HOW TO SURVIVE YOUR FIRST R/C HELICOPTER F(r)IGHT

By Dave Nieman

PART 3

FLYING a model helicopter or any other radio controlled aircraft is not something which can be mastered simply by reading a book. Like any other skill, proficiency only comes with patience and a lot of practice, for which there is no literary substitute. Therefore, I can't give a formula for instant success, just a few basic rules and advance warning of some of the pitfalls that you are likely to encounter as a newcomer to helicopters.

The following is really just an accumulation of random recollections from the dim distant past, and experience gained during the tuition of others.

One point I must stress is aimed at the competent fixed wing pilot who is about to fly his first helicopter. Don't be tempted to fly around straight away, for no matter how good you think you are, there is little chance of surviving a flight without the model sustaining some damage. Really, the easiest way to learn is to start at the beginning. There is far less loss of face by exercising a little restraint than confidently hurtling around the sky for a few brief moments, only to end up by ploughing the model into the ground. Flying around is relatively easy, it is on the approach and landing where most people come unstuck. In forward flight a model helicopter behaves in much the same way as a fixed wing model. It is the type of flying that is peculiar to helicopters that the fixed wing pilot has to learn, i.e. hover, vertical, lateral and backwards flight. As most take-offs and landings employ at least one of the aforementioned, you can see the folly in premature circuits.

Training flights should be made on the smoothest *level* ground you can find, clear of any obstructions and with plenty of space upwind. When flying from a rough uneven surface it is virtually impossible to predict the direction in which the model will travel when you lift it off. Even a slight depression or the smallest tuft of grass is sufficient to trip the model over as it will be skating around quite a bit at first. For this reason, the best all round form of training undercarriage has proved to be inflatable floats. They are very durable and relieve the airframe of much of the punishment found in training, but more important, they allow the model to slide around and reduce the risk of it tripping over. Also, the model does not have to be at a complete standstill before touching down, a manoeuvre which takes quite a long time to perfect. It is not true that helicopters can be flown only under ideal weather conditions, some of the Navy's Air-Sea Rescue operations put the lie to that rumour. Admitted these are full size, but when scaled down you can still be having fun with a model helicopter in conditions where flying some fixed wing models is just hard work. Avoid flying in strong winds during training, particularly gusty conditions, as such conditions call for quick reactions and good throttle response, especially near the ground. On the other hand, a dead calm hot summer's day (we should be so lucky) is not much use to the beginner either. With high temperatures and no wind at all, there is a noticeable lack of lift, which requires more power and increases the chances of the motor overheating.

But more important, without the damping effect of the wind acting on the tail of the model, it is extremely difficult to maintain a constant heading. This would require quite skilful control of the tail rotor at a time when the novice has his hands full trying to co-ordinate the other functions. The most suitable weather condition for the first few outings is a bright day with a light steady breeze. This will have a weather vane effect, helping to keep the nose of the model into wind, relieving your work load and allowing more concentration on the cyclic pitch controls. The stronger the wind, the less you will have to worry about the tail swinging. But on no account should you neglect the tail rotor. It is as important as any of the other controls and the sooner you master it the better. Anticipating difficulty controlling the tail rotor, some people fit a gyro stabiliser, in the hope that this is the answer to all of their troubles. Whilst this device can help to damp the effect of sudden unwanted yaw, it can, under certain circumstances, hinder recovery from an awkward situation.

We have dealt with blade tracking, motor adjustments, tail rotor trim, etc. All these can be carried out fairly accurately without actually flying the model. However, cyclic trim adjustments on the Swash Plate can only be done properly with the model airborne. Initial adjustment of the Swash Plate in the roll axis is done with the trim lever centred. The Swash Plate should be at right angles to the main rotor shaft. I prefer to set the fore and aft trim so that the Swash Plate is at right angles to the main rotor shaft with the trim lever back in the full up position. This gives plenty of forward trim to cope with windy weather. With the Swash Plate level, the model will hover stationary only in a dead calm, even a slight breeze requires some forward trim. Cyclic trim is not a very accurate business even at the best of times, particularly in ground effect, which is where your early attempts will take place.

