Do I Really Need a Helicopter R/C System?

by David Brand

A very reasonable question, especially when you consider that all early, available commercial helicopters were flown initially with standard, four channel proportional, radio controlled systems, way back in 1972. However, that last statement also contains the very reason why all the recognised experts now use a specialist helicopter R/C system. It is simply that the latest model helicopters are extremely sophisticated machines that can out-manoeuvre their bigger brothers, in many respects, and in order to obtain this kind of performance, e.g. autorotation, roll, loop, inverted flying etc., a modern R/C system capable of providing the necessary mixing and control functions is mandatory.

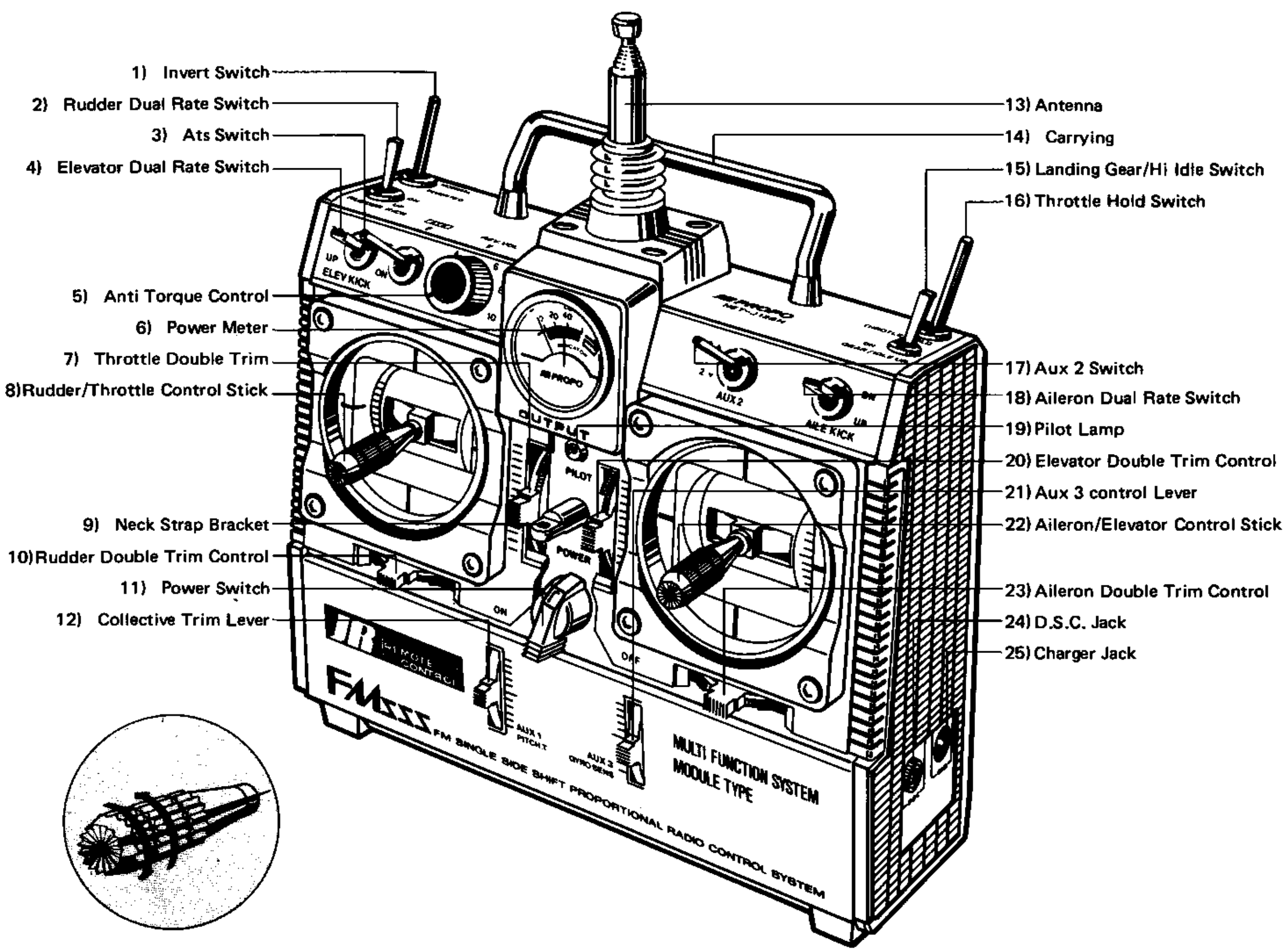
Hold on! – you rightly say. I am not into fancy aerobatics yet, all I want to do is to be able to fly a helicopter competently enough, so that I can take it home in one piece afterwards. Fine – then you have an even better reason to need a helicopter R/C, because it will automatically compensate for the peculiar torque effects that are produced, allowing you to concentrate on flying the machine, rather than fighting it. Incidentally, while we are on the subject, if you are a beginner, always seek the assistance of a skilled flyer to check and trim your model correctly – it goes without saying that all the established specialist helicopter retailers will provide this service, for **their** customers.

One final, but extremely useful advantage, is that the pitch trim, tail rotor torque and gyro sense can be adjusted from the transmitter, which results in a tremendous work load reduction, when trimming the model.

