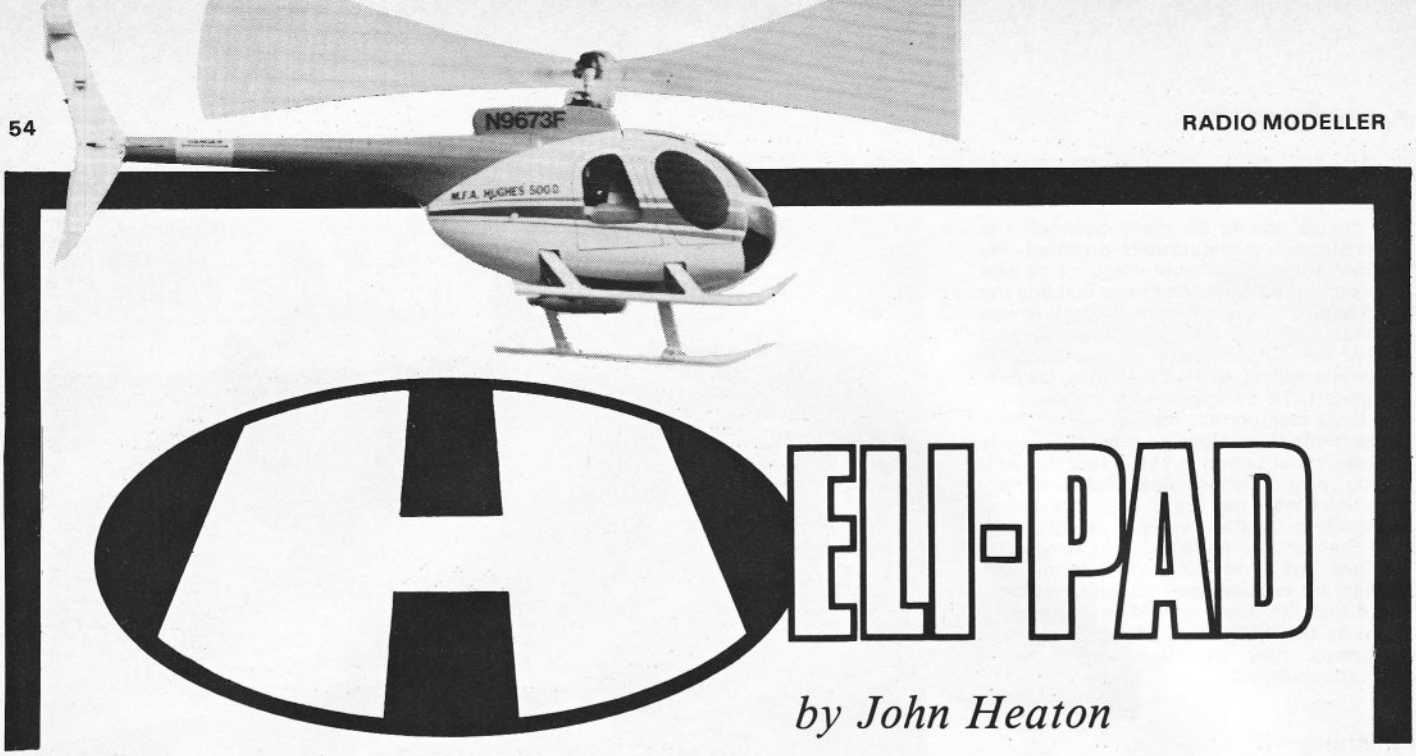

HELI-PAD

by John Heaton

Helicopter manoeuvres explained

The first thing to learn is the hover. In essence this is very simple, as we gradually ease in more collective pitch until the weight is equalled by the thrust of the rotor and we have no effective weight. In this weightless state, whilst still resting on the skids we can manipulate all the controls, as we can swing the tail, tilt the machine in any direction using the cyclic control until happy with all the response, a fraction more collective pitch and the model will rise into the air. In the learning stage I favour the method whereby the machine is kept just a few inches high, and, at the first hint of trouble is safely let down, I know that this is probably the most difficult flight mode and it is much easier a few feet higher. The fact remains that hovering a few inches high is not impossible, just a little more difficult, and the important thing is it is impossible to crash from a one inch hover and, keeping our machine in one piece during the learning stage is of crucial importance. There is also the fact that having learnt the low hover a high flight will appear easy.