Ground effect is an air cushion created by the down wash of the main rotors acting against the ground. This condition can be felt up to approx. one main rotor diameter above the ground. In ground effect the model is slightly more buoyant, but very susceptible to any surface irregularities, which as you lift off tend to launch the model in any direction but the vertical. Model helicopters can be flown hands off quite readily, circuits are just a matter of the appropriate trim, but in gusty conditions the hover cannot be sustained for more than a few seconds. However, there is no real

point in this exercise, other than to prove how clever you are or to show that helicopters are not the vicious unmanageable beasts that many people think they are.

One prerequisite to successfully negotiating the training stage is that the flying controls are set up with sufficient movement. There is one school of thought which brackets helicopters with fixed wing and advocates reduced Swash Plate movement for the novice. The illogical reasoning behind this move is that the model is easier to manage in the hands of a beginner. In actual fact, this is quite the reverse for what you are doing is removing some of the often already inadequate response from the model at a time when it is needed most. None of the kit built helicopters currently available are too responsive for a novice, some may be more stable than others, but it is possible to increase response without affecting stability, a subject which I hope to cover at a later date.

Many of the minor crashes that occur whilst learning, could well be avoided if the models were a little more responsive. Initially your reactions are a lot slower than the model's until you gain experience and learn to anticipate its movements. Flying a helicopter is not the same as flying something like a pylon racer, where you have instant response to a given control input. Something which will give you an idea of the feel of a helicopter is a home made simulator/game. This consists of a table approximately 18 inches square, supported underneath by a ball joint on which it can pivot. Attached to two adjacent sides are pushrods from servos mounted on a baseboard. These represent the cyclic controls, roll and pitch. The servos are connected to a receiver and operated by the transmitter in the normal way. A steel ball is placed in the centre of the table and to simulate a steady hover, you have to keep it there. This is not too difficult with small corrective movements, but as soon as the ball moves any distance from the centre, it really accelerates and you can get into a real pickle trying to stop it – just like the real thing. Remember that you are not having to cope with any wind and the table is maintaining a constant heading, not swinging about its vertical axis, as would be the case if it were a model. By the way, when the ball reaches the edge of the table you have crashed!

This may sound like just a silly game, but in fact it is quite a useful preparation. It costs virtually nothing in time and materials to build. The table must be perfectly flat, if necessary top it with a piece of glass. The pivot can be just a countersunk hole in the table into which you can fit a piece of dowel with a rounded end. A better method is to steal a top from a Roll-on deodorant bottle, screw the ball to the underside of the table and epoxy the socket to a short length cut from the wife's broom handle. Result – a perfect ball joint with no friction and capable of being snapped apart for storage. The only problem with this project is that if the family get their hands on it, you may have to buy another set of radio gear for the model!

The most exacting phase of helicopter flight is the hover and it is this that you must learn first. On no account should the model be tethered or restrained in any way, as this would upset its natural stability and you would learn nothing by doing so, except maybe how to repair crash damage.

Start the motor, place the model on the ground always nose into wind. Stand about 10 feet behind it and slightly to one side. From this angle you can easily see in which direction it is moving when you lift off. Open the throttle slowly until the model becomes light and just starts to shuffle around. Should the tail swing at all, close the throttle and adjust the tail rotor trim until the nose stays pointing into wind. During all this, the model will usually show a tendency to tilt or slide in a given direction, this must be corrected with cyclic trim. Never let the model slide backwards, a touch of forward trim will help to prevent this and ensure a fairly predictable lift off. The trims are not really effective until the model is well clear of the ground, so don't expect that when you have carried out these adjustments you are going to lift off into a perfect hover. All you are doing is correcting any serious tilt of the model, which as you lift off could develop into a rapid acceleration across the ground.

