N.B. The information below is my best shot as a guide based on my personal experience. Pilots have different ways of learning and different expectations so be prepared to take from this article stuff which helps you and, perhaps, not worry about the rest. This article assumes you are already able to hover your helicopter but if you are not sure what you are doing you must get help from experienced pilots. This article may be corrected or updated at any time so if you find a mistake or a better way of doing any of this please let me know.

I first learned to fly model helicopters some time around the mid 1980's. At that time I could find very little training material and developed a set of exercises which were published in an article titled “What Next?” in Radio Control Helicopters magazine. Shortly after, paragliding reached a state of development which made soaring practical and I quit model flying for about 35 years. After deciding paragliding was becoming a bit too hazardous for me (I couldn't possibly have been getting too old!) I took up fixed wing model flying again and later decided to give helicopters another try. Again training material seemed scarce so I checked out the exercises in my old article and adapted and developed them further as I progressed. In this way I hope that the exercises below have the benefit of representing a genuine learning process and that I have have been able to identify issues as they occurred. Nevertheless, hindsight is a wonderful thing so I have altered this article from time as experience suggested it could be improved and will continue to do so in the future.

After releasing the first version of this article I discovered John Salts' web site which is full of useful information.

https://www.rchelicopterfun.com/

His ebook for beginners is very good.

https://www.rchelicopterfun.com/beginners-guide-to-flying-rc-helicopters.html

He also does some online training stuff.

https://www.rchelicopterfun.com/how-to-fly-rc-helicopters.html

John's stuff is very good indeed. I may well not have made the effort to start writing this article if I had known of it earlier.

Flying the model around yourself

In most clubs fixed wing flying is done with pilots standing on a “flight line” between the “pits” area and the “runway” so that flying models kept on the opposite side of the flight line from the pits. This ensures models are not flown over pilots who are preparing their models in the “pits”. My personal view is that in the early stages model helicopter pilots need to fly without other aircraft nearby. This is not just because other aircraft are a distraction, but it enables pilots to fly their models around themselves in order to experience the wind coming from different directions and to see how the direction of the sun affects the visibility of the helicopter in different cloud conditions. Later exercises transition to being one side of the “flight line” in the conventional manner.

The ideal helicopter training field is probably one with nobody else using it. At my flying club, primarily fixed wing, I normally negotiate time slots to fly my helicopter on my own and I often arrive early or hang around after everyone else has gone home so I can practice alone. However if you choose to fly alone, you must take extra care with your own safety.

A few basics

A large part of the process is learning how to observe the attitude and orientation of the model. Helicopters are particularly difficult in this respect as they don't have wings

prominently sticking out either side and are not continuously moving forwards. It also takes time to learn how sun and cloud conditions affect the visibility of the helicopter. Before each flight, check which areas of the sky are likely to give trouble with visibility and their relation to any wind direction. Check if the manoeuvres you intend involve flying the model in silhouette or “up-sun”. If necessary limit flying to the 'down-sun' side rather than risking a crash.

A training undercarriage will be beneficial in the early stages to help stop the helicopter from tipping over on the ground. It may also help you to more easily see the attitude of the helicopter in the roll axis.

Start each flying session with simple exercises and work up to harder ones.

Be careful not to let the machine get too close to you. A safe distance will depend on the size of your model, its stability, and wind conditions.

Try each new exercise in a very light wind or flat calm and only later in incrementally increasing wind.

Do a mixture of different exercises rather than trying to perfect one exercise at a time.

Where manoeuvres involve flying to one side of yourself or turning in one direction try to develop the same proficiency on both ways. Most people find it easier to fly turns and circuits in one particular direction so practice more on your 'weak' side.

One objective of these exercises in the early stages is that the nose of the helicopter should not be pointing towards you at any time. This enables most 'panic' situations to be dealt with by flying it forwards and turning it away from you.

Limit each flight to around ten minutes maximum.

Don't expect to produce the same standard of performance every day. If things aren't going too well, keep to exercises you find easy until you loosen up.

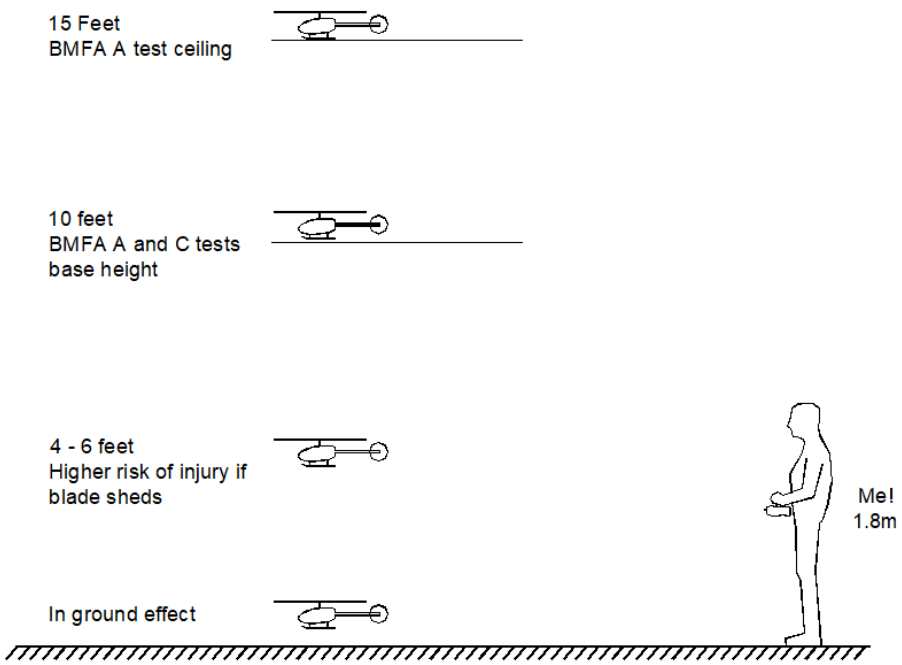
Don't hover too low when trying new manoeuvres. Give yourself a reasonable margin for wind gusts or errors.

Heights to fly

When I first learned to fly helicopters I naturally tended to fly them at about 4 to 6 feet. At this height it seemed relatively easy to observe the attitude, and the helicopter is mostly seen against ground, bushes, trees etc. rather than the sky, depending on the site. However when I came to consider doing my BMFA A test the “base” height for the manoeuvres, as for the B test, is 10 feet. On asking, the reason given was that if the helicopter sheds a rotor blade it most likely to go over the heads of anyone nearby. Having learned most of my hovering at about 4 to 6 feet I cannot say whether initially learning to hover at 10 feet would be more or less difficult. My feeling is that novice pilots will need to learn at heights they find easy, and later at varying heights.

You will have to make your own decisions about this, but you should be fastidious about rotor blade safety checks and other maintenance of your helicopter regardless of your method.

This scale drawing illustrates some typical heights:



Note that close to the ground the helicopter is in “ground effect” and can become skittish. This can make trying to land on a precise spot rather difficult so I don't try too hard! The effect seems greater on smaller helicopters.

As you progress a bit try to maintain a constant height in each exercise and try them at differing heights.

Hovering, forward flying and wind

When a helicopter goes from hovering to flying horizontally the amount of power needed to maintain a given height is reduced and it will tend to climb. You will learn to compensate for this by reducing the collective as the model accelerates and increasing it as the airspeed decreases. When hovering, gusts will tend to make the model climb or sink as well as drift horizontally. A helicopter will also tend to “weathercock”. i.e. It will yaw in line with the direction it is moving through the air.

The combination of these effects can make early flights a bit of a handful. New manoeuvres are best tried in zero or very light winds, and only later in gradually increasing wind strengths as we become more adept.

Helicopter type and size

The size of our helicopter will determine how far away from ourselves we are able to sensibly fly and how strong a wind we can safely manage. My initial learning with these exercises was with an Align 470 electric helicopter which seemed a good compromise between size and the depth of my pocket. Also I can charge the batteries from a leisure battery on the field, something less practical with larger models. With this model I can handle steady winds of up to about 10 mph for most manoeuvres but am wary of stronger gusts. The BMFA B test circuit is a minimum of 50m along its longest leg and is flown at a height of between 30 and 80 feet which feels to be about the sensible distance limit at which I can fly my 470 helicopter at the present time.

A particular aspect of the Align 470 is that the undercarriage seems rather small. This is OK for pilots with some experience and, of course, we can use the standard “cross” type training undercarriage in the initial stages. However, although I have not tried it, I think an overall larger standard type undercarriage might be beneficial for pilots learning on this size of

helicopter. Perhaps one from a larger model could be adapted. This would also help to keep the tail off the ground, make the orientation easier to see.

The winter of 2022/23 brought a natural break to my flying during which I acquired a used Align 550 helicopter. This is easier to fly than the 470. Its orientation is easier to see at a distance and it is disturbed less by wind and turbulence. However it is much bigger and heavier than the 470 and requires more caution. Costs generally are around three times those of the 470 and battery management is more difficult. I can recharge one or two batteries for the 550 from my leisure battery on the field but more is not practical.

I am also tinkering with an OMP M2, a 180 size helicopter which has a separate motor for the fixed pitch tail rotor. This flies very well but I find it rather quick and hard to see. For myself, at the present time, a helicopter in which the tail rotor is driven separately from the main rotor does not feel like a “proper” helicopter. However a friend with some decades of fixed wing aerobatic experience is very much enjoying learning to fly an OMP M2 by sort of “converting” his fixed wing abilities and taking advantage of the relative crash resistance and cheapness of spares. I don't think my own abilities would fit that approach.

The choice is yours. I suspect the optimum model will be different for different pilots.

Gyro types and yaw control

Heading lock gyros were not available when I first learned helicopter flying. When I began re-learning I opted to stick with the gyro in rate mode but have since changed to primarily using heading lock mode. The main difference between these modes appears to be that in heading lock mode the helicopter will weathercock less than in rate mode making it less susceptible to gusts, and accurate rudder trim is less important. Whatever type of gyro you are using you will have to learn the appropriate yaw control, but it is probably beneficial to experiment with the alternate from time to time if your setup permits.

When attempting forward flying manoeuvres:

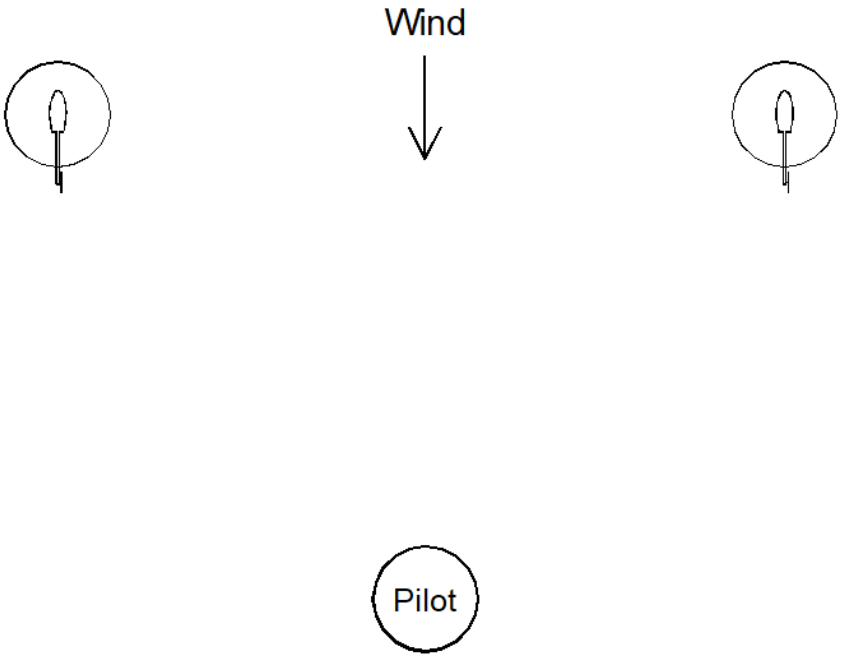
Try and keep the speed even and avoid flying too fast.

Try and keep the helicopter moving forwards during descents.

The fixed wing pilot's adage 'Control height with the throttle and speed with the stick' applies well to helicopters in the form 'Height with the collective and speed with the cyclic'. After much glider flying it took a lot of work to get my left thumb to wake up and actively control the the collective.

“Safe” hovering positions

I think it is safest to take off and land with the model facing into wind, upwind and to one side or the other of myself:

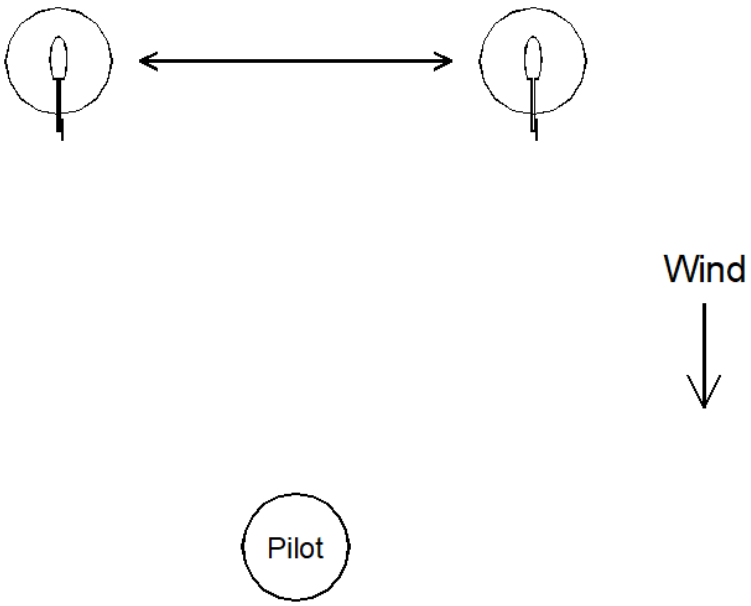


This enables me to see the attitude of the helicopter more easily than with it directly in front of me and if the wind pushes it backwards it will not come directly towards me. These are the positions I initially used to start and finish circuits, and aim for if things get a bit tricky.

The BMFA A and B tests require take-offs with the model directly in front of the pilot although not necessarily directly into wind. Unless you are in a rush to get your A certificate you can develop take-offs and landings with the helicopter oriented in different directions as and when you feel comfortable.

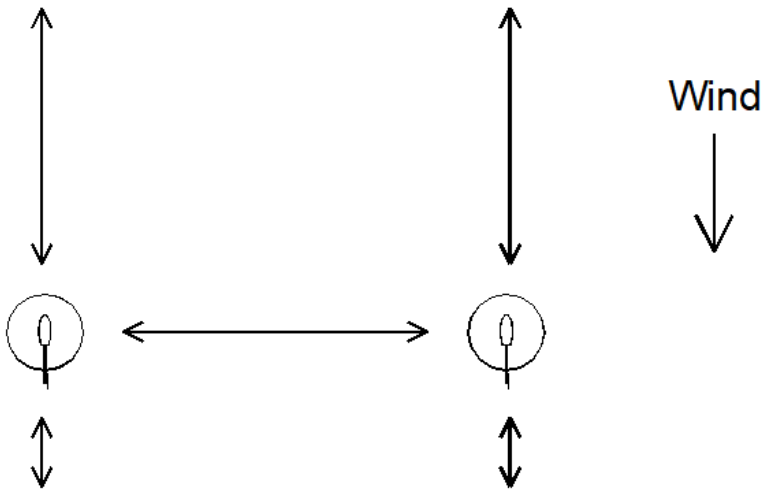
Hovering the helicopter in front of you

Starting with a steady hover, move the helicopter from side to side in front of you. Pause the model by holding a hover at different positions along the line of flight. This will help familiarise you with seeing the helicopter from different angles. If panic develops fly the machine upwind (away from you) and land.

