my way with CHOPPERS *by* MAURICE TAIT

OF ALL the machines a radio modeller can choose to fly, the helicopter is the most weird and least understood. It is also completely fascinating.

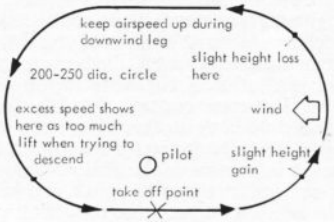
The purpose of this article is to describe some of the mysterious things which can happen during flight when the machine is out of the hover. I am going to assume that you have spent hours of practice, so that you can hover the model instinctively. I will not expect you to fly it blindfolded and with one hand tied behind your back, because you still need all the limbs and concentration you have got.

If you are in the early stages of learning to hover with a kit model, keep going back to the instructions until you have it perfected. Additional aids I found very helpful were to remove the return springs from the transmitter sticks, because transmitter neutral rarely seems to coincide with the helicopter's attitude; and place a piece of coloured sticky tape on top of the fuselage or canopy a few inches in front of the main rotor shaft. This serves as a reference point on which you can concentrate —if it moves in any direction it helps you decipher the correcting control movement. It has the additional benefit of diverting your attention from the hypnotic tail rotor.

The first manoeuvre to learn after the hover is slow forward flight in a large circle, coming back to the hover and landing gently. If you can hover properly this should not be much of a problem.

Start by choosing a day with only a mild breeze. Lift off to 15-20 feet, check that everything is okay, then push the stick gently forwards. As the model moves forwards it will drop slightly. Don't worry. When it reaches a certain airspeed, usually around 15-17mph, the main rotor moves into translational flight and provides considerably more lift. As the model climbs, you have to decide whether to throttle back slightly to maintain constant height and speed, or push the stick forward for constant height and more speed. (The third choice is to keep climbing—but this is not the idea of the first exercise).

At this moderate speed it is quite safe to fly a large circle using very small amounts of control throw. A circle 200-250ft in diameter can be flown using tail rotor only in some



cases, although usually cyclic is needed as well. As you turn, the model cross-wind there will probably be a slight gain in height, followed by a loss as it moves downwind. Concentrate on the model and make sure its airspeed on the downwind leg is always greater than the windspeed—otherwise the helicopter will perform a smart pirouette and end up travelling backwards over the ground yet with a low forward airspeed!

Turning into wind on the final leg towards your chosen landing spot is probably the trickiest part of the whole circuit.

In the first place, the model's airspeed increases as it comes into wind —thus providing yet more translational lift: result—an unwanted height gain. Best action here is to push the nose down and go round again.

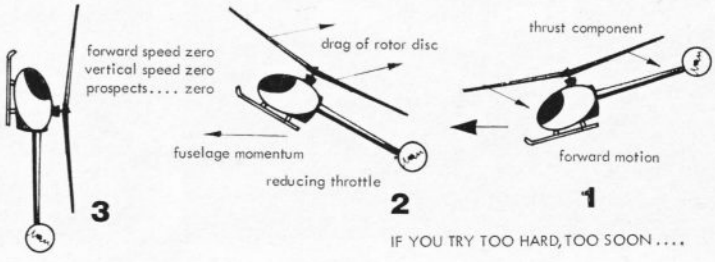
If you have managed to keep the speed under control the height gain should be minimal, and you can start the final approach on carefully reduced throttle with the stick gently pushed forward on cyclic, approaching at about 30 degrees to the horizontal, finally opening the throttle as hover is regained. And, as you have mastered the hover, you are home and dry. Go round and do it again.

Gently . . . or else!

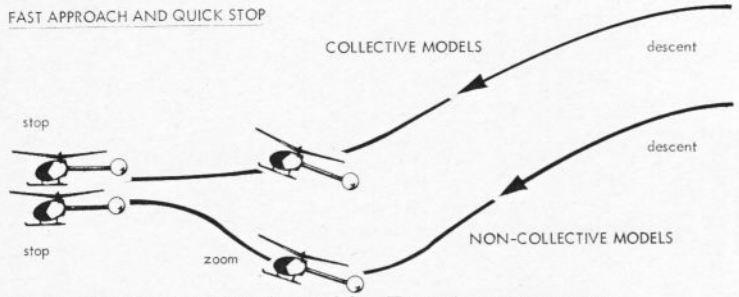
The whole manoeuvre *must* be flown gently Practise a few times, and then relax. There are great dangers in trying to impress onlookers—and yourself—with a fast snappy approach followed by a quick stop over the landing spot. No matter how skilled you have become at hovering it, you will find that flying the model round is something completely different. If you have plenty of fixed wing experience it can lull you into a false sense of security.

