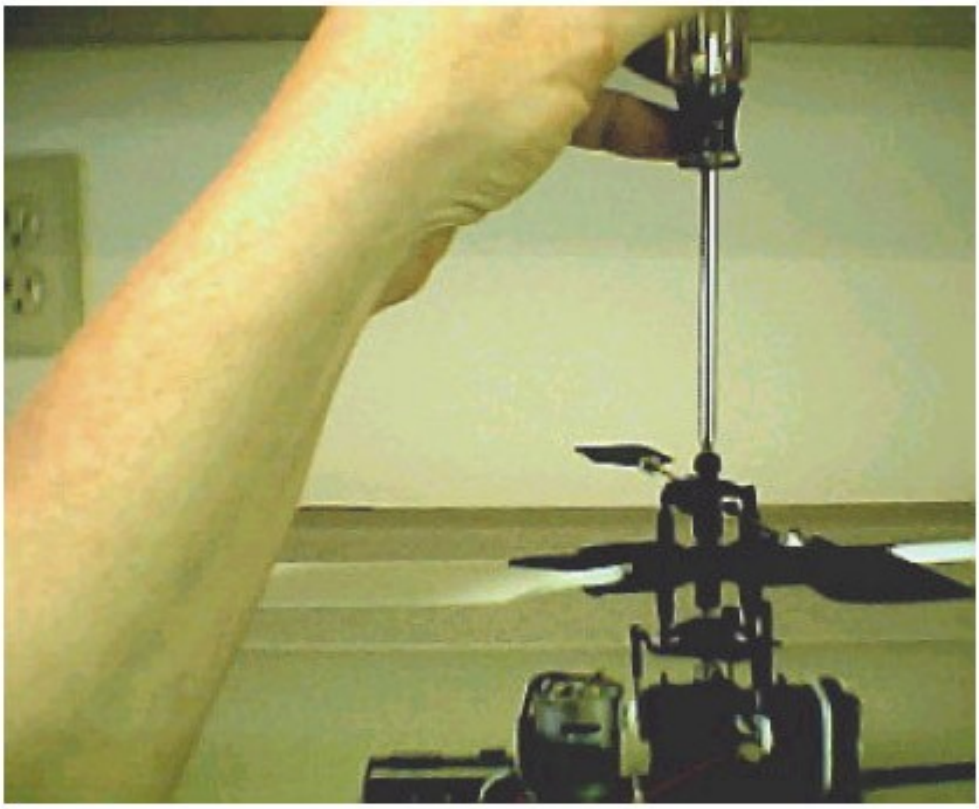
Range Check

The 4-in-1 receiver LED will change when signal is lost from the Tx. So, you can range check the system with the helicopter in hand. Move away from the Tx with it and watch the LED turn red. About 75' or more with the Tx antenna retracted should be fine.

Critical factory rotor head modifications

Although this is documented by Horizon, I wanted to produce a step-by-step

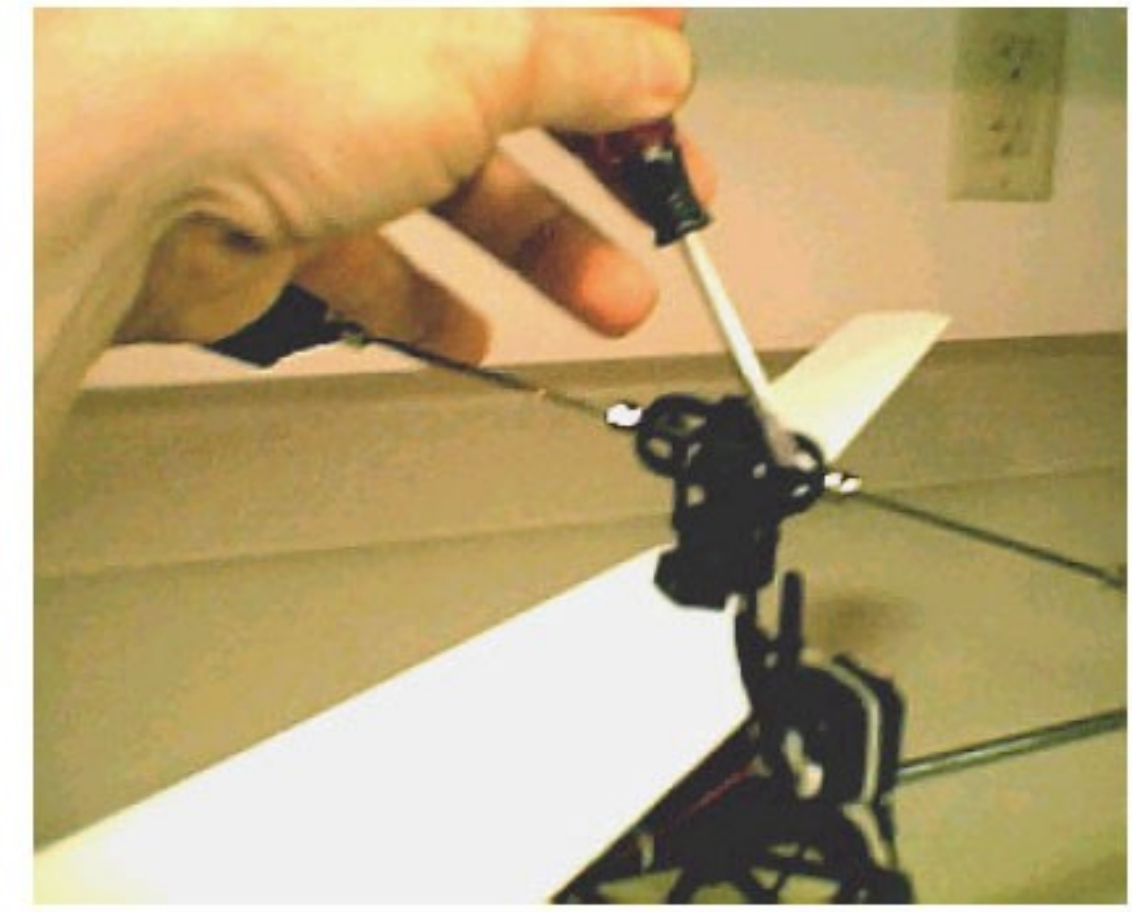
procedure with photos. Whether new or used, you should *not* attempt flight until you confirm this is done. So, let's begin:



Remove the Cap Head Screw [029].

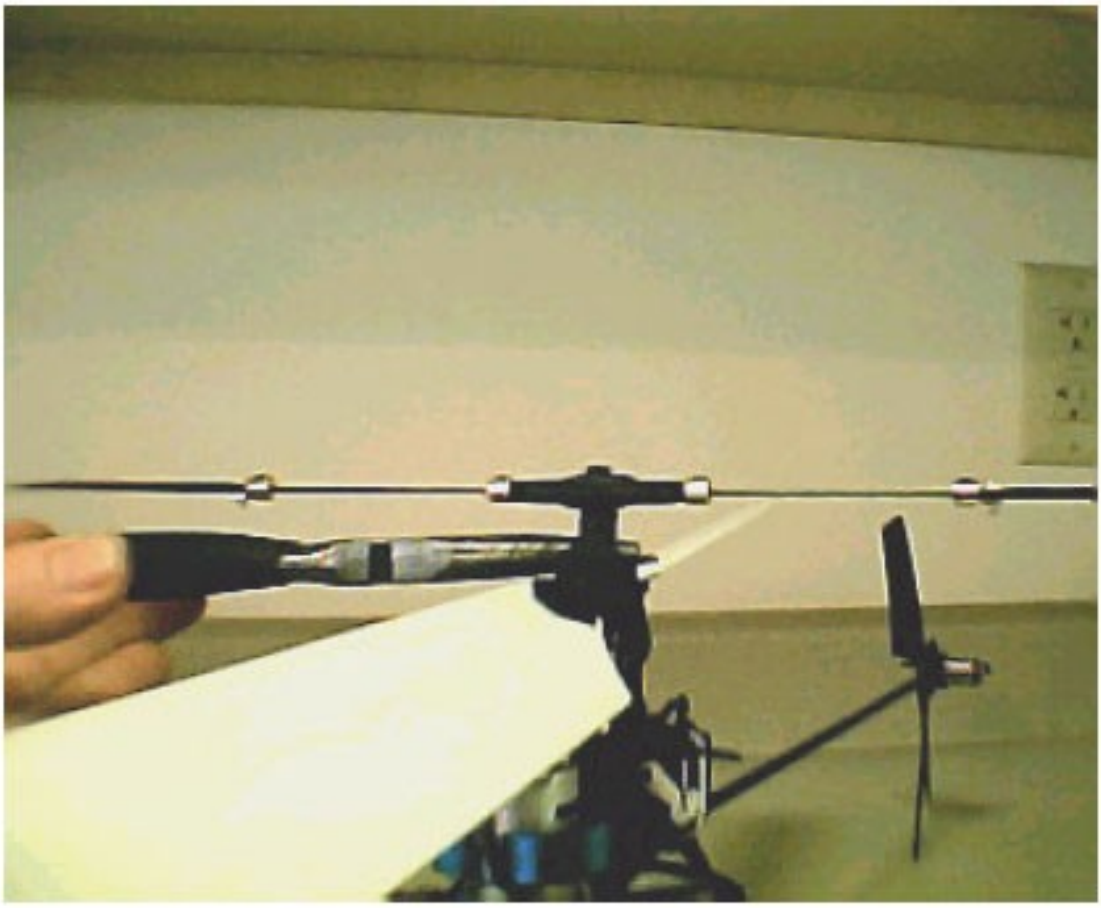
Remove the Center Hub Cap [030].

Remove the top ball link of the Paddle Control Frame Pushrod [009] from the balls of the Paddle Control Frame [031]. I will refer to this pushrod from now on as the “onion rings”.

