**Flying Lessons**

OK, now it's time to learn how to fly the beast you've just built. These lessons will take you from basic hovering to basic aerobatics and beyond.

Here's a plan. Go to the edge of your comfort zone - then "step just outside it" for a couple of seconds - and come straight back inside! Don't spend too long outside your comfort zone, or you'll smack your heli! This is a limitation in the brain department. Then go "outside" again, and then once more, just for a few seconds but a little longer each time. Gradually what was "outside" your comfort zone becomes "inside". So you can take the next bite. If your heart wants to climb out of your chest cavity - or your bowels feel suddenly loose - these are normal reactions to stress - they pass.

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| **Fundamentals** |
| [Hovering](http://www.littlerotors.com/flyinglessons/hovering.aspx) |
| [Figure Eights](http://www.littlerotors.com/flyinglessons/figureeights.aspx) |
| [Nose In](http://www.littlerotors.com/flyinglessons/nosein.aspx) |
| Nose-in hover below 10 metres |
| Nose-in hover below 1 metre |
| Nose-in descent at 45 deg |
| Nose-in landing |
| Nose-in circle around pilot |
| Piroette left & right |
| [Circuits](http://www.littlerotors.com/flyinglessons/circuits.aspx) |

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| **Autorotations** |
| Autorotation to 10 metres then abort |
| [Autorotations](http://www.littlerotors.com/flyinglessons/autorotations.aspx) |
| 180 deg autorotation to ground |
| 180 deg autorotation with dead engine |

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| **Basic Aerobatics** |
| [Basic points for Aerobatics](http://www.littlerotors.com/flyinglessons/basicaeros.aspx) |
| [Stall Turns](http://www.littlerotors.com/flyinglessons/stallturns.aspx) |
| 540 stall turn left and right |
| [Loops](http://www.littlerotors.com/flyinglessons/loops.aspx) |
| Consecutive loops |
| [Rolls](http://www.littlerotors.com/flyinglessons/rolls.aspx) |
| Consecutive rolls |

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| **Advanced Hovering** |
| Circle with centre remote from pilot |
| Nose-in circle remote from pilot |
| Tail-in circle remote from pilot |
| Nose-in / tail-in figure 8 |

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| **Basic 3D** |
| [Flips](http://www.littlerotors.com/flyinglessons/flips.aspx) |
| Flip backward 360 deg |
| Flip sideways 360 deg |
| Flip back 180 then forward 180 |
| [Inverted](http://www.littlerotors.com/flyinglessons/inverted.aspx) |
| Inverted hover tail-in |
| Inverted piroette |
| Inverted straight line flight |
| Half loop / straight inverted / half loop |
| Inverted banked turn 180 deg |
| Inverted figure 8 |
| Inverted stall turn |
| Inverted outside loop from bottom (inverted) |
| Inverted outside loop from top (upright) |

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| **Intermediate 3D** |
| Nose-in funnel upright |
| Tail-in funnel upright |
| [Tic Tocs / Metronome](http://www.littlerotors.com/flyinglessons/tictocs.aspx) |
| Tic-tocs to 30 deg |
| Backwards straight line |
| Backwards figure eight |
| Backwards circle remote from pilot |
| Backwards stall turn |
| Backwards loop |
| Backwards roll |
| [Death Spiral](http://www.littlerotors.com/flyinglessons/deathspiral.aspx) |
| Rolling circle 4 rolls in per 360 deg |
| Backwards rolling circle |
| Inverted Auto |

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| **Intermediate Aerobatics** |
| Vertical down 1/4 roll |
| Vertical down 1/2 roll |
| Vertical down roll 1 turn |
| Vertical up 1/4 roll |
| Loop with pirouette at top |

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| **Advanced 3D** |
| [Funnel/Tornado](http://www.littlerotors.com/flyinglessons/funnels.aspx) |
| [Piroetting Flip/Chaos](http://www.littlerotors.com/flyinglessons/piroflips.aspx) |

**Flying Lessons: Learning to hover**

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| **Lesson objectives:** |
|  Start 'hopping' around to get feel for helicopter.   Controlled tail in hover.   Moving around in controlled fashion.   Controlled side on hover.   Higher altitude hovering. |

The machine is all trimmed, tracked and ready to fly, now it's time for your first flying lesson!

Hovering is the most important flying skill to learn. You take off in a hover and you land in a hover. If you can't hover, there's no hope for you :).

The amount of time taken for people to learn to hover varies from person to person. Some people pick it up within a few flights, others never progress much past it. It's all up to you.

Now, you want to learn to hover, so strap the training gear back onto your helicopter and go through all the procedures you have to do (checking heli, getting your frequency, range checks etc) before flying.

Now that all that's done, crank up the heli and carry it out to a designated hovering area that's obstacle free. Make sure you're not in the way of anyone, or anything and set your helicopter down on the ground.

How, make sure your transmitter aerial is fully extended and walk about five meters behind the helicopter. You always want to be behind the machine when you're learning, otherwise you will get disoriented.

**Your first hops**  
OK, so now you're standing about five meters behind your machine which is sitting there burbling away, waiting. Take a few deep breaths and slowly start moving your throttle stick forward. You'll hear the engine start winding up and the rotors will start turning. It's all on now!

Keep advancing the throttle stick slowly and as you get around mid-stick, the helicopter will probably start to get 'light on its feet'. Don't worry, your training gear will stop it falling over.

The aim of these first few flights is to get a 'feel' for the helicopter. You don't want to be a hero and try and fly around cause 90% of the time the heli will bite you on the ass. Little steps...

You'll probably notice that the heli will be moving around on it's training gear, and may or may not be where you first put it down on the ground. Don't worry about that, just try and get a feel for what the helicopter feels like when it's about ready to take off.

Gradually start advancing the collective until the helicopter is just off the ground. Don't let it climb too high though cause you'll probably lose it. Just get it to the point where it's lifting off the ground. While it's off the ground, use your cyclic controls to stop it drifting around. If it starts moving off and you don't feel you can bring it back, just drop the collective slowly and it will settle on the ground (now you know why you brought the training gear!).

By now, sweat will be pouring down your legs. Don't lie, I know it is. Walk up behind it and try again, and again and again and again. Keep trying until you can keep the helicopter within a two meter radius. If you can do this in one tank of gas, good on you, if it takes ten tanks, who cares? As long as you're having fun!

**Controlled tail in hover**  
OK, so now you can keep you machine in within a two meter radius, you're doing good! The story is now to try and keep the machine in one place.

So, lift off again, and try to anticipate it's movements and correct for it. Helicopter's have natural tendencies to wander off to the side on take off, so try to counteract this when you lift off.

The exercise now is to take off, hover for 10 seconds in one spot and land again in the same place you took off. Keep doing this until you can confidently take off and ascend vertically, hold the machine in a hover about five feet off the ground for ten seconds, then put it back down in the same place.

Keep trying until you can do it!

**Moving around**  
Now you can hover pretty well, it's time to start moving things round a little. Pick a spot about about 4-5 meters away. You're going to take off from your present spot, hover over to your new spot and land.

The purpose of this exercise is to get you used to the cyclic controls.

So spool up the helicopter and take off like you practised earlier. Once you're about 5 feet off the ground. Slowly and gently move the cyclic stick slightly in the direction of your landing spot. Don't give it too much stick else it'll take off on ya! Feel free to walk behind the helicopter if it makes it easier for you.

The best way is to give the cyclic a slight nudge in the direction you want to go then back off nearly straight away. The helicopter will start sliding in the direction you gave it, but if you keep holding in the same amount of cyclic you gave it, it's gonna pick up speed pretty quickly, so back off.

Now your machine should be sliding towards your new landing pad. As it gets near the new pad, slowly feed in a bit of opposite cyclic (ie opposite direction to where the helicopter is heading) to slow the helicopter down. Once it's at a stop, slowly descend until the heli is on the ground.

Congratulations! Now keep doing this until you can confidently move the helicopter from point to point and set it down accurately.

Here in New Zealand, the Clubman class of competition is mostly made up of maneuvers that judge your precision hovering skills.

**Controlled side on hover**  
Good, so you can take off, hover, move to a point, hover and set it down ok? It's time to start working on your orientation.

The desired outcome of this lesson is to have you being able to hover your machine side on from each side. This starts to become more important so you can progress with your flying.

The way I learned side on orientation is hovering the helicopter to a point that was forward and to the right or left of me. So while it was still tail in to me, I was looking along the side of it. This gets you used to looking at the side of the machine. Make sure you do this from both sides. You don't want to practise a lot from one direction and be useless on the other.

As you become more and more confident with each side, gradually move the helicopter further back towards yourself so you're looking at more of the side of the helicopter and less of it's tail.

Keep doing this until the helicopter is hovering side on to you. Once you're comfortable with hovering the helicopter on each side of you, move it back until it's tail in right in front of you (where you lifted off) and slowly start applying rudder to bring the nose of the helicopter around. Keep applying rudder until the nose is at about a 45 degree angle of what it was.

As you become confident at being able to keep the helicopter stable on this heading, keep feeding in a little bit more rudder and repeat the process. Keep doing this until the helicopter is fully side on to you. Ensure you do this for both sides of the helicopter. It is important not to develop a 'favourite' side.

**Higher altitude hovering**  
Right, you can now hover tail in and side on comfortably. Well done! You can either choose to skip this part and go straight to figure eights, but you'll still have to come back to it eventually, so why not get it done now?

When I say higher altitude, I don't mean 100ft, I don't even mean 50ft. I mean being able to keep a stable hover about 20-30ft off the ground. The aim here is to get used to looking at the helicopter from the bottom.

So, lift off from the helipad as normal and bring the helicopter to a nice stable hover with the skids of the machine at eye height (this is the altitude that competition hovering in NZ is done). Keep it nice and steady. Once you're comfortable, slowly raise the collective so that the helicopter slowly starts climbing. Let it climb for about five feet or so and then stop and try and hold it in a steady hover.  
Never let the helicopter get so close that you're looking straight up at it (ie over your head) cause it's likely you'll get disoriented and crash. Always keep it forward of you.

As you get comfortable, climb an additional five feet and repeat the process. Do this until the helicopter gets to around 50 feet or so. Once you can do this, move on to the figure eights!

**Flying Lessons: Figure Eights**

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| **Lesson objectives:** |
|  Begin basic forward flight.   Become used to the rudder controls.   Consolidate looking at the helicopter from side on.   Identify the relationship between the cyclic and collective controls.   Explore the usage of cyclic to make turns.   Learn how to flare the helicopter to a stop. |

Learning figure eights is a popular way to begin forward flight, and learn different orientations (such as nose in). It's how I progressed from hovering, and I recommend it to beginners.

Figure eights begin as slow hovers between two points, and can end up as as full speed banked-right-up-on-the-rotor-tips maneuvers. Full speed figure eights are endless amounts of fun no matter how good you are!

Anyway, lets get back to grass roots. Wander out to your helipad and pick two points about 4 meters either side of your landing spot. You're gonna start hovering between these spots to start with.

**Hovering Eights**   
Go get your helicopter and lift off into a hover. Then slowly start moving the helicopter to the right-most spot. Once it's over that spot, give it opposite cyclic so it starts moving towards the left-most spot. The objective here is to make the helicopter move smoothly between the two points without losing, or gaining too much altitude and staying pretty much on the flight path.

Keep doing this until you can sustain a consistent flight path.

**Incorporating rudder**  
Right, so you can hover between these two points ok, now, as you get over each point, use the rudder to start pointing the helicopter in the direction of the other point. At first, point it in a 45 degree angle towards the direction of flight and try to maintain a smooth consistent flight path. An example of this is displayed below.

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| http://www.littlerotors.com/images/Lessons/HoverEights.jpg |
| *You can see the helicopter moving towards the right most point at a 45 degree angle. As you become confident with this orientation, keep moving the nose of the helicopter around until it's pointing in the direction it should be flying.* |

Once you can fly the machine between these two points with the nose pointing in the direction of flight, it's time to move on and start doing some REAL figure eights.