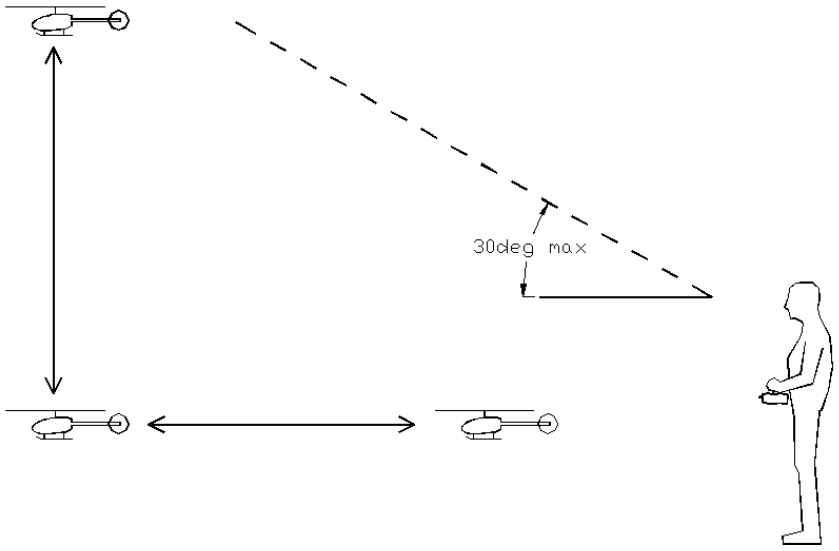


As you improve you can move the model further to each side.

When you are reasonably comfortable moving side to side, begin to move the helicopter forwards and backwards, again pausing to hover at various locations. As you get better at positioning the helicopter try bringing it a little backwards from the “safe” positions.

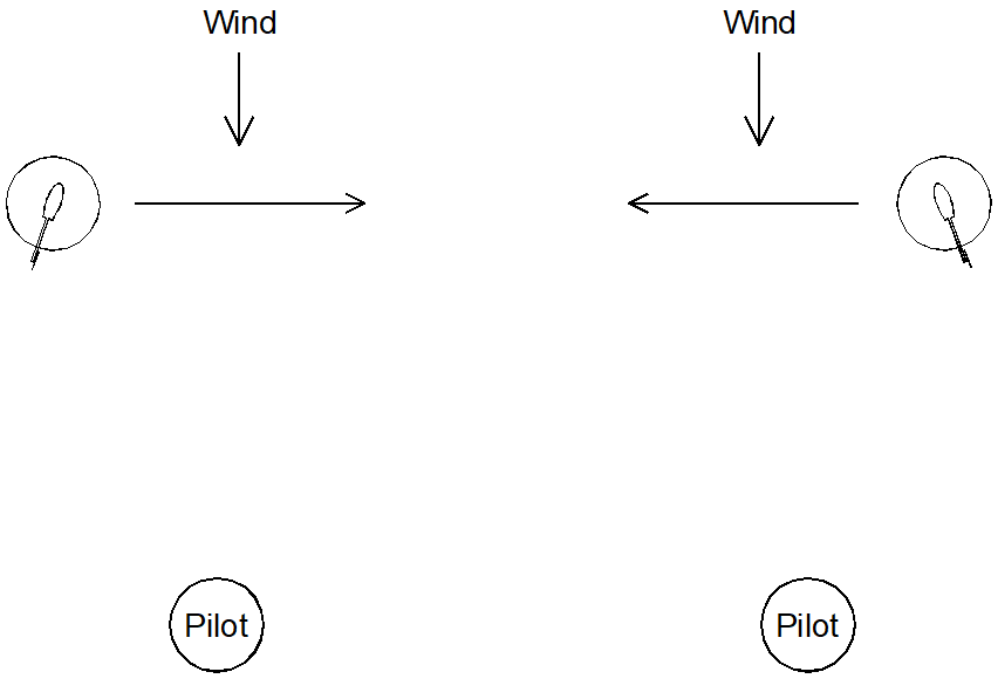


Alongside this exercise also practice ascending and descending the helicopter slowly, vertically at different locations. This skill is important for recovering the helicopter if it overshoots at the end of a circuit or if it just ends up somewhere awkward. Try not to take the helicopter higher than an angle of about 30 deg. to the horizon at this stage or it will become difficult to observe its attitude.



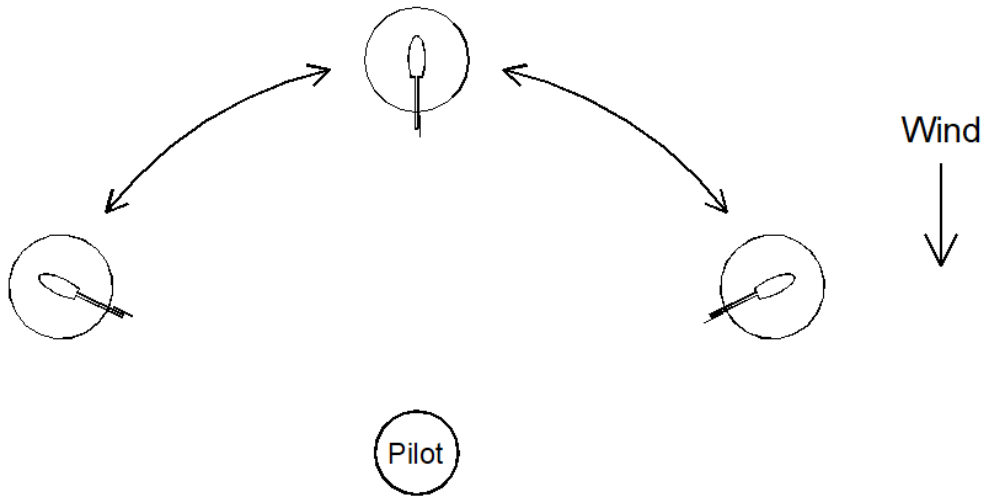
Beginning forward flight

From the side to side exercise develop a little more speed moving the helicopter from side to side. This will naturally begin to make the helicopter turn in the direction of flight, but less so with a heading lock gyro than a rate gyro. You can use the rudder to oppose or accentuate this “weathercocking” tendency. The next exercise will help you to acquire better control of yaw.



Hovering and yaw control

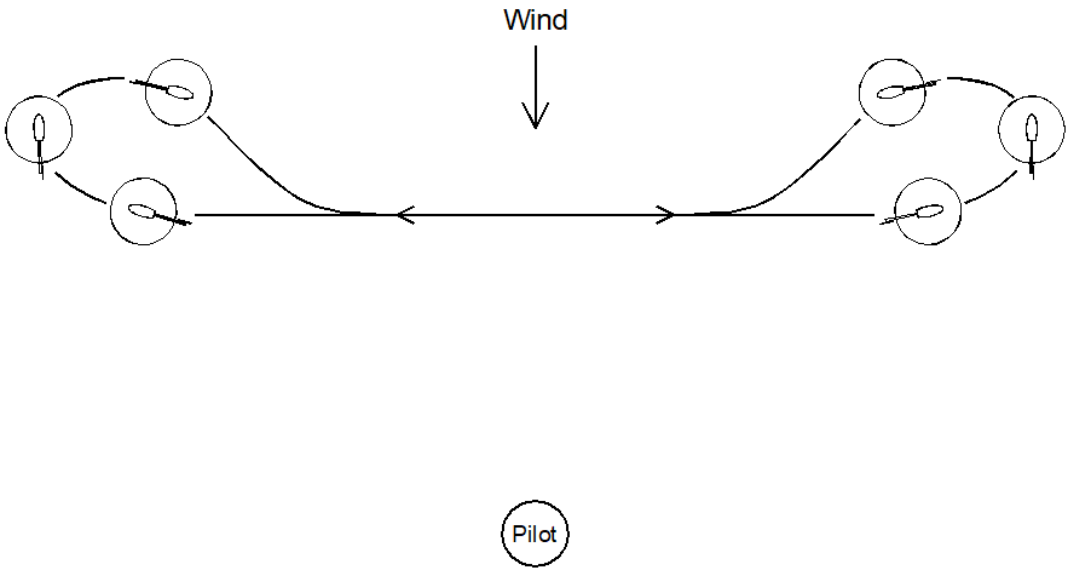
From a steady hover move the helicopter to the left and right as in the first exercise but this time keep the model pointing directly away from you so it moves around you in a circular path. Gradually move the machine farther to each side. As the machine begins to turn cross-wind more rudder may be needed to force the tail against the weathercocking tendency. This exercise is the beginning of a tail in circle, but don't be tempted to take the model beyond the limits shown in the diagram at this stage.



More forward flying

Gradually develop the side to side exercise into longer passes with turns into wind at the ends. Depending on your model and its setup, there may be a tendency for it to sink when turning

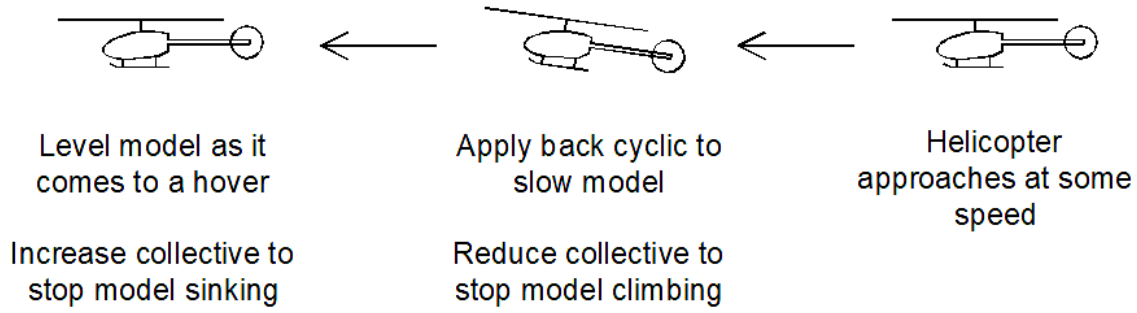
in one direction and rise when turning in the other due to changes in rotor RPM resulting from changes in power consumed by the tail rotor. Compensating for this and similar effects with the collective pitch control becomes almost automatic with practice.



Bringing the model to a hover from forward flight

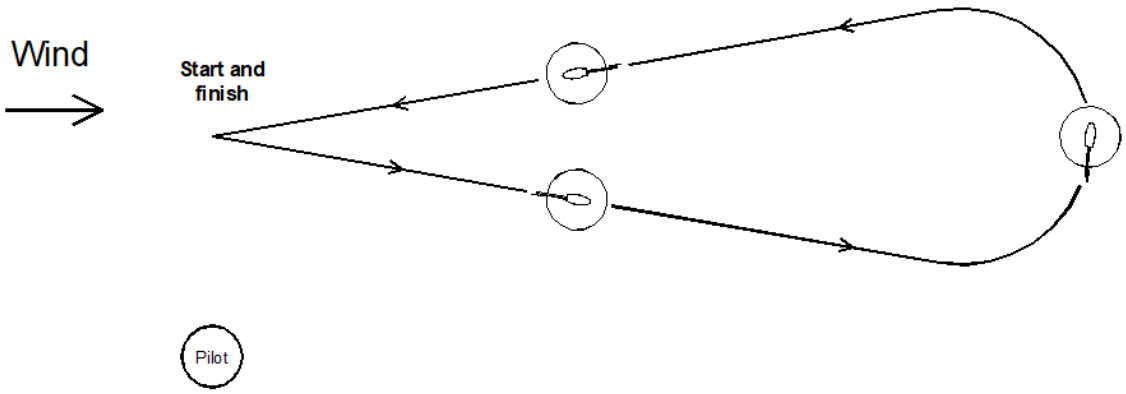
To slow the model we have to apply back cyclic (up elevator) which will also make it climb. To compensate for this we must also reduce the collective.

We have to level the model as it comes to a halt, otherwise it will start flying backwards. However, as it comes to a halt it will also tend to sink so we need to increase collective to compensate.



At this stage it may also be a good idea to turn the model a bit away from yourself using the rudder as the model comes to a halt to make the hovering orientation easier. Later, when you can comfortably hover the helicopter side-on you can try keeping it straight.

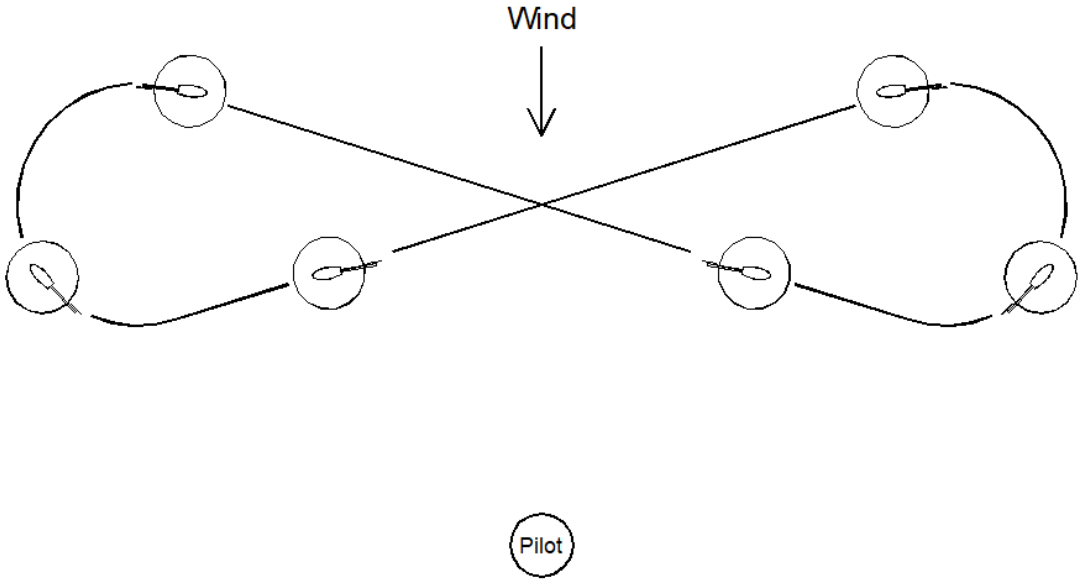
We can practice this by flying out and back:



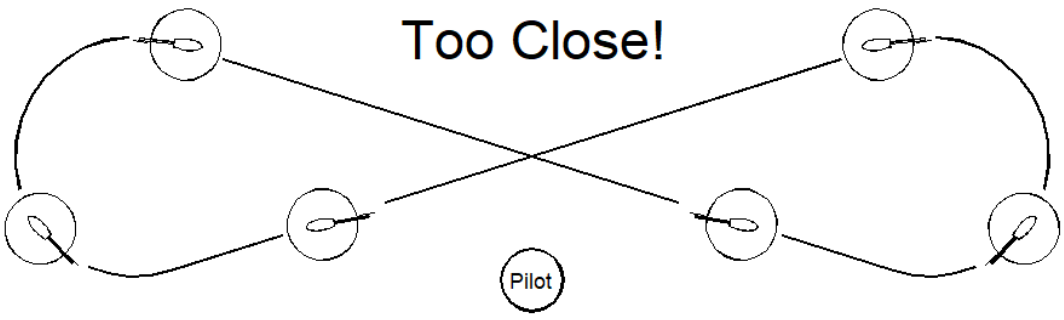
This is half of a “lazy eight” pattern which leaves room to overshoot and we will use this to practice climbs and descents later.

Forward flying

Continue to develop the forward flying exercise into a long figure of eight (lazy eight) in front of you. Try to keep a steady forward speed. At this stage it is easy to let the model pick up too much speed and disappear into the distance so it may be a good idea to bring the machine to a hover every lap or two.



I found I had a tendency to fly the model too close to myself. Try not to do this!



Keeping the model a good distance from us becomes more important for all manoeuvres as we start to fly faster.

As you get more experience try increasing and decreasing the speed, the radii of the turns and the overall length of the pattern. You can also fly the pattern at different heights.

It was some time before I realised the full value of lazy eights. Flying at low (hovering) speeds the helicopter is steered almost entirely by the rudder and the cyclic is used only to keep the machine level and control the speed. As speed increases it becomes necessary to bank the helicopter in order to make proper turns which requires co-ordination of the rudder and aileron controls.