All this seems to take ages, you will probably find yourself mesmerised by the rotors, wondering what the next click on the throttle will bring. It's almost as though the model were glued to the deck.

But don't despair, eventually you will wonder what all the fuss was about. At this point the normal pattern is for the throttle to be opened a little more, the model actually leaving the ground and flying or sliding further with each successive flight. By this time you will have noticed that there is very little feedback and control inputs seem to have anything but the desired effect. There are several reasons for this. The model is quite close to the ground, has usually gained momentum which takes a lot of stopping, but most likely your reactions at this stage are so slow, that whatever you do, it's too late.

Another factor which adds to the confusion is that you will probably be thrashing about in a mad frenzy trying to hover over one spot. This is a difficult manoeuvre even for an experienced pilot, so forget about it for the time being. Only after you have some reasonable feel of the controls, does progress begin to take place. To get this, the model must be airborne and fairly steady for a few seconds. In fact this is quite easy, but it takes a little courage. Put the model on level ground, open the throttle until it feels light, then open the throttle further, steadily but as quickly as possible consistent with keeping the tail from swinging. You use a bit more throttle than you actually need and as the model comes off the ground, you throttle back a little. You will need a few attempts to get just enough throttle so that the tail doesn't swing and at first you will probably ease back too much on the power, but the hops will get higher.

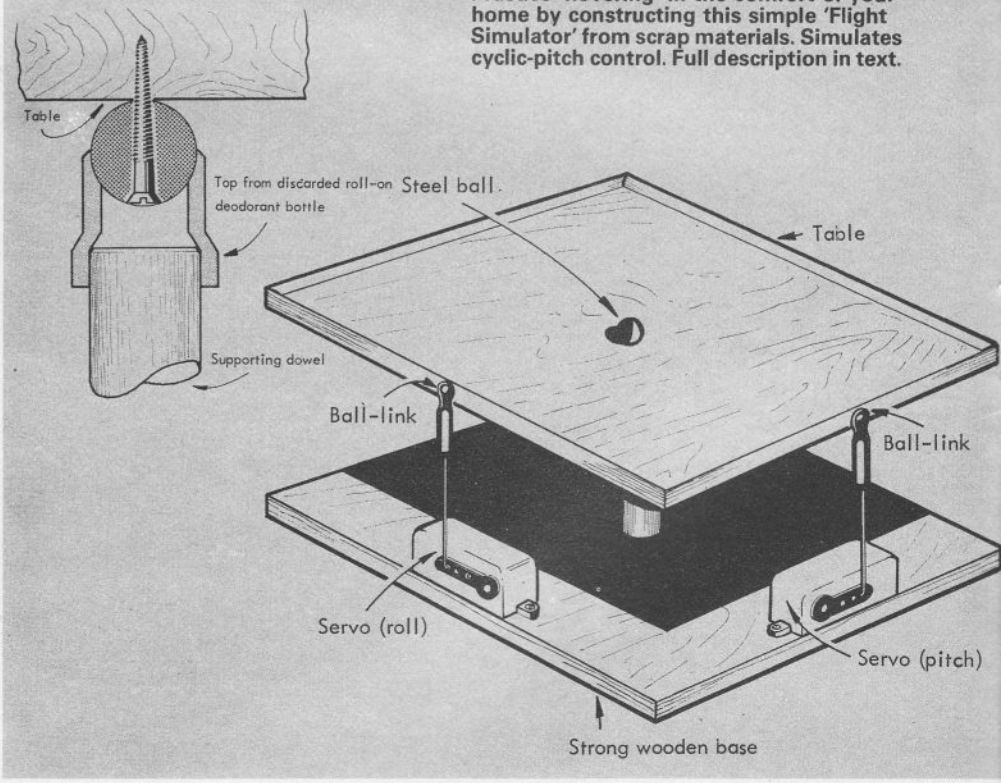
Eventually you will find that you can climb to about 18 inches to 2 feet, have a good old stab at the controls and land before the model knows anything about it. Providing the ground is flat, the model will go up level and stay that way for a few seconds at least, certainly long enough for you to have a go at keeping it there. Should things not look right, then it is just a matter of easing the power and landing. Pumping the model into the air in this way, you can take it by surprise, and you are starting to fly it whilst it is in a pretty stable attitude, whereas if you open the throttle too slowly as is normally the case, any tilt will get progressively worse and immediately the model takes off you have a fight on your hands. Don't go too mad with the power, or else you will find that you are doing 360° turns, or making a premature trip into the wide blue yonder.