Now you have to start flying AROUND the points!

**Relationship between cyclic and collective controls**  
You may have noticed that the more cyclic control you put in, the more the helicopter will start to descend towards the ground. To counteract this, ie keep the helicopter at the same altitude, you have to feed in a little extra collective to compensate. Be careful though, if you feed in too much, the helicopter will climb as it starts speeding away! Not enough, and the heli will continue to descend.

As the helicopter picks up speed, the relationship between cyclic and collective controls becomes more apparent. You have to get used to this relationship, it's essential for fast forward flight.

Start out by doing these figure eights slow. Hover the helicopter around the course using the rudder to manage heading. As you get more confident and pick up more speed, the amount of rudder used gives way to increased cyclic control.

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| http://www.littlerotors.com/images/Lessons/FigureEights.jpg |
| *See that the helicopter now moves around the the points instead of over them. After passing around each point, the helicopter crosses the landing pad.* |

**Higher speed - steering by cyclic**  
As the helicopter starts to move faster and faster, you'll need to start navigating the helicopter by cyclic controls, ie bank the helicopter into the turn as you apply rudder. Now, it's not quite as easy as that, but this is how it generally goes...

**Example: Helicopter flying into a left hand turn**

1. Entering the turn, slowly move your cyclic control to the left.
2. As you're moving the cyclic to the left, slowly reduce pitch. The faster you're going, the more pitch you'll have to reduce.
3. As the helicopter starts to bank over, start applying left rudder to bring the nose around into the turn.
4. As the nose is coming around, the helicopter will be 'nosing down' and heading for the ground. To counteract this, slowly pull back on the cyclic control as you're adding rudder to bring the nose up a little. Again, the faster you're going, the more you'll have to pull back - or, if you want to tighten the turn, pull back some more.

Start practising this by flying your figure eight course. Start off by hovering round the course and as you get comfortable, increase the speed and begin to utilise the steps described above. As you get faster, the more impact those steps will have.

Often when you're learning the helicopter might not stay on course over the figure eight because you haven't got the co-ordination between all the steps just right. Don't worry, just bring the helicopter back and start again.

Figure eights are very important and handy for improving flying skill and orientation. Once you have mastered figure eights, fast forward flight isn't too much of a step up.

Keep doing figure eights and as you get comfortable go faster, higher and further, and in no time, you'll realise you're flying all over the sky!

Figure eights are tonnes of fun, one of my more popular events at fun flys is to set up a figure area and see how many figure eights a person can do in a specific time. Lotsa fun!

**Flying Lessons: Learning Nose In**

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| **Lesson objectives:** |
|  First steps of nose in   Higher altitude nose in hover   Learning orientation tricks   Developing your nose-in skills |

Nose in is one of the more important skills to learn when learning to fly. After all, if you fly the machine away from you, you're gonna have to bring it back aren't you?

Once you've learned nose-in, your flying will really take off. You'll progress a lot faster once you've learned it and you'll find yourself 'less afraid' of the helicopter as you'll be able to deal with it in most orientations.

Learning nose-in isn't that hard if you put your mind to it. Having said that, having a simulator to practise on really makes things a lot easier. I'm going to discuss two ways of learning nose-in, with a simulator and without.

**Simulator**  
Far and away, the best way of learning nose-in is to use a simulator. You aren't afraid to crash the machine and you make much more progress faster. Practise on the simulator each night for a week and at the weekend, get up the guts and just spin the machine around and see how long you can hold it.

**Orientation Tricks**  
Nose-in is certainly different to tail-in, no doubt about that. However, there are a few tricks that I use to help me give the right stick inputs. These are:

* **Push towards the low wing.**  
  When the helicopter is facing you the left/right cyclic controls are reversed. Therefore, if the helicopter is facing you and is leaning to the left (ie the left side of the rotor disc is lower than the right), then move the left/right cyclic control to the left. As you do this, you'll notice that the left side of the rotor disc starts rising towards a level plane. Once the disc is level with both sides, release the stick input.
* **Steer the tail.**  
  When the helicopter is facing you, the rudder controls are also reversed. I find it easier to steer the tail. This means that if you're hovering nose-in in front of you and the tail starts to drift to the left, apply a little bit of right rudder which will start bringing the tail back into line.

**Exercises**  
OK, so those of you with sims will have done a whole lot of practise before you get to the field eh? Well now it's time to get busy!

Now I recommend that you fire up the helicopter and have a fly around just like normal to 'warm up' if you like. Then, once that flight is over, it's time to get serious.

There are two ways I recommend starting nose-in for real. One is to hover the helicopter to a good safe height and spin the heli around so it's facing you, or, to gradually do it by doing figure eights.

**Spin and hold**  
This is the way I learned. Move the helicopter out a safe distance from you (maybe 10 meters or so). Then, once you're there, slowly climb until the helicopter is about 10 meters high. Hold the helicopter in a hover. When you're ready, use the rudder to make the helicopter slowly turn until it is nose in to you.

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| *If you have a heading hold gyro, it's a good idea to do this in heading hold mode. That way you can concentrate on just the cyclic controls and not worry about the tail coming out of line. Then once you have the cyclic controls sorted, learn the rudder controls.* |

Try and hold it as long as you can, but if you feel yourself starting to lose it, make your escape root more collective as you feed in rudder to bring the helicopter tail in again.

Gradually, you'll find yourself able to hold the helicopter longer and longer. When you get more confident, start decreasing the altitude and bringing it closer.

**Figure Eights**  
How you say? Well, what you can do, is start doing more perfect circles on each side of the figure eight. As each side becomes more circular, as the helicopter passes over the middle point, the helicopter will be more and more nose-in to you. Start out doing normal figure eights as practised earlier, as you become more confident, steer the nose around so it becomes more nose-in to you.

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| http://www.littlerotors.com/images/Lessons/noseineights.jpg |
| *See that the helicopter now moves around the the points instead of over them. After passing around each point, the helicopter crosses the landing pad, as you become more confident, gradually bring the nose around until it is eventually nose in.* |

Learning nose-in through figure eights is a little harder than the 'spin and hold' routine I used to learn. However, it teaches you better orientation as you fly the transition between tail in and nose-in. With the 'spin and hold' routine, you learn tail in and nose in, but nothing in between.

It's up to you which one you choose, but it is important to learn nose in, it will rapidly develop your flying abilities!

**Flying Lessons: Circuits**

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| **Lesson objectives:** |
|  Move into forward flight and fast forward flight   Become used to handling helicopter at speed and altitude   Continue to develop orientation skills |

You've got the basics under your belt by now, you can hover tail in, side on, and nose-in. It's about time you get started on flying some circuits.

**What are circuits?**  
Circuits are simply roaring around the sky in a controlled fashion (well that's my definition anyway :)). It's really flying!

Before you can move on to stall turns, loops or rolls etc, you really want to be able to handle fast forward flight and be comfortable handling the helicopter from any orientation.

This is important just incase your loops/stall turns later on come out all curly and the helicopter starts heading off in some crazy direction (it definately happens!).

Some people may not think that circuits are a definative learning step. I think they are. Learning to be comfortable with flying the helicopter high and far away from you is something you need to learn.

**How to do it**  
I learned to do circuits by just gradually flying the helicopter higher, further and faster. In no time I was whizzing around the sky at full noise and I felt like I was actually finally flying!

Just start doing figure eights and keep increasing their size until they're MASSIVE!

**Aim of lesson**  
The aim of the lesson is to get used to looking at the machine as it's screaming around the sky at higher altitudes. This will give you the confidence to recover the heli from most orientations

**Flying Lessons: Learning Autorotations**

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| **Lesson objectives:** |
|  Autorotation setup   Mini Autos   Full autos   Points to remember |

Autorotations are yet another one of those skills that you know you should learn, but seem to put off through fear of crashing while practising. I know this was true for me. I learned nose in, fast forward flight, stall turns, loops, rolls even became fairly skilled at inverted before deciding that it really was time to learn autorotations for real.  
Ironically though, when I had to auto either by mechanical problems or running out of gas (don't ask), I was able to land the heli successfully.  
I knew I was kidding myself if I thought of myself as a competent flier if I couldn't auto properly, so it was time to fire up the 46 for another one of it's 'sacrificial lamb' sessions.

**Do as I say, not as I do**  
One day I'd had a great days flying doing all sorts of inverted stuff and decided to give this auto thing a go. I brought the machine to a 3 ft hover and flicked the switch and the little Ergo settled down with a bit of a bounce. Tried a couple more of these then took it to about 7 or 8 ft with a little bit of forward speed and tried the same thing. The first two were mildly ok. The next one had too much forward speed that resulted in a boom strike and a tumble on the ground. Another boom, feathering spindle and a set of blades later and I was back in action.  
A couple of weeks later and I decide it's time to attack autos again. So what do I do? Yet again I try some forward flight ones from about 8 or 10 feet which results in the boomstrike to end all boom strikes. I knew what I'd done wrong as soon as I did it. I was in too much of a hurry to get the machine on the ground and didn't have anywhere near enough positive pitch on at the bottom of the auto, plus I had a bit of back elevator on to arrest the forward motion. That combined with too much headspeed meant the blades came down and smacked the boom so hard that the blades were torn off at the root!  
What was I doing wrong? A number of things, I wasn't high enough to start with, I panicked when I flicked the switch, I didn't have enough pitch on when I landed and I had some back elevator on. This is not the way to do autos.

**Setup**  
You'll need to ensure that you have the correct ptich range in throttle hold mode on your radio. My helis are set up with -7 through to +10 pitch range in throttle hold. There are many different opinions about suitable hold pitch curves, but this is what works for me.  
If you've got a driven tail (ie the tail rotor continues to rotate when the engine is off either via a slipper clutch or split gear mechanism), then you'll still continue to have rudder control during the auto, if your heli has a non-driven tail, you won't. When you're learning, it's not a bad idea to have the engine idling high enough so that the tail rotor is still slightly driven. This will mean that you've got a degree of yaw control as the machine is in the auto.  
Ensure that your blades are securely fastened in your blade grips. Not too tight that it will cause vibration though. Curtis Youngblood recommends that they're tight enough that if you hold the helicopter on it's side, the blades will not move in the grips. If you have the blades too loose and an auto has gone wrong and you've lost a lot of head speed, there's a higher chance of having a boom strike when you hit the ground than if you've got tight blades.

**Make sure the engine will light back up again!**  
The last thing you want to happen is for the engine to die when you've flicked the switch to abort a bad auto. What I do to check this on both helicopters is fly them around for a couple of minutes to get the engines up to operating temperature then land and let them idle for about 10 seconds, then quickly stab the collective and make sure they spark up without any hesitation. Be careful how you do this. For a hi-torque machine like the Z230 or high powered 60, stabbing the collective like this on the ground could cause the machine to suddenly rotate slightly so be ready for it.   
If your engine doesn't immediately respond (ie it bogs and dies, or even hesitates), then tune it properly before trying an auto.

**Mini Autos**  
Now it's time to get used to the feel of your machine under zero power situations. I recommend flying around for a bit first to get your engine up to operating temperature, then bring your machine into a low hover at about 3 feet. Get yourself comfortable and when you're ready, flip the hold switch and let the machine settle to the ground adding collective as it does so.  
If the helicopter 'jumps' or 'dives' when you flip the switch, your hold pitch curve needs a bit of refinement. Ideally, you want the helicopter to smoothly settle to the ground.  
Once you're used to the feel of flipping the switch and letting the heli settle to the ground, it's time to move on!

**Practice your approaches**  
It's time now to start getting a feel of how the helicopter reacts in a unpowered descent. The idea of this exercise is to feel comfortable at the beginning of the auto so you don't panic and get used to managing the pitch on the way down so you don't lose headspeed and keep the helicopter on the intended flight path.  
Fly the machine up to about 80 to 100 feet at about a 45 degree angle downwind to a spot in front of you where you wish to land. While in slow forward flight coming towards yourself, flip the hold switch and smoothly reduce collective to about -2 degrees. Try and ensure that the heli is still retaining some forward speed. You don't really want it to come straight down.  
Manage your elevator and aileron controls so that the machine maintains it's flight path to the spot you picked out in front of you. As the helicopter gets to around 8 feet, begin smoothly flaring the helicopter and try to arrest it's descent, as soon as the helicopter has 'stabilised' and stopped descending, abort the auto by flicking the hold switch. Continue this exercise until you can bring the helicopter down while retaining good headspeed and maintaining control of the flight path of the helicopter.