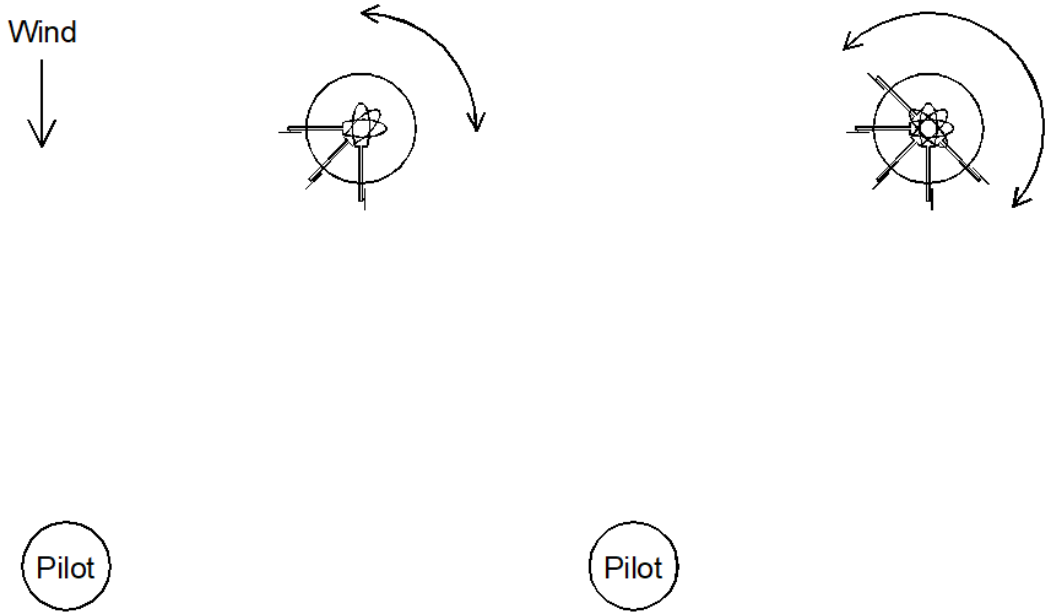
Co-ordination in lazy eights

Co-ordination becomes more important when we begin to fly circuits, and we can practice with lazy eights. The aim is to fly the straight section tidily, make a good co-ordinated entry into the turn, co-ordinate the rudder and aileron through the turn, and then make a tidy exit from the turn into the next straight. This is quite a lot to do, and of course we are also trying to control the airspeed with the elevator control and height with the collective at the same time!

However, whilst we are working towards good co-ordination, a good rule of thumb when things are a bit stressful (say, when the model has got a long way away) is to under-bank turns. i.e. Turn mainly with the rudder and don't use much aileron. The resulting “flat” or “skidding” turn may not look elegant but is less likely to get us disoriented. Once a helicopter is in a steep bank or dive at a distance it can be very difficult to recover.

Turning on the spot (pirouette)

Hover the helicopter and slowly rotate it a little from side to side using the rudder. Gradually increase the angle through which it turns up to about 45 degrees each way. This is harder than it sounds as any movement of the rudder control seems to send the model wandering all over the place. Do not initially do this manoeuvre directly upwind of yourself as any gusting will blow the model towards you. I found the simulator very effective for progressing this.



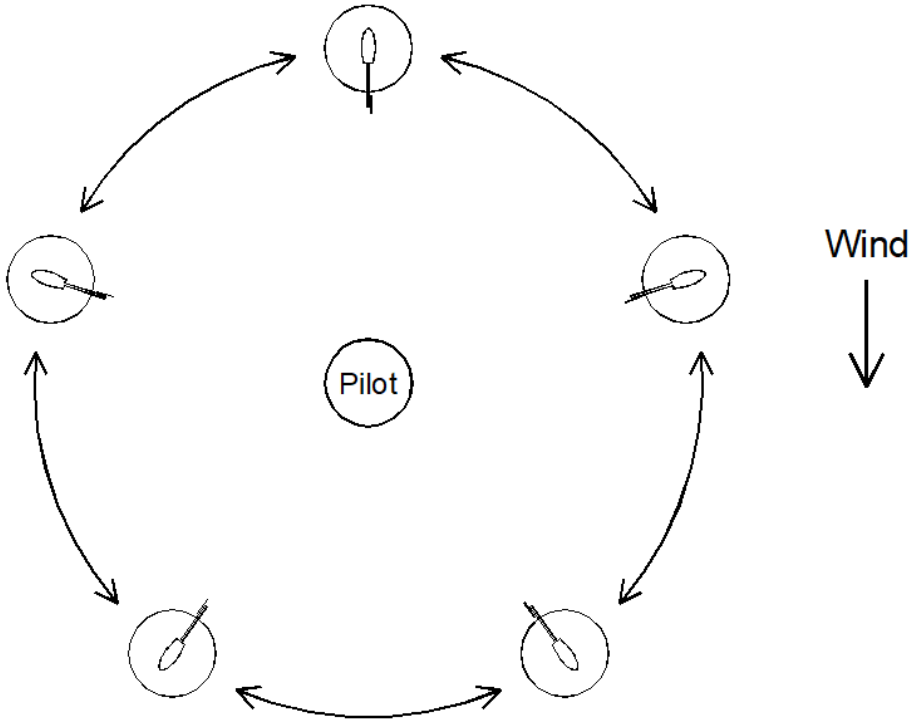
As you improve gradually increase the angle you rotate the helicopter through until it is side on to you each way, but no further at this stage.

If you can do this with the helicopter actually staying “on the spot”, well done! More probably,

like myself, you will struggle to keep it in a limited area. The main thing is to keep things safe and low stress. Don't worry if it wanders about a bit initially as long as it doesn't go too far. As you improve you can try to keep it closer to one spot.

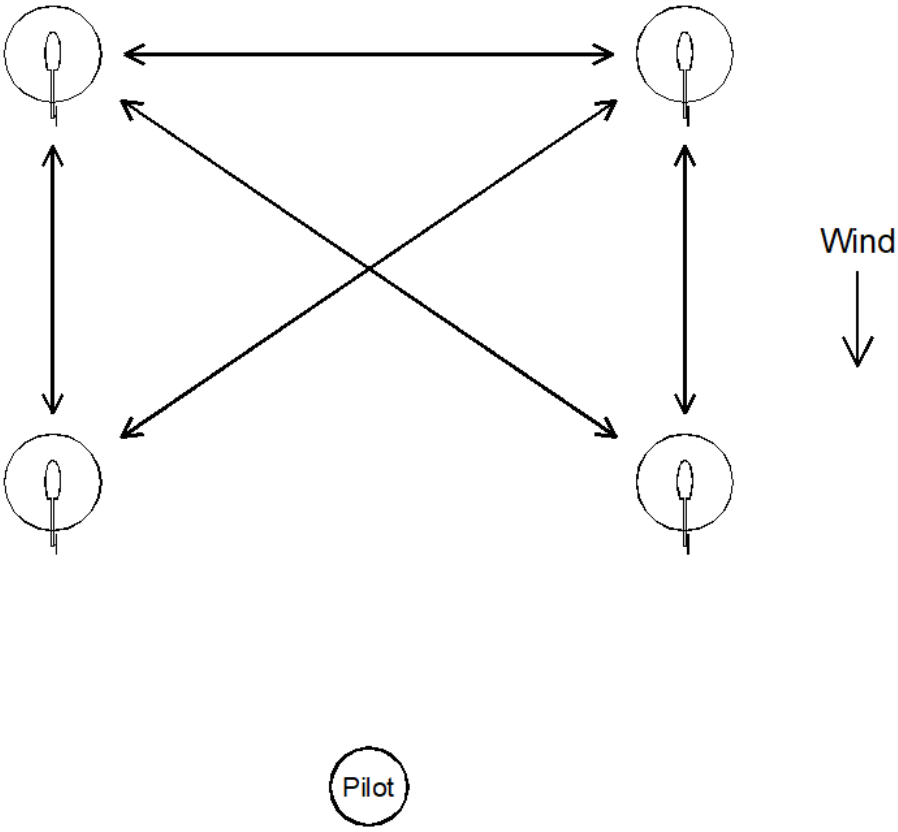
Tail in circle

We can extend the hovering and yaw control exercise and work our way towards to a full 'tail in circle' around ourselves. Make sure your first attempts are in flat calm conditions. Any wind will effectively make the helicopter fly backwards with respect to the air on the down-wind side, an unstable condition which may require very firm rudder control. Note you may have to fly across an area of the sky which is backlit by the sun. As in earlier exercises if panic develops fly the model away from you, turn it into wind and land.



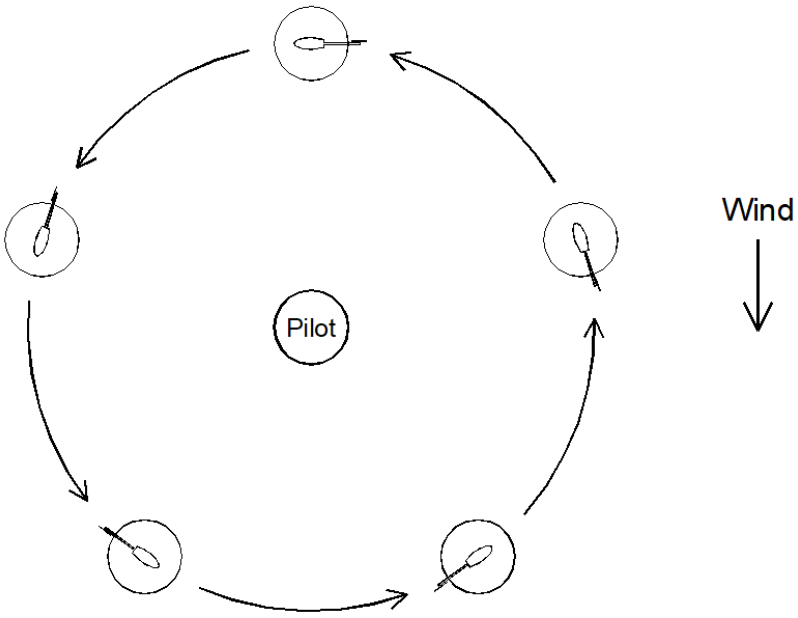
Diagonal hovering

If we are using Mode 2 on our transmitter we can consider the aileron and elevator cyclic controls to be a single two axis cyclic control. This exercise develops our ability to move the cyclic stick (or sticks in Mode 1) in both axes together.



Forward hovering circle

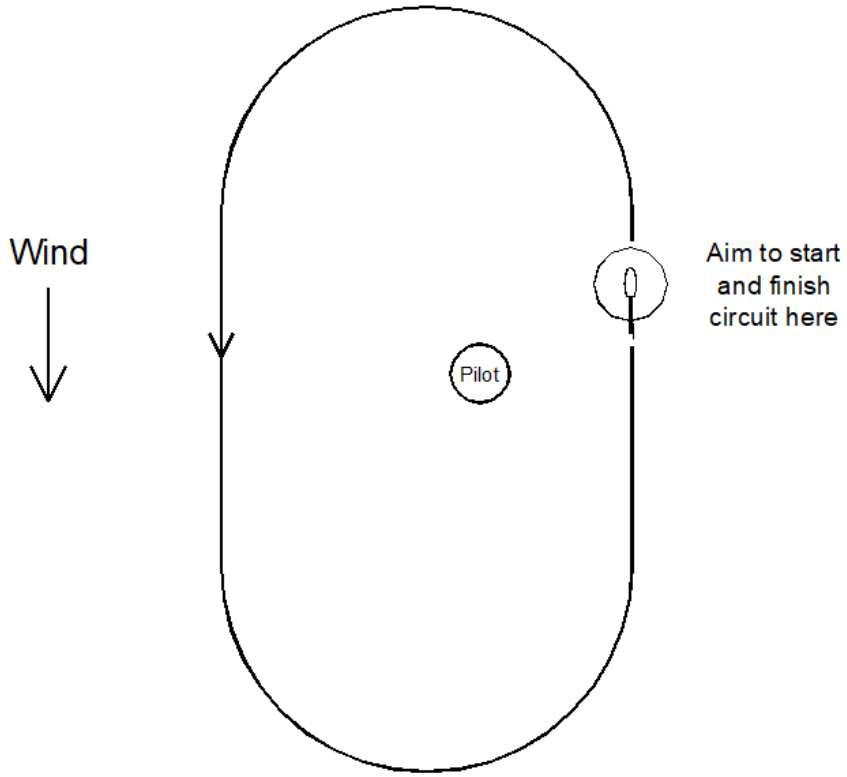
This exercise should first be attempted in flat calm conditions. It may be developed from the tail in circle by gradually turning the model closer to the line of flight or it may be attempted directly once you are able to hover the model side on. Remember that again we may have to fly across an area of the sky which is backlit by the sun. If the model is silhouetted, looking at the skids may help us see whether the machine is tilting towards or away from us.



Beginning circuits

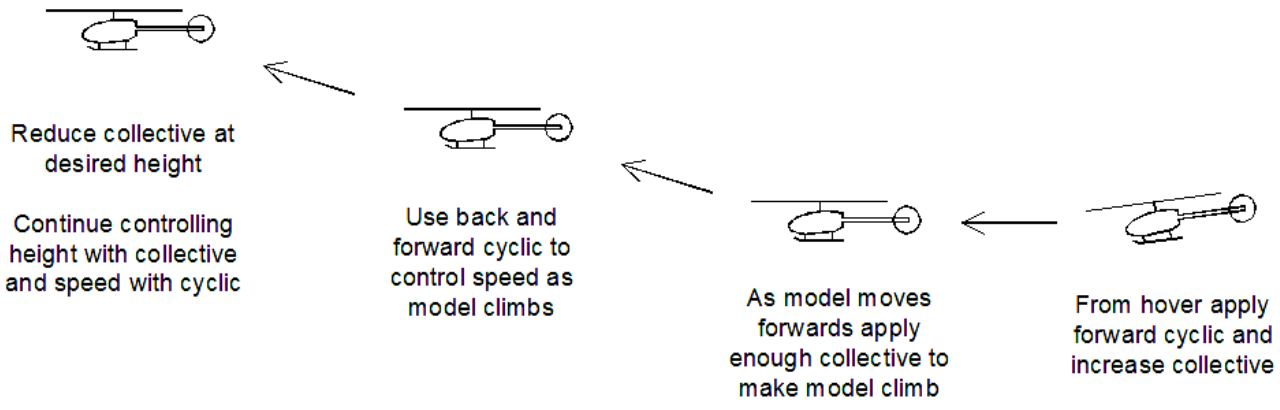
When we are fairly happy flying forward circles we can start to elongate the circle and offset it to make more of a circuit shape. As we progress we can begin to accelerate and climb the

machine a little at the start in order to maintain some forward airspeed on the downwind leg and slow it as we bring the model to the finish. We can aim to start and stop the model in a hover in the "safe" area upwind and to one side of ourselves.



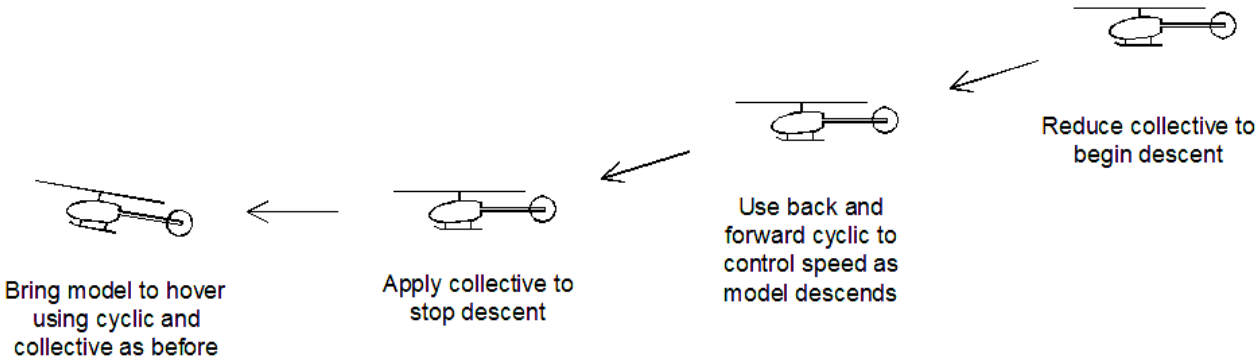
Climbs and descents

If we are going to do nice circuits we want to make smooth climb outs and approaches which we can develop doing long "lazy eights" or "half lazy eights". Make your climb outs fairly gentle to begin with. We don't want to get the model too high and have to make a dramatic descent.