If you feel a little apprehensive, then there is a variation of the foregoing method. Apply a little forward cyclic trim and with the nose into the wind, lift off and fly forwards a few feet then gently ease the power and land. It is still important to get clear of the ground quite smartly, but watch the power, as a helicopter climbs a lot quicker when flying forwards. Walk with the model, not necessarily while you are actually flying as this could distract you, but between hops. If the model accelerates away too quickly, then land immediately, but as you do so, try to lose the forward speed by giving some back stick. When you feel happy with these hops, try easing in a little back stick earlier in the flight until such time as you can take off and hover without moving forwards at all.

It is amazing how far you can travel during all this hopping around, so when you reach the edge of the field, or your flight box is a dot on the horizon, stop the rotors, or if it is a long way back, stop the motor. Carry the model back and start all over again. Don't be lazy and try to fly back downwind as even a gentle breeze will make the model swing around into wind with disastrous results.

An important point which has been mentioned before is that from the start of your training you should always focus your attention on the forward part of the fuselage, otherwise you can have difficulty with tail rotor control. For example, when the model yaws left, the nose moves left and the tail right. If you only watch the tail your natural reaction would be to give left tail rotor, which instead of

Practice 'hovering' in the comfort of your home by constructing this simple 'Flight Simulator' from scrap materials. Simulates cyclic-pitch control. Full description in text.



checking the left turn just makes it worse. Whilst training, you will find the model must be flown all of the time, or so it would appear. The reason being that any corrective action you may take is usually far too late and the model is already leaping off in its chosen direction. The delay between control input and response doesn't help. At first the tendency is to under control and when this seems to have no effect, more is given and held on for too long. This makes a lot of hard work, as all you seem to be doing is trying to catch up with the **!!**!!**!! thing. Don't have a nervous breakdown, stop, take a breather and try to analyse the flight. Find out where you are going wrong and how you can rectify it. It doesn't take long before you can relate what you are doing with the sticks to what is happening to the model. Control inputs should be positive and just long enough to initiate a change of direction or to stop any unwanted movement.

One occasion when you need not be too dainty on the sticks is when the model drifts back towards you. Give plenty of forward stick and keep it there until you see some definite forward movement. One common mistake at first is that you will be slow in closing the throttle. If you lose control when the model is close to the ground, either sliding around or teetering on one float, close the throttle quickly, you will lose lift and save it from tipping over. Using floats you can drop two or three feet quite safely. If you get into trouble any higher than this, then do not just slam the throttle shut. Stick with it, try to regain control as you let down steadily. On touching down close the throttle smartly. Any rapid change in power settings can upset the balance between the main and tail rotors, causing the tail to swing. This can be compensated for by moving the stick diagonally, giving tail rotor control and throttle simultaneously. That is assuming you have them both on the same stick.