**Heading hold**  
If the flight mode you were in when you started the auto is programmed with heading hold and you do not have a driven tail, you might be in for a bit of a surprise when you abort if the head speed has decayed considerably. You see during the auto, the gyro may still be in heading hold and could be putting in rudder control to compensate for any yaw movement that may have occured. Because the tail rotor is not driven, the tail will not be moving as much as the gyro expected it to and so it will put in even more rudder input. It can get to the stage where the rudder might be at full lock. Now, when you restore power in an aborted auto, there's a good chance you're at full stick on the collective which ofcourse means full throttle. This means the drive train goes from no power to full power in an instant. Your rotors will spin up and so will your tail rotor, which is still at full lock. This can result in a pretty exciting piroette (or three) that you didn't expect. To avoid this, enter the auto in a flight mode that is programmed with normal gyro mode, or abort your auto before your head speed decays too much.

**Full blown autos**  
By now, you should be ready to do a complete autorotation. They really are easier than you think. Begin in the same way you did with your approach practices. Remember to always auto into wind if possible! Manage the descent just as you did previously. You want to begin flaring the heli and slowlyg applying pitch as it gets to about 5 feet off the ground to arrest it's forward speed. As the forward speed dies off, and the helicopter is at about 2 to 3 feet off the ground start applying some forward elevator to level the helicopter off and continue apply pitch, continue to hold in forward elevator to prevent a boom strike.

**Points**

 Always auto into wind (if you can!).

 DO NOT panic when you hit the hold switch.

 DO NOT panic when the helicopter gets near the ground.

 Be smooth on the controls, sudden, jerky movements will sap precious energy from the rotor disk.

 If you're losing too much headspeed and you're above 4 or 5 feet, abort the auto by hitting the hold switch.

 If you're losing too much headspeed and you're below 3 or 4 feet, go to full pitch, hold in some forward elevator and ride it out. Don't try and bail out by hitting the hold switch again. By the time the engine has spooled the drive train up enough to get any lift, there's a good chance that the helicopter has already touched down on the ground. If the landing has been a bad one, any damage will be instantly amplified by the sudden increase in power, ie what may have been a small boom strike will probably turn into a 'scorpion tail' boom-bending, blade smashing mess. Don't ask how I know this. Also, remember how we discussed what happens if you're in heading hold? Well throw in one of those nasty full power piroettes and things aren't looking good. Believe me, if you just ride it out, you'll probably get away with a popped off link or maybe a bent spindle shaft if at all.

**Summary**  
Autos really are much easier than you might think. As soon as I did my first couple it clicked and instead of being scared to auto, I really enjoyed it and started to concentrate on landing accurately. I believe it's easier to land smoothly doing an auto than it is to land smoothly under power.  
Autos is one of the few skills that will actually save your money. One day, you are going to have a flame out, or blow a plug or run out of fuel (it happens!) and the sky will go silent. Only your ability to auto is going to prevent your wallet from taking a hammering.

Once you get a feel for autos, you'll find they're really enjoyable!

**Footnote**  
Soon after writing this article I was out and about with the little Ergo. Flew about six or seven tanks. On the last tank of the day, I was doing a full speed roll at about 80-90 feet. As the heli rolled inverted the engine quit. I managed to roll it upright (you could just about count the blades as they slowly rotated!) and just decked the collective as much as I could to spin them back up again. I held out till the last minute then pushed in full collective at about 3 feet. The heli thumped down damn hard, but there was no damage whatsoever. If I hadn't been able to auto, this crash would have cost me upwards of NZ$300 or so. Learn to auto, it WILL save you cash.

**Introduction to Aerobatics**

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| **Lesson objectives:** |
|  Introduction to aerobatics   Correct placement of maneuver.   Straight and level entry into maneuver.   Smooth and controlled execution of maneuver.   Straight and level exit from maneuver. |

First of all, I want to explain some of the most important aspects of any aerobatic maneuver. These are:

**Correct placement of maneuver**  
Most people confident in fast forward flight can execute aerobatics such as stall turns, loops and rolls without too much trouble. However, many aren't so successful at executing the manuver in a specified position such as right in front of them each and every time. Contest judges will deduct a large amount of marks for maneuvers that are not correctly placed.  
You should aim to practise a maneuver until you are confident that you can execute the maneuver from any direction in any position.

**Straight and level entry into maneuver**  
Many people (and I'm more guilty than most!) make a hash of the entry into a maneuver. Starting the maneuver whilst diving, climbing and/or flying sideways (damn that heading hold!). This is just about guaranteed to screw up the rest of the maneuver. It can also produce some very hairy moments too! An example of this is at the first competition of this year here in New Zealand (the first competition that I'd flown the Vigor in) I entered a roll a bit low and with the nose well down. The result was a high speed diving roll that had everyone's hearts in their mouths as the Vigor pulled out at about 10ft off the deck... That taught me a thing or two real quick!

**Smooth and controlled execution of maneuver**  
Another big mistake (and once again, I'm as guilty as everyone else!) is that pilots are often in too much of a hurry to get the maneuver over and done with. One of the more common occurances of this is during the stall turn where people just lay into the rudder and hold it in until the heli has come around at max piroette speed. It looks a bit crazy in comparison to to a smooth controlled piroette which will just about always score more.  
Take your time and slow down, the quality of your stunts will thank you for it.

**Straight and level exit from maneuver**  
How you exit the maneuver is important as well. The helicopter must exit where you want it to, not where it wants to! Doing a roll is great, but if the helicopter is heading off in another direction when you exit, you won't score too highly!

These basic principles can be applied to any aerobatic maneuver. They are mainly concerned with FAI style flying, but many can be applied to 3D flying as well.

**Basic Aerobatics: Stall Turns**

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| **Lesson objectives:** |
|  Continue to develop fast forward flight skills.   Identify relationship between collective and cyclic controls for vertical climbs.   Identify amount of rudder required to execute 180 degree turns.   Timing of collective vs cyclic for vertical climbs and dives. |

Stall turns are one of the first aerobatic maneuver that a pilot will do once they begin Fast Forward Flight. They begin as a small chandelle (for want of a better explanation: a steep climb, followed by a good amount aileron till the heli has ceased forward speed, then rudder to set the machine back the way it came) through to 540, 720+ stall turns.

A stall turn, in the true meaning of the term means entering the maneuver at speed then pulling up into a vertical climb. Once, the helicopter has ceased forward momentum (stalled), then rudder is applied to turn the helicopter around (180 degrees) so that it is facing the way it came. A good stall turn will end with the helicopter pulling up out of the dive at the point at which it entered. Variations such as 540 stall turns mean that the rudder has been held in until the model has completed a 540 degree piroette, a rolling stall turn is one where the model completes a half cyclic roll in either the climbing or diving aspects of the maneuver.

**Setup**  
I do my stall turns in Idle Up One which is about -5 at bottom stick through to +10.5 - 11 (this is a 91 powered Vigor :)) degrees pitch, and the gyro is in rate mode (many, if not most, people like to do it in heading hold).

There are some things you should know about this setup. On a very windy day doing a stall turn into wind, you often need a lot of negative pitch to stop the heli 'travelling' backwards (being pushed by the wind), therefore, in this case I do stall turns in Idle Up 2 (-9.5 to 9.5 and gyro in Heading hold).

**Beginning**  
First of all, you should be able to conduct straight level flight in either direction. Flying in a line parallel to where you are standing, do some straight and level passes back and forth and constant altitude. Continue to do this until you are confident of controlled level flight. Once you're confident, you're ready to setup your stall turn.

Make sure you're at a good altitude, 100 feet is a good start as it will give you ample room to fix up any mistakes. Give yourself plenty of run up room for your entry. Fly out 200-300 feet downrange and then begin your turn to come back on a heading parallel to you. The reason for this is to give you plenty of time to 'straighten' the heli out and chill out before entering the maneuver. Build up a good amount of forward speed, you need not enter at full speed, 3/4 stick should be plenty.

**Entering the maneuver**  
Now that your helicopter is lined up and all straight and level, you'll want to think about entering the maneuver. I found for the first attempts it's better to let the heli fly past you for a distance of say 50 feet or so so that you are looking at the top and back of the helicopter when it executes the maneuver. DO NOT execute it right in front of you at this time! The helicopter will go straight up and likely go over your head which will result in an orientation problem (I'm speaking from experience here!).  
When the helicopter has reached your designated entry point, GENTLY ease back on the cyclic and then release as the helicopter goes vertical at which point you should be lowering your collective to approximately mid stick (say 3.5 degrees or so). You should find that your helicopter will then climb in a near vertical fashion.

**Executing the maneuver**  
Now that the helicopter is climbing, it will soon come to a stop (stall). You now have two options, one, you can bail out using one of two methods, inputting a forward cyclic to push the nose over so that the helicopter level's out, or, you can execute the 180 degree turn and increase collective and the helicopter will fly away without loosing altitude. There is nothing wrong with any of these options because at least you're getting a feel for how the helicopter climbs.

The next option is to execute the full maneuver which at this point means completing the 180 degree turn. Now, one of the biggest mistakes you can make is to give it FULL rudder, with today's modern gyro's, this will probably result in some bluringly fast piroettes and it will be hard to stop the piroette with the nose pointing straight down. It is more likely that you'll come out sideways which can be very scary if you didn't expect it!  
Therefore, the better plan is to gently feed in rudder and let the helicopter come around slowly, this will make stopping the piroette in the nose down attitude much easier and will result in a much better looking stall turn.

The helicopter will appear to 'hang' for a moment and should then start falling down the same trajectory it came up on. Again, you should still be at about mid stick or lower (ie 3.5 degrees or so) and as long as the nose is pointing straight down, you should not have any cyclic input.

**Exiting the maneuver**  
When the helicopter reaches the point where it went vertical in the climb, you want to GENTLY start pulling back on the cyclic and SLOWLY feeding in collective. As the nose of the helicopter comes up, keep feeding in the collective until the helicopter has a slight nose down attitude and is flying level. The helicopter should then be flying back down range along the path it entered on.

Congratulations! You've completed your first stall turn!

**Things to watch out for**

* **'Yanking' back on the cyclic controls.**   
  You will lose precious forward speed that will mean your vertical climbs will be shorter. It will also mean the maneuver won't look very smooth.
* **Not entering straight and level.**   
  If you enter the maneuver with a slight aileron attitude, the helicopter won't climb straight, it will either climb up and away from you, or up and coming at you.
* **Don't be in a hurry to execute the 180!**  
  As discussed above, if you whack in full rudder it's going to be hard to stop it with the nose pointing straight down which will mean that the helicopter will 'fall out' of the maneuver sideways. This happened to me with the Z230, it wasn't pleasant.
* **Manage the collective**  
  If you don't reduce the collective as the helicopter is climbing or falling, the helicopter will 'travel'. This means that the heli won't climb or dive straight and your stall turn will look crazy.
* **Weight in the nose**  
  If you're having trouble getting your helicopter to climb very high when in the vertical stage, putting a little bit of weight in the nose can help. I added about 40 grams of weight (using tyre weights from mag wheels - they have double sided tape and come in 7 gram blocks) to the nose of the Vigor and wow, that made a difference!

**Points to perfect**The following are a list of aspects I look for when judging a stall turn.

* **Smooth transition from horizontal to vertical (and back again)**  
  You want to make the the transition from horizontal to vertical flight as smooth as possible, ideally a quarter arc.
* **Clean vertical climb/dive**  
  Learn to manage the collective to ensure that the helicopter climbs and dives as vertically as possible.
* **Timing of 180/540 turn**  
  Practise timing the execution of your turns so that they begin when the helicopter ceases it's climb and is about to enter the dive.
* **Smooth pullout and exit**  
  A smooth pullout replicating the quarter arc you scribed on the entry and then smooth forward flight out of the turn.