Quite a few people comment that their machine always seems to wander to the left (machines with clockwise turning rotors that is). This is quite normal, because the torque compensating tail rotor pulls to the left to balance the torque put into the fuselage by the main rotor. The helicopter is not fixed in space, therefore this tail thrust will tend to pull the machine bodily to the left. So, when we lift our pride and joy off, as we apply a little tail rotor control to balance the torque, we also have to apply a little right cyclic to stop a drift to the left. These two torque effects are the main things to overcome. The other two controls, fore and aft cyclic and collective, are straightforward and it is difficult to get it wrong.

A big advantage when learning to hover is that only a small space is required, a small back yard being quite adequate, after all, if the machine moves more than a yard or so when we are trying to hover then it is out of control and should be set down before it gets out of hand. This advice I feel applies to the more advanced machines available today with precise control, it might be difficult to apply to a first generation machine. Depending on how capable you are it will take from five minutes to a month or so to be able to hover for a whole tankful. When you have achieved this we can think about progressing to higher flights and circuits.

A high hover into a breeze is quite simple and can be attempted at quite an early stage However, a circuit is a little more difficult. If you are an accomplished fixed wing flier and know your right from your left then you should have no problems. Just make sure that the machine is in A1 condition and be prepared to use the rudder more than you are used to, especially the amount of left you may need when descending. Try and keep the speed constant in the circuit, airspeed that is; be careful not to fly slower than the wind downwind or you will end up in effect flying backwards with a quick 180° turn back into wind, on the other hand do not overstrain your machine by screaming round at ultra high speed. You will be amazed at how little power is required whilst in the circuit. This increase in lift is due to the rotor blades meeting undisturbed air as opposed to hovering when the air the blades draw has been sort of forewarned and has started moving towards the rotor.

Circuits

If you have not flown a circuit before there are two options I would recommend. Either get a competent helicopter flier on a buddy box lead, or if not available, wait for a really calm day and do a slow small hovering circle walking with the model all the way, then gradually increase the size and speed of the circuit. One of the difficulties normally experienced in the early circuit stage is the transition from forward flight to hover prior to landing. As you gently raise the nose to lose speed you have to increase the collective pitch to compensate for the loss of translational lift whilst keeping the tail straight all the time. If you can get through this far without too much hassle you are well on the way to becoming a competent flier.

More advanced helicopter manoeuvres

Stall turn or torque turn

This can be a very graceful manoeuvre with a helicopter and also is one of the easiest. From a fairly fast cruise just raise the nose until the model is vertical, as speed decreases it will in fact rudder itself round to the left due to torque effects although I usually help it round a bit with left rudder. With practice this can be done at extremely low level.

Autorotation

This evaded the radio controlled helicopter for a long time but now has become so commonplace and easy that I believe the manoeuvre is being downgraded for competition. Obviously the model has to be set up correctly for full autos and equipped with a free-wheel. There are two methods (a) come down at a constant speed and simply apply collective to cushion touchdown, this method is more feasible with weighted blades; (b) descend at about 20 or 30 mph, which, contrary to popular belief may not need forward stick, my models in fact need a touch of rear cyclic to hold speed in check, this is because, as you descend, air striking the horizontal stabiliser imparts a nose down movement. At about 10-20ft raise the nose, which slows the airspeed and tends to arrest the descent and, at the last moment, level the machine with forward cyclic and cushion with collective.

Hovering turn on own axis

This seemingly simple manoeuvre is the start of real progress. I don't mean just whacking on a handful of tail and whipping the model round, I mean doing a controlled slow turn in a breeze holding station over a fixed ground point. If you are capable of maintaining orientation whilst doing a slow 360 turn, then all the other high K factor manoeuvres will be in your scope i.e. Swiss hovering circle, shovel etc.