If the approach is made too fast several things can happen, usually all at once. As throttle is reduced, the rotor disc changes from a lift producing device to an efficient air brake. If the transition is made gently you should be able to cope. But, should you get over-excited or over-confident and reduce throttle/collective rapidly, the disc produces drag and tries to slow the model. The fuselage continues on its merry way

Above: just off the ground and starting to accelerate forward. Note angle of pennant in strong wind.



IF YOU TRY TOO HARD, TOO SOON....



with all the momentum of the model structure, engine, and radio, behind it.

The result is a sudden sharp upward swing of the fuselage. So there you are 50ft. high with the model's nose pointing *vertically* to the heavens . . . about to start travelling vertically in the opposite direction . . . on low throttle . . . its underbelly facing you so orientation is tricky . . . with a tail rotor spin imminent.

If you get in that situation, the only answer is to push hard forward cyclic pitch and open the throttle—and stay that way until you regain control. It's very exciting—I've done it!

(This effect is useful in some models which are reluctant to pull up from a high speed dive. Throttle back).

A further point to consider when descending, especially important on non-collective models, is that as you throttle down to quite amazing low engine rpm to come down, the speed of the main rotor drops. This brings two unwanted side effects—stability produced by the weight of the gyro paddles is decreased, and so is control response. These are more reasons why the pilot should have first rate hovering ability.

Having got this far check the level of fuel in the tank. It's easy to forget in all the tension and excitement. I always fly by stopwatch, pressing the plunger immediately after removing the glowclip from the engine. I give myself ten minutes' flying and then land, no matter how much fuel I can see in the tank. That way I have avoided any engine failures due to low fuel, in more than 1200 flights. The other sure way to an engine failure, of course, is running too lean.

Fast chopper stopper

Having flown a few circuits and learned any differences between left and right hand circles (and they can be considerable), how then does one make a fast approach and a quick stop?

Try it at height first. As the model comes out of the upwind turn ready for approach, flying moderately fast, throttle back/reduce collective and push on plenty of forward cyclic pitch simultaneously. If you get it right the model will begin to descend rapidly forward with the fuselage remaining horizontal. Push on more forward stick if the nose begins to rise. Tail rotor control, at this stage, should be easy as there is plenty of airspeed to keep the model straight.

On approaching the desired point, ease back on the cyclic pitch and kill the zoom with yet more reduction in collective. Now comes the interesting part. The model is travelling forwards, downwards, decelerating, in autorotation, nose up 30-45 degrees, low throttle/collective, maybe only three feet above the ground (so remember: practise at at least 50ft.).

This is when prompt action is needed with three simultaneous control movements. A massive amount of collective pitch is used to prevent the model sinking further and arrest forward motion—tail rotor correction of the increased torque will be essential—and the model must be levelled out with rapid application of forward cyclic pitch. If in doubt, put in collective pitch first. When the model stops the collective must be instantly and accurately reduced to the level needed to sustain hover.

If you get it right the model will stop dead into a stable hover and await further commands from its master—*you*. If you get it wrong, let's hope you were high enough.

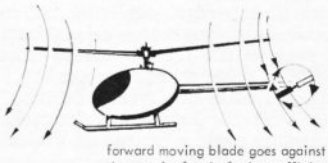
As a co-ordination exercise the fast approach and quick stop takes a lot of beating.

The fast stop cannot be perfected with non-collective models because the main rotor speed and therefore the lift cannot be changed quickly enough. You can get near it but usually throttle has to be applied early in order to avoid striking the ground, resulting in a zoom as the model levels off.

Tail complexities

A curious thing with some model helicopters, and full-size too, is that they tend to point in one direction in forward flight and travel in another, maybe as much as ten degrees out. This is far more noticeable on choppers on which the lower tail rotor blade moves backwards. The machine can be set up to hover straight into the wind but on fast forward flight the tail rotor disc creates its own additional translational lift and becomes too effective. Opposite command is required to correct this.