Get out there and burn some fuel!

**Basic Aerobatics: Loops**

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| **Lesson objectives:** |
|  Continue to develop fast forward flight skills.   Develop cyclic control to achieve nice round loops.   Develop skills in positioning maneuvers. |

Looping is one of the basics of aerobatic flight in any model aviation discipline and one of the first aerobatic maneuvers a pilot will attempt.

In basic terms, a loop is executed by gently pulling back on back cyclic (elevator) while in fast forward flight and continuing to hold in that cyclic as the helicopter proceeds through the vertical, inverted, back to vertical and finally, horizontal attitudes.

Sounds pretty basic and it is. However, once again, doing a nice round loop right in front of you isn't so easy!

Most first loops really end up either being flips (too tight caused by the pilot yanking back on the stick), or come out in a '9' shape, caused by running out of forward speed over the top of the loop. Getting a nice round 'O' can take a bit of practise!

**Setup**  
I do all my loops in Idle Up One which is about -5 through to about 10 degrees or so. Lately, I have begun to fly around in constant heading hold now after flying in rate mode most of the time. The reason for this was that I found that in gust conditions, the tail could wander a little during the loop which made it corkscrew. Heading hold goes some way to fixing that.

If you're going to loop in rate gyro mode, be sure to have your REVOlution mixing set correctly. This way, as you decrease pitch as you go around the loop, the tail won't kick out on you and cause a 'stressful' condition :).

You want to make sure that your throttle curves are setup to give you a good headspeed. I like do have about 17-1750+RPM doing loops.

**Beginning**  
As in the Stall Turn lesson, you should be confident in maintaining straight and level fast forward flight before attempting a loop.

For your first loop, you want to let the helicopter go past you for a short distance before entering the loop, this will probably help your orientation a bit better than doing it right in front of you (it did for me anyway).

OK, give yourself a good amount of room, climb out to about 100 feet or so as you're flying 3-400 meters down wind, make a smooth turn back into wind and enter fast forward flight at full power and establish a straight and level flight path back past you. You need to ensure the helicopter is flying level, otherwise your loop will corkscrew out.

As the helicopter flies past you, let it continue for between 20-50 meters or so. This is to ensure that the helicopter doesn't end up over your head as it goes over the top of the loop. At a point you feel comfortable, gently ease back on the back cyclic and the helicopter will enter a vertical climb.

**Executing the maneuver**  
As the helicopter is entering the loop, be sure not to yank back on the stick, this will kill off precious forward speed and/or rotor speed. Continue to hold back elevator with the collective at full power.

As the helicopter has gone over the top of the loop, slowly reduce collective a little while continuing to hold in cyclic. About now the helicopter should be in a vertical dive. Resist the temptation to yank back on the cyclic, it will only cause the heli to 'snatch' and it'll look ugly!

Instead, slowly pull in a little more cyclic and begin slowly feeding in collective again because you want to be at full power again for the exit of the loop.

**Exiting the maneuver**  
Ideally, you don't want the helicopter to be fully horizontal as it's exiting the loop, this will kill off your forward speed and will cause the heli to climb. You want the heli to have the same nose down attitude that it does in fast forward flight so that it seemlessly exits the maneuver.

Congratulations! You've completed your first loop!

**Things to watch out for**

* **'Yanking' back on the cyclic controls.**  
  'Yanking' on the sticks will kill off precious forward speed and/or headspeed. It will also make the maneuver look jerky and bad. It will also limit the size of your loops.
* **Not entering straight and level.**  
  If you enter the loop with a slight aileron attitude, the helicopter will corkscrew out of the loop and it'll all look bad.
* **Manage the collective.**  
  I've found that I do the best loops by not altering the pitch much at all. I found that if I reduced pitch too early, my loops would look like '9's and if I didn't reduce it at all, and stuffed up the cyclic management, the heli would 'snatch' at the bottom of the loop. Generally, I do not reduce collective until the heli is well over the top of the loop.
* **Weight in the nose.**  
  As with stall turns, if you're having trouble getting your helicopter to climb very high when in the vertical stage, putting a little bit of weight in the nose can help. I added about 40 grams of weight (using tyre weights from mag wheels - they have double sided tape and come in 7 gram blocks) to the nose of the Vigor and wow, that made a difference!
* **Unintentional thumb interaction.**  
  I've found that during my loops I seem to unwittingly put in a bit of aileron input. I'm a mode two flier so my elevator and aileron controls are on the same stick. I've talked to mode one fliers who say they often put in a bit of rudder input (rudder and elevator are on the same stick for them). You can either practise and practise until your thumbs don't do it, or put in a bit of negative expo (for Futaba fliers, positive for JR) to reduce the sensitivity around mid stick so that unintentional thumb inputs don't have as great an effect.

**Points to perfect**  
The following are a list of aspects that I look for when judging loops.

* **Smooth entry (and exit) from (to) fast forward flight**  
  A smooth pull up into the loop and graceful exit at the same altitude and point as entry are important (and difficult to continuously achieve!).
* **Symmetrical execution of maneuver**  
  The first half the loop should mirror the second half and the helicopter should maintain a constant speed throughout the maneuver.

Get out and give it a go!

**Basic Aerobatics: Rolls**

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| **Lesson objectives:** |
|  Continue to develop fast forward flight skills.   Develop cyclic control to achieve consistent smooth rolls.   Develop collective control to achieve consistent, continuous rolls without loosing altitude.   Develop skills in positioning maneuvers. |

Once you've got loops under your belt, it's time to try rolls! Rolls are another basic maneuver that can take time to work up the nerve to attempt, and perfect.

A roll is quite simple in concept, it's simply entering aileron control and smoothly reducing collective as the heli goes through the inverted section.

Once again, simple in concept, but not quite so simple once you come to try your first one!

Personally, it took me an age to work up the courage to try my first roll, and when I did, they all were terrible, a mix of split s's (ie half roll then diving towards the ground like a Stuka divebomber) which plays havoc on the nerves and doesn't encourage continuing to try! However, try we must and a month later I decided the little Ergo was going to roll or die trying (which is really the attitude you have to take when trying any new maneuver I reckon!) and all of a sudden it happened and I've not looked back since!

**Setup**  
I do all my rolls in Idle Up Two which is about -9 through to +10 on the ptich. I also have Idle Up Two set for Heading Hold so that I needn't worry about the rudder as I'm rolling, makes things easier.

Once again, if you're going to roll in Normal gyro mode, be sure to have your REVOlution mixing set correctly other wise as you de-pitch, the tail may wander out of line and you'll corkscrew out.

Sort your throttle curves so that you're achieving approximately 17-1750RPM. Later on, we'll discuss getting a bit of aileron to throttle mixing action going on so that the engine keeps it's revs up through the maneuver and there is no noticable change in note.

**Beginning**  
As in just about every maneuver you'll ever do, one of the most important aspects of the maneuver is the entry so you have to make sure you enter it straight and level.

One thing that can really have an impact on the success of your roll is the attitude of the heli of entry (ie how far down the nose is pointing). If the nose is really pointing down on entry, there is a good chance the heli will start to dive as you roll, unless you give it a good dose of negative pitch as it goes inverted. Likewise, if the nose is pointing slightly up, there is a good chance the heli will 'stall' and loose a lot of forward speed or even stop in a hover. Getting the right amount of 'nose attitude' is critical to the doing a smooth roll.

Rolls are usually performed downwind and you want to give yourself a fair bit of height when you first try rolls. Even higher than your first loops. Remember, when I first tried rolls they ended up diving towards the ground pretty quick! Fly off up the field into wind climbing out to say 150-200 feet (ie plenty of mistakes high!) as you go. Begin your turn so you start flying back down range past you with the wind.

Straighten the helicopter up into level fast forward flight, you needen't be going flat out, just at a good pace. You're aiming to commence the maneuver as the helicopter passes in front of you.

**Executing the maneuver**  
Remember, the attitude of your helicopter's nose is going to impact upon the amount of negative pitch you need to pull as the helicopter rolls over. For your first rolls, you really don't want the nose anymore than slightly nose down.

Begin the maneuver by doing a gently moving your cyclic to the right. Don't stab it, gently move it across. Make sure that you do not pull in any elevator by mistake cause that will cause the heli to dive (back cyclic) or climb (forward cyclic). A tip that I've used to ensure that I don't pull in any elevator is to completely let go of the cyclic control to let it center, then gently move it across. That way I'm minimising the possibility of adding any unwanted elevator.

Just before the helicopter passes through the 'knife edge' (ie completely on it's side), begin reducing collective. Because the heli didn't have too much of a nose down attitude when you started, you're not going to require much negative. As the helicopter becomes inverted your collective should be just below half way (say about -3 degrees or so) which should prevent the heli from 'falling out' of the maneuver.

When the helicopter passes through the inverted position and is beginning to move into the knife edge position, start moving your collective control back up again so that as the heli returns to the upright position the collective is back at full stick.

**Exiting the maneuver**  
Ideally, the helicopter should exit the maneuver at the same altitude it entered it on. In the real world, there's a good chance it didn't, but hopefully the heli is still alive!

Don't worry though, once you've got past the first one, the rest are easy! Just keep going at them!

**Things to watch out for**

* **Entering the roll too fast.**  
  Entering a roll too fast (ie with the nose well down) will mean you have to feed in more negative collective as the helicopter goes inverted, failure to do so will see the heli start to dive (pretty damn fast in some cases!).
* **Feeding in unwanted elevator.**  
  If while your rolling you add in elevator, the helicopter will begin to dive (back elevator) or climb (up elevator), either way, it won't make the roll look very flash. One way of minimising this is to release the cyclic control just prior to rolling so that the stick center's itself first. Another way is to add a bit of negative (Futaba) or positive (JR) EXPOnential so that even if you do add a little elevator, it won't show up as badly.
* **Aileron to Throttle mixing.**  
  One thing I use to ensure smooth, seemless rolls is using aileron to throttle mixing. This means that as aileron inputted, throttle is added, when the cyclic control returns to center, the throttle returns to where it was prior to the aileron input. Most transmitters have available mixing functions for this. For transmitters like the 9Z, they have built in functions specifically for this purpose without the need to take up a mix

**Points to perfect**  
The following are a list of aspects that I look for when judging rolls.

* **Smooth entry (and exit) from (to) fast forward flight**  
  A smooth start to the roll (as opposed to a aileron 'snatch').
* **Consistent rolling action**  
  The roll should be smooth and consistent all the way through the 360 degree rotation.
* **Consistent speed**  
  The helicopter should not alter speed during the execution of the maneuver, it shouldn't slow down, nor speed up. This requires careful management of the collective control.
* **Consistent altitude**  
  The helicopter should not alter altitude during the execution of the maneuver either, again, this requires careful management of the collective control.

Get out and give it a go!

**Beginning 3D: Inverted**

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| **Lesson objectives:** |
|  Begin basics of inverted flight.   Master inverted hovering tail in/nose in/side on.   Become confident in handling the helicopter in forward inverted flight.   Safely control the helicopter through turns in forward inverted flight. |

Flying inverted is a great party trick. Do some inverted flying in front of some spectators and they'll think you're the man. However, while inverted used to be 'the' maneuver, it has now become a fairly basic requirement in order to execute some of the harder 3D (and even F3C) maneuvers.  
Some would say you can do the more basic 3D maneuvers before learning inverted. However, I counter that by saying "what happens if you find yourself inverted in a critical situation?". There's a good chance it's not going to end well, so continuing to subscribe to the 'walk before you run' theory, we'll do inverted now.

When I first learned inverted flight, I must have spent a full week of nights on the simulator before I tried for real, and I would recommend this to everyone. You'll learn much faster on a sim.