By the time you have some degree of control of the model and can maintain a reasonable steady hover, you will have ventured further away from the ground. About six to eight feet is a good height to practise the hover, it is out of ground effect and makes control easier. Up until this time, your flying will have been more a constant series of corrections than anything else. Now you should practise flying from side to side forwards and back and hovering in different positions. When you feel more at ease with the model, try climbing to 20 or 30 feet and descending vertically. Take care as vertical descent must be made slowly or the model could sink into turbulent air and drop rapidly. This condition, known as the Vortex Ring, occurs when a helicopter sinks fast enough to catch up with its own downwash. The rotors are unable to draw air down through the disc to provide lift due to the pressure of air from below, because of the rapid sink rate. Turbulent air is thrown out towards the blade tips, causing separation of the boundary layer with a resultant loss of lift. As the whole shooting match plummets earthwards, you can take comfort in the fact that this happens to everyone sooner or later!

If you have sufficient height, a recovery can be made from this situation by giving forward cyclic and flying into cleaner air. After the last exercise, change your trousers and try descending with some forward trim, steep at first but getting progressively shallower walking with the model as you do so. This will prepare you for the approach when flying circuits and you will get some idea of how much you will have to reduce power when making a descent in forward flight.

Circuits should be attempted only after plenty of hover practice and when you feel comfortable in all situations. The first circuit is usually an involuntary one with no warning at all. If you survive this, it will boost your confidence a great deal. Choose a day with only a light wind blowing and have a little hover around to unwind. Make sure you have plenty of fuel in the tank because you don't know how long you will be up there. Warn other flyers of your intentions. They will have become used to you just hovering around and they ought to be given a chance to run for cover. Lift off into your normal hover position, then, without altering the power, ease in a little forward cyclic. The model will move forward, accelerating and climbing as it does so. Fly straight out until you have sufficient height to turn, about 50 or 60 feet. If the speed builds up, ease back on the power, but keep the model moving forwards or you will end up in a hover at a distance. At this point you will probably notice that the tail rotor trim, which was alright in the hover, is not right for forward flight. This is because when hovering, the tail rotor must balance the torque of the main rotor by itself. But in forward flight the fuselage and fin area relieve it of some of its load.

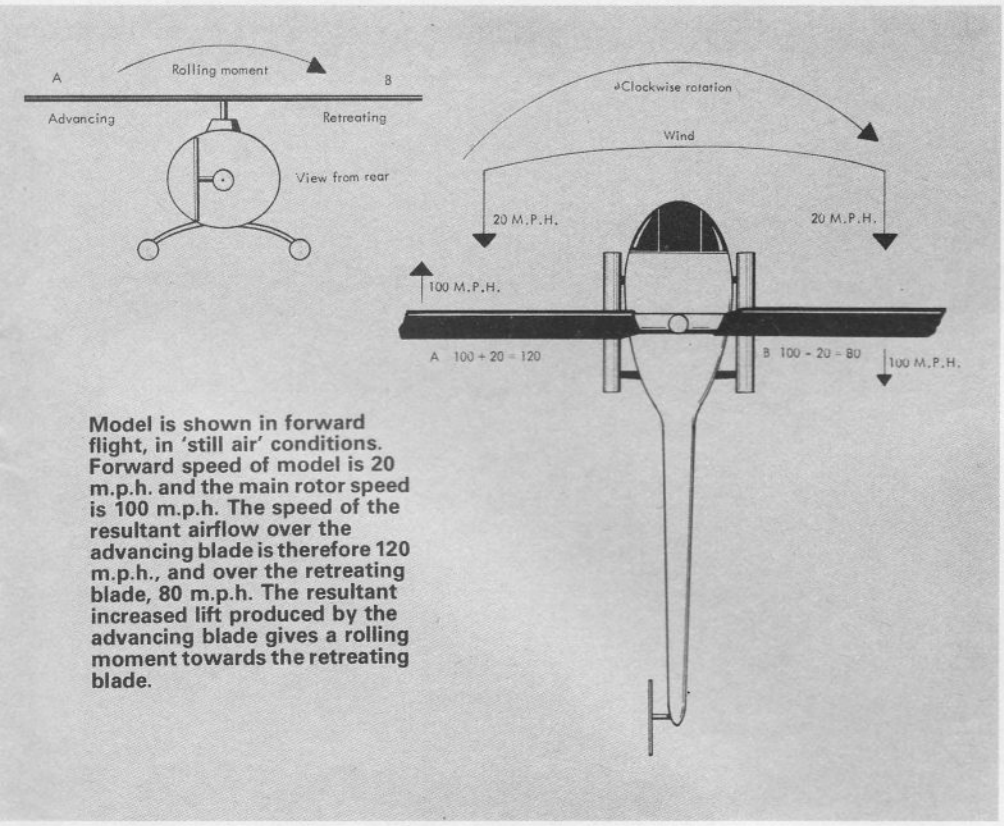
Therefore it becomes more effective and causes the model to yaw a little. This is easily rectified with the trim lever, but as it would take explosive to shift your fingers from the sticks at this point in time, carry on and trim later. Something else you will notice is that the model has a tendency to turn in one direction. This is because the *advancing blade*, the one which is moving against the relative airflow caused by the model's forward speed, produces more lift than the *retreating blade* which turns with the airflow. The direction of this rolling moment is dependent upon the direction of rotation of the main rotors. This is clockwise on most models, therefore the left hand blade will be more efficient than the right, resulting in a right turn. This can be used to good effect on the early circuits as a right turn will not require a lot of effort.