Speed control is very important. If the model is flying fast, turns and the descent will be stressful but if the speed is controlled well we can take our time with the descent. If we feel the helicopter is too fast we can take a lap or two of our lazy eight to bring it to a hover.

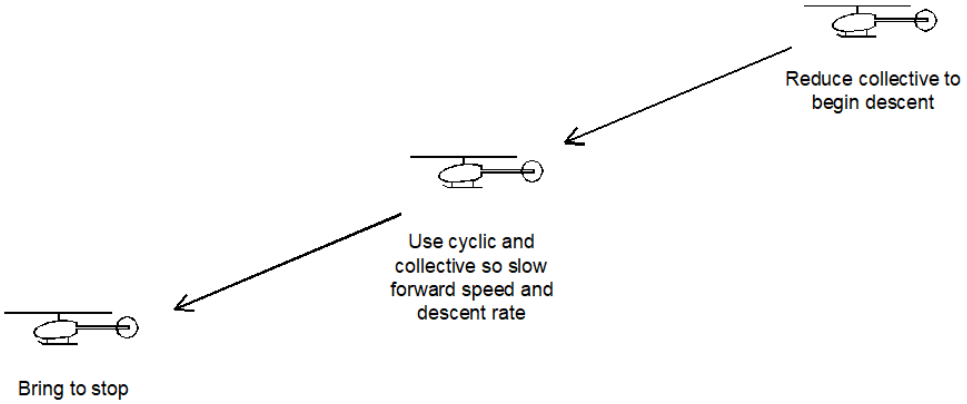
Descents can be done like this:



It is probably a good idea to start these exercises so the descent is into wind as shown but with a bit of experience we can try different directions. We can alter the direction in as small steps, perhaps of about twenty degrees, as we prefer.

Don't take the model very far out or high initially. Do what is comfortable and extend the pattern and increase approach angle a bit at a time as you gain experience. Don't rush!

With practice the descent and flare shown above can be combined to make a straight approach to a stop if we wish.



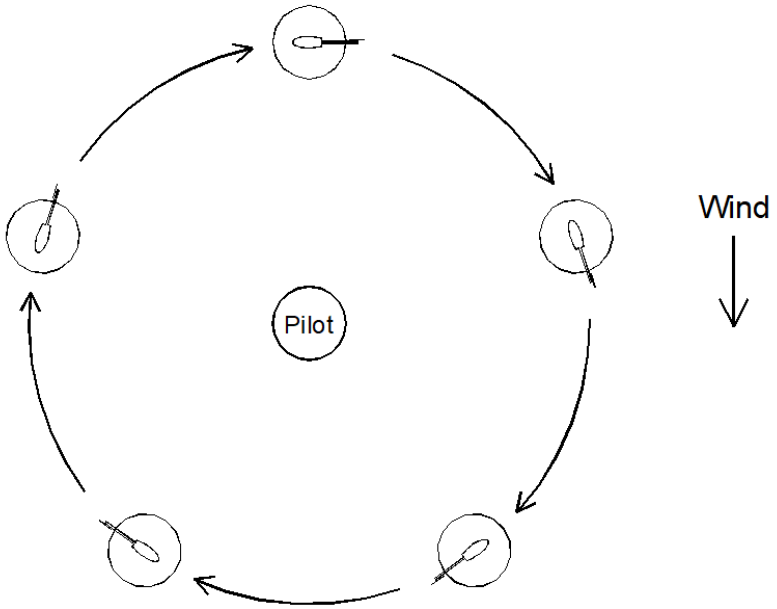
Descents like this can be quite realistic to full size flying and (I think!) look really cool.

Reverse hovering circle

This is quite a difficult manoeuvre which should only be attempted when we can comfortably hover the helicopter looking directly side on. Simply fly the machine backwards in a circle but under no circumstances allow the helicopter to pick up any speed. There are two particular hazards to this manoeuvre:

a) Flying too fast may make the helicopter fly off at a tangent with the nose pointing towards us.

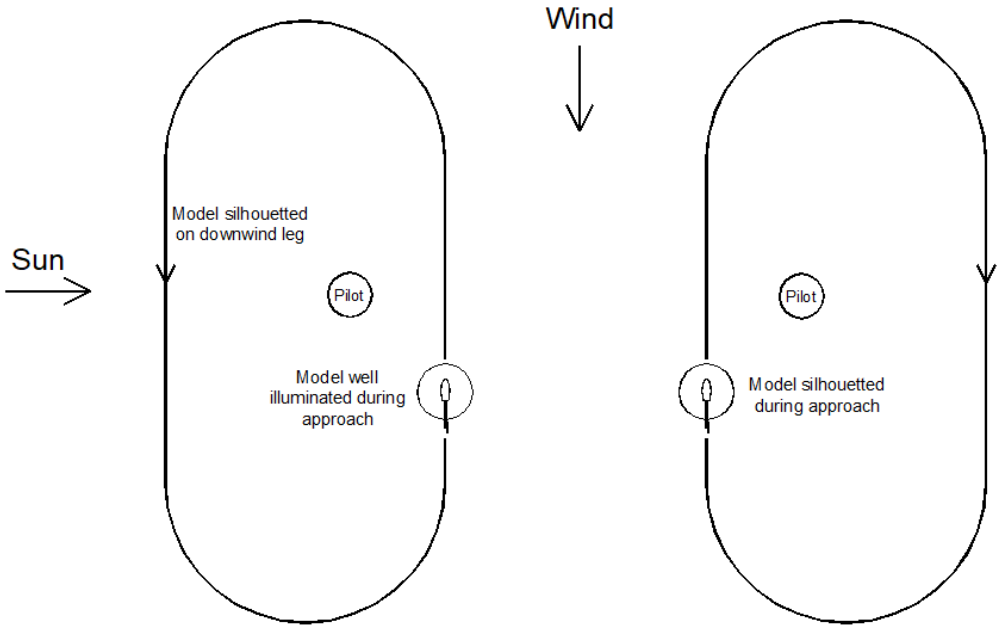
b) Very firm rudder control may be necessary at the point where the tail of the machine starts to turn towards the wind.



Continuing circuits

The aim now is to tidy up our circuits a bit. The diagrams illustrate some issues of wind and sun direction. Start the circuit from a hover and accelerate the climb steadily before turning but try not to let the helicopter go too fast. Try to maintain a constant height along the downwind leg and begin to reduce collective as the model turns into wind. Aim for a steady descent bringing the machine to a hover at a height of a few feet over the starting point.

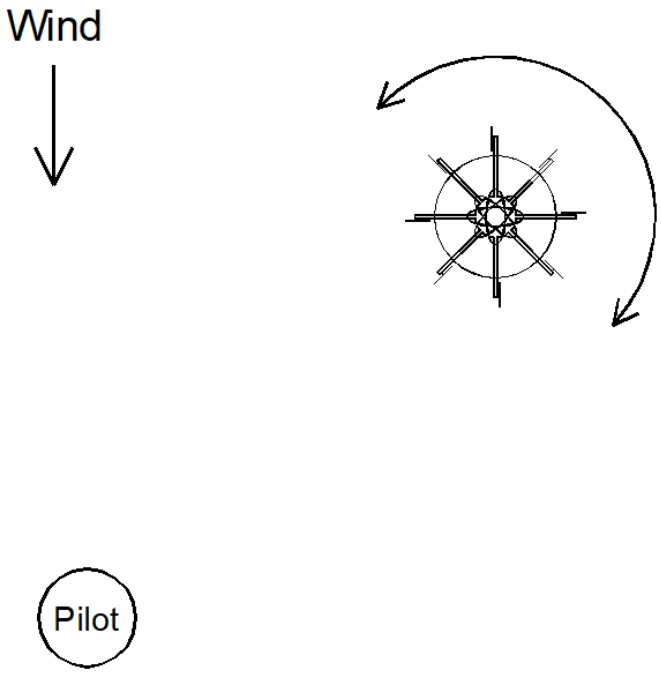
Try varying the radius of the turns and how far you fly upwind and downwind, but beware particularly of going too far downwind. With the airspeed of the model adding to the wind speed the model can quickly become a very small dot in the distance.



Advanced hovering

Continuing the turning on the spot exercise it is possible to work towards a 'nose in hover'. Be extremely cautious and prepared to turn the model away from yourself if things start to go wrong. I find it useful to rotate the model in 45 degree steps, stabilising it between each step for a short time before turning it through the next step. Don't practice excessively or be too

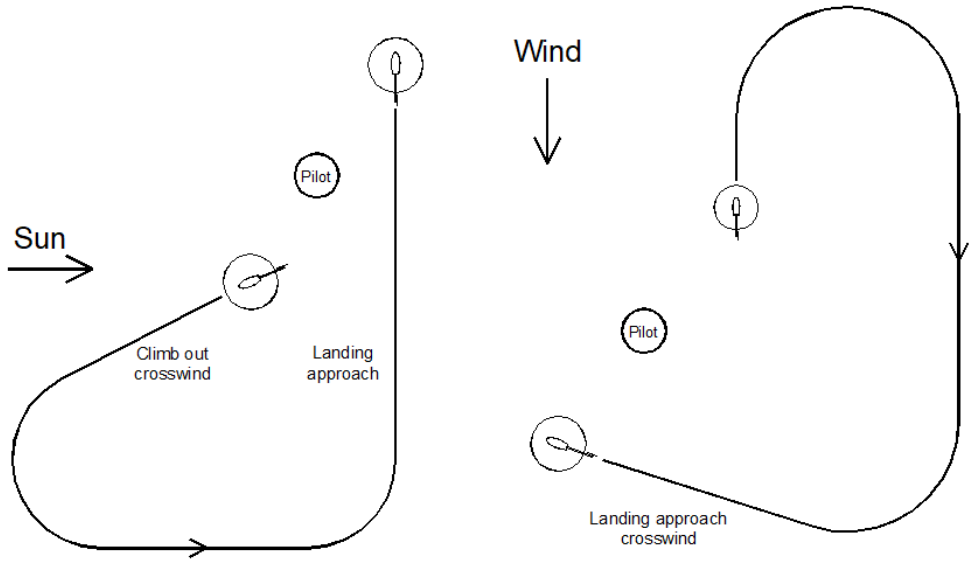
keen to achieve a nose in hover. Do a little each time you fly and it will come when you are ready. A simulator is good practice for this when you cannot get to fly.



This took me a lot of work and I still practice frequently. Initially I had to be content with the helicopter wandering around quite a lot but with practice I was able to improve my ability to keep it in a relatively small area. Theoretically there is no reason why any hovering manoeuvre should not be done with the helicopter pointing in any direction.

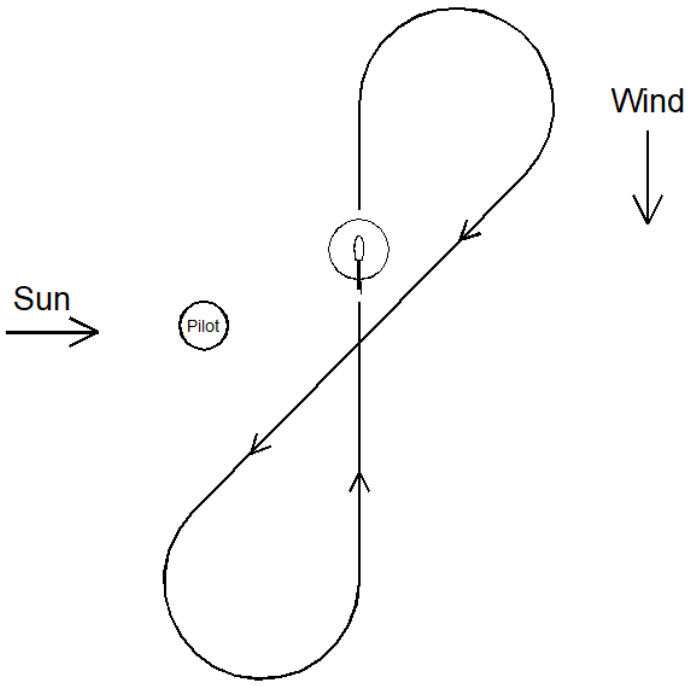
Flying in difficult sun directions

When the relative sun and wind directions make circuits difficult it may still be possible to practice some of the techniques of circuit flying without entering the 'backlit' areas of the sky. The main difference between these manoeuvres and normal circuits is that they require either a crosswind climb out or a crosswind landing approach. As long as the wind is not too strong this may not be as difficult as it sounds. It is useful to practice crosswind flying and carefully determine the wind limits for yourself and your model.



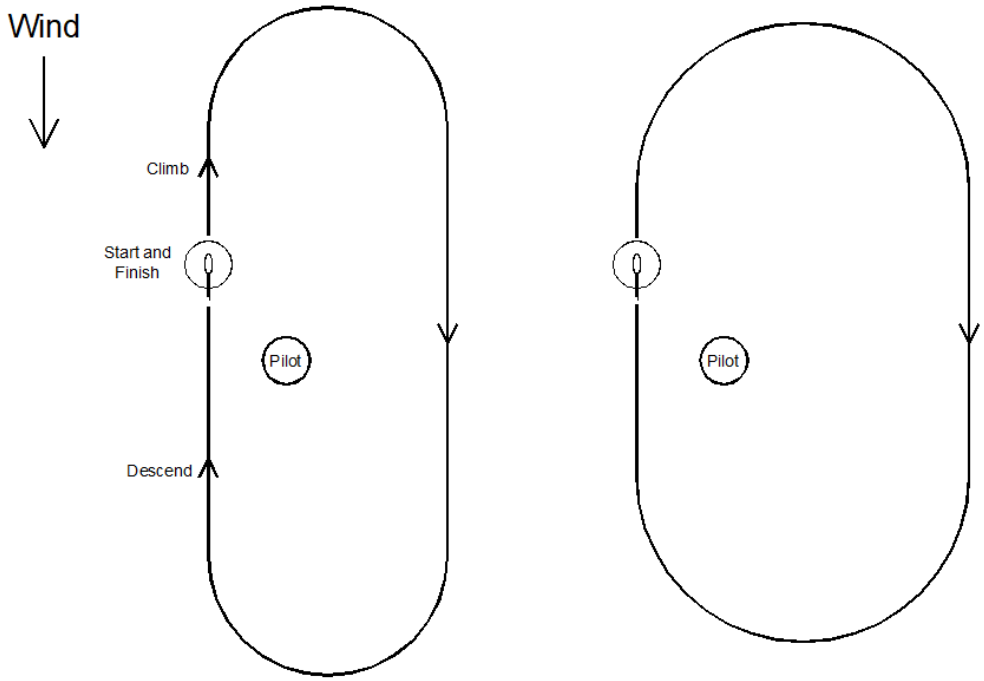
Flying in difficult sun and strong wind

If the wind is too strong for a crosswind approach and the sun is in an awkward position it is best to play safe by keeping the model on the 'down-sun' side and performing an elongated figure of eight. Obviously we can only practice approaches from one side in this way but we can make up for it on the other side when conditions are more favourable.



