

HOVERING

WITH JIM MORLEY

ABOUT

IS IT REALLY as difficult to fly them as they say? must be the most frequent question at exhibitions where the public are shown model helicopters.

I don't know of course how difficult 'they' have said it is, nor do I know exactly how to answer. It depends largely on the mood of the moment. Of course it's difficult, everything worthwhile is difficult. It's difficult to learn to ride a bike, drive a car, even play a computer game to win. What I do say is, if I've got the stamina left after the umpteenth time, is that if you want to fly a model, then a helicopter nowadays is very much easier than it was a few years ago (due mostly to being able to have the four controls at much the same rate of response) and that at least with a 'copter, you don't have to commit it at vast speed into the blue distant yonder. You can ease into it gently, learn to fly it while its still on the ground, and near to you. You can see what's happening, and if you break something you repair it, you don't have to begin again as very often happens with fixed wing.

Modern 'copters can be quite stable, as could the older ones if set up right, which is not always the advantage it may seem. Witness a story I have recently heard.

The model was an expensive one, new and with all 'mod-cons'. The flyer, though, thinks that perhaps he had the charger connected to the receiver all night instead of the receiver Ni-Cad — it's possible with some radio gear — and soon after take off the model circled up and away never to be seen again. Maybe we should revert to the system of putting name and address within the model, which is something not many helicopter flyers tend to do.

Memory Test

I hope there are enough regular readers of this column to justify a bit more space on what is now an old chestnut. The editor has received a letter: "while Jim Morley is very definite, not to say scathing, in his re-analysis of the 'Dangling Man' problem (RCM&E December 1983) I am afraid that he is also completely wrong".

The helicopter pilot won't be aware that he is doing anything but circling unless he looks at the ground, and the same applies to the 'Dangling Man'. The pilot won't have to do anything apart from whatever it is pilots normally do when circling, and Jim Morley's carrier-born R/C pilot wouldn't have to make power or trim changes either.

Think of it this way, suppose the helicopter and DM are circling in still air — a simple enough situation. Now suppose that the ground somewhere starts to move at velocity W ". There then followed 10 pages of mathematics to prove the point and two more correcting errors.

Thank you very much Mr. B, I'm glad you didn't interpret my ramblings as scathing; this is a hobby magazine and enjoyment the purpose. I don't want to upset anybody, but my immediate reaction to your letter was; are you a member of the flat earth society? I then gave it some more thought and wondered if I had forgotten more than I ever knew about inertia navigators.

My contention was that nowhere in the universe is there any still air, it is all travelling

at little bit more or less than the speed of the earth's surface, and secondly, if the ground starts to move at velocity W , then so does the acceleration due to gravity.

If you do have the helicopter circling in air that is 'still' relative to the earth's surface, your inertia navigator on the DM will give the same answer as the one in the car underneath him travelling at a steady speedometer speed. If however, the car is on an aircraft-carrier deck moving relative to the earth's surface, then the car's acceleration pedal will have to be used in order to hold position with the man while the inertia will still read the same.

I'm sorry Mr. B, I stand by what I said about accelerometers in the car and on the DM, and about the helicopter pilot having to make trim changes if the windspeed is significant. But you have made me realise I have a lot to learn about navigating a space ship.

Below: diminutive electric power R/C helicopter available as a kit from Ishimura in Japan. Power is supplied by an umbilical cord.



I had a belief that when setting an inertia navigator to go to a certain point, it is not set to the co-ordinates of that point, but to those of that position where that point will be in space when you get there. I now remember that one of the experiments that the astronauts were going to do on the way to the moon was to find out what happens to a gyro in deep space. If NASA didn't know then I don't feel particularly ignorant now for not knowing. I never did hear the answer and enquiries haven't helped. What does happen to a gyro in deep space? How does an inertia navigator work without gravity? What has this to do with a model helicopter? You're right! Try this one:

Two very large perspex boxes are suspended on an equally large balance. Each box contains an electric R/C helicopter, one of which is made to hover within its box. What happens to the scales' balance? The weight of the 'copter has got to go somewhere so don't be too hasty.

Scale Rotor Heads

While I've got you in an intellectual frame of mind (you must be unless you skipped over the last bit) I shall go a bit further into the question of response of cyclic control on a rotor head because flybarless heads, only for scale reasons are beginning to get about.

You may recall that is the 'copter comprehension articles I mentioned that response was like balancing a pole vertically on your fingertip. A broom handle is easy, except if you let it lean too far you can't move fast enough to get it back upright, and a pencil is

Below: Augusta-Westland EH101 1/32 model of type to succeed the Sea King in the mid 80's. Note the efficient and noise reducing Westland blade tips.





