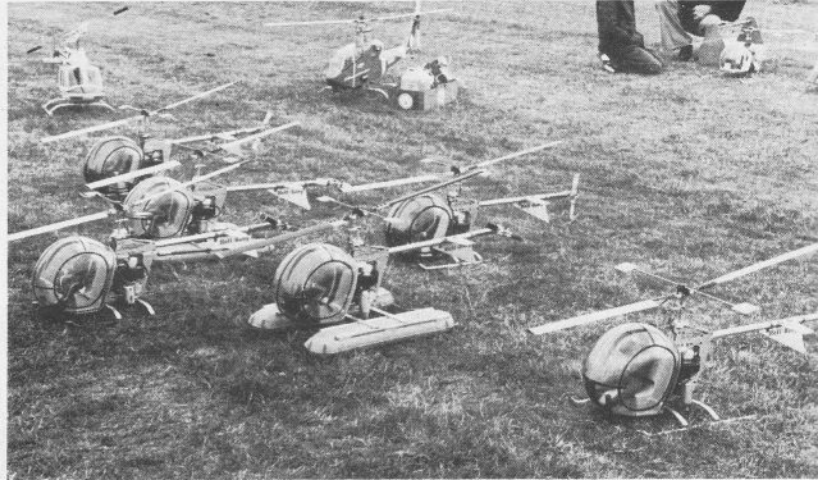


YOUR FIRST R/C HELICOPTER F(r)IGHT!



HOW TO SURVIVE

PART 2

By

DAVE NIEMAN

LAST month we covered the choice of model, radio, motor, building, etc. This month I will try to pass on as much information as I can to help keep your helicopter intact through the early stages of learning to fly.

Having completed your model, there are a few items of equipment left to acquire before you can fly it. Starter, battery, fuel pump, glow lead, fuel, etc.

Most helicopters are designed to be started with an electric starter, either with a belt or a conventional cup direct onto the motor's crankshaft. Some of the smaller models can be started by other methods. Although lashing away with a length of cord may perpetuate the pioneer spirit, it is far easier and less frustrating to use a starter. There are many home made starters in use, most of which are adapted from car or motor cycle starter motors. Apart from being bulky and heavy, these tend to be rather aggressive to use. If the motor floods and results in a hydraulic lock there is a danger of bending the conrod or causing damage to the piston or ring. Also, if the starter runs at too high a speed, the clutch can engage, causing premature wear and making the motor difficult to start. There are several good proprietary starters available. Two of the most widely used where starting by a belt is called for, are the Challenger II and the Sullivan. Both of these are of the ungeared type and come with a pul-

ley which is suitable for use with helicopters or boats.

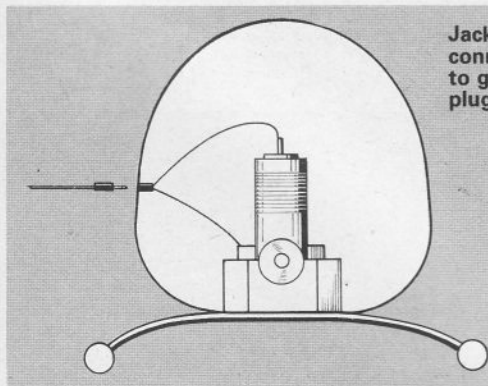
If you are lucky enough to be able to get your car onto the flying site, then there is no reason why you should not use its battery for starting. But don't fly near cars. This point was pressed home recently when a fixed wing model belonging to a fellow club member did a high speed touch-and-go off the roof onto the bonnet of a car. It carried on inverted for 50 yards or so until it finally piled into the tarmac. The whole event was extremely spectacular, but it happened to be my car!

If, as in most cases, you have to carry your gear any distance, then use a smaller battery. A 12-volt motor cycle battery, or two 6-volt types in series will do. There should be no need for an expensive heavy duty battery, as once you have the motor set up properly and you develop a starting technique, the battery should stay healthy with a regular charge. On some batteries it is possible to take a 2-volt tapping for the glow plug. If you have the type of battery that is fully sealed with only the positive and negative terminals showing, you can often locate the connecting straps between the cells by carefully drilling through the top of the battery case. Often, this position can be identified by a small hole or slight depression in the sealing materials. If this is not possible, or you have any doubts, then you will have to use a separate 2-volt battery.

