HOVERING ABOUT

WITH JIM MORLEY

Why Special Helicopter Version Radio Gear?

Being in the business of promoting model helicopters and the sport of radio control flying, I would be spoiling things for a lot of people if I were to say that special radio gear was essential but costs a lot of money! The fact that helicopter radios have been developed and sell proves that they are desirable. I will endeavour to explain why and perhaps, because the majority of readers are briefed in fixed wing flight, I can best do so by pointing out the differences and the similarities.

Loosely speaking, in forward flight a helicopter can be flown in exactly the same way as a fixed wing aircraft. That is, forward stick on elevator (forward cyclic) will put the nose down and increase speed, back stick for up. In the same way sideways movement on that stick causes roll, aileron if you like, or lateral cyclic. Cyclic control of the rotor blades is applied through the swash plate and changes the blade pitch as they rotate — cyclically.

A third control channel, rudder if you like, is coupled to the tail rotor. Generally with helicopters you have to do co-ordinated turns, that is apply lateral cyclic and tail rotor, in order to get a smooth turn. The fourth channel is where the differences start, forward and backward on the same stick as tail rotor (usually) controls not only the throttle on the engine but, on all but the primitive cyclic only models, collective pitch on the main blades as well. That is, the change of pitch on both, or all blades together for the purpose of more or less lift — collective control.

Now, since the tail rotor is there to react against the main rotor torque and stop the airframes going round in the opposite way to the rotor, obviously the first special helicopter radio requirement is to be able to feed in a little extra tail rotor pitch with main rotor pitch. So you have *Collective/Tail Rotor Mix.* The next special requirement is not so obvious, it can be called Pitch Trim.

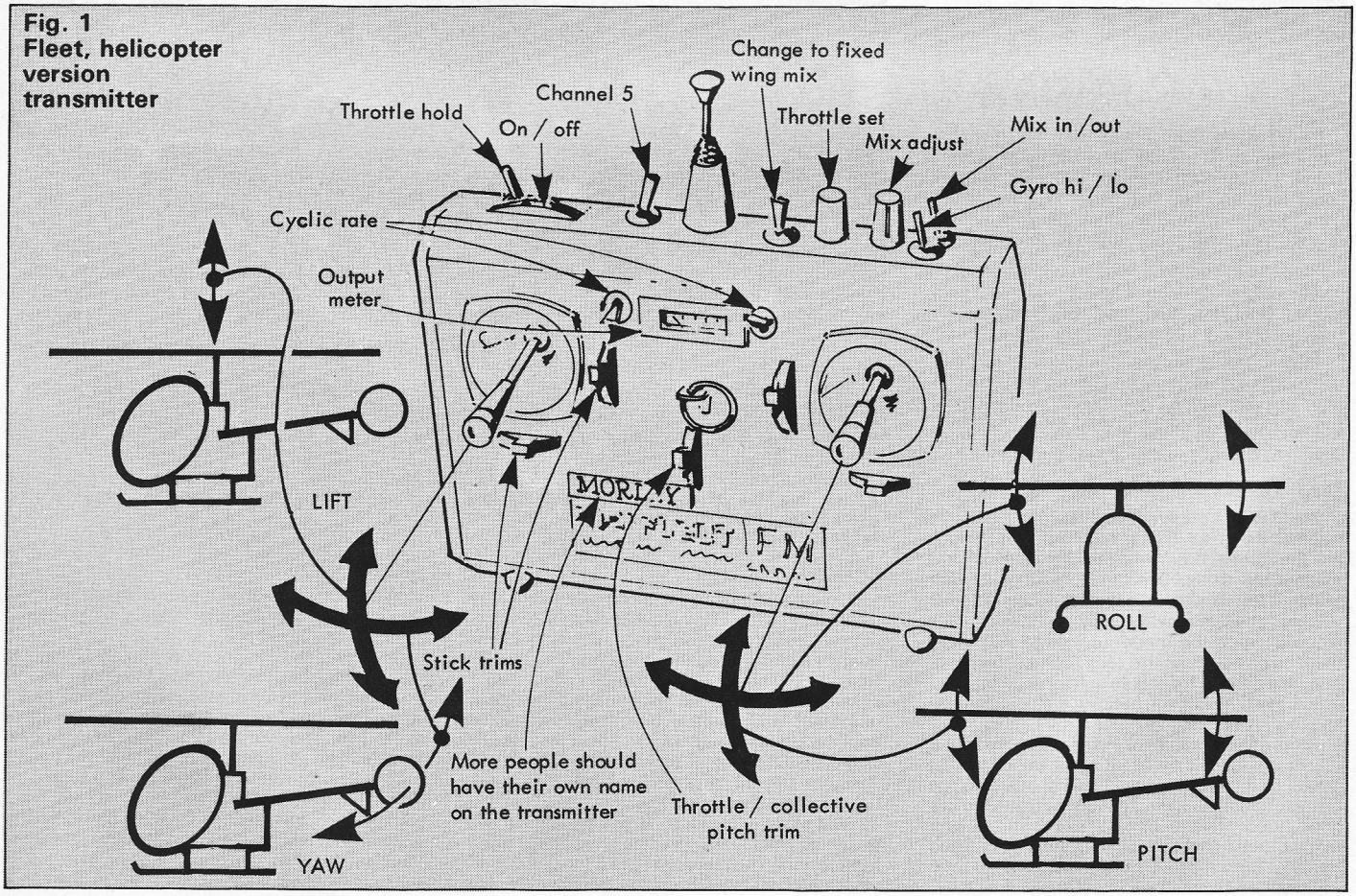
Pitch trim is the facility to change the setting of the collective relative to the throttle, and can therefore accommodate the variations in efficiency of the rotor and engine with ambient conditions. You get a lot more lift from the rotor at a given speed in cold damp conditions than you do in hot or high altitude thin air. Normally this can be corrected by a quick tweak on the rotor head links after you have test flown and decided that rotor speed is too high or too low. Given a seperate servo for throttle and collective (very often this simplifies installation too) the pitch trim control on the transmitter will give the equivalent of that physical tweak of the links and it can be varied in flight. With 2 servo systems the rotor can be speeded up for an aerobatic manoeuvre and slowed for an impressive scale-like approach and landing. a refinement of that is changing the shape, or rate of control movement at one end of stick travel compared with the other. This is normally done by having the take off point of the control rod to one side of centre on the servo disc, giving therefore more travel one way than the other (differential).