Start the turn with cyclic and tail rotor and give just enough back stick to keep the nose from dropping, don't overdo it or you will do a tight climbing turn. When flying the downwind leg, the model must travel faster than the prevailing wind or else it may weather vane. Don't cut the corner on the turn back into wind, as flying towards yourself at low speed with a helicopter is far worse than with a fixed wing. If you are feeling comfortable then go aroun l again. If your nerves are shot, go round again anyway! You've done it once, so the second time will be easier and may help calm you down. To attempt a landing shaking like a leaf would probably end in disaster.

Don't make a pig of yourself, for it may take longer to get down than you think. Most people overshoot on the first few landings and descend vertically from 50 feet or so. This is not so good because you are hovering in an unfamiliar position which could develop into a 360° spin or a drift downwind. The correct way is to reduce power in the circuit to lose some speed and height, but keep flying forwards. You can lose height in the last turn by not giving so much back stick. The final approach should be straight with a further reduction of power. You will be amazed at how little power is required to keep the model airborne when flying forwards. Keep it coming, if necessary use a touch of forward stick, which may seem completely alien to you, but it is necessary. If the model sinks too low, just a small tweak of power is sufficient to maintain height. Pulling the model in under power this way, you can maintain excellent control. Aim to arrive in your familiar hover position at first and as you lose the last of the forward speed, power should be increased steadily until you are hovering. Then it's just a matter of landing in the usual way.

When you have fully recovered, successive flights should be made with priority given to practising approaches and landings. Don't just bat around the sky, that's the easy bit, try an approach and landing as often as you can. If you become disorientated or lose control whilst flying circuits, don't close the throttle, hang in there and sort it out. You have more time than you think to do so and while you have height, you are pretty safe. It's only the ground that does the damage. When flying around make full use of the tail rotor in the turns, you will need less cyclic and lose less height.

Don't stick to circuits in one direction only, try flying figure eights out in front of yourself. Practise landing from different directions and as you progress, put the model into as many unfamiliar positions as you can, the combinations are endless. Only by doing so will you be prepared for all likely emergencies. The beauty of a helicopter is that you never stop learning. Don't pat yourself on the back and dive off to the pub – you've only just started!



Model is shown in forward flight, in 'still air' conditions. Forward speed of model is 20 m.p.h. and the main rotor speed is 100 m.p.h. The speed of the resultant airflow over the advancing blade is therefore 120 m.p.h., and over the retreating blade, 80 m.p.h. The resultant increased lift produced by the advancing blade gives a rolling moment towards the retreating blade.