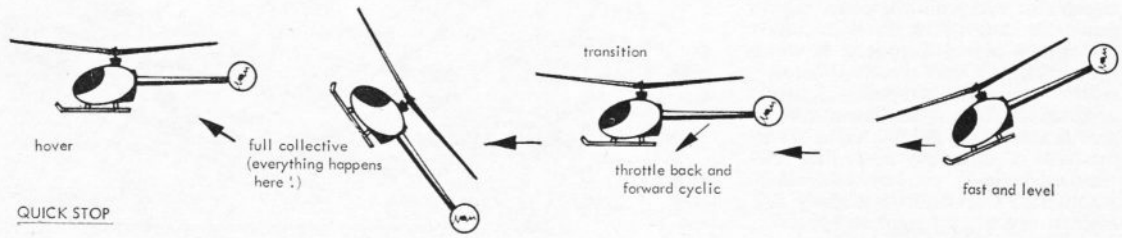
But a tail rotor in which the lower blade moves forward is meeting the downwash from the main rotor even in the hover, thus its airspeed is higher. It is therefore more effective


forward moving blade goes against downwash of main for best efficiency

and requires less power to drive it. And there is less difference in airspeed over that blade when comparing hover with forward flight. If you think about it you will see that, even in the hover, that forward-moving tail blade is producing some translational lift.

By this time, if you are not totally confused and boggled, you will be ready to fly Chandelles, or stall turns as the fixed-wing boys insist on calling them. (Pssst! . . . helicopters don't normally stall . . .).

These can be approached in



stages, starting with gentle 'wing-overs' and gradually increasing the vertical angle and decreasing the vertical speed. As the model is at the right point in the sky, on about one third throttle/pitch, full deflection on the tail rotor will spin the model over. It's easier sideways to the wind so that the breeze can help push the tail round. Plenty of control response is needed to pull up from the vertical dive which follows—and be ready to open throttle.

With practice this can be a very pretty manoeuvre. Next stage from this is consecutive spins. When the model is vertical, put on full tail rotor deflection as if flying a Chandelle, but keep it on so that the fuselage spins round and round. The most I have done so far is 4½ turns, but there are brave souls who have managed 6½.

As you progress from the hover into confidently flying round the field and steep descents, watch out for the dreaded vortex ring effect. This is met when the helicopter is descending in calm air into the turbulence created by its own rotor blades. The effect is sudden and dramatic. The helicopter falls like a stone.

The fall can generally be arrested easily with collective-pitch models, but if you meet the vortex below about 15ft. altitude with a fixed pitch machine, put on forward cyclic and fly out of it. Opening the throttle only will be too slow a response.

Yo-yos

One of my favourite manoeuvres is to slow the model deliberately while flying downwind. As its airspeed reaches near zero, apply tail rotor and watch the model perform a series of 360 degree spins the length of the field, drifting with the wind. Provided there is no turbulence this can be done safely as low as two feet above the ground, for as long as you like, but it looks prettier at 10-15ft.

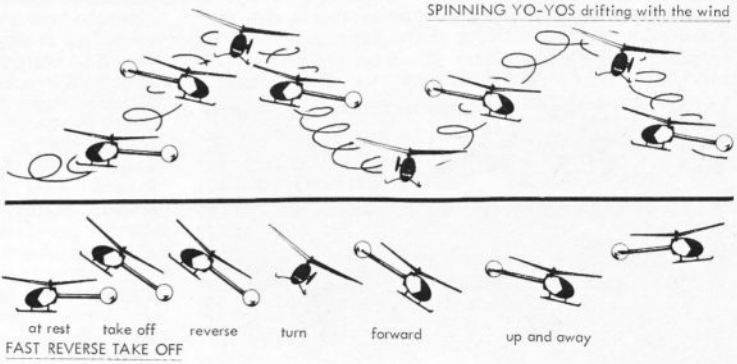
Maurice takes his model in a fast diving turn over the slope which he uses for practice, (howls of anguish from the slope fiends!)

If you get into trouble, open the throttle and up she goes. A variation is to 'yo-yo' the model up and down while spinning with tail rotor applied, starting from a vertical take off. These antics look best in gentle to moderate wind conditions—try them in high winds and the thing disappears over the boundary like a giddy scalded cat!

Finally, why not try a fast reverse take off? This looks very snappy and is easier than you think. Stand about 60ft. behind and slightly to one side of the model, facing into wind. Apply a fair amount of power, well over that needed to hover in flat calm. As the model lifts off, apply reverse cyclic pitch so that it comes back at you tail-first, and keep it straight with the tail rotor. As the model accelerates downwind and passes backwards by you, its actual airspeed will decrease. When it is travelling at about zero airspeed (surprisingly this is not critical) apply tail-rotor and sideways cyclic in the same direction and the model will turn gently and head off, nose-first, downwind.

Fetch it back with a Chandelle followed by fast approach and quick stop. All it takes is practice and patience.

What it adds up to is that helicopters are like women—contrary and wilful, but wonderful when mastered. Now my wife says she wants to learn how to fly the things!



Below: nose coming up just before giving full collective in a quick stop. *Left:* backwards again.