# BasicTraining

Ashley Lightfoot

**Genesis Hobbies Tiger 50 CCPM**

A Tiger by the Tale
O' Gather now ye helifolk,
And lend to me an ear,
It is I, Uncle Ashley, your favorite bloke
Bringing forth a tale to hear.

A tale of plastic, fuel and rotors.
Of the Audacity Models sort,
A Tiger 50 with its motor,
And the performance it reports.

So now without any hesitation,
"Cause your interest's so intense,
We start, as is our obligation
With the "Table of Contents"

*(OK. Poetry seemed like a good idea for an opener at the time...)*

**Tiger 50 Table of Contents**

- Bearings on all pivots
- eCCPM (120° swash orientation)
- Steel tail hub
- Long tail boom (27")
- Two-point fork pitch arm on tail rotor
- Horizontal fin mount for any fin (or none)
- Rear frame mounted tail servo
- Floating tail rotor pushrod guides
- Two platforms for gyro mounting
- Integral frame wire clips for servo wires
- Large, vibration isolated fuel tank
- Stiff, high fiber FRP frames
- Integral fuel line pinch shutoff
- 8.9:1 gearing ratio (89 tooth main gear - 10 tooth pinion)
- 10mm hollow main shaft
- Machined Aluminum Head Block
- 5mm spindle
- Adjustable output on see-saw, wash-out, and swash plate
- High fiber content FRP main grips
- Thrust bearings on the main grips
- Vibration isolated switch mount
- Large radio equipment platform
- Variable servo mounts
- Excellent ARF construction
- Pre-reamed links
- Large-cased bearings
- Quality 600mm wood blades
- Impact resistant "bleach bottle" canopy
- Colorful "cut and stick" decal sheet with interesting "mud flap chick" stickers

As you glance over the list, you'll notice that the Tiger incorporates a lot of nice features found individually on other helis on the market. However, the Tiger is the first heli that I'm aware of that incorporates so many in such an inexpensive package.


**This is what you get in the box. A box o'ARF.**

**Something Wicked(ly Fun)This Way Cometh...**

My Tiger 50 arrived via the Big Brown Toy Truck as an ARF kit. And being the good, destructive ex-Marine I am, I quickly dismantled it. This was done under the pretense of discovering just how well the ARF was built, but in reality, it was because I just like to take things apart.

I was pleasantly surprised at how well the ARF was assembled. I did not find any looseness in the integral plastic bearing blocks, especially the bearing-pinion fitting. Everything was constructed very well. Thread-locker had been used in all the appropriate places, and had not been overly used or used in the wrong places. I can recommend, based on my ARF, that one can assemble the ARF as it comes without worry of poor construction. That doesn't mean that one shouldn't give it a good look-over, because there's always a chance that something slipped through during QA. After all, although I'm perfect, I've learned to live with those who are not...

**More Reading Material**

As many of my fans know, I enjoy reading technical manuals. And the manual that is supplied with the Tiger 50 is by far the clearest, most detailed manual for a R/C heli that I have ever read. It goes into great detail about not only construction of the helicopter, but of the set-up as well. And it"s all done in our native tongue! In fact, I'm going to go out on a limb here and say that one could successfully build and set-up the Tiger 50 with only the manual without prior knowledge of R/C helicopters - it's that comprehensive! Heck, if you slapped a price tag on the front and made arrangements with Amazon.com, this manual could easily be passed off as a Beginners Guide to R/C helis. The guys at Audacity Models hit a homerun here!