I find it helps if the model is trimmed in still air, i.e. if on a breezy day we try these things we have to hold in forward cyclic to remain stationary, as we slowly rudder round left we realise that we have to ease off forward stick and move it right to counteract the breeze now coming from the machine's right. Now the helicopter stops turning as the left rudder we held on to initiate the turn is neutralised by the breeze blowing on the fin, trying to impart a right turn. So we have to hold station with cyclic and give a coarse rudder steer to the left to continue turning. As the tail turns into wind, we have to stop steering cyclically to the right and hold on rear cyclic as we are flying backwards into wind. What happens now is that the wind is now from the other side of the fin, helping, not hindering, the turn and the model whips into wind at 90mph, getting the idea?

All the other basic manoeuvres like figure eights, nose in hovering etc. are really exercises in orientation stemming from a 360° turn. It is very easy to cheat with the 360° turns and do them out of control, just gather height, slow down to about zero airspeed and hold cyclic central, rudder one way and the model will drift with the wind, spinning round.

Hovering downwind

To an observer, not even a manoeuvre, but a real test of control which I recommend any keen flier to perfect, as hovering downwind is really flying backwards. This brings me to one of my favourite stunts. This is to hover into the wind then initiate backward flight, gently climbing and, when up to about the maximum rearwind speed you can hold on the tail, apply forward cyclic and the machine does a graceful zoom upwards tail first, comes to a halt nose down and then zooms towards you at increasing speed. (Where-

upon you just crash in the normal way. Joke!).

Quick stop

A neat little trick this, fly at high speed across the field about four inches high, put the machine into autorotation, raising the nose to stop the descent into the ground. Eventually kill the speed, ending up with a 45° nose attitude, level with cyclic and cushion on with collective. If you leave the engine idling you can zoom to about 40ft high from a high speed low run, in autorotation, when you run out of speed that high just pour on the coals and start powered flight again.

540 stall turn

Just an extension of an ordinary stall turn this one, you raise the nose from the cruise until vertical, rudder hard round until the machine has spun round twice. Give yourself plenty of height for this one (yes I speak from experience!).

All these manoeuvres are ones which can be safely carried out with any model helicopter as they are low stress safe authentic ones, with 540 excepted. The aerobatic routine, which needs a specialised machine, I will cover at a later date.

Your letters

Now to the correspondence. It is nice to start receiving some feedback on our subject. Captain Murray-Twin from BFPO 605 (which I believe is Brunei) who owns a 707 comments among other things "I agree with your article on Modes in that pulling for power is more realistic" and goes on to ask how one works out the correct rpm. Well that is a tricky one and really depends on one's aims. If you are set on aerobatics you are really committed to using a high power set up

In last month's Heli-Pad John gave a brief account of experiments he is carrying out with flybarless rotor heads. This is one of his experimental models — a Hirobo Falcon fitted with a Kalt rotor head.

i.e. high revs tuned pipe and Heliboy style model. My philosophy is towards the other extreme, where I try to set my models to fly on extremely low power and revs. This makes in my view for more relaxed flying and certainly more mechanical reliability. As a matter of interest I have measured the rotor rpm of some of my models with an optical tacho and came up with 875 rpm on the main rotor which gives an engine rpm of well under 9000 revs, which is very sedate.

In a way this trend was forced upon me as I was determined to perfect the flybarless rotor and made all my calculations at 1000 main rotor rpm (the centrifugal force on my own blades works out at 236lbs at this speed). In fact the rpm is far more important than the weight of the blades as the centrifugal force goes up by the square of the rpm, not the weight squared. Since this development I have started using a low rev set up for my standard, i.e. flybarred, system with satisfying results. The bottom rpm limit is reached when you (a) run out of right rudder, (b) clutch slip occurs and (c) engine produces insufficient power to take off. It will be noted that general response becomes more docile with lowered rpm but just about all the popular models retain full control at the bottom end of the rpm scale. For the uninitiated you lower the rpm of a helicopter simply by increasing the pitch. As an example my models have a collective pitch range of from around zero to at least 10°.

I also have a very entertaining letter from Andy Hopkins who is one of those right hand throttle fiddlers and is so bigoted that he is proud of it!

Well, thanks for a nice letter Andy, I was very entertained. More next month.