**Setup**  
Your heli should be able to pull at least 9 degrees pitch both ways in Idle Up 2. Set your pitch curve for 0 degrees at mid stick. Ensure you don't have any binding at full pitch (both positive and negative) while adding in a little cyclic.  
For the throttle curve, start off with something like 100, 70, 50, 70, 100. Remember, you're aiming to hover at points 2 and 4, so you don't want the engine screaming it's nuts off there, I wouldn't recommend anymore than 70% throttle at either of these points.  
If your radio has some extra mixers (or if you've got a radio with a dedicated SWASHPLATE function that mixes in throttle with swashplate movements), then become familiar with the use of these functions. They'll become very useful when we get into more advanced aerobatics. I wouldn't recommend complicating things right now by setting them up, but become aware and familiar with their operation.  
If you've got a heading hold gyro, it's a good idea to setup Idle Up 2 for heading hold. That way the tail can look after itself while you're trying to come to grips with the cyclic controls.

**Orientation Tricks**  
Learning inverted isn't easy and takes a bit of practice. Many people can hover inverted, but can they fly circuits?  
I found that inverted was easier than tail in at first. Not sure why, but it just was.

**Aileron**  
This is exactly the same as 'upright' flying. If the heli is inverted nose in, treat the aileron the same as upright nose in and vice versa.

**Elevator**  
This is one of the harder ones to learn. When the heli is inverted nose in, you 'push' the stick to push the heli away from you, and 'pull' the stick to pull it to you. Ofcourse this is reversed when tail in. This one here just takes time.

**Rudder**  
Rudder isn't easy to learn either. The trick I use now is to 'steer the bit closest to me'. For example, when the heli is nose in to me, and I want the nose of the heli to turn to MY right, I push the rudder right. If I want it to go to MY left, I push the rudder left. Same deal with tail in, if I want the tail to move to the right, I move the rudder to the right.

**Pitch**  
I don't have any tricks for pitch! You've just got to remember that down is up and up is down!!!

**Getting Started**  
The best and most safest way of entering your first inverted flight is by trying to hold the heli at the top of a loop.  
Enter the loop at a nice comfortable height in ID2, and as the heli reaches the inverted stage, release the elevator back to neutral and increase negative pitch to 'prop it up'. Hold it there for a few seconds until it starts to drift, or you become uncomfortable, then ease back on the elevator and continue on with the loop. The aim of these first attempts is to get the hang of the cyclic controls, what does what etc.  
Continue on with trying to hold it at the top of loops. Make small determined stick movements. If the heli starts moving towards you nose in, push the elevator stick forward a little, if it's moving sideways, correct it as you would if it were nose in.  
Check your inverted climbout ability by giving it a stab of negative pitch to try and gauge how quickly the heli climbs out. This will ensure that if you get in trouble, stabbing on the negative pitch to gain you some altitude is going to be effective.

Once you can stop the helicopter drifting off by itself and can maintain a stable hover at altitude, start exploring the elevator cyclic controls. Gently pull back on the elevator to start the heli in slow forward flight towards you, move it along ten meters or so, then gently push on the elevator to bring the heli back into a hover. Then try the same with aileron. Ofcourse you will need to make the appropriate pitch changes as you would if you were doing this same exercise upright. At all times, if you feel it getting a bit 'uncomfortable', bailout, take a breath and try again.

When you can maintain a stable inverted hover and can move from one place to the next confidently, start getting the helicopter lower and lower, ensuring that you have a bailout plan in your head. For me, this plan is pushing forward on the elevator and down on the pitch so that the heli is climbing and flipping to upright if I 'get lost'.

**Forward Flight**  
Now that you can hover inverted in a controlled fashion, it's time to work on the forward flight aspect. Not surprisingly, it's much like when you take your first steps into upright forward flight. Take things slowly.  
I recommend you get comfortable with hovering the heli inverted side on to you. It doesn't have to be at low level cause we'll not be going that low to start with. Initially, we're going to start flying inverted back in forth from side to side in front of us. The reason for this is we don't want to be flying at us incase of a 'brain fade' and the wrong stick is pulled and you have an upside down hedge trimmer racing at you, and that is not what we want.

Just as you practised the hovering, enter the inverted forward flight from the top of a slow loop. Do not get too much speed up, take everything slowly. As the heli comes over the top and inverted, slowly start applying some forward elevator and some negative pitch so that the heli continues straight on in forward flight. Not too much else the heli will stop and start flying backwards, and not too much negative pitch before forward elevator else the heli will pick up speed very quickly!

When I was doing this, I would let the heli 'glide' past me with as little input from me as possible, I would give little inputs so as not to 'upset' the heli. Let it continue past you until you are ready to stop. Do this by pushing forward on the elevator for a forward flip. This will gain you altitude instead of losing it. Get yourself sorted, and then do the same again, but going in the opposite direction. Continue doing this until you are comfortable controlling the helicopter in straight line forward inverted flight.

**Turning**  
When you can confidently control the heli in forward inverted flight, it's time to start adding some turns into the mix. The issues here are timing the rudder with the aileron and elevator. The aileron works exactly the same as it does right side up. However, when you enter a left hand turn, you're adding some left aileron, some right rudder and a little forward elevator to bring the nose around. The aileron and rudder work on the 'together/apart' rule, where if aileron moves toward the center of the radio, so too does the rudder. If the aileron moves to the outside of the transmitter, so too does the rudder. This rule holds true for both Mode One and Mode Two radios.

Enter inverted forward flight in the same way as you did above, and as the heli glides past you from left to right, start executing a left hand turn by adding a little left aileron and a little right rudder, as the heli begins to turn, add in a little forward elevator to stop the heli from diving. Continue to hold this in as the heli turns, again making small movements. As the heli completes the turn and begins to head back down the track from which it came, let it continue for a while, then either forward flip, or aileron roll out to upright. Complete this maneuver again and again until you are comfortable with making banking turns. Make both left and right hand turns as well as nose in and tail in turns.

**Points**

 Always have a bailout plan. Most of the time, I do forward flips as they gain altitude (unless flying backward inverted).

 Be smooth on the sticks! Sudden movements can accelerate bad situations!

 Make sure that you have a good inverted climbout. Adjust your pitch curve until you get one. I've flipped a heli over and hovered inverted quite low to the ground and gone to climb out and found the heli climbs at a snails pace. Not good if you have to bail quickly!

**Bringing it all together**  
Once you've sorted out the 'turning' business, it'll pretty much all come together and you'll get to a stage where it doesn't matter if the helicopter is right side up, or up side down. It's when you've achieved this, that you're ready to get into some of the more demanding 3D maneuvers.

**Beginning 3D: Inverted**

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| **Lesson objectives:** |
|  Begin basics of inverted flight.   Master inverted hovering tail in/nose in/side on.   Become confident in handling the helicopter in forward inverted flight.   Safely control the helicopter through turns in forward inverted flight. |

Flying inverted is a great party trick. Do some inverted flying in front of some spectators and they'll think you're the man. However, while inverted used to be 'the' maneuver, it has now become a fairly basic requirement in order to execute some of the harder 3D (and even F3C) maneuvers.  
Some would say you can do the more basic 3D maneuvers before learning inverted. However, I counter that by saying "what happens if you find yourself inverted in a critical situation?". There's a good chance it's not going to end well, so continuing to subscribe to the 'walk before you run' theory, we'll do inverted now.

When I first learned inverted flight, I must have spent a full week of nights on the simulator before I tried for real, and I would recommend this to everyone. You'll learn much faster on a sim.

**Setup**  
Your heli should be able to pull at least 9 degrees pitch both ways in Idle Up 2. Set your pitch curve for 0 degrees at mid stick. Ensure you don't have any binding at full pitch (both positive and negative) while adding in a little cyclic.  
For the throttle curve, start off with something like 100, 70, 50, 70, 100. Remember, you're aiming to hover at points 2 and 4, so you don't want the engine screaming it's nuts off there, I wouldn't recommend anymore than 70% throttle at either of these points.  
If your radio has some extra mixers (or if you've got a radio with a dedicated SWASHPLATE function that mixes in throttle with swashplate movements), then become familiar with the use of these functions. They'll become very useful when we get into more advanced aerobatics. I wouldn't recommend complicating things right now by setting them up, but become aware and familiar with their operation.  
If you've got a heading hold gyro, it's a good idea to setup Idle Up 2 for heading hold. That way the tail can look after itself while you're trying to come to grips with the cyclic controls.

**Orientation Tricks**  
Learning inverted isn't easy and takes a bit of practice. Many people can hover inverted, but can they fly circuits?  
I found that inverted was easier than tail in at first. Not sure why, but it just was.

**Aileron**  
This is exactly the same as 'upright' flying. If the heli is inverted nose in, treat the aileron the same as upright nose in and vice versa.

**Elevator**  
This is one of the harder ones to learn. When the heli is inverted nose in, you 'push' the stick to push the heli away from you, and 'pull' the stick to pull it to you. Ofcourse this is reversed when tail in. This one here just takes time.

**Rudder**  
Rudder isn't easy to learn either. The trick I use now is to 'steer the bit closest to me'. For example, when the heli is nose in to me, and I want the nose of the heli to turn to MY right, I push the rudder right. If I want it to go to MY left, I push the rudder left. Same deal with tail in, if I want the tail to move to the right, I move the rudder to the right.

**Pitch**  
I don't have any tricks for pitch! You've just got to remember that down is up and up is down!!!

**Getting Started**  
The best and most safest way of entering your first inverted flight is by trying to hold the heli at the top of a loop.  
Enter the loop at a nice comfortable height in ID2, and as the heli reaches the inverted stage, release the elevator back to neutral and increase negative pitch to 'prop it up'. Hold it there for a few seconds until it starts to drift, or you become uncomfortable, then ease back on the elevator and continue on with the loop. The aim of these first attempts is to get the hang of the cyclic controls, what does what etc.  
Continue on with trying to hold it at the top of loops. Make small determined stick movements. If the heli starts moving towards you nose in, push the elevator stick forward a little, if it's moving sideways, correct it as you would if it were nose in.  
Check your inverted climbout ability by giving it a stab of negative pitch to try and gauge how quickly the heli climbs out. This will ensure that if you get in trouble, stabbing on the negative pitch to gain you some altitude is going to be effective.

Once you can stop the helicopter drifting off by itself and can maintain a stable hover at altitude, start exploring the elevator cyclic controls. Gently pull back on the elevator to start the heli in slow forward flight towards you, move it along ten meters or so, then gently push on the elevator to bring the heli back into a hover. Then try the same with aileron. Ofcourse you will need to make the appropriate pitch changes as you would if you were doing this same exercise upright. At all times, if you feel it getting a bit 'uncomfortable', bailout, take a breath and try again.

When you can maintain a stable inverted hover and can move from one place to the next confidently, start getting the helicopter lower and lower, ensuring that you have a bailout plan in your head. For me, this plan is pushing forward on the elevator and down on the pitch so that the heli is climbing and flipping to upright if I 'get lost'.

**Forward Flight**  
Now that you can hover inverted in a controlled fashion, it's time to work on the forward flight aspect. Not surprisingly, it's much like when you take your first steps into upright forward flight. Take things slowly.  
I recommend you get comfortable with hovering the heli inverted side on to you. It doesn't have to be at low level cause we'll not be going that low to start with. Initially, we're going to start flying inverted back in forth from side to side in front of us. The reason for this is we don't want to be flying at us incase of a 'brain fade' and the wrong stick is pulled and you have an upside down hedge trimmer racing at you, and that is not what we want.

Just as you practised the hovering, enter the inverted forward flight from the top of a slow loop. Do not get too much speed up, take everything slowly. As the heli comes over the top and inverted, slowly start applying some forward elevator and some negative pitch so that the heli continues straight on in forward flight. Not too much else the heli will stop and start flying backwards, and not too much negative pitch before forward elevator else the heli will pick up speed very quickly!

