Micro-Mold autogyro revisited

Written for 'RCM&E' June 1984.

In the November '82 edition of 'RCM&E', there appeared a kit review of the Micro-Mold 'Wallis Autogyro'. It must have been obvious to the more astute reader that the writer had some problems with this very early kit; some of which were not completely resolved.

Now, after many flights, much has been learned concerning the setting up and flight characteristics of this machine and the purpose of this article is to pass on what has been learned and to reassure any readers who may have been discouraged from trying the model.

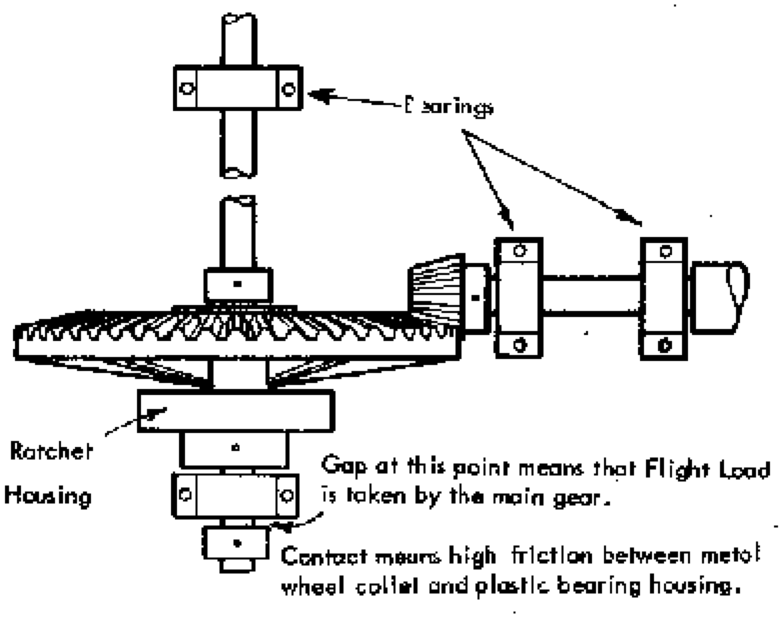
Take off and turn left

This mannerism, which was very obvious during early flight tests, can be put down to one thing only - insufficient rotor rpm.

The effect is most noticeable in calm or light wind conditions and when operating from rough grass surfaces. It can range from a gentle left turn followed by a loss of height up to a stall turn and crash. This latter is caused by lifting the model off with insufficient speed or rpm. Raising the nose will cause a temporary increase in rotor speed which will lift the model well clear of the ground despite it not having enough air speed. Fortunately, damage is usually light.

Mick Harris produced the first real clue to a solution for this behaviour, when he mentioned that his own model had been much improved by adding a plug washer between the lower shaft bearing and the load carrying wheel collet on the shaft. Investigation of the writers model showed that there was a gap at this point and the shaft load was being taken by the main gear. (See Fig. 1).

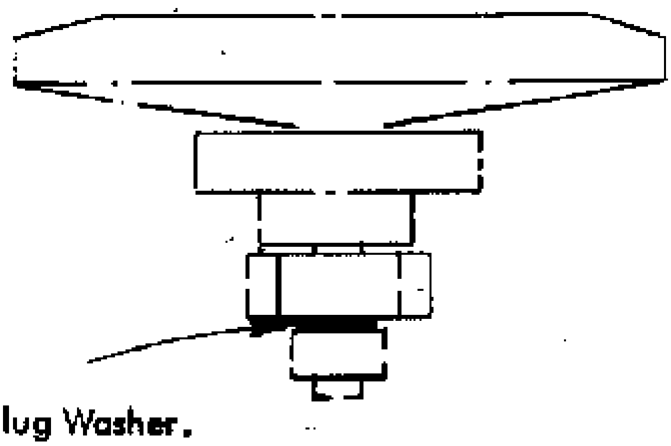
Fig.1



On dismantling the model, it was found that the plastic housing of the lower bearing had evidence of wear caused by contact with the wheel collet. Therefore, under *flight loads* the main gear was deforming enough to permit contact at this point. This led to considerable drag on the shaft due to the gear bending and the metal to plastic contact was responsible for a large loss of rpm immediately after take-off.