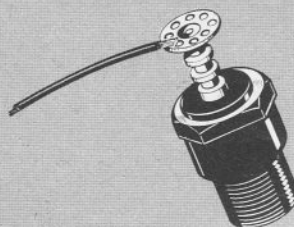
On models where the motor is exposed, you can use a normal glow clip. If you have one of the larger models where the motor is often buried deep inside the fuselage, it can be a nuisance having to remove and replace a door or canopy as part of your starting procedure. A tidier method is to fit a small jack plug or similar connector to the side of the fuselage. Connect one wire to the glow plug and one to an engine mounting screw, or to the bed plate if it is metal. To attach the wire to the glow plug I use a very small crocodile clip. If you get the correct size, it is possible to push it right down onto the plug without shorting out on the plug body. An alternative is to use a snap fastener, the kind used for dress making. Just solder the female part of the fastener to the wire and snap onto the glow plug. They are available in several sizes and will fit most glow plugs.

Fuel

There has been a lot of rubbish talked about the great Castor-V-Synthetic oil saga. There have also been several good articles written on the subject, so I do not propose to add to the controversy. I will just state my own personal findings and let you make your own choice. It is an accepted fact that castor is more tolerant at extreme temperatures, breaking down slightly slower than a synthetic oil. But if the use of castor gives a few degrees grace, or a couple of clicks leaner on the needle, then

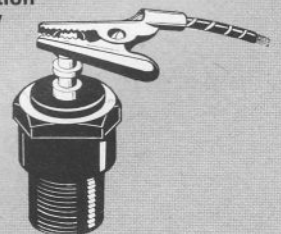


Jack plug connection to glow plug



Snap fastener connection to glow plug

Alligator clip connection to glow plug



motor cooling is too marginal and needs looking into. The deposits built up by burnt castor both inside and outside the motor are often very difficult to remove. In cold weather the treacle-like residue from the exhaust is really messy. You may say "he doesn't like getting his fingers dirty", but using a synthetic oil spoils you. The exterior of the model is easy to clean and you don't get the build up of muck around the mechanics and other awkward places to clean. With a synthetic oil, the piston and cylinder can stay perfectly clean indefinitely if you don't run the motor too lean. Should an overheating situation occur, the resultant deposits are quite easy to remove. For all my models, I use a mixture of 75% methanol 20% ML70 5% nitro. With castor costing as much as 30% more than synthetics, there can be a considerable saving on your modelling budget. During a fourteen month period with my first helicopter I went through 40 gallons of fuel and then gave up counting. I would suggest that the use of these perfectly good substitutes for castor has been retarded mainly by the panic merchants and in some way by model shops, who, not wishing to get involved, just cater for the popular demand. This is understandable of course, but the whole situation is self-perpetuating. I know people who still blow up motors even after switching to castor, because they run too lean. Enough of this biased propaganda, I said that I would not stir it up again.

Fuel Pump

You will need a pump to transfer this controversial liquid to your model. There is a wide selection to choose from, both electric and manual. Some are better than others, but one to avoid is the cheap automotive screen washer pump. The materials used in this type of pump are not usually compatible with glow fuels. In some cases the seal between the electric motor and the pump housing leaks, ruining the motor, or worse still, the tips of the impeller blades break off and end up in the fuel system of the model. Two or three of these blades in a filter could restrict the fuel flow enough to stop the motor.

Transmitter

Many people fly helicopters without using a neck-strap, just holding the transmitter and operating the sticks with their thumbs. A model helicopter's movements can be a little unpredictable when first learning to fly, calling for some pretty fancy footwork. Therefore, it is advisable to have the transmitter attached to you, unless of course you prefer to throw it away and run! I strongly recommend using some form of holder or tray for the transmitter. This device can be very comfortable and provides a good stable platform, so that your hands and the transmitter are one unit. The one that I use is manufactured in Germany and to my knowledge there are none commercially available in this country at present. It is a simple job to make one and well worth the effort. You may find it more comfortable if you fit longer knobs to the control sticks with or without using a tray. Talking of control sticks, I fly with no springs on mine as I find it much



smoother to fly and easier to produce those nice scale-like co-ordinated turns. I think the springs centring the sticks are of no real use with a helicopter. They may even be a hindrance, as quite small but continual movement is used in some situations and the stick is being moved diagonally for most of the time. Unlike some fixed wing models, you can't rely on the centres to keep a helicopter level for any length of time. Providing the model is trimmed correctly and especially if you use a tray, you find that the hands take up a centre position quite naturally, in fact so accurately that the trims are used in the normal way. As an experiment I have passed the transmitter over several times to people that did not know there were no springs and it was surprising how few noticed their absence until told. Concentration is really at a peak when flying choppers, so the resistance of the springs felt through one's fingers must surely constitute a minor distraction. Perhaps it is significant that many of the leading European fliers do not use springs. Before passing judgment, give it a try.