### Slow down-Construction ahead

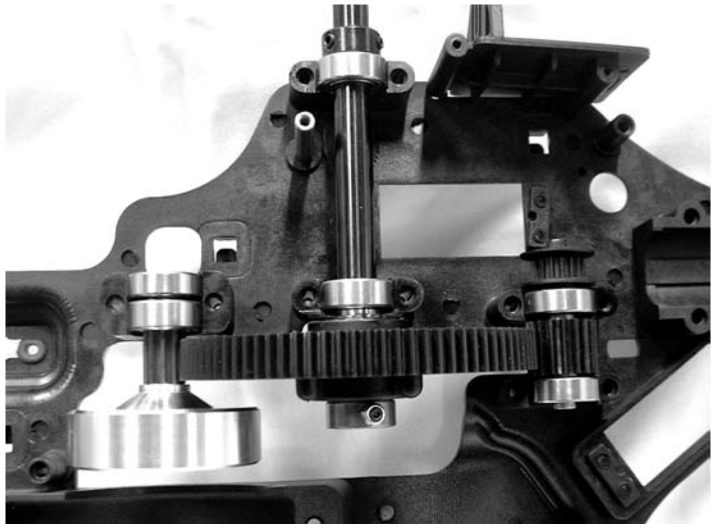
One of the things that struck me about the kit version of the Tiger 50 (as well as the ARF) is the high degree of pre-assembled components. For example, the rotor head is completely assembled in the kit, as well as the ARF. That means that some of the mistakes that are made during assembly (like getting the thrust bearing races reversed) are avoided. Also, all of the bearings were of good quality and packed with a light grease. Now, since I'm anally retentive and I already had this thing apart, I went ahead and re-greased all of the bearings with my Greaser. It wasn"t necessary, just fun... in a demented, masochistic way. And speaking of the bearings, the pinion bearing and the main shaft bearings are 7mm wide, vs. 5mm on many other models. This wider case gives a greater area for lateral stability, which should increase the reliability of the bearing and lower the wear on the plastic bearing blocks.

### As You Like It

As I mentioned earlier, the Tiger 50 incorporates many nice features in its design. Many of these deserve closer scrutiny.

First, we"ll start with the tail rotor assembly. The tail rotor belt cage can be disassembled and the bearings, shaft, and pulley removed without removing the entire tail case from the boom. The back-plate of the cage simply unbolts, giving access for maintenance to this critical area. Additionally, the tail hub is made from steel, not aluminum, and is secured to the shaft by two independent grub screws and not the axle screws. This is a nice design and should ensure excellent tail hub reliability and security. However, my favorite feature of the tail rotor is the two-point fork slider for controlling tail rotor pitch. This is a very positive control link and eliminates the adverse torque applied when using a standard single point bellcrank.

Now we"ll move down the boom, which is longer than many 50-size birds (33" from tail rotor shaft to main shaft). This fact, linked with the 5.2:1 tail rotor ratio, gives slightly more control authority to the tail rotor. The tail rotor push rod is guided through a series of "floating balls" mounted in tail boom clamps, giving a very smooth control feel to a standard metal push rod configuration. Also along the way we find the two tail support rods joined together on the fin mount, which is independent of the horizontal fin, and thus can be used for mounting the stock fin, specialized 3D fins, or no fin at all if you're a cheap narcissistic minimalist like me.



**TG50_frm-brg.jpg - Caption: A peek at the main mechanics. The wider bearings are obvious.**

**Note different ball link lengths on swash. Also note metal sleeve inside wash-out base. Nice touch.**

The main gear is an 89-tooth gear with a 10 tooth pinion, giving a 8.9:1 gearing ratio. This allows the use of a .46 engine or a .50 size engine in the Tiger. Running this high of gearing on a .50 will mean that you'll be turning higher engine RPM to get your blade RPM, but it also operates on the higher end of the engine's power curve.

The side frames are exceptionally stiff, with a fairly high concentration of fiber in the Fiber Reinforced Plastic (FRP). I especially like the rubber grommets used to isolate the large fuel tank and the power switch; both very nice touches. As I mentioned before, the integral bearing blocks are tight when assembled without any need to shave their mating surfaces ( I will refrain from making a joke here). The frame assembles with 20 pass-thru bolts. This all comes together to make a surprisingly stiff and precise frame as a basis for the heli; something that is essential in a 50-size helicopter. This frame stiffness also translates into minimal ground resonance. So the Tiger doesn"t jump around on turn-up like a like a Jack Russell Terrier after eating a birthday cake.

One thing that did jump out at me during assembly is the metal sleeve on the inside of the wash-out base. This is a nice touch because the wash-out base is a very important link in ensuring head precision. Plastic wash-out bases tend to wear quickly, allowing slop in the linkage, which translates into slop in flybar pitch and control. The Tiger"s wash-out base has a metal lining that should allow for long term use without developing slop. Also obvious is the machine"s aluminum head block. Plastic head blocks can become worn and slightly off-center, often causing an imbalance and vibration that will drive you mad searching for it. The aluminum head block on the Tiger eliminates this issue altogether.