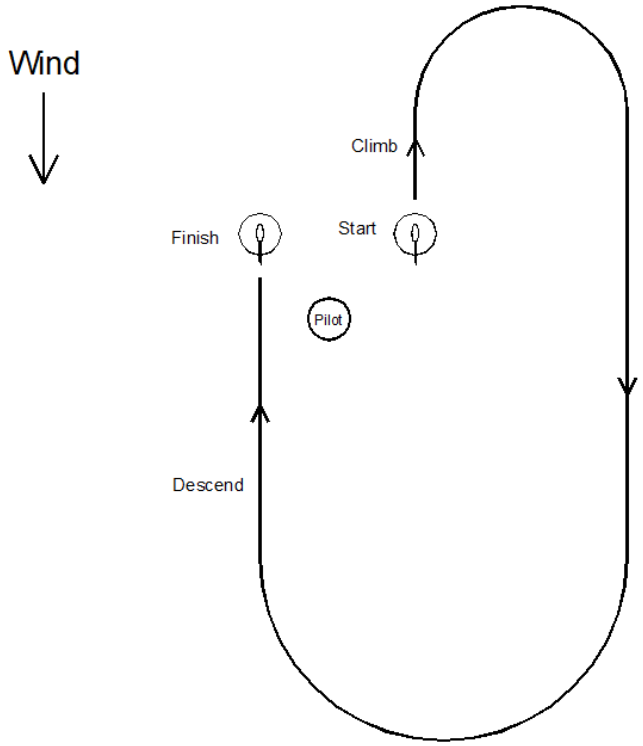
More circuits

By varying the length and radius of turn of our circuits we can begin to control their shape a bit.



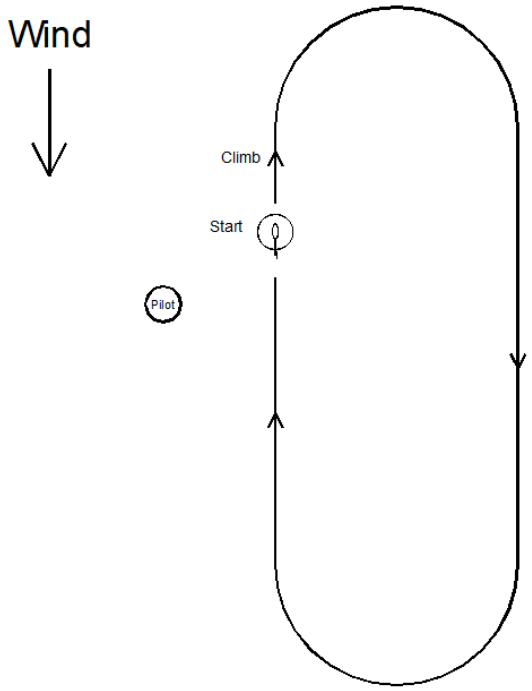
Once we are controlling our turns nicely we can work further towards flying a circuit to one side of ourselves rather than around ourselves. The next step is to fly a sort of hybrid circuit I shall call an “open circuit” pattern. At this point we are almost doing a circuit to one side of

ourselves except for the bit where the model is briefly fully nose in. Again, as you practice this try to vary the dimensions of the pattern and speed, and work to get those climb outs, turns and approaches nice and controlled.



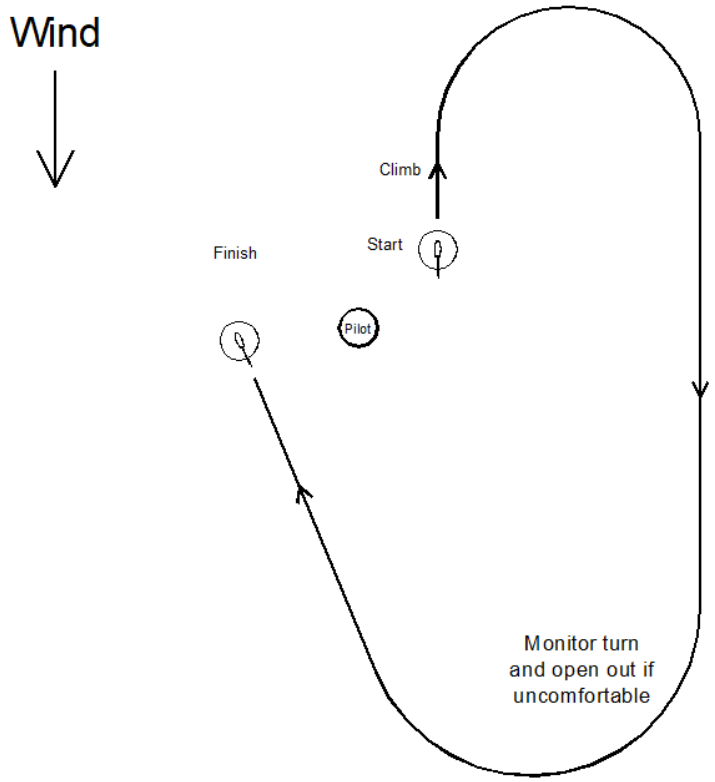
Circuit to one side of yourself

If we can fly the "open circuit" pattern comfortably, all we need to do to do a circuit to one side of ourselves is to widen the upwind turn and tighten the final turn a little.



Sounds easy! However it does involve the model briefly flying directly towards us in the final turn and "switching" the side the model is approaching us on. This can be a bit stressful if the final turn goes a bit wonky.

To ease this a little we can monitor carefully the first part of the final turn. Then, if we are not happy, we can open the turn out and bring the helicopter around ourselves similar to the earlier “open circuit”.



i.e. The decision to bring the model to the right of the pilot (in this drawing) can wait until we are happy that the final turn is going well, otherwise we let it come to the left of us. We can keep repeating this type of circuit trying different radii of turns until we are happy to keep the final turn going and make the approach on the side we started from.

These circuits don't have to be perfect or neat to start with. Mine were all over the place. (They often still are!) They do need to be comfortable and safe. We can tidy them up later. However, if you are having difficulties don't force yourself to do circuits to one side:

1) Do more circuits around yourself and “open circuits”. Do lots! Make sure you practice them in both directions.

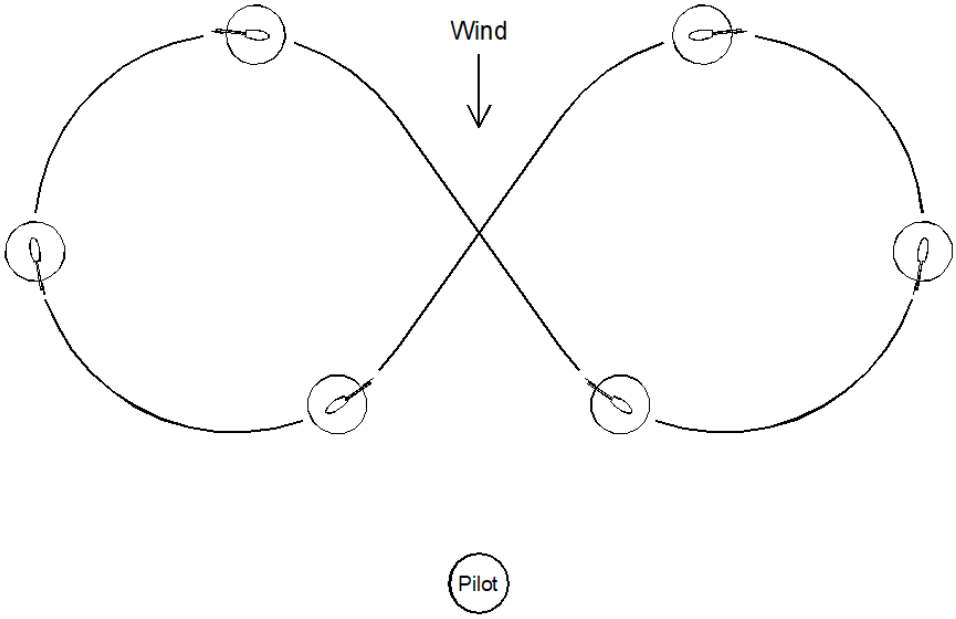
2) Practice differing radius turns in these circuits, particularly wide radius turns. A wide radius of turn means a shallower angle of bank which is less likely to give problems of disorientation. Try to control the speed of the model through the turn and keep the speed fairly low. A slower speed in a wide turn will give more time to sort things out. You can practice flying faster and making tighter turns later on.

3) Do some hovering exercises. You may be surprised how much they can help your forward flying.

4) Do more “lazy eights” to improve rudder/aileron co-ordination, control of radius of turn, height, speed and bringing the model to a hover.

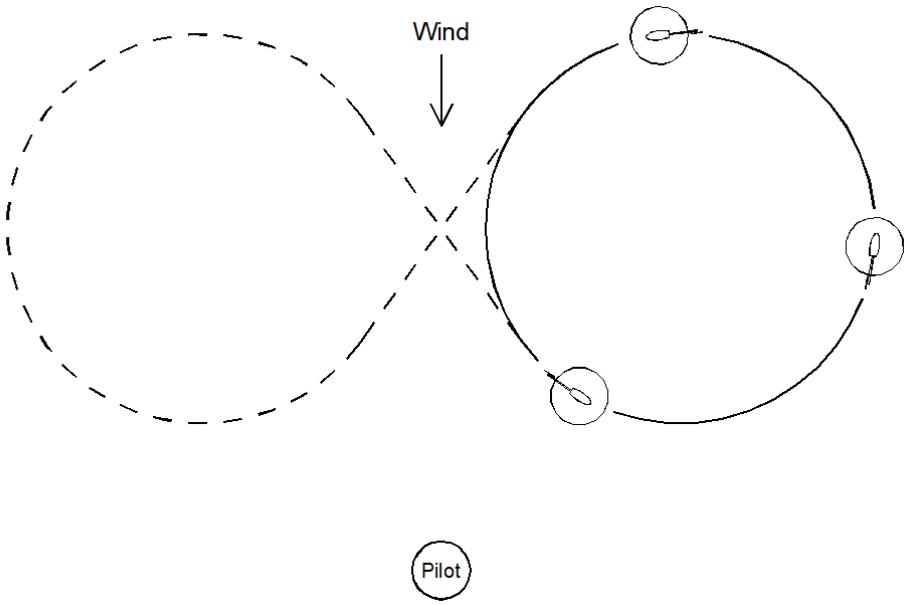
<u>Hovering circles to one side</u>

If we have stuck with doing slow pirouettes enough, we can also work on some very slow lazy eights with nice circular ends. This is a hovering manoeuvre. i.e. The helicopter should not pick up any significant speed and turns will be almost entirely with the rudder.



The rotation (yaw) rate of the helicopter is very similar to our pirouettes but the helicopter is moving slowly and steadily forwards with the direction of turn switching to cross the middle of the eight.

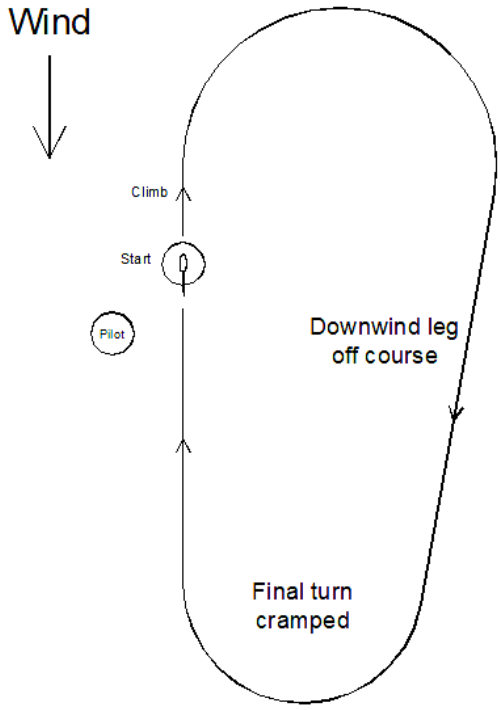
If we are really comfortable with the pirouettes and this slow, rounded, figure of eight, to fly a circle all we have to do is to keep the turn on instead of changing its direction in the middle.

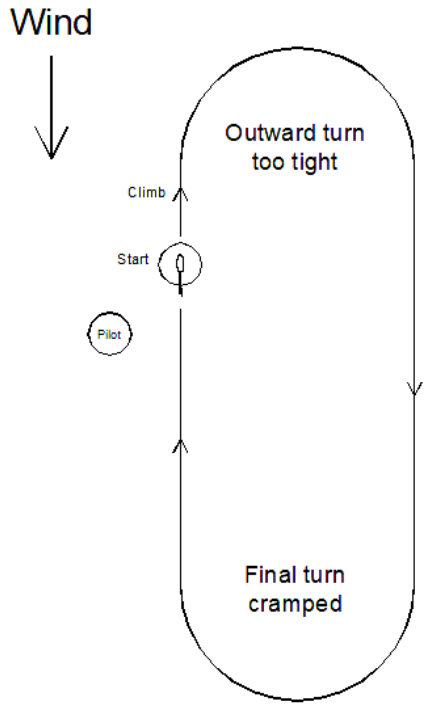


Initially, just do one circle and return to the figure of eight pattern. If it feels good perhaps try a circle in the other direction. Then, perhaps, two circles sequentially and back to the figure eight. If any of this feels stressful do more slow pirouettes and rounded lazy eights.

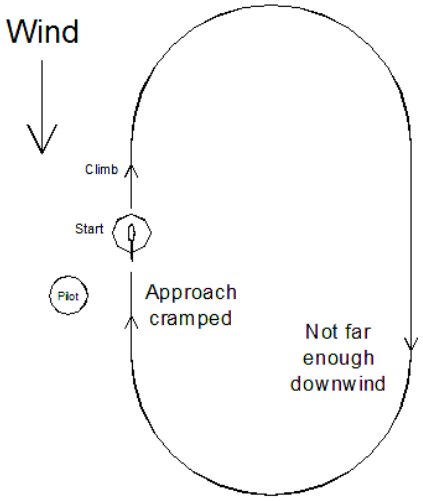
Things that go wrong with circuits!

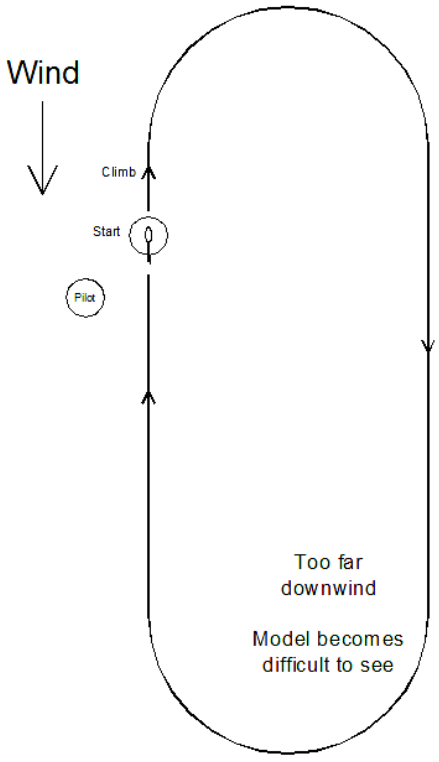
I had a lot of difficulties with the final turns of my circuits becoming cramped. The main culprits were that either I didn't fly the downwind leg very straight or that my initial outward turn was too tight.





Next, although the circuit seemed nice and wide, there often seemed to be no room for my final approach and the helicopter came past me far too high. This was because I had not flown the helicopter far enough downwind. Of course, flying too far downwind bears the hazard of the helicopter becoming difficult to see. Flying too fast will worsen this.