When I was doing this, I would let the heli 'glide' past me with as little input from me as possible, I would give little inputs so as not to 'upset' the heli. Let it continue past you until you are ready to stop. Do this by pushing forward on the elevator for a forward flip. This will gain you altitude instead of losing it. Get yourself sorted, and then do the same again, but going in the opposite direction. Continue doing this until you are comfortable controlling the helicopter in straight line forward inverted flight.

**Turning**  
When you can confidently control the heli in forward inverted flight, it's time to start adding some turns into the mix. The issues here are timing the rudder with the aileron and elevator. The aileron works exactly the same as it does right side up. However, when you enter a left hand turn, you're adding some left aileron, some right rudder and a little forward elevator to bring the nose around. The aileron and rudder work on the 'together/apart' rule, where if aileron moves toward the center of the radio, so too does the rudder. If the aileron moves to the outside of the transmitter, so too does the rudder. This rule holds true for both Mode One and Mode Two radios.

Enter inverted forward flight in the same way as you did above, and as the heli glides past you from left to right, start executing a left hand turn by adding a little left aileron and a little right rudder, as the heli begins to turn, add in a little forward elevator to stop the heli from diving. Continue to hold this in as the heli turns, again making small movements. As the heli completes the turn and begins to head back down the track from which it came, let it continue for a while, then either forward flip, or aileron roll out to upright. Complete this maneuver again and again until you are comfortable with making banking turns. Make both left and right hand turns as well as nose in and tail in turns.

**Points**

 Always have a bailout plan. Most of the time, I do forward flips as they gain altitude (unless flying backward inverted).

 Be smooth on the sticks! Sudden movements can accelerate bad situations!

 Make sure that you have a good inverted climbout. Adjust your pitch curve until you get one. I've flipped a heli over and hovered inverted quite low to the ground and gone to climb out and found the heli climbs at a snails pace. Not good if you have to bail quickly!

**Bringing it all together**  
Once you've sorted out the 'turning' business, it'll pretty much all come together and you'll get to a stage where it doesn't matter if the helicopter is right side up, or up side down. It's when you've achieved this, that you're ready to get into some of the more demanding 3D maneuvers.

**Beginning 3D: Flips**

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| **Lesson objectives:** |
|  Learn stationary elevator and aileron flips.   Incorporation of swashplate mixing.   Learn correct collective pitch management to avoid 'over pitching'. |

Now that you have mastered inverted flight, then you'll be looking to get onto something different, and the natural progression from there is both elevator and aileron flips.

**Introduction:**  
Although flips are quite easy in concept, like everything else, doing them consistently, controlled, and well can be a little more challenging. Flips make up the basis of a lot of 3D maneuvers and as such, time taken to get them right will help extensively with more advanced maneuvers.

**Setup:**  
Your heli should have the standard Idle Up 2 (Inverted) setup. It should be able to pull at least 9 degrees pitch both ways in Idle Up 2. Set your pitch curve for 0 degrees at mid stick. Ensure you don't have any binding at full pitch (both positive and negative) while adding in cyclic.  
For the throttle curve, start off with something like 100, 70, 50, 70, 100. Remember, you're aiming to hover at points 2 and 4, so you don't want the engine screaming it's nuts off there, I wouldn't recommend anymore than 70% throttle at either of these points.  
If your radio has some extra mixers (or if you've got a radio with a dedicated SWASHPLATE function that mixes in throttle with swashplate movements), then become familiar with the use of these functions. They'll become very useful when we get into more advanced aerobatics. We'll discuss the use of this function a little later on.  
If you've got a heading hold gyro, it's a good idea to setup Idle Up 2 for heading hold. That way the tail can look after itself while you're trying to come to grips with the cyclic controls.

**Steps:**  
The concept of a flip is quite simple. For an elevator flip:   
· Either push forward or back on elevator as you reduce pitch slowly and smoothly.   
· As the heli goes through the vertical plane you should aim to be at about midstick (zero degrees). This will prevent the helicopter moving too much.   
· As the heli passes through vertical, you'll be slowly and smoothly adding negative pitch until the heli is fully negative at which point you should be at the inverted hover point (around -4.5 to -5 degrees).   
· As the heli passes through inverted back to vertical, you'll again be reducing pitch back to around midstick and then adding the pitch back on as it becomes upright again.

The same steps are true for aileron flips.

**Points:**  
· Do not over pitch! If you swing on the collective too much you'll kill both headspeed and engine revs which will take time to come back. An inconsistent headspeed will result in a varying flip rate which will throw your timing off. You'll also probably loose precious altitude!  
· Make sure you're straight and level before beginning a flip otherwise the heli will 'walk' or 'run' off in some direction and will make it difficult to control.  
· Ensure your gyro is holding well and that your drive system is ok. I did a forward flip with my Standard Vigor the other day only for it to do it's own impromptu piro flip because the tail belt had lost it's teeth! That was exciting I must say and luckily no damage occurred, but it was stress that needent have occurred. If your tail breaks out, do not panic, just continue to follow through with the maneuver until you are upright, then correct, don't try to correct during the maneuver cause you'll just about always screw up (until you have gained more experience).  
· To increase your flip rate, ensure that you're getting the most out of your setup first by making sure you have as much cyclic control as you can get without binding, then your next bet is different paddles. My Voyager increased it's flip rate a lot once I installed Hirobo Sceadu paddles, same for my Vigor's with Freya paddles.

**Swashplate Mixing:**  
Something I like to do on my helis for Idle Up 2 is program in a bit of swashplate mixing. What this does is for every cyclic input, the transmitter mixes in a little increased throttle to compensate for the extra loading the cyclic input is putting on the engine.  
I use this so that the headspeed is nice and consistent throughout maneuvers, but when hovering either upside down or right side up, the engine isn't screaming too hard.  
My radio, the 9Z WCII, has a swashplate function built in, with some of the other radios, you will need to use some of your free mixers to achieve the same result.

**3D: Tic Tocs/Metronome**

**Introduction:**  
As with most 3D maneuvers, Tic Tocs (or Metronomes as they are sometimes called) are a challenging maneuver to do successfully and very cool when done right.  
A Metronome is one of those timer things that they used for teaching music timing I think. Basically, the top of an arm swings back and forth from left to right through the centerline. That's pretty much the same as what we're aiming for from the heli. The helicopter is going to be the 'arm' with the tail of the heli representing the base which is generally pretty stationary, and the nose will rock forward and back representing the top of the arm.

**Setup:**  
The setup for this maneuver requires the basic 3D setup (-9 or so through to +9), I ensure that I have heading hold switched on to stop the tail breaking out. Some swashplate mixing (throttle to aileron/elevator) doesn't hurt either. Try to maintain a headspeed of around 1750RPM or more.

**Steps:**  
The steps involved in the Metronome can be described as follows:  
· There are various ways to enter the maneuver, you can enter by doing a stall turn to get the helicopter vertical, or do a 1/4 flip.  
· As the helicopter becomes vertical, gently add in back elevator while slowly adding negative pitch.  
· As the helicopter reaches a 45 degree angle, halt the movement of the helicopter by adding further pitch and as the helicopter stops, continue to add in some more to get it moving back in the opposite direction again while adding forward elevator, but leading with the pitch.  
· Once the helicopter has reached the opposite 45 degree angle, add positive pitch to halt the helicopter's motion and as the helicopter begins to travel back along it's original path, add back elevator to send it on it's way again.

**Points:**  
Points to watch during this maneuver include:  
· Do not over pitch! If you do, you'll lose valuable headspeed and altitude. Or, conversely, you could climb which will put your heli out of position.  
· Do not stab the sticks, cause again, you'll sap headspeed and things won't go well. Be smooth and deliberate in your movements and you'll get better results.  
· Lead with the collective (ie use collective before cyclic).  
· Start high, I still tend to lose altitude when doing this maneuver!

**3D: Death Sprial**

**Introduction:**  
Don't let the name intimidate you, the death spiral maneuver needent spell the end for your pride and joy as the death spiral is fairly basic in design and execution. The majority of the maneuver is basically just a prolonged elevator flip, it's the knife edge falling part that can raise the blood pressure a little!

**Setup:**  
The setup for this maneuver is your basic 3D setup (Idle Up Two) (-10 to +10 pitch). Try to maintain around 1750 - 1800 RPM on the head. Gyro in heading hold.

**Prerequisites**:  
Before you attempt this maneuver you should be comfortable with the following:

 Fast Forward Flight.

 Nose in.

 Inverted hovering (both tail in and nose in).

 Inverted circuits.

 Quick hand-eye co-ordination :).

Please make sure you are comfortable with the above before you try this, nothing is worse than watching someone try and fly outside their ability and screwup and not have the ability to catch it!

**Steps:**  
The Death Spiral is made up of a number of different actions. You start at a good altitude (for your first one start very high!) then:  
- Quarter aileron flip to knife edge. It is important that the heli is right on it's rotor tip and falling straight down. If it is not, your death spiral will not be straight.  
- Apply some forward or back elevator while in the falling knife edge position, the heli should now be 'spiraling' straight down.  
- After about two to three flips (depending on your flip rate) I recommend bailing out. Do this by applying the OPPOSITE aileron to what you applied to start the flip. This way you will come out with the heli the right way up.  
- Continue to practise this maneuver but continue to increase the number of elevator flips that you do before bailing out.

**Mix it up:**  
Once you have become comfortable with pulling out of the maneuver upright, try adding a little extra something in there by pulling out inverted, backwards etc.

Try doing a 45 degree Death Spiral by adding negative pitch while nose in, then positive pitch while tail in.

Also try compensating for wind conditions by adding in the appropriate pitch controls to ensure the heli falls straight.

Also, once you've got yourself sorted here, start trying to transition the helicopter from vertical falling flight to sideways horizontal flight while flipping. For example, while doing forward elevator flips, had in a little right aileron and a little negative pitch when the heli is nose in to you, then once it gets tail into you, add in a little left aileron and a little positive pitch. Be careful not to 'overpitch' the controls else you'll bog the engine, loose headspeed, make lots of noise etc and the result won't be great. If you do it correctly the heli should end up flying sideways while still flipping.

**Points:**  
Points to watch while doing this maneuver include:  
- During the spiral part of the maneuver, ensure that you have zero pitch on the blades as the helicopter is falling, otherwise the heli won't fall straight.  
- Make sure the heli enters the maneuver on the knife edge falling perpendicular to the ground other wise the maneuver will be 'crooked'.