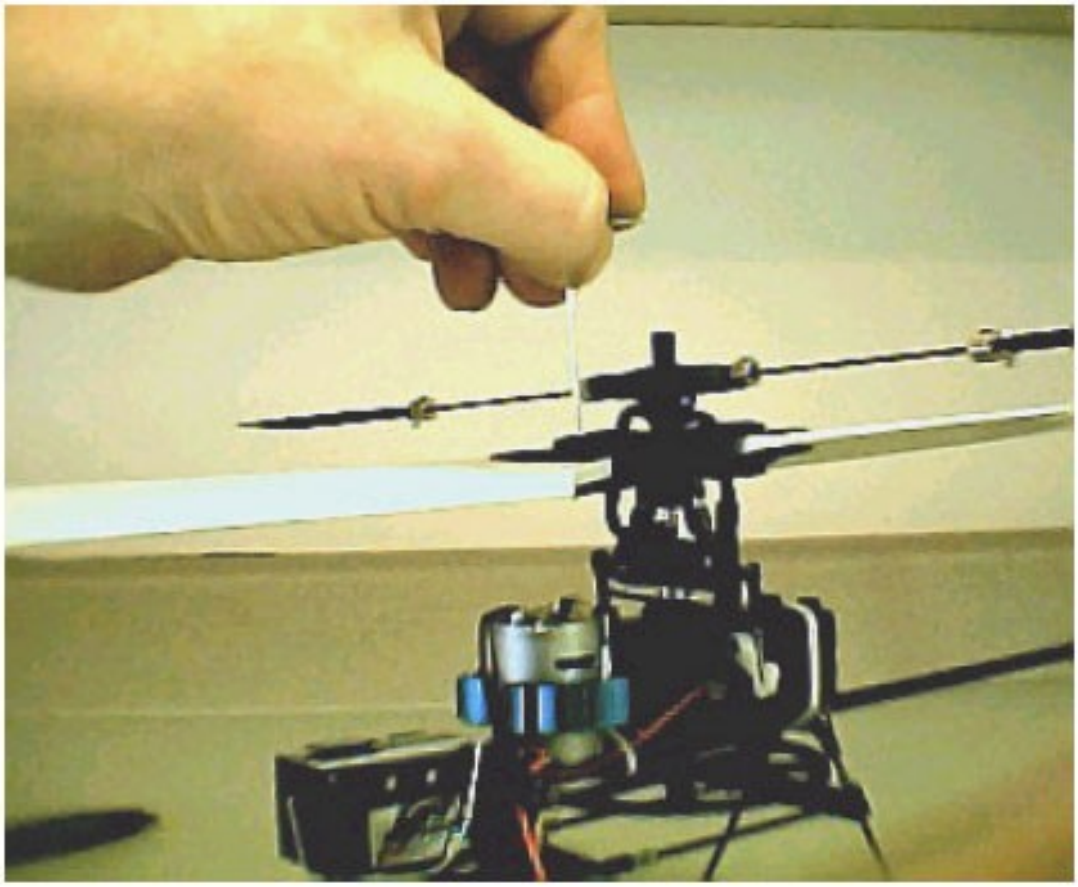


Pop the upper Pitch Control Link [006] off the inner Paddle Control Frame [031] balls. Now make sure the rotor head [034] slides freely up and down the Center Hub

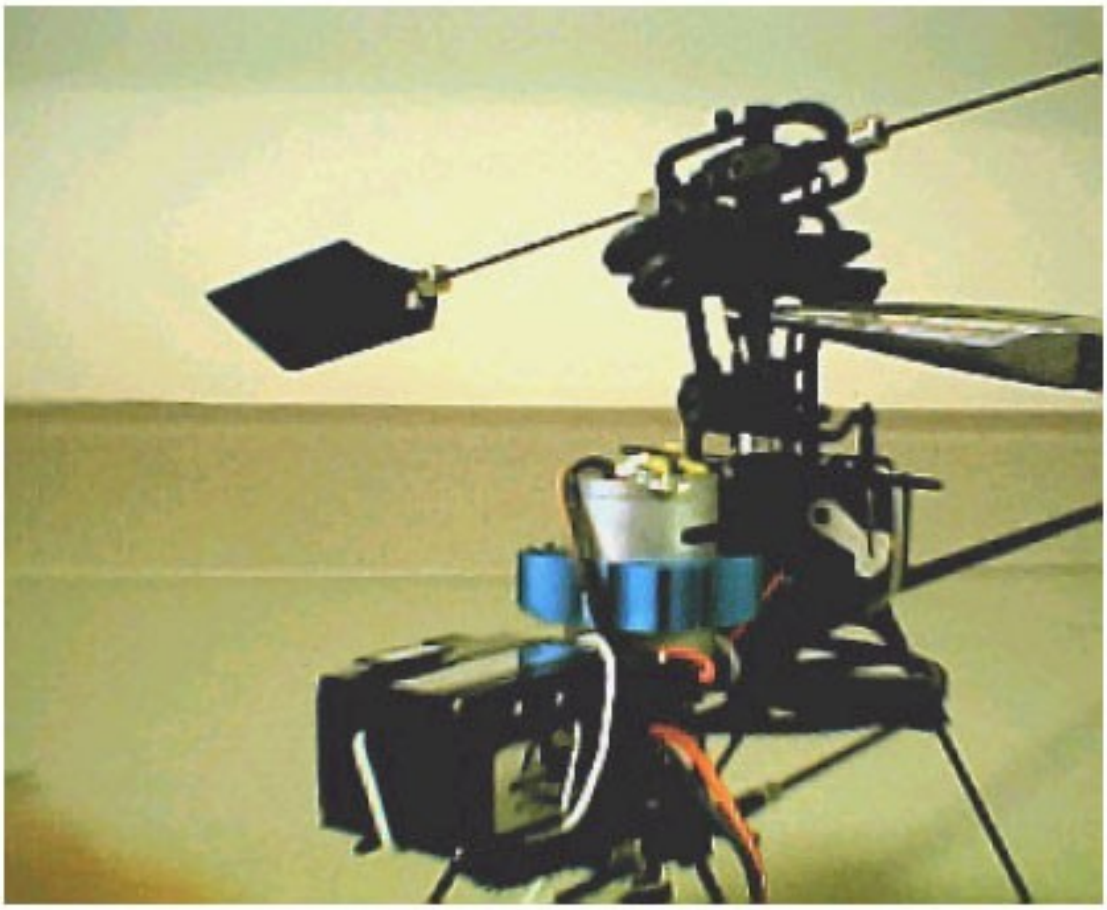
[008] without any wobble or snagging. Since it is channeled, there is not much modification you can do to the rotor head. So if it hangs, you can try oiling or just replace it.