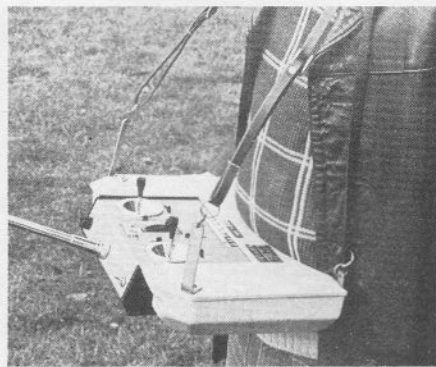
The sort of equipment accumulated when flying choppers differs slightly from fixed wing. Screws, Nuts, Spanners, Sockets, Pitch Gauges, Spares, etc., make it necessary to use a decent flight box. The instructions for the Graupner Bell 212 give drawings of a useful flight box which also doubles as a stand on which the model can be placed for starting purposes. Something along these lines suitably modified to take your own personal goodies would be very handy.

From here on, let's assume that you have not been able to enlist the help of an experienced helicopter pilot. Something worth mentioning at this point is that not all good pilots are good teachers. Your club's resident prima-donna is not necessarily your best choice of instructor.

The last and most important item on the list is a good assistant. Ideally he should be someone who is keen but not too pushy, to lend a hand, give moral support and encouragement. Although difficult to find, such a person can be a real asset to help you through the initial stages. Also very useful to carry the heavy gear!

Safety

Before venturing out to the field, stop and think for a moment. The machine you have created offers a real challenge, a great deal of



Author's recommended method of mounting a transmitter to fly an R/C helicopter. Cradle arrangement leaves hands entirely free for control manipulation. This rather smart unit comes from West Germany but anyone capable of making an R/C helicopter should be able to copy it without difficulty.

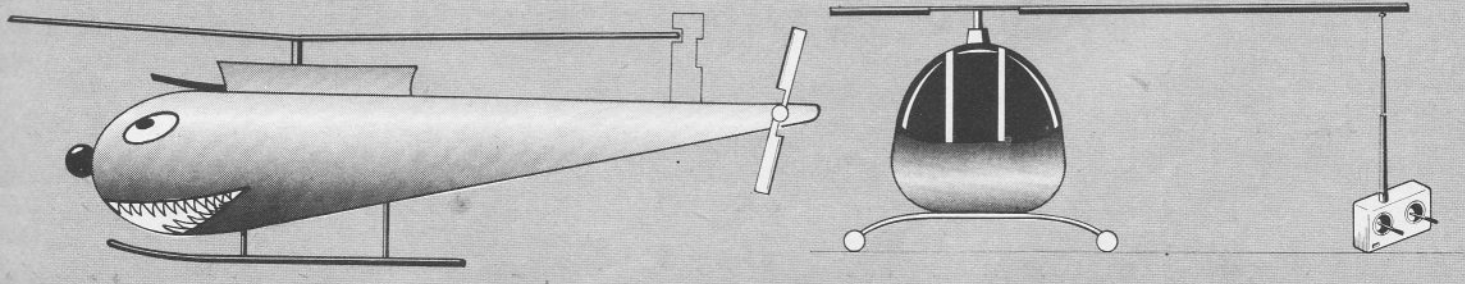
satisfaction opening up new horizons and adding a whole new dimension to your flying. But these rewards don't come without a certain amount of potential dangers, all of which can be minimised with a little commonsense and patience. Don't be frightened of the model, but treat it with a healthy respect. Do not underestimate the forces involved in all those rotating parts. As you would not dream of poking around under a motor mower whilst it was running, likewise keep a safe distance from your helicopter when it is doing its thing. Should you become a little blasé about the dangers, something to bear in mind is that in some cases, the tip speed of the main rotor blades can reach over 250 m.p.h. and centrifugal forces acting on the blades can exceed 250 lbs. If the rotors were to hit you on the head, you'd know all about it, then again - you probably wouldn't. If you have any reason at all to doubt the reliability of the model or the radio, then DON'T fly it. Avoid flying near obstructions such as buildings, trees, cars, etc. as apart from the obvious dangers the turbulent conditions created by these in even the slightest breeze will make flying very difficult. DO NOT fly near or over spectators or other fliers, at any time. 11 lbs. of whirling and thrashing machinery dropping in unexpectedly will do little to enhance relations with fellow man.