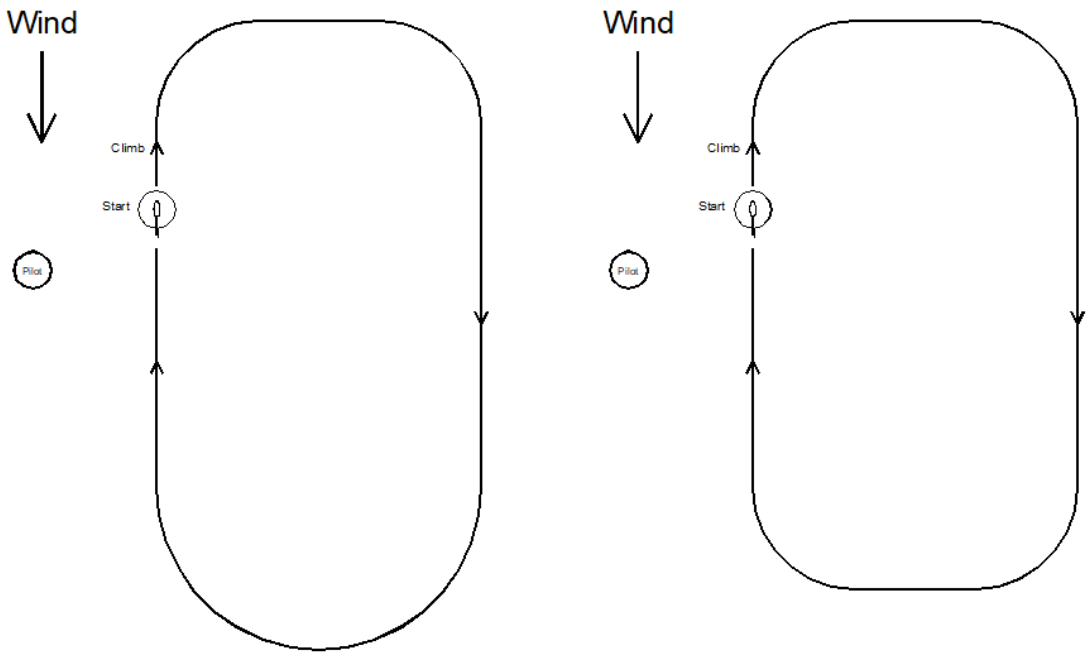


Lots of practice!

<u>Rectangular circuits</u>

Well done! After all that work we are doing some quite nice circuits. This is the point at which someone suggests we should be doing rectangular circuits rather than the oval ones

above. Most of the techniques for oval circuits can be applied to rectangular circuits, so we could start by simply doing an oval circuit and "flattening" the middle of the outward turn a bit. When we are fairly happy with that we can start to flatten the middle of the final turn and we have a rectangular circuit.

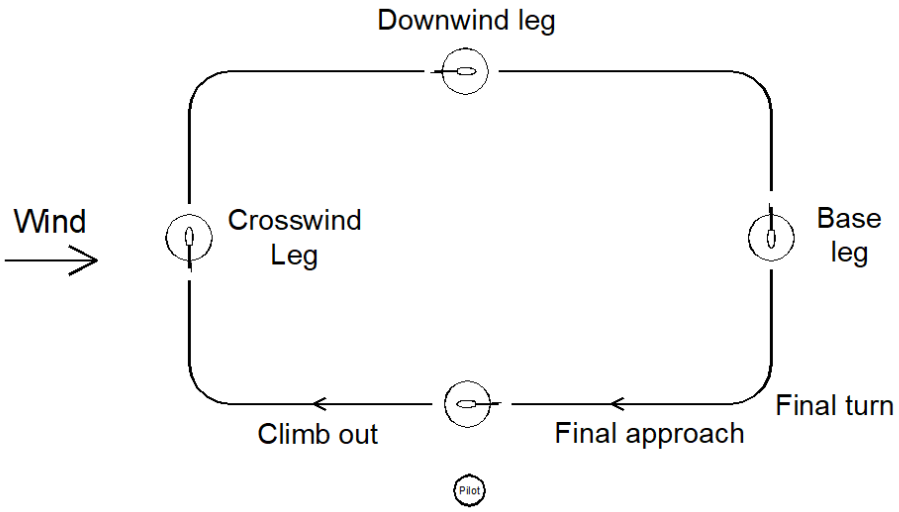


The circuit will tend to be wider than our oval circuits as we work to fit in significant crosswind and base legs. As before, one hazard is that the circuit might become too big so the model gets a long way away and difficult to see. The final turn may become rather cramped with a small turn radius, this time as a result of having to fit in the straight crosswind leg. Take your time and do lots of practice.

If we wish, as with the oval circuits, we can first try them as "open" circuits and later as circuits to one side.

Circuit terminology

Before going further with circuits I will just have a little rant about terminology. Circuits were developed for fixed wing flying where the aircraft normally takes off into wind. The standard names for the bits of a circuit are more or less like this:



These define the directions of the “legs” relative to the wind or the runway in use. As model helicopter pilots we might want to fly circuits in any direction relative to the wind or runway so we have to be a bit careful in the use of terms crosswind, crosswind leg, downwind and downwind leg. I don't want to invent unnecessary terminology so I have tried to be careful not to confuse, but be aware of the issue when reading on.

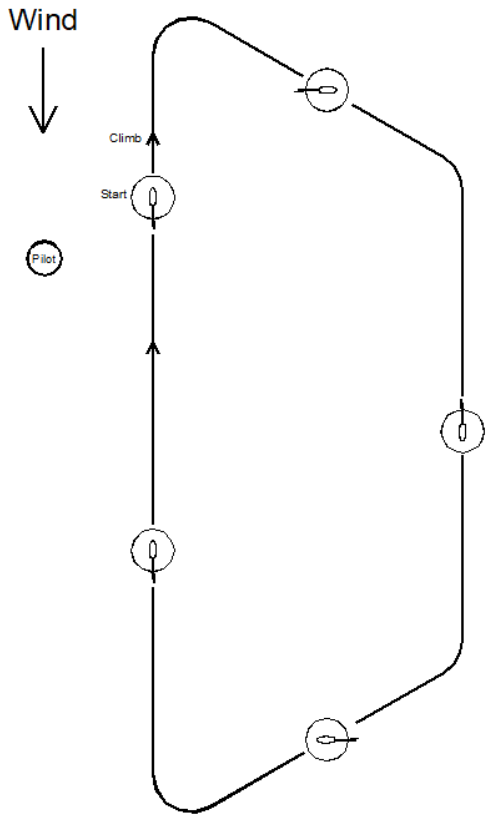
Wind and rectangular circuits - Wind gradient

It took me some time and a few scares to realise just how much wind can affect circuits. I found sometimes that my rectangular circuits were fairly neat but that on other occasions the model would end up a very long way downwind. Eventually I realised that winds up to about 10 mph didn't feel very strong and seemed OK for most flying but could have a large effect on circuits.

Wind gradient is how wind strength increases with height. Depending on conditions, this increase can be gradual, or a sharply defined sudden change at a particular height. Either can worsen the “disappearing downwind” effect above. I eventually realised that I could sometimes do a large amount of hovering manoeuvres at a height of around 10 feet without problems but when I flew a circuit the helicopter climbed into faster air above and disappeared rapidly downwind. I needed to be more “switched on” and expect stronger winds at height.

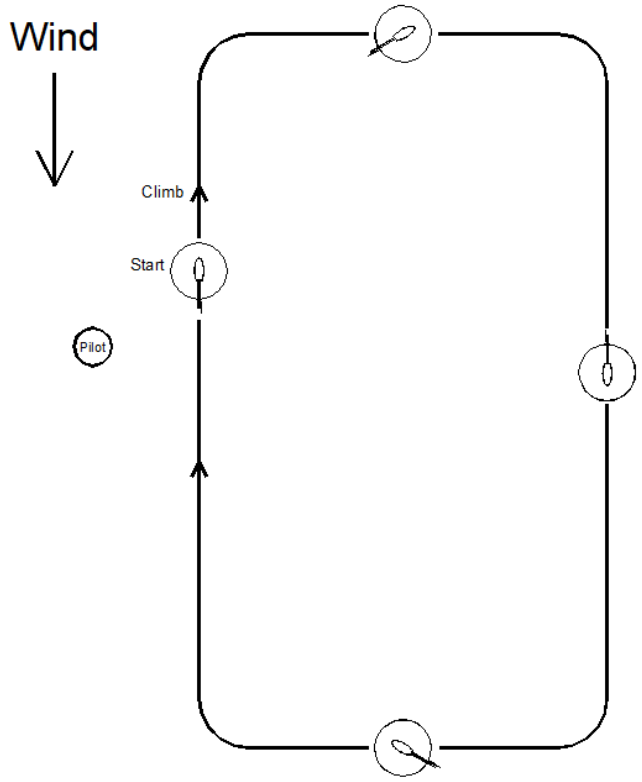
The limited airspeed of the helicopter at this stage of our flying makes the effect of wind much greater than with a fixed wing model.

This is how a circuit could turn out flying at an airspeed of 15 mph in a 10 mph wind:



This distortion is because the wind speed is a high proportion of the airspeed making the model drift strongly sideways when heading crosswind.

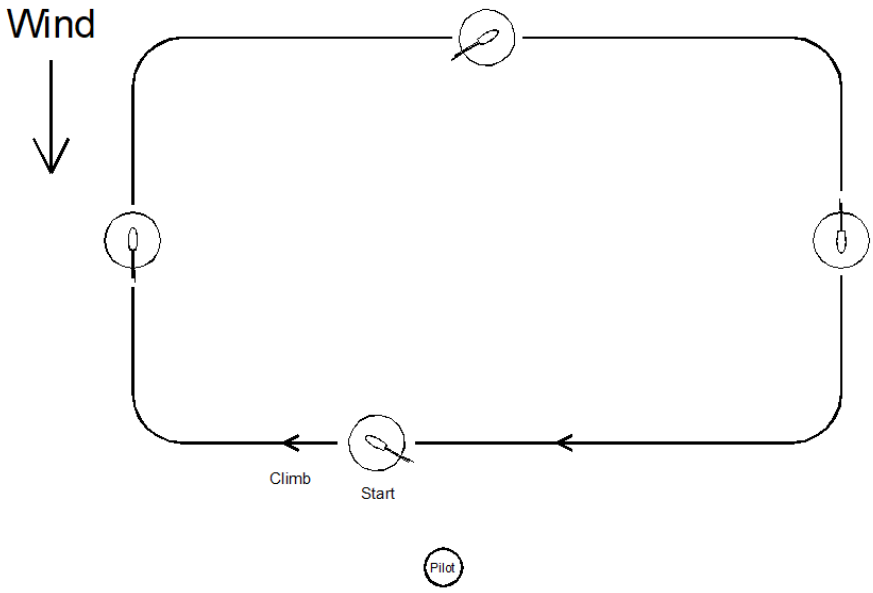
To compensate for this we need to make quite a large correction to the headings along the crosswind and base legs of the circuit.



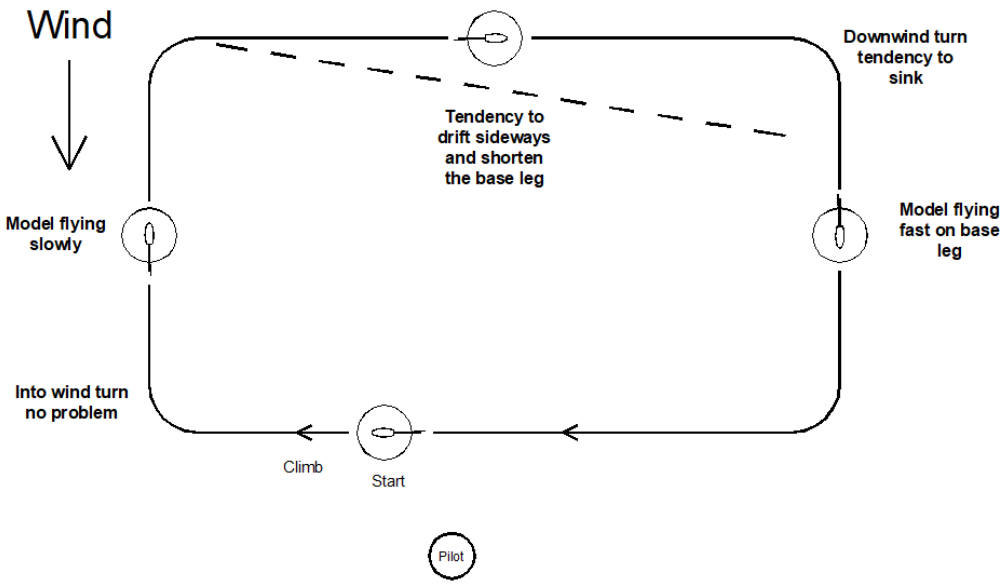
It was quite a surprise to me how much bigger the correction had to be than with fixed wing models. The helicopter is much slower (or I tend to fly it slower).

Wind across the circuit

If the wind is across the circuit we have to make corrections on what would have been the into wind and downwind legs (which are now actually crosswind).



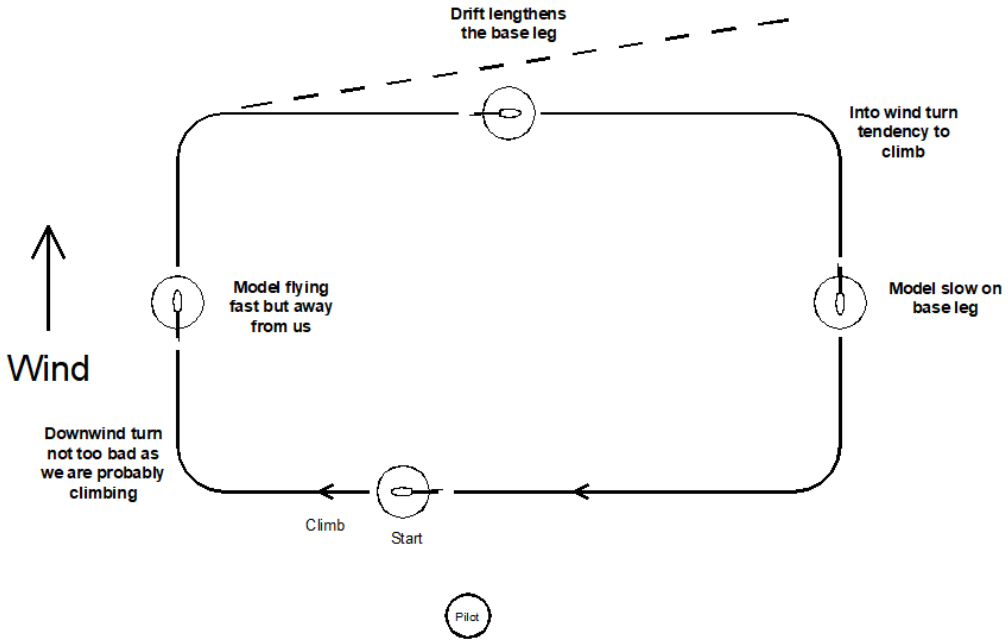
Instead of crabbing, as in these diagrams, corrections can be made by banking the helicopter into the wind and the helicopter will appear to fly straight. The helicopter will be sideslipping and flying less efficiently than if crabbing, but that does not necessarily make it an invalid way to fly.



In this diagram the wind is blowing across the circuit towards us. Our circuit begins OK and the first turn takes the helicopter into wind. The helicopter may climb, but as the wind makes this leg slow there is plenty of time to sort the height out. The second turn takes us crosswind and makes the helicopter drift sideways which, uncorrected, will shorten the base leg. The turn onto the base leg is downwind and may cause the helicopter to sink. Once on the base leg the model is flying downwind and ground speed will increase giving us less time to prepare for and execute the final turn.

That makes a lot to think about and correct during a circuit but we are now flying with less regard to wind and perhaps more to constraints of the particular flying site and of the sun.

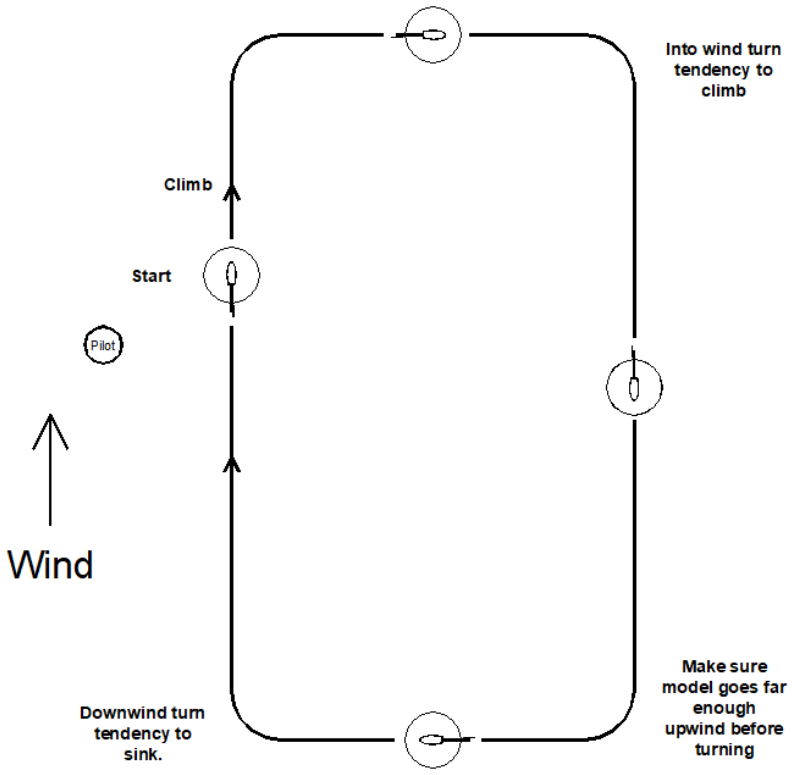
With the wind from behind the pilot things are a little easier.