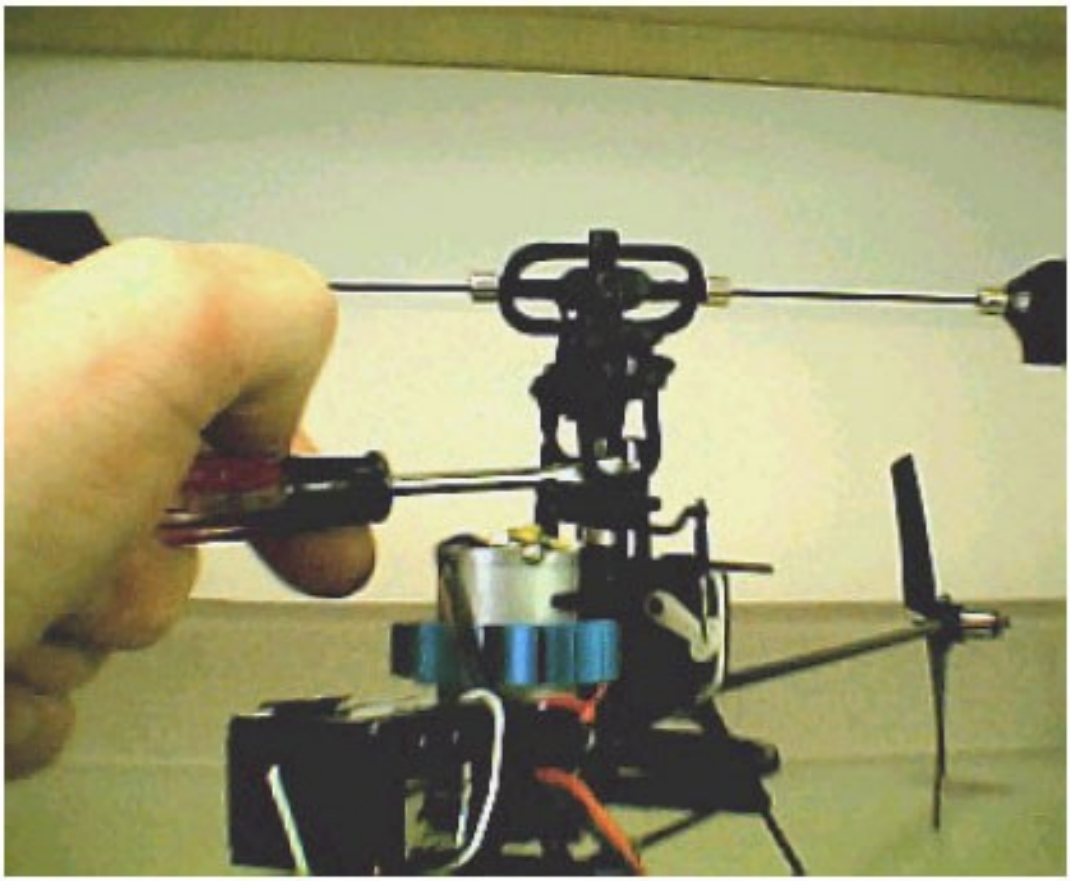
Now is the ideal time to check flybar balancing as shown. The 2 inner wheel collars [004] may be shifted back & forth to attain balance. Also align your paddles with each other and the Paddle Control Frame... *all* being 0° to each other.