An ordinary copper glow-plug gasket is exactly the right size for inserting at this point and provides a complete cure! (Fig. 2). If you do lots of flying however, it would be advisable to replace it from time to time.

Fig.2



I would reinforce the advice given in the handbook to the effect that the fuselage should turn round at least four times when spun while the model is supported from the rotor shaft. This is a good test of bearing and drive train freedom, but only under *static* conditions.

The clutch

In the original review I stated that I had better luck with the clutch converted to a trailing shoe layout rather than leading shoe as designed. Well, er, yes, that WAS true for the first dozen flights or so, but eventually there was not enough drive to spin up the rotors and it was returned to a leading shoe type.

The amount of oil needed for correct operation becomes markedly less critical after lots of flights and eventually ceases to be a problem. Access to the clutch is remarkably simple, which makes experimentation, and conversion, very easy.

Flying

As previously mentioned, the take-off is much easier from smooth surfaces and/or with some wind, since it is essential that the model is allowed to fly off the ground at a normal angle of attack rather than be hauled off at a high angle of attack. Since an Autogyro cannot stall, in the normal sense, there is virtually no limit to the take-off angle, so be careful

If you do leave the ground at a high angle, apply full down until the model returns to level flight, be ready to correct with rudder as necessary, and expect a loss of height. Remember that down elevator on an Autogyro means lower rotor speed. Hitting the ground in a nose-up attitude will maintain rotor speed and reduce the impact, but at the cost of greater risk of rotor or tail damage. Let the nose leg take the shock if necessary.

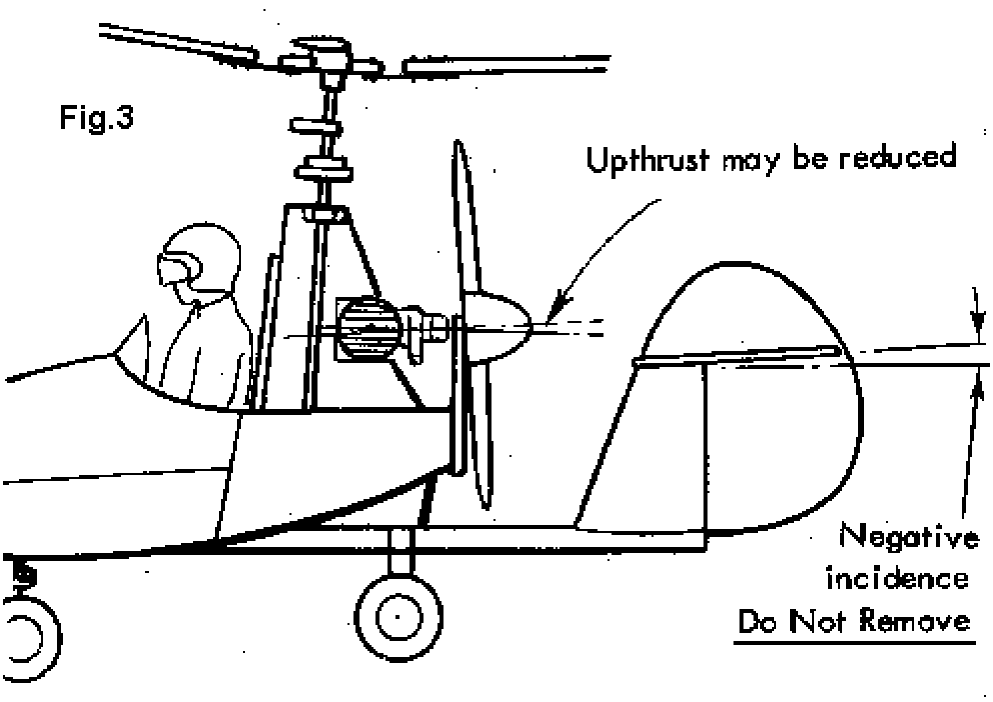
One of the problems caused by rough ground is that during the start of the take-off run, when rotor and ground speed are both low, the machine bounces around and the rotors may strike the ground.