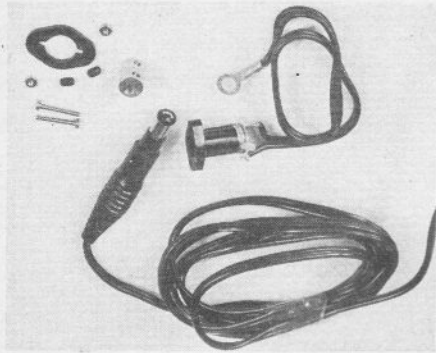
Off to the field

You will probably be very proud of your model and eager to show it off to the rest of the lads. This is only natural. But you can do without an audience on the first outing as you will be pretty busy and any distractions at this critical stage could mean costly mistakes. Therefore, it is better to find a quiet spot away from it all to carry out the initial adjustments. Model helicopters are still a novelty and consequently they attract a lot of attention, so on your first trip to the local flying field BEWARE!

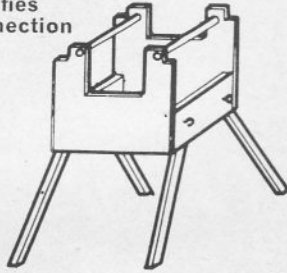
Don't leave your model unattended, be-

Two methods of checking blade track.





Left: purpose-made for R/C helicopters is this Jack plug unit from Schuco Hegi which simplifies internal connection to glo-plug. Right: a workstand like this is preferred equipment for convenient handling of an R/C helicopter.



cause the "How's it work" and "What's this for" brigade are everywhere. They are usually well meaning but notorious for blade tweaking and tail rotor kicking, which, if passed unnoticed, can be extremely dangerous. When all the questions have been answered and all curiosity satisfied, at the risk of appearing unsociable it is best to move away from the main group, ensuring of course that there are no frequency clashes. Set up at a safe distance where you can still be seen, but out of the path of other models. For some unknown reason there are a few unenlightened fixed wing fliers who have a real aversion to helicopters. Happily they are a very small minority. During training the model spends most of its time on or near the ground and you can be droning your way through a tank for up to half an hour or more so even the most amiable of your fellow club members may get a little disenchanted with you once the novelty has worn off. This is another reason for keeping your distance.

Once you are set up, carry out the prescribed range check for your particular radio gear. Although this first outing may be only to carry out adjustments, it is as well to get into the habit of doing a pre-flight check. Something along these lines:

- Check for damage in transit.
- Radio charged and operating properly.
- Rotor head correctly fitted.
- Main and tail rotor blades secure and undamaged.
- All ball links secure and in good condition.
- Tank, fuel, and pressure lines secure and undamaged.

All these are quite easily checked, but the more involved items such as all nuts, bolts, couplings, drive shafts, push-rods, servos, etc., should be inspected as part of your routine maintenance and not left to be done on the field.

Only when you are completely satisfied that all is in order should you attempt to start the motor. Pump in only half a tank of fuel initially. This will reduce the risk of flooding and, if you are not running on pressure, will give an average fuel level to adjust the mixture. Switch the radio on, open the needle valve the required amount and prime the motor if possible. I usually pinch the pressure pipe and gently squeeze the tank. If direct priming is not possible, then open the throttle fully and without connecting the glow lead, spin the motor with the starter for a few seconds. You can tell when the fuel has been drawn into the motor by a slight increase in r.p.m. Always ensure that the starter rotates in the correct direction. When starting a model with a belt, keep the starter at right angles to the belt and use only sufficient downward pressure to spin the motor. Check that the belt is properly engaged in the pulley and not on the clutch drum, otherwise you could turn the rotors even though they are being restrained and give yourself a thick ear. Having primed the motor, **close the throttle and advance the trim lever a little.** Get your faithful assistant to hold the rotor head, taking care not to grab any links or push-rods. Connect the glow lead, engage the starter and away you go. If the motor bursts into life and stops just as abruptly, it is probably too lean. Open the needle a little. If it starts, four strokes and then fades out, it is too rich and needs leaning off. If

the motor only turns very slowly or intermittently, it could be flooded, although the same symptoms can arise when the motor is very dry. To check this, give it another prime. If it starts now it was dry, on the other hand if the situation was aggravated by priming and the thing is locked solid, then you were right, it was flooded. But you will know in future. To clear a flooded motor, the quickest way is to remove the glow plug and washer and turn over with the starter for a few seconds, placing a rag over the motor to save covering yourself and the model with fuel. If the motor does get flooded or just refuses to start at all, don't keep bashing away with the starter until you flatten the battery, find out why it won't start. Fuel, plug, lead, battery, etc. Once the motor has started, let it idle with the clutch disengaged. The safest setting for the low speed mixture is one which will allow the motor to idle consistently, but when opened up does so with a slight hint of being rich. Avoid an ultra crisp idle and instantaneous response to throttle opening, at least until the motor is fully run in and you are familiar with its characteristics. The main needle is adjusted at full throttle. Set it on the rich side just breaking into a four stroke. Set for a satisfactory top end mixture, some motors may run too rich at about mid range which is where most of your training will be done. This state is particularly likely if the fuel system is not pressurised. If mid-range over rich state exists, then lean it off a little but not at the expense of being too lean at full power. Don't tether the model to carry out this adjustment as the rotors are obviously turning at very high speed and should anything come adrift, there is a risk of serious injury. Another method which I feel is courting disaster is one which is advocated in some quarters for adjusting and blade tracking. It requires you to hold onto the tail boom with your fingers inches away from the tail rotor and open the throttle until the model lifts off into the hover. If you perform this operation correctly, you should end up with everything screaming away at arms length and the main rotors nicely placed at eye level. To place yourself in such a vulnerable position, particularly with an un-flown model, requires a certain amount of nerve and an empty space in the brain which used to house the instinct for self-preservation!