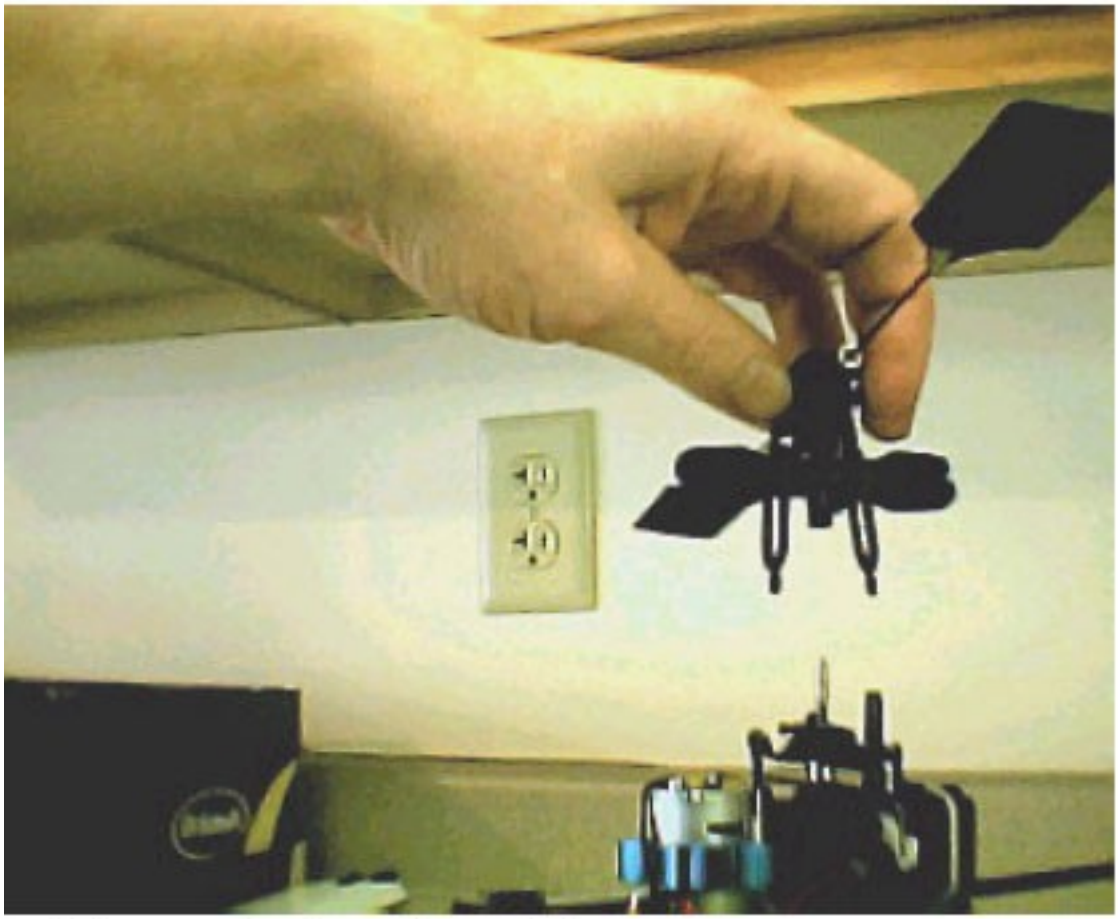
Remove the main blades. **Note** there is no Loctite on the hex nut in the lower Blade Grip [037] so you should add some when you reinstall the blades later.



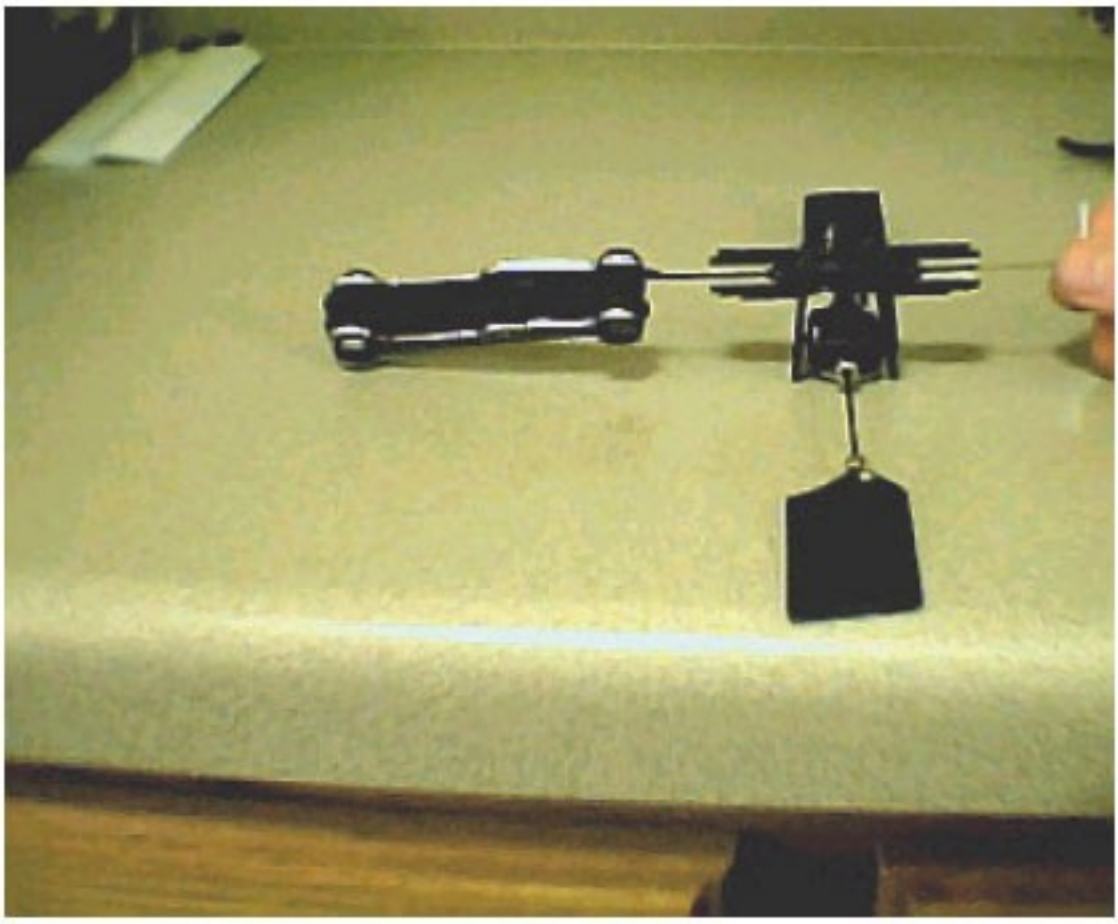
Pull the Jesus Pin [035]. If you ever lose it, a paper clip works fine.