In the first turn sink as the helicopter turns downwind tends to be masked because the helicopter climbing anyway. Drift on the next leg can lengthen the base leg and slowing of ground speed on the base leg gives the pilot more time to set up the final turn. However the turn into wind onto the base can make the model climb and end up high on the final approach.

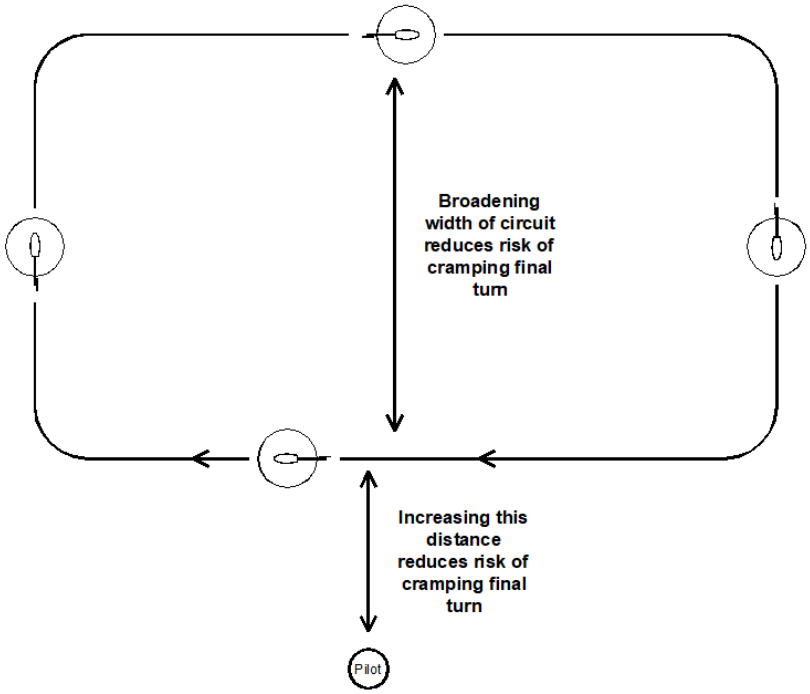
"Downwind" circuits

We can also begin to do circuits with our climb and descent downwind.

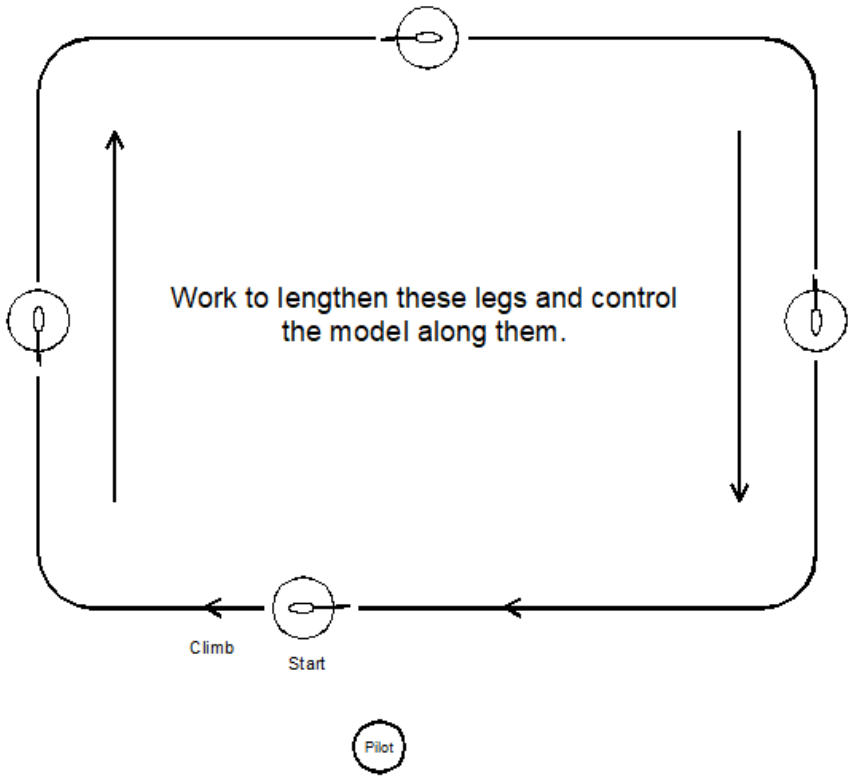


With all circuits it is important to understand where the helicopter is likely to climb and sink, and to make sure the final turn does not become cramped. However, be aware there are other ways wind can make the model climb and sink I have yet to figure out!

As mentioned earlier, I have a tendency to fly the model too close so I have had to learn to fly the model further away from myself.



Learning to fly the model comfortably at greater distances has been a key skill for me. It has taken me time to learn how light and cloud conditions affect my ability to see the orientation of the model at a distance. However as we become comfortable with the model at greater distances we can extend the crosswind and base legs a bit:



If these legs are longer we have time to steer and adjust speed and height along them rather than rushing into the following turn.

Multiple circuits and variations

There came a point at which I started to feel circuits were more in my control than at the mercy of some malicious random dice thrower. i.e. I was mostly getting the model around the circuit and back in front of me without feeling I needed a rest to calm down before trying again! At this point instead of bringing the model to a hover after each circuit I began to do two or three consecutive circuits flying the model past myself along the “runway” between each circuit. Doing multiple circuits we can more easily start to practice varying the following:

Overall size, length and width of the circuit.

Radii of turns.

Speed. From almost a hover to fairly fast.

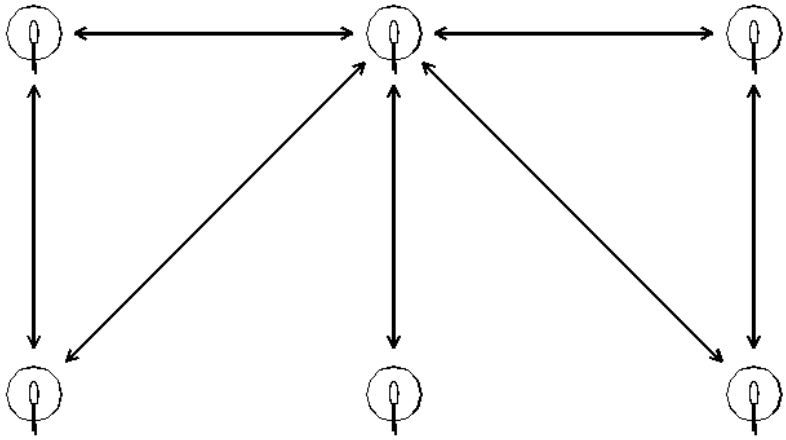
Height. Also intentionally changing height at some point in the circuit.

Steepness of climb outs and approaches.

That's a lot of different things but they can all be tried one at a time and changed gradually as we improve.

Bow Tie

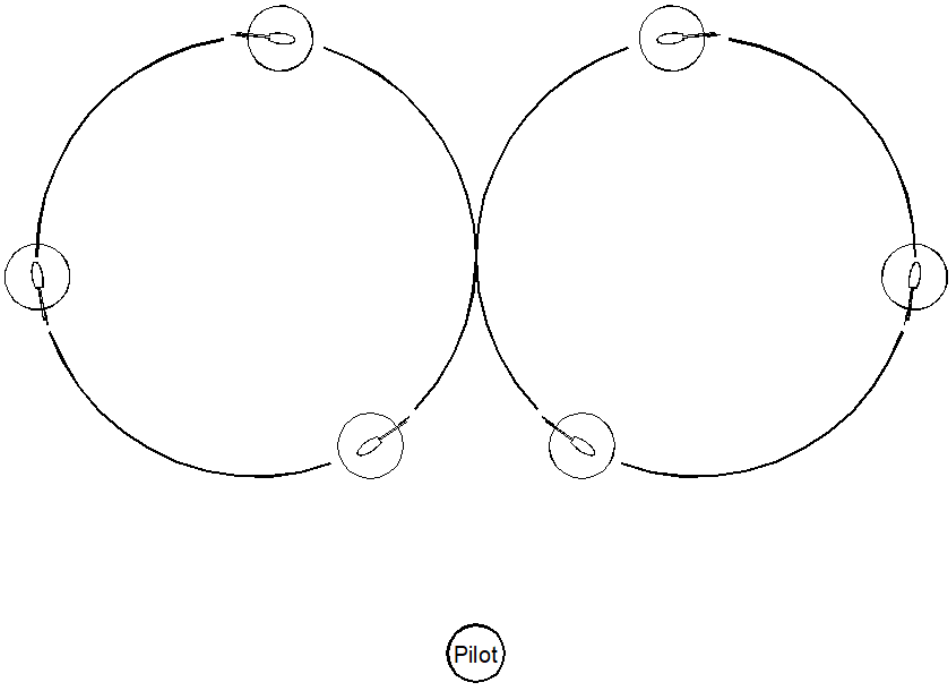
This hovering pattern is part of the BMFA “B” test.



For the test it is done over a line of markers in a particular order with a pause of 5 seconds at each “station”.

More eights and circling

If we are controlling our hovering circles well and coping with light winds and gusts from odd directions we can try tidying up hovering lazy eights by making the helicopter fully nose in before changing the direction of turn.

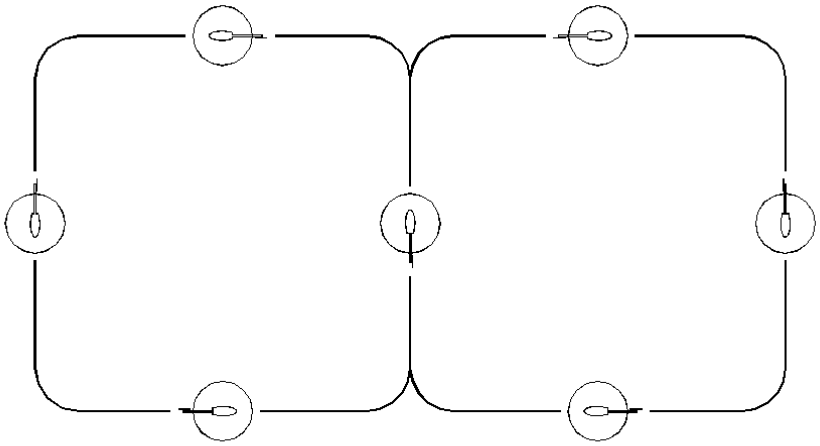


This is very much an “if it's not comfortable don't do it” exercise. If it is not comfortable go back to earlier exercises for a while.

Hopefully by now we are now getting to “read the sky” to assess the visibility of our model and

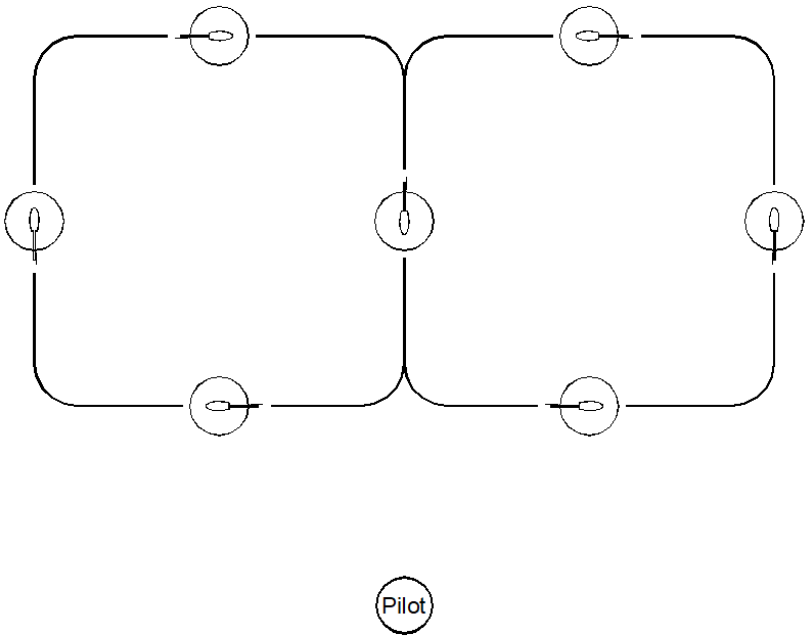
“feel the wind” to decide the limits we should put on our flying for the conditions on the field. We may also feel that the wind direction is less critical for our manoeuvres than it has been. Maybe we are getting to be fairly happy hovering in almost any orientation relative to ourselves at a fair distance.

Square Eight



Another hovering manoeuvre. Simply fly a square figure eight. The corners are shown rounded but we could also just stop and rotate at each corner.

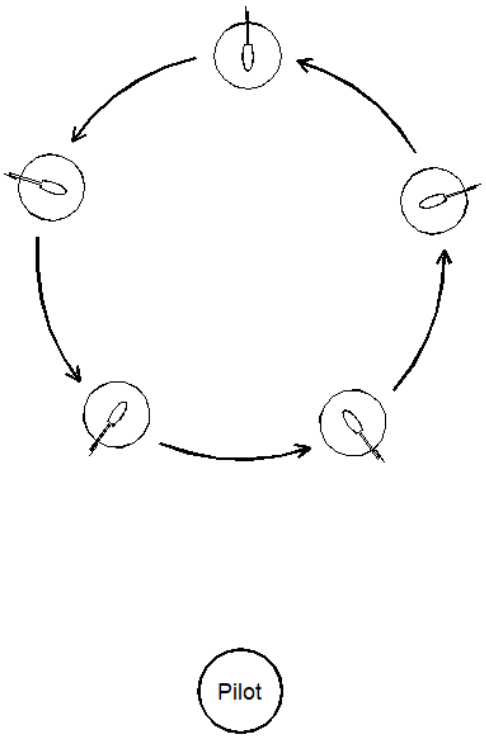
As with normal figure eights the square eight can be reversed.



This, of course, requires us to fly the model directly towards ourselves for the middle leg so be very careful. As before, if it's not comfortable you have not reached the necessary level of control so don't do it! Go back to earlier exercises.

Nose In Circle

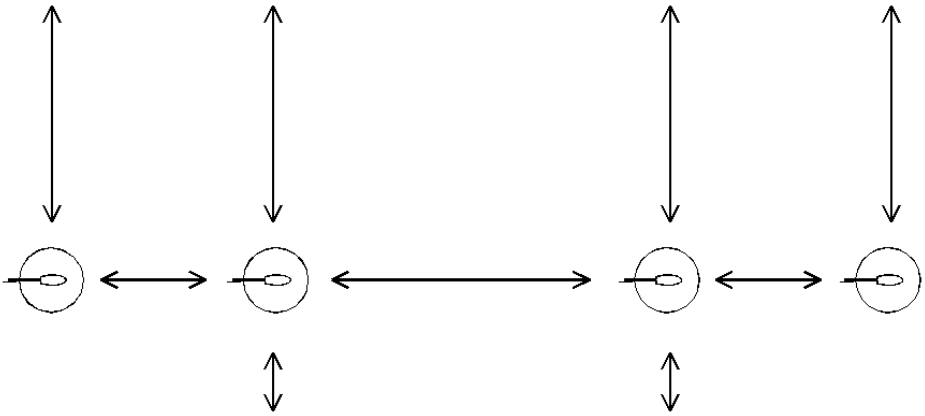
So far most of the hovering manoeuvres have been with the model moving forwards. If we are becoming comfortable with hovering the helicopter facing all directions we can try the nose in circle (in front of us rather than around us).