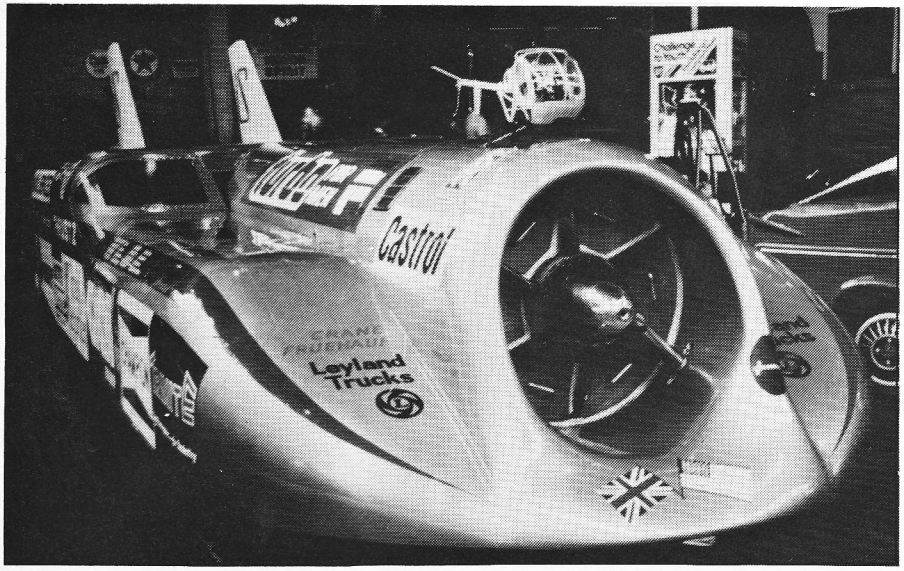
Another special, for autorotation descent practice, is *Throttle Hold.* This enables you to lock the throttle servo, and the transmitter stick then only controls the collective as you wish without interference from the motor. It can also be used as a safety device while carrying the model and transmitter with the engine running, or as a rotor brake by allowing you to put on full collective without opening the throttle after landing. It is usually set to hold the throttle at tickover but for some aerobatics you can adjust it to hold at full.

A desirable refinement of the throttle hold switch, and the latest idea, is to have *Fast Idle.* This means principally that your rotor speed doesn't drop embarrassingly in descent because you have set your fast idle switch at the point just before lift off, and the electronics in the box ensure that above this point the throttle travels normally with collective, giving more power as needed but below it the collective operates on its own. This is going a long way towards making for easier setting up of the throttle and collective relative movements which make so much difference and are so necessary for the optimum flying characteristics of a model.

Also there is the *Inverted Flight Switch.* Personally I am quite content with flying helicopters the right way up but for those with that ambition there can be a switch which reverses the direction of collective to throttle, so that 'up' is still 'up' with the model upside down and similarly fore and aft cyclic and tail rotor are reversed. Those who are

Fig. 1
Fleet, helicopter version transmitter





Left: Richard Noble, world land speed record contender in 'Thrust 2' has built himself a Morley 'MkIII Hughes 300' as a diversion from trying to beat 622mph. 'Thrust 2' has topped 615mph so far and further attempts are to be made this summer.

exponents of this art, trim the model in inverted flight and 'fly it' when it is the right way up.