Unclip the lower ball links of your “onion rings”.

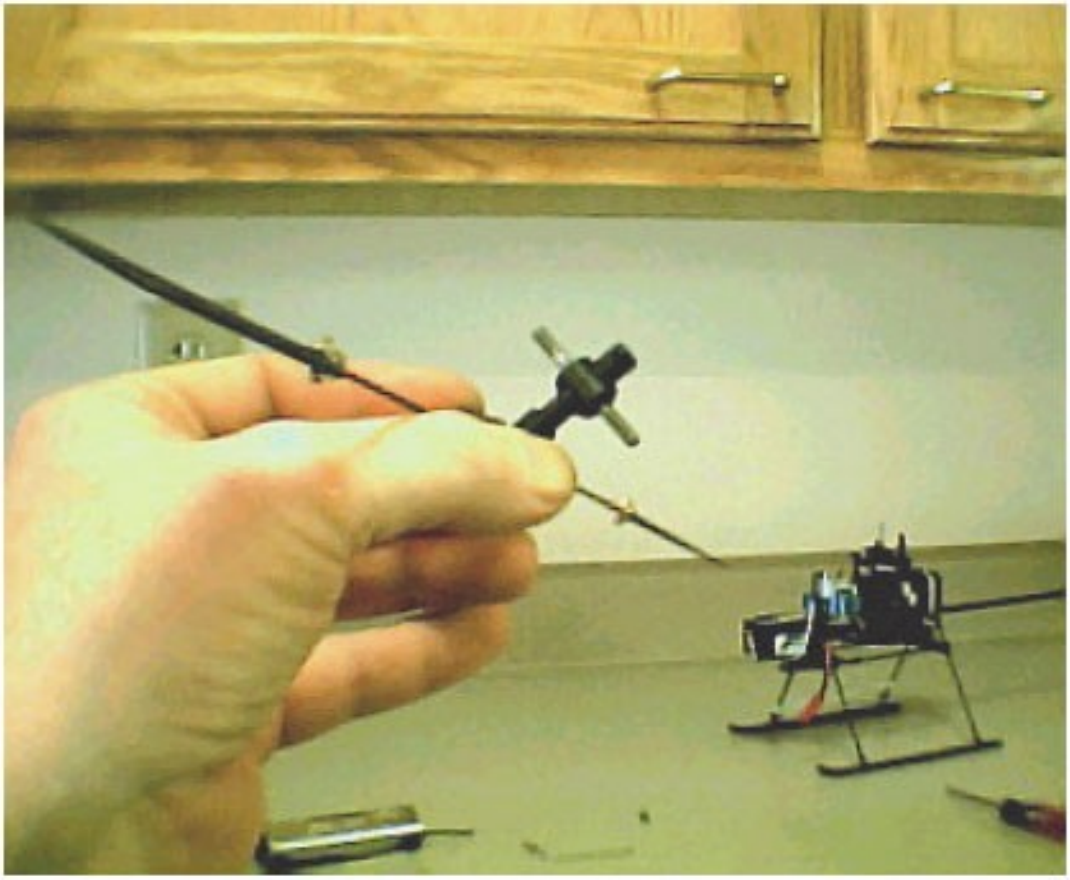


Pull the entire head straight up.



This is the very critical “sticky collective” mod! Using (2) 1.5mm hexkeys, turn to loosen and remove one of the Cap Screws [013]. The other will remain.

After removing the Blade Grip, wrap the Spindle [016] with paper towel and grab tightly with the *unserated* lower portion of your needle nosed pliers. Loosen and remove the remaining Cap Screw [013], the M2 washer [040] and thick washer [039].