### Holy See-saw, Batman!

In a previous, highly informative article, I discussed the flybar's function and really confused the matter by discussing flybar ratios. Well here comes a test. Now you get to put some of that knowledge into action because the Tiger not only gives two link points on the wash-out arms, but also gives two mounting holes on the flybar see-saw. This allows you to choose a 1:1 fly bar ratio (high flybar authority) or a .7

:1 (moderate fly bar authority) Thus, one can use the various combinations to tune the Tiger's flight characteristics. For example, one could use the outer wash-out arm points to increase the reaction of the fly bar (for crisper, more responsive cyclic) or use the 7 :1 see-saw position to minimize the pitchiness in forward flight. If you're just learning, stick to the inner holes on the wash-out arms and the 1:1 see-saw points to create an exceptionally stable platform to learn the basics with. You'll be glad you did.

Another ingenious area for adjustment is on the swash plate. If you'll check the swash carefully, you'll notice the bell link balls on the swash are mounted closer to the swash hub than are the hiller link balls. This configuration allows for more hiller input and less bell input from the swash, again, making the heli more stable. An extension kit is included with the Tiger to lengthen the bell link balls, or you can choose to reverse the set-up and use the shorter balls for hiller input and the longer balls for the bell side. Again, this is just one more tuning feature for you to experiment with when setting the Tiger up for your flying style.

**Tail rotor has an easily removable belt cage, steel hub, and a two-point tail pitch fork.**

As many of you remember, I hate making up links and then reaming them to fit. It's a lot of work, but it pays off in the end. But it's still WORK, and I'm allergic, so doing work could be deadly for me. However, the Tiger comes with all links prefitted and reamed. It's a miracle, I tell you! A miracle! I did have one link that was not symmetrical, in that one of the link ends was screwed on the link all the way and the other end was barely halfway on, but a few twists and that problem was solved.

There was also one small, yet important thing that almost evaded my discerning eye. The see-saw arm bearings and the wash-out arm bearings ride on a flanged sleeve rather than a simple tube sleeve butted up against a washer. This seemingly minor point is critical when it comes to having precise, slop-free control over the disk, and allows the Tiger to utilize trailing blade arms with non-correcting delta to allow superb hover qualities without running into blade divergence, known to most of us as "woof and poof". Not only is that excellent attention to detail, but if you memorize that last sentence, you'll be able to impress just about everyone.

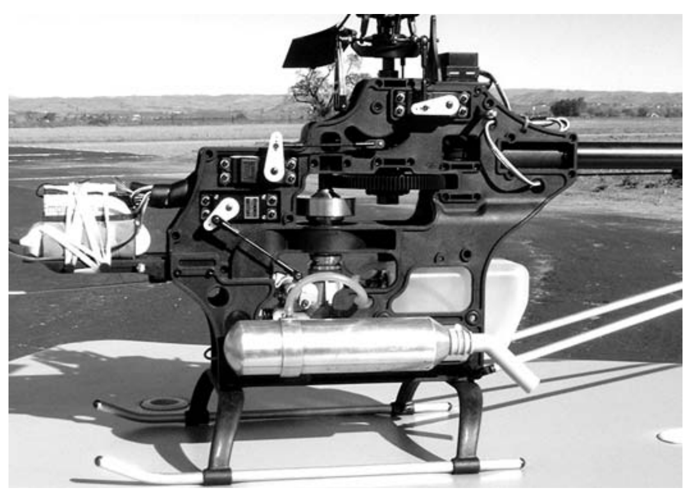
The 600 mm wood blades supplied with the kit were of surprisingly high quality. I say "surprisingly" because I'm skeptical of wood blades and always expect to have to perform some major tuning and balancing, followed by some serious tracking adjustments on the first flight. However, the stock woodies balanced almost perfectly with the CG's within .5 mm. That's good even for Carbon Fiber blades. And they tracked very solidly on the first flight, even though I had a slight tracking problem initially, which I'll get to in a bit. Oh, and while we're talking about balancing, the fan and clutch balanced nicely right out of the gate. Sweet!