Above: Morley Helicopters Ltd stand at the Model Engineer Exhibitions. The marquee was also to be seen in the Avon Suite. N. Fuller's 1/7 Bell 47g and G. Bowd entered a 2c and H300.

nearly impossible requiring too quick a movement. I said that somewhere in between the pencil and broom handle is your optimum control speed. It's a bit more involved than that.

All helicopters, large full-size and agile models have pretty much the same maximum roll rate. When you consider how different the roll is on a Jumbo jet compared with a Pitts 'Special', let alone a model of one, this surprising. The other surprising thing is that the type of rotor head makes very little difference. Flybar, flapping, teeter, articulated or rigid. What is different is the rate at which they reach the maximum roll rate, the acceleration if you like.

The reason all helicopters have nearly the same maximum roll rate is partly by design — emergency manoeuvring near the ground — and partly because it's difficult to avoid, because rotors are designed to carry the load of the 'copter efficiently they come out something akin to proportional. The principal way it can be changed is rotor speed and 'Lock Number'.

Lock number is one of those peculiar numbers like Froude for water and Reynolds for air, except that it's more modern being inverted especially for helicopters. It is calculated using a mixture of aerodynamic properties of the blade and its inertia. Increasing rotor speed increases the maximum roll rate, adding tip weights decreases the Lock Number and the maximum roll rate.

Anyway, what it is that makes the 'feel' of the 'copter is the response to reach the roll rate and some rotor heads can accelerate two or three times as fast as others. We're talking about fractions of a second and in full-size they base comparisons on the time to reach two-thirds of the maximum. If you think about it you will see that a teeter head will make a slow start to its acceleration of the helicopter and then have to catch up. A flybarless head has tip weights added to lower the Lock number and the sensitivity, and we're back to scale model rotor heads.

Pilots of full-size machines have the advantage of such devices as stability and control augmentation systems to shape the control input to what the swashplate and rotor require, or can handle. With models



Above: one of the prototype Morley Mk 3 Augusta 109. This one made by Mike Young. Retractable gear will be in kit but not 4 blade rotor head available early summer.

there is a grave danger of over controlling with a very sensitive head, or if you cut down the control stick movement (rate switch) you can run out of sufficient control later on. Perhaps we have a need for non-linear pots on servos, as used to seem desirable on the steering servo in a model car.

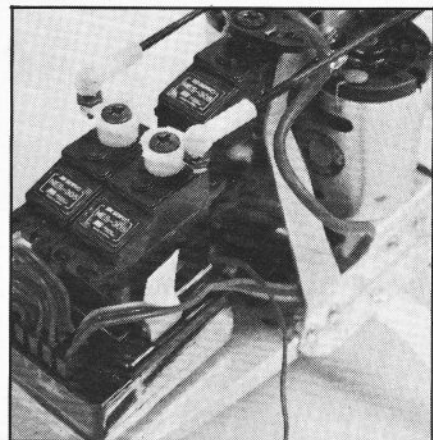
Of course the pendulum factor has an effect when the roll has reached a certain stage and the rotational inertia of the airframe make the response in pitch very different to that in roll, even though both are governed by the same cyclic power. Just as well, an impressive 'bank' is a lot less frightening than a violent nose up or nose down.

Scale, or flybarless rotor heads are quite manageable on models providing everything is just right. They will improve, what will be the breakthrough? Mechanical or pneumatic damping, or electronic devices?

Summer is icumin in'

Writing this in this chill of winter it's nice to look forward to interesting events in the summer months to come, I am very confident that helicopter activity is becoming more and more significant.

The long established Sywell event at Easter is moving to Cranfield this year, Sandown Park in the middle of May, shows off helicopters to advantage and then of course there will be the usual specialist events such as Woburn, Bretons, Slough — no dates yet so keep your ear to the ground, and there will be many lesser specialist



Above: 3 servos are fitted to the mini electric powered Ishimura helicopter. Speed control for the electric motor could be handled externally by say, a foot operated switch as no provision can be seen on the model.

events. If you want publicity in this column about three months notice is required. Bretons is again catering for the masses this year rather than being a bit upmarket like last year. The NRCHA are having European FAI Championships at Eibergan on May 18, 19 and 20 and an informal International meet at Ermels, Holland, on August 26th.

Seeing you hovering about.

Below: multibladed rotor heads will be seen more this coming season at scale events. Photo shows a 3 blade Morley A T head for Hughes 300 etc.