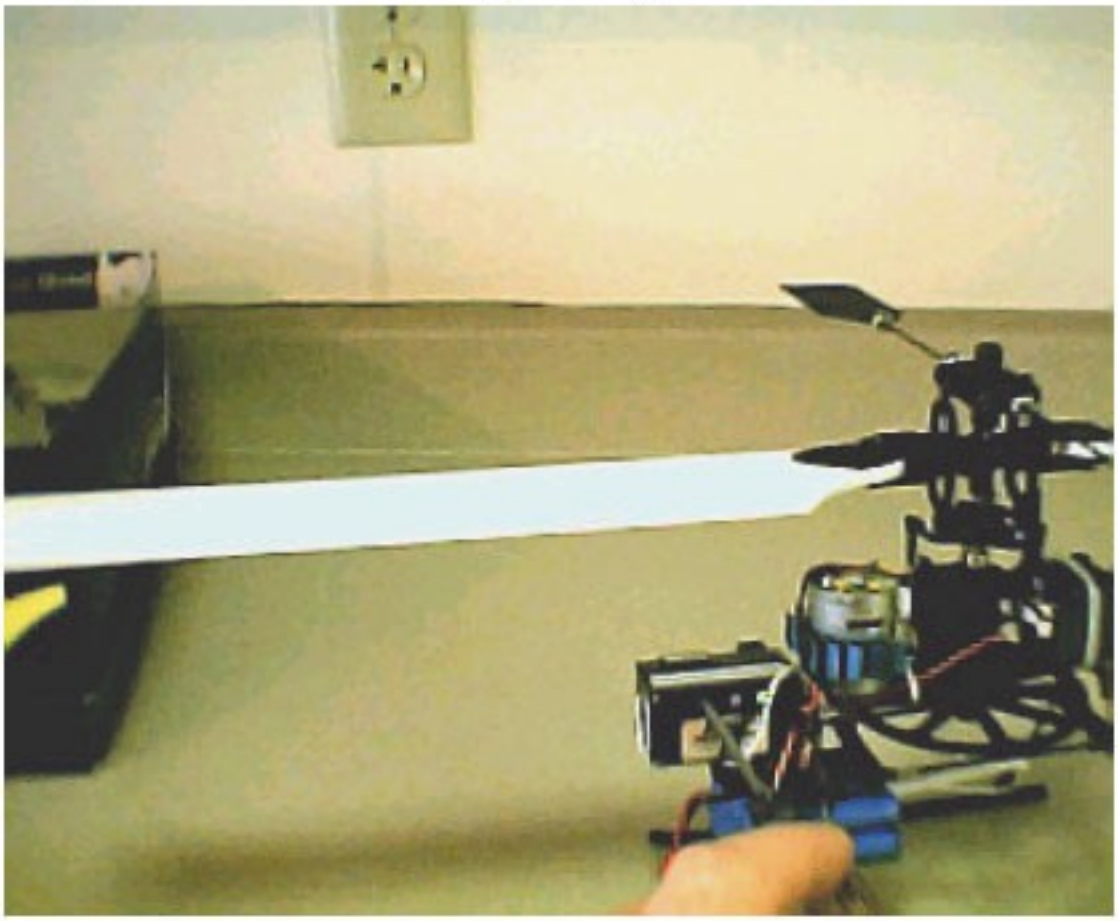


Now the Blade Grip Spindle should be comletely exposed. Inside the Center Hub [008], notice the (2) O-rings [038]. Against these should be (2) Washers [015] *but* note these are *shouldered* washers. The smaller diameter (shoulder) faces outward so that only the inner race of the Blade Grip ball bearings [014] are contacted. Make sure (2) [015] shouldered washers remain on the Spindle against the rubber O-rings. **Note:** Use Loctite inside the Spindle threaded ends when you reassemble later!

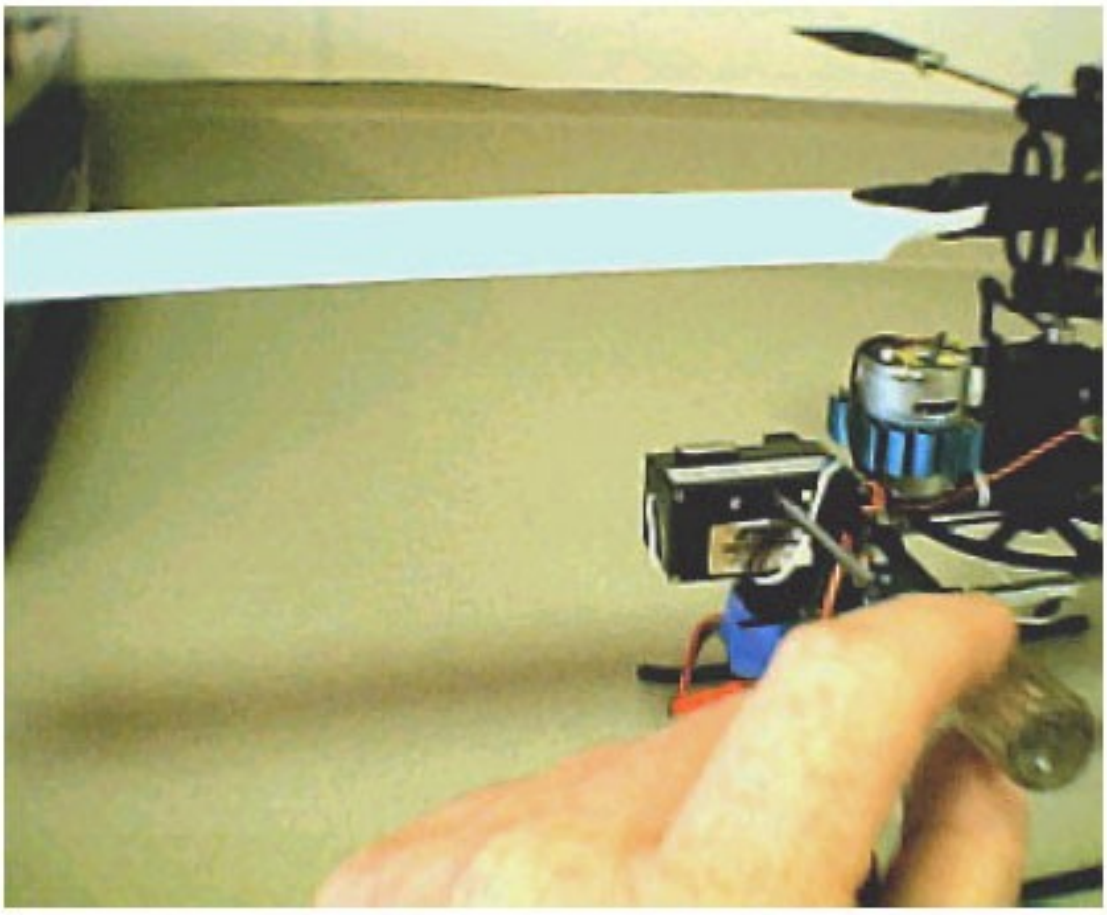
Here's the correct order: The Cap Screw [013], the *thick* larger diameter spacer [039], the *thin* smaller diameter M2 washer [040], the Blade Grip [037] itself, the shouldered washer [015] and finally the Spindle [016]. Duplicate, both sides of the Center Hub. Now make sure your Blade Grips turn freely and *very* smoothly, no high spots or sticking!!!