The final special is a switch for the gyro. It is desirable to be able to switch the gyro out at some stages though normally they are left on all the time. Maybe this is because modern gyros can cope with aerobatic manoeuvres, there was a time when a model would 'kick' in a turn if fitted with a gyro system with too much gain. Contrary to instinctive thought, the additional gain amplifiers were for the bigger models not the touchy ones.

A gyro is a motorised flywheel which is mounted on pivots so that when it is subjected to a turning motion, the processing action generates an electronic output. The motor and flywheel are statically balanced so that only a turn generates output. The gyro does not respond to sideways, forwards or up and down movements. This output comes from a potentiometer, similar to that which controls your servo output position, or by a more scientific and friction free device such as an infra red detector, capacitance or magnetic proximity. The fashionable 'Hall Effect' device comes into this last category. All gyros have the motor/flywheel held relative to the model by springs to make it a rate-of-turn gyro, as opposed to a direction or heading gyro. If sensitive enough, and for small increments, a rate gyro is a heading gyro. The output signal is fed into the receiver and produces a signal to the tail rotor control servo and produces the same result as you would by operating the stick on the transmitter if you were aware of the need. The gyro is more aware than you and acts more quickly so smoothing out the flight.

Fleet helicopter radio

In the last 'H.A.' I said I would have some practical experience of the *Fleet Control Systems* helicopter version radio and would be able to relate this first hand.

General impression of the outfit is very favourable, the appearance being of a piece of technical equipment, which it is, and the feel and performance satisfying. Of course you can leave all the extra switches alone and fly your model using it as a straightforward four channel system and then introduce the extras as you wish. First thing to do is reverse the ratchet plate on the throttle stick to make it a smooth friction action suitable for a helicopter, I would also like a weaker centring spring on the tail-rotor control but that is a minor consideration.

The outfit has a switch to change the mixing from helicopter needs (Collective/tail rotor) to fixed wing needs (rudder/aileron) and with this in the right place you can control the amount of mix and switch it in or out. The directions of the mix can be changed by removing the transmitter back cover.

Separating the collective and throttle (fitting the fifth servo) was easy and the advantage of pitch trim was very soon apparent. At this stage I didn't have a gyro in the model.

Above: Vago Nordigan of Watford Model Centre, holds his Star Ranger 'Bell 222' at Woburn.

The outfit has performed exactly as I hoped in all conditions and all mishaps have been due to mis-use. On one occasion I was experimenting with setting the collective/tail rotor mix and doing full stick movement climbs. I hadn't, as I usually do, gone into the middle of the field and was on the downwind edge. After a few interesting lift-like ascents I tried a very abrupt stop to the climb and the model started to pirouette immediately above me. No panic, just the usual emergency action of forward on both sticks to straighten and climb the model out of trouble, but then panic, it was heading fast and straight for the poplar tree behind me. Rapid left cyclic and then full back cyclic put the model into a sharp turn but to no avail. It did a heavy landing, wall of death style, onto the side of the poplar tree.

The rotors were still turning, I hadn't shut down, and the model took off again but gravity was giving it an unhealthy yaw, (like taking-off in a strong sidewind), and it fluttered downwards looking very confused. Recovery was made at an altitude of approximately two feet.

On another occasion I again took-off with one of the rate switches in the 'low' position as it had been flipped over by the neckstrap. This I found very embarrassing as the model appeared O.K. in trim checkout before lift off,

Above: helicopters in the pound at Old Warden all scale day. Dave Nieman flew big petrol motor, pull-start equipped Hirobo.

and even in the hover, only to run out of control at speed and when the model headed downwind.

So you can see, I have had great fun experimenting with the extra facilities fitted to the helicopter outfit. *Century Systems* have had these available at a reasonable price for some time for the radio kit builder, but now for very little more than the average outfit, the *Fleet Control Systems* outfit will provide you with helicopter specialities plus fixed wing ability.

If you are about to change from two channel and may well wish to fly a helicopter, or fixed wing and want the specialities to suit, then the *Fleet Control System* Helicopter outfit must be considered. I wouldn't like to be without the pitch trim now. Needless to say I didn't have the inverted flight switch fitted, which is available as an extra, and I shall probably use the very conveniently situated switch for 'hi-lo' of gyro for the retract gear on the *Agusta* 109, using the channel 5 switch by the aerial for the gyros. The servo reverse and throw adjust (inside the transmitter case) make the outfit far easier to fit to the model than the old idea of having to put servos in the right place. It also means, if you are prepared to swap plugs at the receiver, that a model can be changed from one flying mode to another reasonably easily. Very useful if your trainer or local expert uses a different stick layout.