### And Now a Word From Our Sponsor - Acronyms Anonymous

"CCPM" is shorthand for "Collective Cyclic and Pitch Mixing". And if you think about the term, it dawns on you that most modern R/C helis are CCPM in that they all have some kind of mixing that occurs in the flight controls. However, some models accomplish this by mechanical means (Raptor, Sceadu EVO, Hawk, Xcell 60, etc.). This type of mechanical CCPM is usually abbreviated mCCPM (catchy, huh?). On the other hand, some models use electronic mixing (eCCPM) such as the MA Fury, Venture, Voyager E, etc. The Tiger 50 also uses eCCPM for its flight controls. Now, most of the time, when someone refers to a model"s control system as being "CCPM", they mean "eCCPM". And you're also going to hear many people swear by one control system or the other, and swear at each other over which one is better. But as in most things, both have their pluses and minuses. Here's a quick rundown of the basic differences:

mCCPM uses a servo for each axis, linked through various arms and bellcranks to apply the appropriate control to the swash plate. One of the most popular mechanical methods is the use of a pitch arm that is controlled by a pitch servo, linked to the cyclic servos. This is a very simple, precise, and reliable method of controlling a heli. It also allows use of dissimilar servos for the three control functions, thus giving separate and direct variation of the three control axes.

eCCPM uses three servos in unison with each other to produce the desired movement of the swash plate. For example: for pitch, all three servos move the swash plate up or down. For cyclic, all servos move in a way to tilt it the swash in the proper direction. The advantage of this is the reduction of linkages and the inherent friction that goes with them, as well as minimizing the mass of the control linkages and mixing arms that has to be overcome on each command. Additionally, with eCCPM, the loads are divided among all three servos rather than just one. If one of those servos fails, the other two still allow limited control in all axes, albeit squirrelly, unnatural control, which should offer some excellent entertainment for bystanders. The other side of the eCCPM equation is that in order to use eCCPM, one must have a radio that can be programmed for



this type of control, which rules out many of the older or low-end R/C radio sets. However, it is rare to find a modern R/C radio transmitter that has helicopter programming without eCCPM mixing capabilities.

A downside of eCCPM is that there is some interaction among controls because of the fact that all three servos are never perfectly matched and won't be able to react in exactly the same manner or time frame. Additionally, the three servos should have precise centering and hold in order to minimize this effect. That's why I recommend using digital servos for eCCPM. Digital servos are generally very precise on center and have excellent resolution. This is not to say that standard analog servos won't work; they will. And for a beginner, they will work fine. But as one gets into more areas of precision flying, digital servos, or at least high quality analog servos, are almost mandatory on an eCCPM machine.

Having said all of that, I used digital Futaba 9252's on my Tiger 50 because a.) they're good, bullet-proof digital servos with excellent centering and holding power, and b.) because I already had them on hand. Remember- I"m cheap. Now, Back to our program...

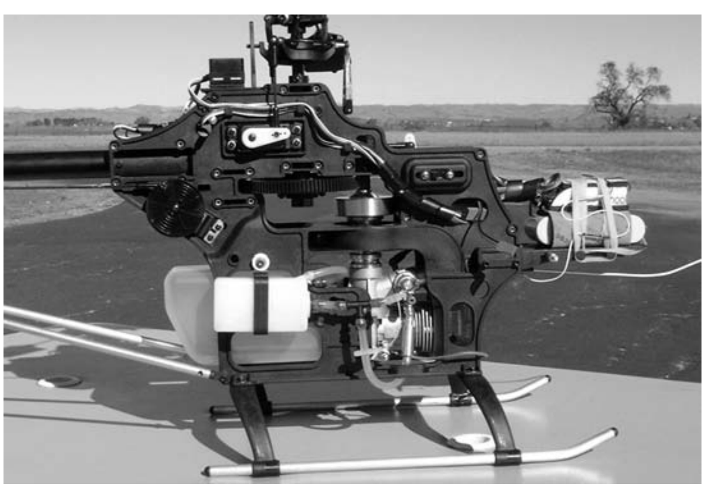
### Some things to be aware of

In the construction manual, the Audacity crew mentions checking for proper engine and clutch alignment when installing the engine into the frame. And that's good advice for all helicopters when constructing them. I, of course, failed to heed this when I assembled my engine into the Tiger's frame. I checked the lateral alignment (side to side), but not the fore and aft alignment. This is important because the engine can move in this axis also. So make sure that the engine and clutch are aligned properly both side to side and fore and aft before tightening down the frame bolts to the engine mount. "What happens if you don't", you ask? Well, the engine will put a slight side-wards force on the pinion, which in turn puts a side force on the pinion/bearing interface, causing it to loosen slightly. Then you'll have to drop the pinion/clutch bell out of the bearing race and resecure it with red loctite. Or if you are really a bonehead like me and don't catch your mistake until many flights later, you"ll need to use JB weld. The moral of the story? Follow instructions.