I think the safest alternative is to get the whole thing above head height. Make sure there are no spectators around, start the motor and have your assistant hold the model level by the skids over his head. Both man and model should be facing into wind. This way the motor can be adjusted quickly and accurately without the risks involved with the other methods. The motor will probably require further adjustments when it is properly run in.

Blade Tracking

An experienced chopper pilot can gradually lift the model into the hover checking the blade track as he does so. Obviously this is not practical for a novice, so the model will have to be held over head again. First set the pitch of the blades to the exact angle as per the instructions. Then check the static level of each blade. To do this, place the transmitter on the ground and extend the aerial until it just touches the tip of one blade. Rotate the head 180° and check

the other blade. If the level differs adjust whichever blade is necessary to achieve the correct coning angle (Dihedral). A nicer way of checking blade level is to use your pitch gauge. Place the gauge on the rear of the fuselage and put a mark or cut a notch at the level the blade should be.

To facilitate blade tracking, the tips should be marked with contrasting colours. Have your assistant hold the model over head, then open the throttle until the model is just supporting its own weight, giving you a nod when the model reaches this light condition. Accurate blade tracking cannot be obtained by running the motor at full power whilst the model is being restrained, as this creates an abnormal rotor disc loading. Stand to one side and observe the rotor tips, they should both be rotating at the same level. If they are not, stop the rotors and check with the pitch gauge. You will probably find that one, or even both, blades are out of pitch. If so, adjust and check again. If both blades are correct according to the gauge, but rotate at different levels, this is probably due to the blades having slightly different aerofoil sections or being of different densities. If this is the case, then adjust one blade up and the other down until they both rotate in the same plane.

Adjustments may have to be repeated whilst the rotors are settling in or after a heavy landing. If you neglect this adjustment, the model will become more difficult to control and will certainly suffer from vibration. Remember, during adjustments with the model overhead, always wait until the rotors have come to a standstill before lowering the model.

The last item to adjust is the tail rotor pitch. Place the model on the ground nose into the wind, with the motor running and stand behind and to one side of it. Open the throttle slowly and note in which direction the tail tends to swing. If you can't counteract the swing with the trim lever, then stop and adjust the tail rotor pitch on the model. Correctly adjusted, the model should remain fairly straight up to the point of lift off. This adjustment is less critical if there is a breeze blowing, as the model will tend to weather vane and dampen the tendency to yaw. This brings us to one of the most important rules of training, that is, do not watch the tail rotor. For example, if the nose of the model swings to the right, the tail will move left and if you are concentrating on the tail you will automatically try to counteract by giving right rudder. This will only aggravate the swing to the right. Therefore it is important to stand behind and to one side of the model and watch the front half of the fuselage only. Standing in this position and concentrating on the front, you are able to detect any unwanted movement in all directions, pitch, roll, yaw. Also the control input on the tail rotor will be a natural reaction, although maybe not very rapid at first.

Your antics to this point will no doubt have attracted the inevitable audience. You must discipline yourself, ignore any sarcastic comments and resist any pressure to fly your model around. They would not be so keen if they had built and paid for the model. Even though you may be an accomplished fixed wing pilot, any circuits attempted now may achieve some degree of control whilst flying round but will almost certainly lead to a disaster on the approach and landing, so it is far better to be a little humble at this stage. Having completed all the initial adjustments and trimming, you are now ready to go to it. I personally found the training stage to be the most enjoyable and rewarding part of the whole scene and I hope you do the same.

Some of the comments I have made may appear rather scathing and a trifle "holier than thou", but they are made in good faith and with a sincere regard for your welfare and safety. Believe me, success and satisfaction will come a great deal easier if the proper techniques are used during the construction of your model and a sensible attitude is adopted towards safety.

(To be concluded)