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| **Flying Lessons – Pirouetting Flips**  Simon Lockington  Perhaps the most famous and sought after 3D maneuver is the pirouetting flip. It’s a spectacular maneuver when done well and probably one that you might really strive to achieve if 3D is your thing. For some, the pirouetting flip is the ‘holy grail’ of 3D maneuvers and that once you can achieve it, vast riches, glory and supermodels will befall them. Well there won’t be vast riches (infact there’s a very real possibility you’ll be financially worse off!), the glory will only be in your head, and the women will still be as disinterested in helicopters as they were when you were just hovering.  Some people even change modes from Mode One to Mode Two thinking this will help them achieve the nirvana that is the pirouetting flip. This madness will do you no good and I just about guarantee you’ll be worse off than if you had just put that effort in to learning this maneuver on your ‘native’ mode. There are MANY mode one guys who can piroflip VERY well indeed.  A lot of people get confused between a pirouetting flip and a Chaos/Kaos. They’re not the same thing. While they may look similar, there’s subtle differences that distinguish the two maneuvers.  **WHEN IS A PIROUETTING FLIP CHAOTIC?** I was once told by Curtis Youngblood who I believe was the inventor of the Kaos maneuver that the difference between a pirouetting flip and the Kaos was that with a Kaos, the axis of the flip changes throughout the maneuver. With a correct pirouetting flip, it doesn’t.  The axis of a pirouetting flip is the same as the axis of a normal elevator (forward or back) flip, it’s just that the helicopter is pirouetting.  With a Kaos however, the axis changes throughout the maneuver and in effect, you get a very compact, pirouetting globe.  For most of us however, the result we get when trying a pirouetting flip, is a mixture between a pirouetting flip and a Kaos.  Don’t think that you can go out to the field and in one weekend pull off perfect pirouetting flips. This can be a long term learning lesson this one. Hell I’ve had some of the top dogs of our hobby tell me it took them upwards of a year before they could do the maneuver correctly, so take your time, do what I tell you, work smart and it’ll come.  If you take the smart route and break a complex maneuver down into simple components, then you will succeed in this maneuver.  As with all maneuvers, before you attempt this one, you should have the prerequisites down.  **PREREQUISTIES** Before attempting this maneuver on the whole, you should be fully competent in the following ‘sub-maneuvers’. These are:   * **Stationary upright pirouettes.** You should be competent in controlling the helicopter whilst doing continuous upright pirouettes on the spot, right in front of you. * **Moving upright pirouettes.** You should be competent in moving the helicopter around whilst continuously pirouetting. For example, a pirouetting figure 8. * **Stationary inverted pirouettes.** You should be competent in controlling the helicopter whilst doing continuous inverted pirouettes on the spot, right in front of you. * **Moving inverted pirouettes.** You should be competent in moving the helicopter around whilst continuously pirouetting inverted. For example, a pirouetting inverted figure 8. * **Stationary elevator flips.** You should be able to do continuous elevator flips on the spot without the helicopter moving laterally or changing altitude. You should also be able to do this without the engine bogging. * **Stationary aileron flips.** You should be able to do continuous aileron flips on the spot with the helicopter moving laterally or changing altitude. You should be able to do this without the engine bogging.   Once you have mastered all of the above components, THEN you can move on, otherwise don’t bother, you’re only kidding yourself!  **PUTTING IT ALL TOGETHER** So now that you’ve mastered all of the above components, we can now concentrate on attempting the maneuver itself.  As always, you want to give yourself a bit of height for your first attempts at this. However, don’t make the mistake of going too high! Some people think they’re doing themselves a favour by flying really high. They’re not. Instead, they’re only making it harder for themselves because they just can’t see what’s going on.  You should be no higher than three mistakes high. If you need more than three mistakes of room to fix any problem, then you’re not ready for this maneuver. Go back and learn the basics.  **1. FLIP WITH PIRO PAUSE** Begin by pirouetting and watching the helicopter. You need to pick a point to ‘key’ off, this will be the point you watch to control the maneuver. Normally this is the nose, or the tail. For the purposes of this exercise, we’ll use the nose of the helicopter and we’ll pirouette to the left.  As the helicopter is pirouetting, watch the nose, as it comes round to face you, stop the pirouette and execute a half back flip to inverted tail in. If the helicopter has started drifting off, correct it before resuming pirouetting again.  Complete two pirouettes before stopping the nose again when it is pointing at you and then execute a half forward flip. Correct any drift before resuming pirouetting again.  Now you’ve completed a full flip. Do another one!  The purpose of this exercise was to get you to get used to the idea of keying off a reference point of the helicopter (ie the nose) and acting upon it when the reference point reached a given area (ie pointing straight at you).  Once you feel happy about step 1, complete it again but this time, after each half flip, if the helicopter is drifting about, resume pirouetting again and correct the drift during the pirouettes. This is an important step!  **2. PIRO FLIP WITH FLIP PAUSE** Now that you can key off a reference point on your helicopter, and you can correct any movement while pirouetting we will work on the process of flipping while pirouetting.  Resume pirouetting again, but this time, when the nose comes round to face you, instead of stopping the pirouette, continue it as you give a jab of back elevator. As you do so, continue to watch the nose of the machine only. About now, your instincts (picked up from doing inverted pirouetting circuits) should kick in and give you a good idea of what cyclic inputs you need to get the helicopter inverted.  I’m not going to tell you what cyclic inputs you need because if you have to be told, then you’re not ready for this maneuver.  Don’t expect that you be able to flip the helicopter inverted while pirouetting on the first attempt! Remember this takes time…  Once the helicopter has become inverted, settle the helicopter into a steady hover again before resuming pirouetting. It’s important to do this rather than chase it all over the sky. Simply ‘surviving’ a maneuver is not the same as being ‘able to do it’.  Complete the same process again this time from inverted to upright. Each time, remember to stop at each half of the maneuver and correct any ‘unplanned’ movement.  So, to recap, practice flipping from upright to inverted while pirouetting, then maintain a steady hover while pirouetting inverted, then resume a flip from inverted to upright while pirouetting.  Why pause in the middle? This is important because you need to recognize when the helicopter is upright and inverted. While this may sound really stupid, you’d be amazed how you can lose track of simple things while completing a maneuver! It is also doing this ‘pause period’ where later on, you’ll add the inputs that will let you do tricks such as change altitude or steer the maneuver around in a controlled fashion. That’s why it’s important to be able to pause.  In summary, you should be able to:   * Complete a flip from upright to inverted while pirouetting. * While continuing to maintain that pirouette rate, maintain a stable inverted hover while pirouetting for a duration of two pirouettes. * Complete a flip from inverted to upright while maintaining the pirouette rate.   Once you can do all of the above successfully, you can then work on maintaining a constant pirouetting flip where you do not pause between half flips.  **VARIATIONS ON THE MANUEUVER** Once you’ve got all these steps down, you can then work on variations of the basic maneuver, such as:   * Moving the piroflip around laterally (ie traveling from left to right, right to left). * Changing the height of the piroflip (ie giving jabs of pitch during the ‘pause’ segments to climb, or reducing pitch in the ‘pause’ segments to fall). * Fast flip/Slow piro. Change the maneuver combination so that you flip fast but pirouette slowly. * Slow flip/Fast piro. A combination that looks really good is a very slow flip but very fast pirouette.   **WHAT I DID WRONG** This lesson is a result of me trying to learn pirouetting flips the wrong way. I had been trying to learn them in a haphazard fashion that meant that I could only ever do one pirouette per flip.  The lesson described above is a mix of what Todd Bennett taught me while I was in Bali, and what I worked out for myself as a result of that.  I had resisted doing it Todd’s way for ages thinking it was going to take too long and be too frustrating. In the end, I spent more time trying other ways and getting nowhere that I gave up and did it Todd’s way and got much better results.  **TIPS** There aren’t really any short cuts to this maneuver, there are however a couple of things that might make it a little easier to try. That is cutting your rudder pirouette rate down on a Dual Rate switch. If you are having trouble maintaining a constant pirouette rate during your maneuvers cause you think your fingers are moving too much on the rudder when they are not supposed to, try assigning a lower Dual rate value to a switch and activating it before you try the maneuver. This will allow you to use full rudder stick deflection and not yield a blisteringly fast pirouette rate which will let you concentrate on everything else.  As you get better, gradually reduce the amount of dual rate you’re using until you don’t need to use it anymore. This should only be used as ‘training wheels’ rather than a permanent fix.  **SUMMARY** The pirouetting flip is a great maneuver to execute and watch when done correctly and if you follow the procedure outlined in this document, then it need not be impossible either. It isn’t however the be-all and end-all of maneuvers and therefore don’t get too stressed if you find it’s just not working for you. There are other just as interesting maneuvers out there to be worked on! | |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  | | --- | | **Featured Link!** | | [Hirobo Japan](http://www.littlerotors.com/links/referrer.aspx?LinkID=23)  *Hirobo's official website, lots of information on the new Shuttle replacement, the Sceadu. Lots of information on the Freya as well.* | | [Add your own link here](http://www.littlerotors.com/links/addlink.aspx) |  |  | | --- | | **Free newsletter!** | | Register for the free newsletter, pilot locator & Market [Click Here](http://www.littlerotors.com/register/index.aspx) |      |  | | --- | | **Top 10 Product Reviews** | | [T9CHP](http://www.littlerotors.com/productreviews/details.aspx?ProductID=63) [Century Hawk Sport](http://www.littlerotors.com/productreviews/details.aspx?ProductID=256) [Sceadu 50 Evolution](http://www.littlerotors.com/productreviews/details.aspx?ProductID=207) [Freya SST 90](http://www.littlerotors.com/productreviews/details.aspx?ProductID=209) [Raptor 30 V1](http://www.littlerotors.com/productreviews/details.aspx?ProductID=238) [Raptor 30 V2](http://www.littlerotors.com/productreviews/details.aspx?ProductID=239) [GY401](http://www.littlerotors.com/productreviews/details.aspx?ProductID=60) [Max-50SX-Hring](http://www.littlerotors.com/productreviews/details.aspx?ProductID=138) [Caliber 30](http://www.littlerotors.com/productreviews/details.aspx?ProductID=202) [Shuttle Plus](http://www.littlerotors.com/productreviews/details.aspx?ProductID=212) |      |  | | --- | | **Email this page to a friend!** | | [Click Here](http://www.littlerotors.com/refer/index.aspx) | | |
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***MY OPINIONS ON HOW TO LEARN TO FLY R/C HELICOPTERS***

***Every one will have a different idea on how to learn to fly. I believe that you should learn slowly and get good at one step before the next. Its hard to just be hovering about when the others around you are flying around and having a great time. Your wishing you could be doing what there doing, so you get impatient and try to do more than your capable of doing. End result CRASH! So take your time and learn. Its not a fast thing to do but think of the end result. A great pilot with only a few crashes. Yes you will crash, be prepared! Don’t let it get you down. But make that day take for ever to get here. I have people that fly with us that haven’t crashed in 2 years. This could be you to!***

***Over the years I have seen a lot of people trying to learn how to fly r/c helicopters. The following is my opinions on how to do that. When I learned to fly we didn’t have any of the flight simulators that are available today. There’s nothing wrong with them, I think that they are a great tool to have if you can afford it. If having a flight simulator will prevent one crash, then they basically will pay for them self's. How ever, even if you can afford it, there’s still nothing like the real thing. These simulators work real good at teaching you how to move the sticks and what will happen. This is very good to know but you just don’t get that feel that you get from the real flying. You will also need to or want to have it set up like the helicopter you will be flying and if your a beginner you really won’t know how to do that.***

***One of the best things you can do for your self is to go to that local flying field and find some one who flies well. Some one you can trust and you like how they fly. Check out there helicopter. See that its put together like a pro would do. They might fly well but if there helicopter is "HACKED" together, then that's probably a sign of who your dealing with. Once you find that person ask if they will help you. After you find that person stick with them, don’t change from person to person. Every one will have there own opinions and techniques. This will also apply when setting up the helicopter. You need to get it set up right, so you can fly. If you go from person to person and they change your set up, you’ll never get flying.***

***REMEMBER PATIENCE IS A VIRTUE! GET COMFORTABLE WITH ONE THING FIRST THEN MOVE ON TO THE NEXT STEP!***

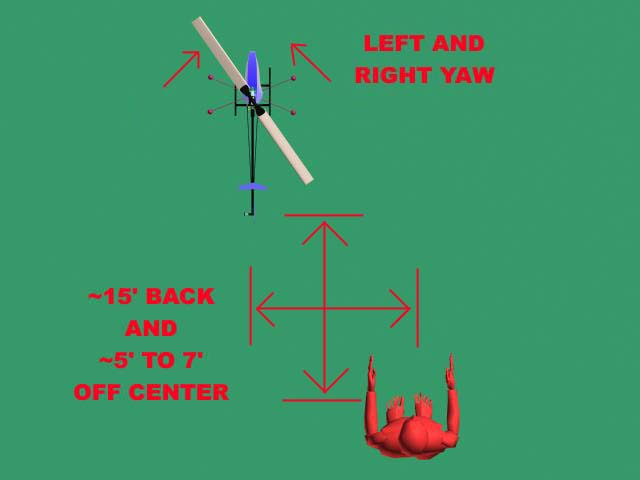
***This is how I first learned to fly. I relate my learning to bowling. ( and I’m not a good bowler! ) My first game is warm up. My second game is my best, and my third is... well not so good. This is because my mind will work overtime and will confuse me. This to me is the same as r/c helicopter flying. My first flight is warm up. My second flight will be the best I will get the hang of it and just when I think I got it, my third flight something different will happen and I’ll be all baffled again. The point here is that you should try only to fly a few flights when you start or take some time between the flights so you do confuse your self. What will happen is that you will think you have done something right and then the next time one thing will be a little different and that will screw you up!***