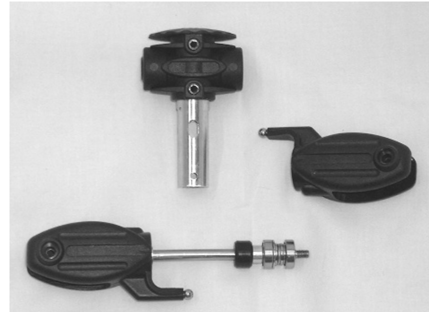
Another area to note is the mounting of the fan and clutch assembly. This assembly tightens to the front of the engine against the prop drive mount that normally comes with the engine when new. This minor part is essential for assembly in the Tiger. If the engine came from other birds that use a different fan/clutch, chances are you removed the prop drive and key and threw it into the box o'parts that we all have on our workbench. So you'll have to dig it out and slap it back on the front of the engine. Now here's where it gets slightly tricky. As you tighten the fan to the front of the engine, the tightening pulls the fan tighter against the prop drive. But the prop drive is knurled to grab into the backside of a prop, so it's not exactly a good, precise mating surfaces. Unfortunately, tightening the fan against this uneven surface tends to throw the fan/clutch assembly out of true. To fix this you have two options. Well, three if you count "not taking any action at all"...

### To Lathe or not to lathe; that is the question.

If you or a buddy has a lathe that can turn down aluminum, then you can smooth the face of the prop drive to near perfection, and the fan will tighten down without going out of true. However, if you're like me, and barely know how to spell "lathe" much less know how to use one, then there's another,more time-consuming method. Basically, it's the "hunt and peck" method.



First, tighten the fan to the engine, but leave it loose enough so that it can be turned with some effort against the prop drive by hand. Then, use a dial indicator to find the position where the fan/prop drive connection causes



**Dismantled head. Bearings are in place on shaft for photo only. Note aluminum head block.**

the least amount of run-out. If that run-out is .003" or less, you may want to call it good, since that is a fairly acceptable run-out. However, if you want to get closer, then make an indelible mark on the fan hub and the prop drive on the opposite side of the high point according to your dial indicator (this is the point where it indicates the point of greatest deviation). You've now marked the "high point" of the prop drive. Disassemble the fan/prop drive, and with a rotary tool (a.k.a. "Mr. D") or a fine-toothed file, shave a very small

**Here"s a shot of the flanged bearing sleeve. This is an excellent engineering touch.**

amount of aluminum from the face of the prop drive on the marked "high point". You only need to shave the knurling on the inner ring of the prop drive, since this is the only area that contacts the fan hub. Go slowly, testing the fit each time until there is .001 run-out or less between the two sides (180 degrees apart.) If you're patient, you can get the run-out to .0005", which is inside the margin error for most low cost dial indicators.

Of course, many of you are going to blow all of this off and tighten the fan to the engine and call it good. And, as we all know, the heli will still fly. Inability to adjust the run-out of the fan hub and clutch assembly on the engine is normal with some popular heli models. However, if you want to save yourself the frustration of foaming fuel and mysterious wire breaks in flight, followed by even more mysterious berserk flight and unscheduled meetings with mother earth, you should spend a few bucks on a dial indicator at least and take the time to adjust run-out when you can. It's certainly cheaper than all the repair parts required for your unexpected heli rebuilding opportunities.