This showed up a lot of my weaknesses! I find control is most difficult where the helicopter is side-on (9 and 3 o'clock positions in the diagram).

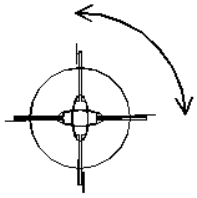
When the helicopter is pointing mostly, but not completely, towards or away from the pilot the pitch attitude is controlling movement mostly towards and away from the pilot. This pitch attitude is relatively easy to observe because the long tail of the helicopter makes a good indicator. Roll attitude is less obvious, but less critical because errors move the helicopter sideways and don't threaten the pilot.

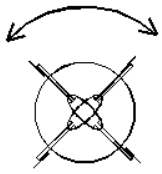
However when the helicopter is side-on to us roll attitude is more difficult to observe and errors can bring the helicopter (alarmingly!) towards the pilot. We can do specific side-on manoeuvres to practice this orientation:



This is rather like one of our early exercises but side-on.

As our hovering confidence grows we can also do pirouettes in 90 degree steps.

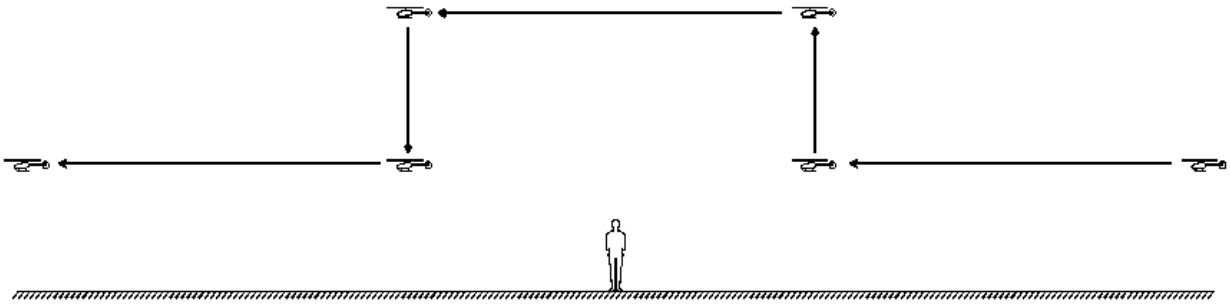




We also begin to do them directly in front of ourselves with less concern for wind direction and we can do them in random steps. If we can quickly and confidently stabilise the helicopter in any orientation we have a powerful tool for dealing with some of those awkward moments when things go a bit awry.

Top Hat

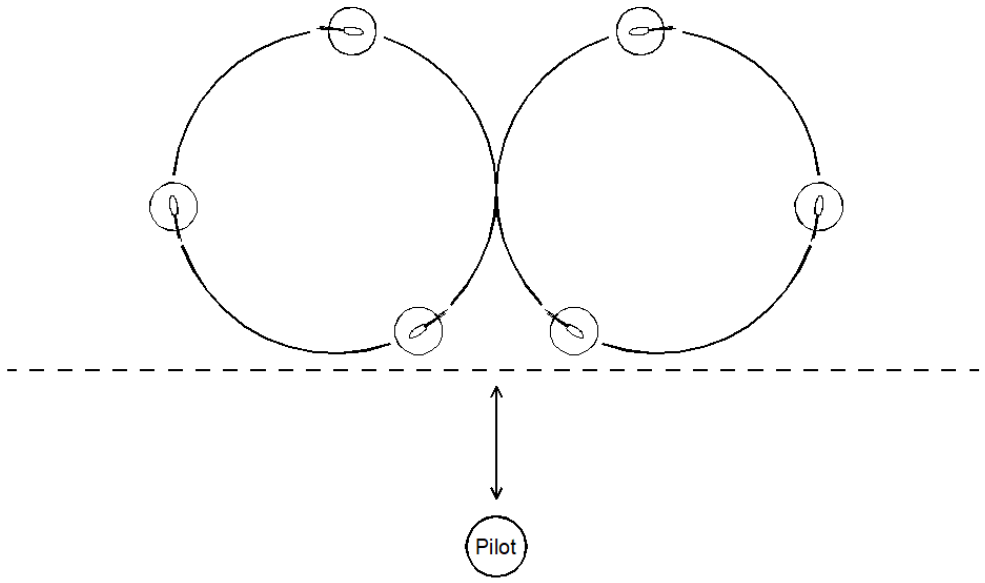
Another hovering pattern from the BMFA "B" test. This is done along a line of markers approximately 10m in front of the pilot. As with the "bow tie" there is a 5 second hover at each "station".



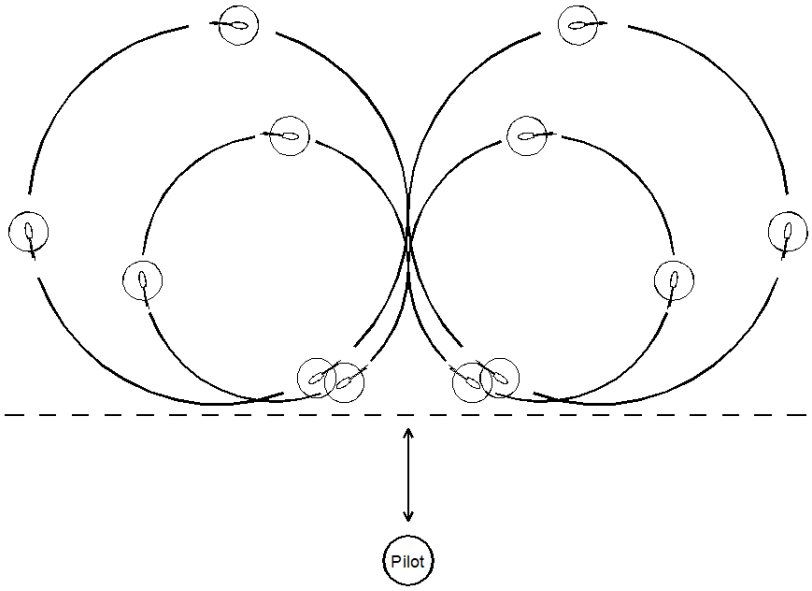
This involves hovering the helicopter at a distance of 18m with the nose almost in and a bit closer at some height. This is significantly more difficult with a small helicopter. When you get good at it try doing it backwards.

Faster eights and circles

One of the advantages of helicopters over fixed wing is that we can fly basic patterns very slowly by hovering and gradually increase the speed we fly them. We can develop rounded eights and circles by gradually increasing their size and speed. At this stage I realised I still tended to let the model get too close to myself so I made a conscious decision to set an imaginary line for most manoeuvres that I would use to space the model from myself and anyone else standing behind me.

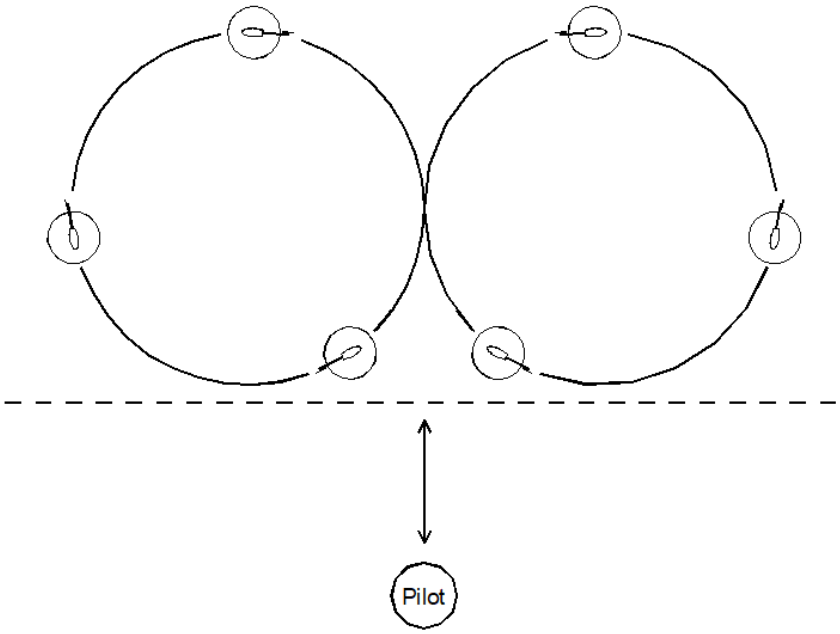


For myself with the 550 size helicopter this is around 10m, but I will adjust it as I see fit as my flying progresses. Having this line means that as I increase the sizes of my circles and eights I have to make sure I move the centres away from myself.

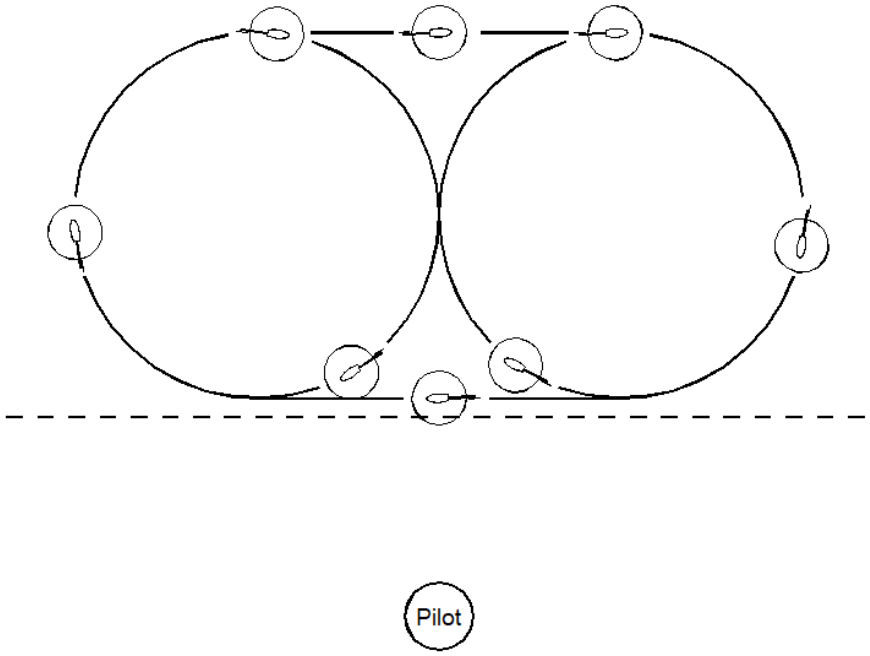


We can gradually increase the size of hovering rounded figure eights and the height we are doing them to around 20 feet or more. Flying a little higher is less threatening to the pilot if we begin to lose orientation a bit.

We can also do this with eights and circles in the opposite direction.



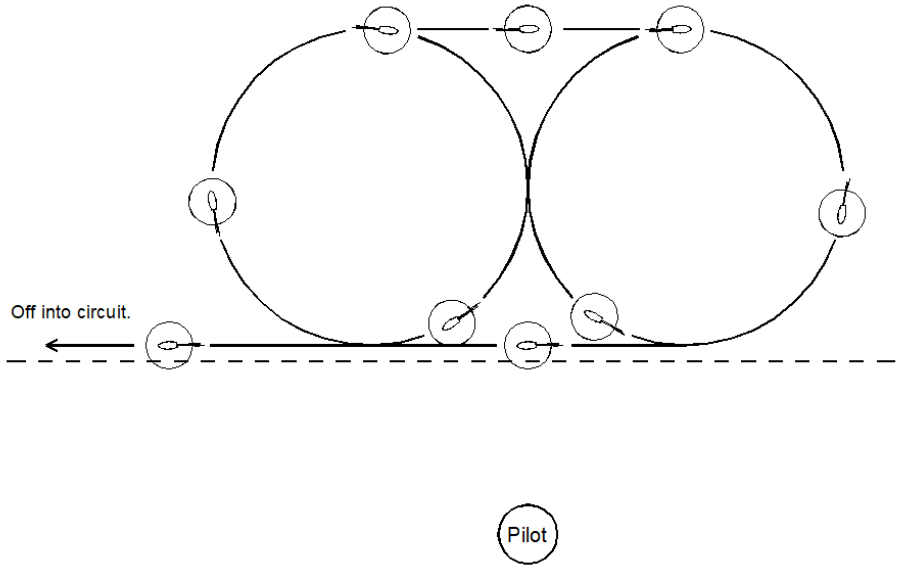
The idea is to get really comfortable with these in both directions and, perhaps, start to occasionally switch directions by flying straight across from one side to the other.



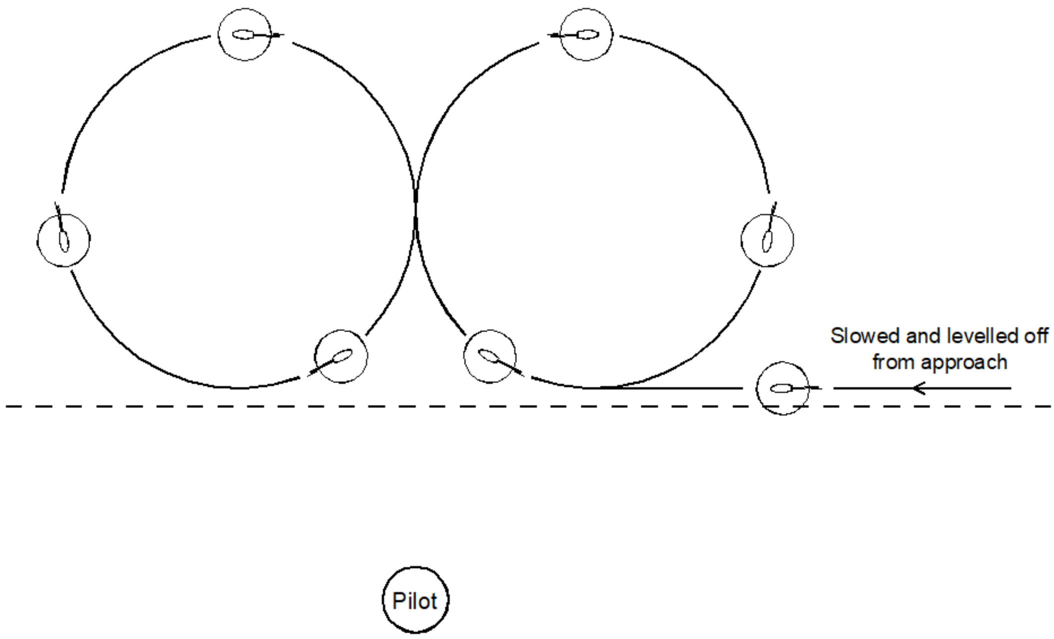
We can also start to increase the speed a little at a time but being careful to keep good speed control. It should not be too big a deal if we get a bit disoriented at low speed but much more so if we are having to significantly bank the turns.

Always remember to make changes and developments gradual.

We can now also start to go directly into a rectangular circuit from the cross over nearest the pilot.



Conversely, once we are fairly happy with our circles and eights and our approaches from circuits are well controlled we can also go into rounded eights or circles from a circuit.



We have to make sure that we have slowed enough and levelled off at an appropriate height before starting our eight or circle.

We are now doing quite a large range of exercises in four categories:

Hovering - pirouettes, nose in circles, top hats, bow ties - getting comfortable hovering at increasing distance.

Lazy eights - smooth and co-ordinated transition between turns and straights, co-ordination through turns, varying speeds, heights and radii of turns.

Circuits - control of speed and height - compensating for wind - differing sizes, heights and speeds of circuits - getting comfortable with orientation on each leg in different wind and light conditions.

Rounded eights and circles - gradual increase of speed and size of circles - working towards symmetry of circling in both directions of turn and both directions of eight.

We may also be mixing circuits, eights and circles.

As always, for best progress we should work most on our weakest exercises but keep doing a wide range of them and gently probe the boundaries of our ability.

At present I am experimenting with stall turns and steep descents at different rates where the helicopter may be going into autorotation. I will continue adding stuff to this article as I think appropriate.

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