***BEFORE YOU BEGIN!... MAKE SURE YOU HAVE YOUR TRAINING GEAR ON!***

***Now onto the flying it self:***

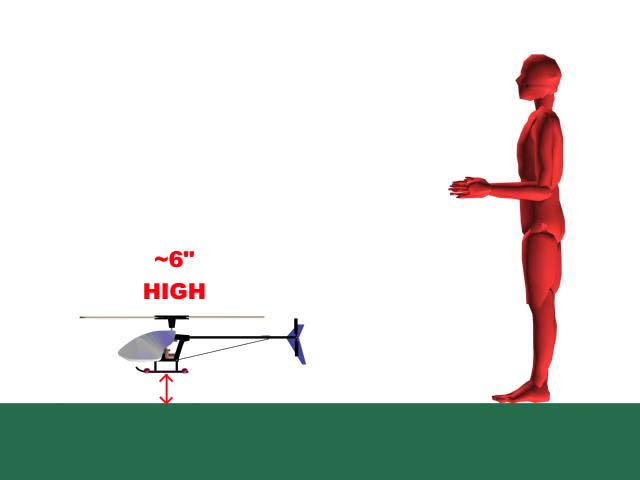
***STEP #1:***

***First you will want to learn the yaw or tail rotor command. With the helicopter light on its feet, learn to control the T/R. Try to keep it behind the helicopter. Position your self as in PHOTO #1. You will want to be positioned behind the helicopter and off to one side. NOTE: notice that on PHOTO #1 my left and right yaw arrows are in the front of the helicopter. This is because you FLY the NOSE of the helicopter.***

***PHOTO #1***

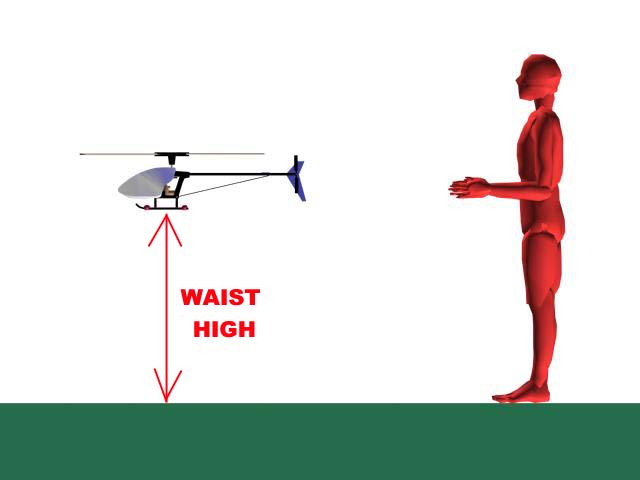
***STEP #2:***

***When you feel comfortable with that, just add a little power and get the heli to lift off about 3 to 6 inches. Do this for a few seconds, then land. After a while you’ll be able to keep it up longer and longer, till you’ll be able to hover for a longer amount of time. PHOTO #2***

***PHOTO #2***

***STEP #3:***

***Now that you can hover at 6 inches. Proceed to learn to hover at a waist high altitude. Get Full control of shorter hovers before going to the next level. As you get higher, you will get out of GROUND EFFECT and things will get different. PHOTO #3***

***PHOTO #3***

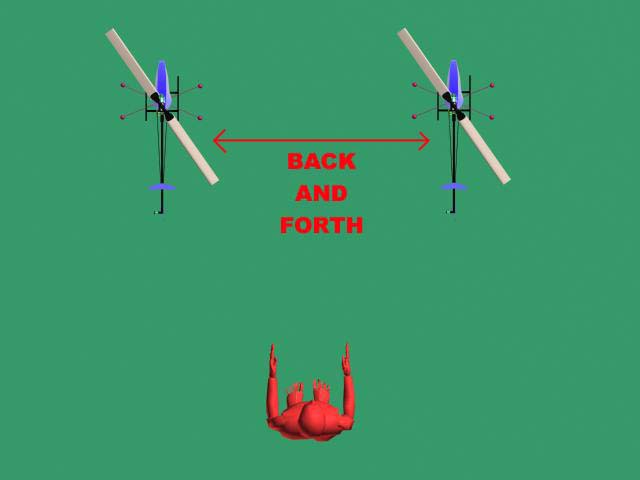
***STEP #3:***

***Well now you have learned to hover, you should now learn to hover both 90 degrees to your self. Lift of into a hover and slowly rotate a little to the left then the right and do this till it gets comfortable. Keep doing this till you are able to hover both directions 90 degrees. Do this because when you start learning approaches you will be coming in at 90 degrees to your self, hence the 90 degrees hovering! By now you have grow comfortable with hovering, so now is the time also to practice when the breeze is light. Get used to the wind, but be careful not to get behind on the controls. This is why you start when the breeze is light. What I mean about getting behind on the controls is that the breeze will move the heli and you will want to correct for that movement before its to late. PHOTO #4***

***PHOTO #4***

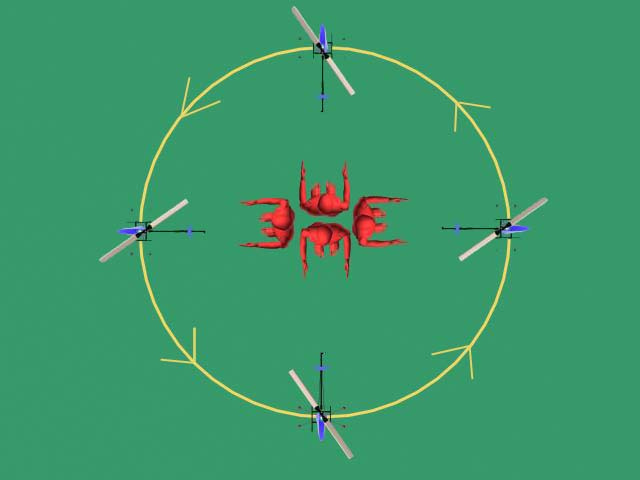
***STEP #4:***

***Next learn to do side swipes with the helicopter. Move the helicopter a little to the right, then a little to the left. Only move a foot or two at first. Get comfortable. Move on to slightly larger distances. If you want you can take the heli small walks. just move the helicopter a little and then you move with it. This will let you learn what it looks like to see it moving. PHOTO #5***

***PHOTO #5***

***STEP #6:***

***Then you can learn to do TAIL IN circles around your self. Do them slowly. Get used to doing them in both directions, although one way will be easier do to the direction of the rotating blades. You will also follow the path of the circle your self. PRACTICE ON ALL YOU MANEUVERS TO DO STRAIGHT UP AND DOWN DESCENTS FROM THE PAD. PHOTO #6***

***PHOTO #6***

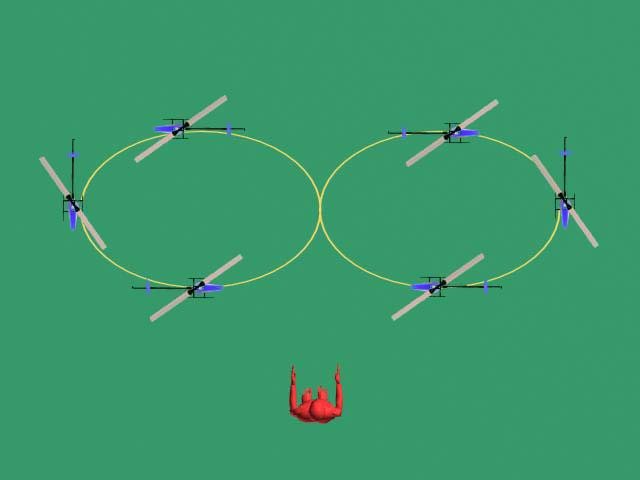
***STEP #7:***

***Now learn to do your side way swipes mixed with your 90 degree hovering that you learned earlier. At first you will not put the full 90 degree yaw in. Move the helicopter to one side or the other and stop its motion. Give it a slight amount of opposite TAIL ROTOR YAW. Just a little amount. Then leaving the helicopter in that condition, Move it back over to the opposite side of you. Stop its motion and give it opposite TAIL ROTOR YAW again. Give it about the same amount you did earlier. keep doing this till you get comfortable again. When you are comfortable with that, try giving it more TAIL ROTOR YAW and so on till you are now flying it back and forth at 90 degrees to your self. REMEMBER!!!! keep in mind that at any time you get in trouble how your going to get the TAIL ROTOR back behind the helicopter. This then is back into the position of a normal hover .... a hover that you practiced at first and everything will feel familiar and you will be ok. PHOTO #7***

***PHOTO #7***

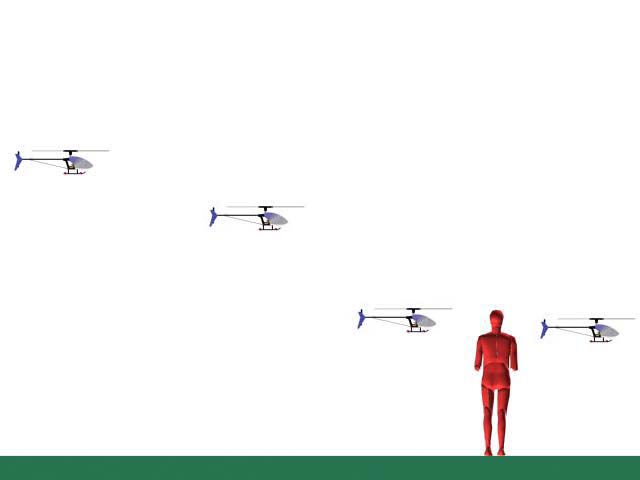
***STEP #8:***

***Next its time to start to learn the basic forward flight. This is an expanded version of the sideways swipe mixed with your 90 degree hovering techniques. Since you can already fly left and right and put in your 90 degree hovering, this will be easier now. at first you will want to add a slight amount of corresponding ROLL CYCLIC. just a little bit is all you need. Your figure 8 will only be about 20 foot big. DON'T GET TO FAR TO ONE SIDE OR ANOTHER OR OUT IN FRONT OF YOU! Do this till your comfortable with it. As you get into this you will find that the helicopter will want to keep traveling out away from you. Stop the helicopter after one or 2 turns and do some backwards hovering to bring the helicopter back where you started from. After a while of doing this you will be able to take the "8" and bring the helicopter back in line with your self so it doesn't fly away. Once you get comfortable with a small version of the figure "8" then increase it size. DON'T GET TO FAR OUT. YOU STILL NEED TO LEARN APPROACHES TO "FLY" THE HELICOPTER BACK, NOT JUST DO BACKWARDS HOVERING. After you get the approaches down you can increase the size of your figure "8"s. The next thing you know.... your flying higher and farther and...YOUR IN FORWARD FLIGHT.....!!!! PHOTO #8***

***PHOTO #8***

***STEP #9:***

***The approaches. When your comfortable with the above and can fly about 15 to 20 feet to the right and left and can be about 10 feet high so you can learn to approaches. Fly to one side of your self like you did to learn side swipes. Now turn the helicopter 90 degrees pointing back the way it came from. Slowly increase you altitude to about 10'. Start a slow forward movement like you did before and slowly come of the THROTTLE / COLLECTIVE PITCH a little and descend to your waist high altitude again. DO NOT USE A LOT OF FORWARD CYCLIC. This will drop the nose and the helicopter will pick up speed fast! As the helicopter comes down to about head level start adding the power again. At the waist altitude you can level off, fly past your self, and then stop. Go back and re-practice this. Then do it from the other direction. One habit you don't want to get into is only learning this from one side. If the wind comes up, you don't know what side you will have to do your approaches from. Always try to do them into the wind. These approaches will also help when you get into autorotation. PHOTO #8***

***PHOTO #9***

***Well this should get you going. The next steps of forward flight will be just what you have practiced above only at a higher and farther distance. DON’T short change learning to hover. Everything will eventually evolve around it.***

***HB***