Here's another view of the *fat* spacer under the head of the Cap Screw, the *thin* M2 washer laying on the counter next inline towards the Blade Grip. Also, your ball links must not bind on the Blade Grip balls. If so, sand the balls with 600 grit fine paper or just replace the whole Blade Grip. Replacement kit is: EFLH1162-B ($8) and now uses (3) ball bearings instead of (2)! Only the older kit is listed in the manual. Rebuild/reconnect the head and all linkages.

Proportional Mix & Gyro adjustments



This is *very* critical, but also very simple and necessary! So, just do it *exactly* as I outline here. The manual is not that clear on this. Set the forward gyro screw 50% (screwdriver notch perfectly vertical). Set your tail rotor trim (left stick) to perfect center and *never* touch it again! Set the throttle trim completetly *down*. Power on the Tx, with the throttle at idle.



Set the Proportional Mix screw 75% (screwdriver notch running from 8am to 2am). Use the battery you intend to fly with most often, as the settings change slightly between NiMH and Li-Po packs. Power up the 4-in-1. Wait for the red blinking LED to become a green blinking LED and finally solid green!

Place the Blade CP on the floor (no wind!) and bring the throttle upto where it gets light on its skids. If the nose turns left, give the Prop. Mix screw a little (+) clockwise rotation. If the nose turns right, give the Prop. Mix screw a little (-) counterclockwise rotation.

Ideally, the tail rotor motor starts spinning *before* the the main rotor motor with respect to throttle stick position.

Mega Note: You *must* power cycle the helicopter each time you adjust the Proportional Mix screw. Just disconnect the battery and reconnect it so the 4-in-1 can reinitialize with the new setting. The goal is to bring the machine to a hover with no nose drift left or right and the tail rotor trim tab on the Tx centered.

Now back to the gyro adjustment. At 50%, it should “tail wiggle” slightly as mine did. So, you will turn the gyro screw a little (-) counterclockwise until it just stops while in a stable hover. When you progress to more advanced flight and aerobatics, you will want even less.

Hop Ups

I have found the stock wooden blades just fine for basic flight and hovering, you don't need the carbon fiber high-priced blades. If these woodies are cheap, try 'em on your DF#4! The Blade CP also lifts off earlier on the throttle than with the fully symmetrical blades. I strongly recommend you use the heat sinks I called out in chapter

10 for the DF#4 also, to prolong motor life.

Conclusions

Overall, I found this machine much easier to setup than any Walkera and a dream to hover! Once the tail is adjusted right, it is rock stable and has a sweet sound to it! The main drive gear gets chewed up easily, so make sure you have plenty of backlash there as the owner of this machine did not adjust it and I am missing some gear teeth. It's not effecting flight so far. One drawback though is there is no autorotation clutch, so Walkera has 2 points on that feature!

The 4-in-1 is factory adjusted to give you +10° and -10° when in “idle up” aerobatic mode. In regular mode, the blades are always in positive pitch and never go negative. Since the pitch is factory set within the radio gear, everything else you can adjust is simplified due to this. Also, I have found the blade pitch links [006/007] to be very loose and easy to turn. Turn the links all the way in until the plastic pieces [006] bottom out against each other. Now hold one rod stationary, and turn out a link 5 half-turns. Hold the rod [007] and turn the other plastic ball link out 5 half-turns. This seems to be a good starting point. This also insures you have equal “meat” threaded inside both plastic ball links!

Do not rely on the velcro holding the battery to the bottom of the machine in flight, add some heavy rubber bands around the Battery Support Rods [052]. The main shaft [050] bends easily, so check this after a crash by powering up the machine with the head removed and watch the top tip of the shaft while it spins at below half throttle. Is it wobbling? Either replace or try straightening by bending and rolling on a pane of window glass. A straight shaft should not wobble when you try rolling it on an inclined piece of glass.

As with Walkera, I fly this with the canopy removed.