### Strappin' a saddle on the Tiger

Since I happened to have one lying around, I chose the JR 6102 radio with the 770 SPCM receiver to guide the Tiger around the sky. And since this is an eCCPM bird, the set-up is slightly more involved than mCCPM. The Tiger uses a 120 degree swash, so most eCCPM radios should handle this with ease. However, I did stumble across a deficiency in the 6102's manual in describing the eCCPM set-up. So, to help all of you who come after me, I've taken the issue of programming eCCPM and boiled it down into two distinct phases: getting the servos to work correctly as a team, and then getting the "team" to move in the correct direction.

On the 6102, one should first adjust the individual servo direction in the CCPM menu. This means if you give it a cyclic command, the servos should work together to tilt the swash in the axis you've commanded it in. In other words, if you tell it to pitch forward in cyclic, adjust the servo directions until they pitch either forward or backward. All we're trying to do right now is get them to work together. We'll get them to go the right way in the next step.

The magic settings for the 6102 and the Futaba 9252 servos were as follows:

| | | |
|---|---|---|
| *AILE* | *60%* | *N* |
| *ELEV* | *60%* | *R* |
| *PIT* | *60%* | *R* |

The "N" and the "R" represent "normal" and "reverse" directions on the servo. After getting the "normal" and "reverse" settings correct, the servos will respond as a team. However, they still may not be working together in the commanded direction. Such was the case with collective pitch. When I gave positive pitch, the servo "team" moved the swash in the negative direction, and vice versa. This is where that little minus sign between "PIT" and "60%" in the above example makes a difference. By adjusting the percentage throw from 60% to - 60% on the pitch channel, the problem was solved. The

**Fan and clutch assembles. Note fan blades are more efficient airfoils, not just flat paddles. Nice attention to detail.**

**Fan/clutch assembly on engine with prop drive.**

same would hold for cyclic response if one or both of the cyclic commands were reversed. This took me a while to figure out since it's not mentioned in the 6102's manual. But, as is expected from a heli expert such as myself, I reigned victorious.

Balancing the Tiger before flight requires some attention because the tail boom is significantly longer than normal and thus the heli comes out slightly tail heavy. That's where the extended radio tray comes in. With the long tray, you can strap your battery pack out further away from the rotor head and correct the imbalance. I also used a heavier 2400 mah battery pack to counter-balance the tail and give more juice to those power-hungry digital servos.

### Flying Tiger

I decided to set the heli up using beginner settings, and then work up from there so as to give the most in-depth analysis your money can buy. Remember, I'm always thinking about you, dear reader, even though the heli expert in me wants to go and wring this thing out. Luckily for you, I still have a modicum of self-discipline.

And it took all of that discipline to not yell out, "this thing is a hovering monster!" on the first flight. Despite 30 mph winds, it locked in solid without much disturbance from the wind burbles. I did notice that there was an asymmetry to the tracking, however. Even though the right side of the disk was tracking properly, the left side was out. So, I checked the head again and found one of the see-saw arms was slightly loose laterally.

Later, I disassembled the arm and found the flanged sleeve was .006" too long, and the bolt head could not snug down against the bearing"s inner race. So, Mr. D (the rotary tool) and I ground that puppy down to the proper length (very slowly... Mr. D can be very aggressive), reassembled, and voila! On the next flight, the tracking was dead on.

Next, I set the power curves and the OS 50 purred along without a hiccup. No unwanted vibrations or fuel foaming was evident. This is an exceptionally smooth flying helicopter. Forward flight was uneventful with high speed passes stable and straight; no pitchiness whatsoever. I set up a few max pitch climbs and high speed "dump collective" approaches to check for proper mixture settings. All worked great! Then I decided to try a few minor aerobatics, such as loops, rolls, pirouettes, stall turns, etc. The tail lived up to it's billing of having plenty of control. The GY401 gyro held the tail perfectly, yet gave me plenty of authority for quick piros on demand. Removal of the solid tail fins will help ... when that time comes.

Because I had the Tiger set up in beginner mode, the roll and pitch rates were slow, yet stable, demanding collective management through inverted orientations. Of course, setting up faster cyclic rates will make these maneuvers a piece of cake ... (patience, me boy... patience...)