Having outlined the reasons for purchasing a helicopter radio control system, let's see if I can explain what it can do. We'll begin by defining the two main types of helicopter:

a) **Non-Collective** (fixed pitch). Where the main rotor blades are tilted via swash plates for control in the pitch plane (elevator) and roll plane (aileron). However, the pitch angle of the main rotors, once set mechanically, is fixed, and this type of machine climbs or descends on variations of engine rpm.

b) **Collective** (variable pitch). In addition to pitch and roll control, the main rotor blades of this type of helicopter have their pitch angle controlled by a fifth



servo, plugged into AUX 2 of the receiver.

This servo, and the throttle servo, are both operated by the throttle stick, so that on opening the throttle the main rotor blades will go into a higher pitch in conjunction with increased rpm, allowing the helicopter to take off. Although more expensive, this type of helicopter is both smooth and positive, giving a greater degree of control plus the capability of advanced aerobatics.

The first problem is to maintain the tail of the helicopter steady, by overcoming torque changes caused by throttle operation. This is carried out by judicious use of the tail rotor, and is an acquired art. Luckily there is an operating system that carries out this function automatically – it is called ATS. This stands for Automatic Tail Stabilisation, and comprises two parts Acc. (acceleration) and Rev. (revolution).

Acc. On opening the throttle a helicopter will swing in the direction of torque. When the main rotor speed has built up, this torque will decrease allowing the helicopter to return to its original direction. We therefore need to give an adjustable amount of opposite tail rotor on opening the throttle, to compensate for this effect, but it must also have an adjustable delay time, so that there will be no compensation once the main rotors have reached the desired rpm. This is provided by the Acc., which compensates for the swing by giving an adjustable amount of opposite tail rotor control, combined with a variable time delay which will return the tail rotor servo to its original hovering position after the rotor speed has increased, maintaining the helicopter on its original stable heading.

Incidentally, the amount of compensation is also proportional to the rate of movement of the throttle stick, i.e. quick movements of the throttle will produce large correcting movements of tail rotor servo, from the Acc.

Rev. Normally in the case of collective pitch helicopters, there is a continuous torque effect once the helicopter has reached a steady state operating rpm (e.g. in the hover position).

The purpose of the Rev. controls is to overcome this effect and maintain the tail steady under these conditions.

You can now appreciate the advantage of ATS in that once having had it set correctly by an expert, a beginner can operate the throttle without the helicopter revolving.

Remember, flying a helicopter is a delicate balancing act, requiring the interpretation of its movements, and operating four controls simultaneously that also interact. The ATS, although it will never fly the helicopter for you, will control the tail – leaving you to concentrate on rpm, pitch and roll.

Hovering Point Throttle. If the engine stops in a non-collective pitch helicopter, you will see one of the quickest conversions of a flying machine into a falling brick.

In the case of a collective pitch helicopter, and provided you have enough height, you can pull the throttle stick back – putting the main rotor blades into fine pitch. The model will gain speed on descent and then when it is approximately two metres above the ground, open the throttle and the blades will go into coarse pitch, slowing the helicopter down and hopefully it will land with little damage. The engine having stopped, will obviously not rev up on opening the throttle.

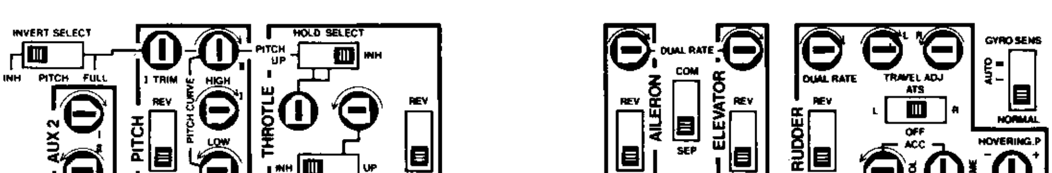
With the throttle hold feature, you can now repeat this stunt quite deliberately. Having attained altitude, simply throttle back. The main rotor will go into fine pitch, the engine rpm will reduce to a fine tickover, and the helicopter will drop. Flick on the throttle hold switch and this will isolate control of the engine from the throttle stick. Again when the machine is approximately two metres above the ground push the throttle stick forward, the main rotor blades will go into coarse pitch, the engine will remain at tickover rpm and the helicopter will slow up and land. One word of caution. When you switch the throttle hold off, make sure that the throttle stick is in the tickover position. The helicopter, although dropping, must still be controlled to keep it level, and misjuding the point at which you go into coarse pitch could be expensive. You would be well advised to seek the advice of an expert before carrying out this manoeuvre.

Pitch Curve. These two extremely useful presets are used to match the engine torque curve with the change in pitch of the main rotor. They independently adjust the pitch of the main rotor blades at low rpm and high rpm. Remember you will have adjusted the mid rpm pitch with the hovering point throttle control.

Idle Up. The purpose of this feature is to give a preset high engine rpm at a low throttle setting of the throttle stick, in order to maintain the engine at its best operating power band at low collective pitch. This is very useful for loops, rolls, reversals, etc., as it maintains rpm while the blades are in negative pitch during these manoeuvres.

Inverted Flying. When a helicopter is inverted the pitch plane (elevator) must be reversed, otherwise the machine would pull itself into the ground. The tail rotor, and consequently the ATS must also be reversed to maintain the correct control sense in relation to stick movement. All this is achieved by operating a single switch, when the helicopter has been rolled over. Incidentally, an inverted helicopter is more stable than when it is the correct way up!

After a short and simplified article like this, I hope I have given you enough insight to appreciate the advantages of a specialised radio control system for helicopters, mainly for two reasons. Firstly, it will assist the beginner by compensating for torque changes and secondly, it provides the means for advanced aerobatics, when required – well worth the small increase in cost over a traditional four channel system.



The reverse switches and trim controls on the back of the transmitter.