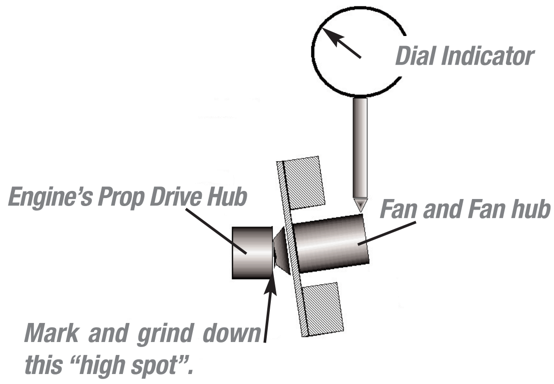
Then I set up for my first autos. The Tiger does not have a driven tail rotor, so it should have plenty of energy in the rotor system for some pretty forgiving autos. Or at least that's what I told myself as I flipped the throttle-hold switch and held my breath. And, true to theory, the Tiger performed flawlessly. In fact, it auto'd so smoothly that I was stunned! The recovery at the bottom was smooth and effortless! This thing autos like a 60-90 sized machine! What a great heli for teaching autos!

Overall, flying the Tiger 50 was a delight.

**The new "Mud Flap Chick" Rating system**

One thing that I found slightly odd on the decal sheet was the inclusion of the kind of female silhouettes that one normally finds adorning the mud flaps of large trucks. Since I'm not in my teens anymore, I didn't feel the need to use these decals on my Tiger 50. However, they did give me an idea for a new rating graphic:

Uncle Ashley's Mud Flap Chick rating system: (A scale of 1 to 5 Mud Flap Chicks)




**Using a dial-indicator to get the fan hub run-out true**

*Construction:* 

*Overall Quality:* 

*Parts Cost:* 

*Overall Value:* 

*Engineering:* 

*Flight Characteristics:* 

*Parts Availability:* 

**Living Happily Ever After**

I have to admit that the Tiger 50 is an awesome helicopter; easy to build and a pleasure to fly. And the best part is the price. The ARF runs $299.99 and the kit is only $15 less! It's an excellent buy. Also, the folks at Audacity Models learned the lessons of other helicopters and decided to avoid the specter of parts shortages. So, they invested heavily in a deep domestic parts stock. And the parts are exceptionally affordable. They've also opted to introduce the Tiger through your neighborhood hobby shop. However, if all else fails, contact the Audacity crew at *www.audacitymodels.com* for ordering information, parts, and kits. Additionally, when you register your Tiger 50, you will receive a free Limited Slip Drive for the tail rotor. Of course, you'll want the limited slip drive when you teach your new Tiger a few tricks, but that's the subject of our next article...

And I promise no more poetry.

***Epilog:***

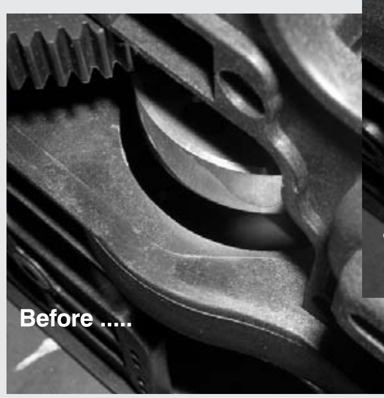
*Audacity Models was updating this model, even as we were deep into the review process, so I thought it might be interesting for readers to not only be informed of the new upgrade parts, but to see some of the design refinements that typically go on behind the scenes in RC Helicopter design and manufacture. I'll bet that all the modern heli manufacturers go through this refinement stage, but we rarely get to see the action. Here are a few of the mods in pictures.*

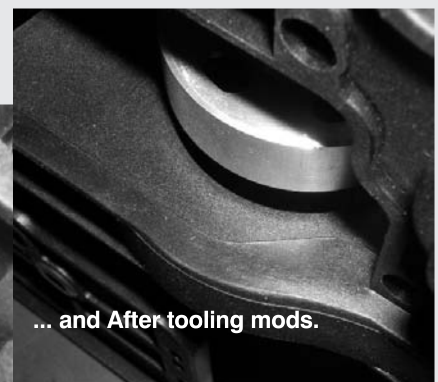
***MHT***

*MHTjef*


Before and after mods to the mold and parts to make the cooling duct longer.

Top edge of cooling shroud refinements ......


Before .....


... and After tooling mods.


The Updated parts: Flybar and paddles, See-saw, Hard Dampeners, Fan Hub, Driven Tail Slipper, Longer Electronics Tongue and a set of Servo Mounts.