Once airborne, the handling characteristics are similar to a high-powered fixed wing aircraft with a high lift wing section. Any excess speed will produce a zoom climb which is exaggerated by a sharp increase in rotor speed. Here again, a smart application of down elevator is the cure, but prevention is better. If flown around at full power it is almost impossible to trim for smooth level flight, so throttle back to a comfortable speed and use co-ordinated throttle, lateral cyclic (aileron) and rudder with the elevator used as little as possible.

In an attempt to combat this zoom characteristic, a new tail was built without the large amount of negative tailplane incidence which is a feature of the design. One flight was sufficient to prove that this wasn't the answer! When the nose dropped and speed built up, it was almost impossible to recover from the ensuing dive. The moral is obvious!

Here again Mick Harris has suggested a cure. (See Fig. 3). He has removed all upthrust from his model with encouraging results (I think it's upthrust - anyone care to analyse the force set-up on this model?). It does involve a fair amount of cutting and drilling however.

Fig.3



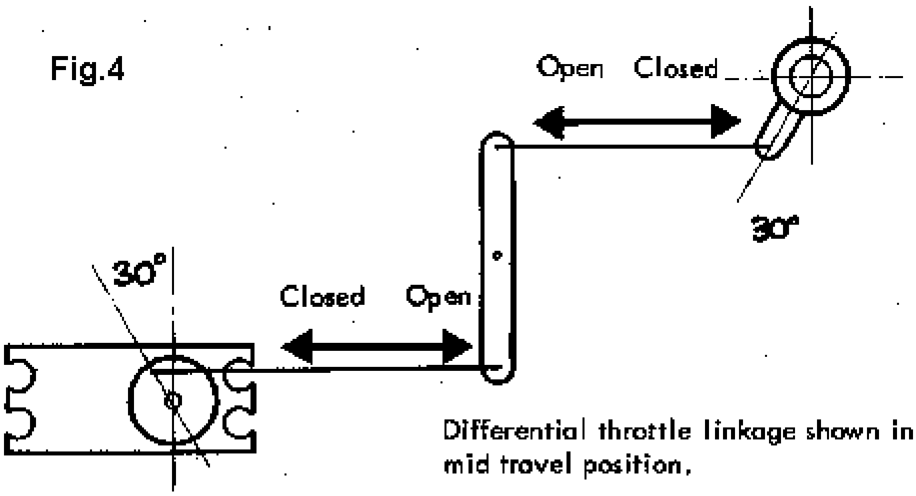
The problem here, of course, lies in the differing power requirements for this type of model. During spin-up and take-off, the motor is turning a high pitch prop (11" x 7.5"), and a 63" diameter rotor, so lots of power is required. Once airborne with the rotors freewheeling, the model is drastically overpowered and will fly happily on 1/3 power (Super Tigre G60 'Bluehead'). Flight speed is quite modest with the rotors turning much more slowly than the average model helicopter, which produces great realism. In fact, the appearance in the air makes it all worthwhile!

Don't be misled into thinking that a finer pitch prop would produce better results, however, it does not! Similarly, don't consider using a high performance 60 in the model. What is needed is a high torque 'slogging' motor with a good tick-over.

Landing

This is where that good tick-over is needed since you cannot simply close the throttle and glide down to a power off landing. Therefore, most of the flying is carried out between half throttle and a point above the tick-over which gives a reasonable descent angle. Some sort of differential throttle linkage is an advantage here (Fig. 4) or a helicopter radio with adjustable throttle response.

Fig.4



Differential throttle linkage shown in mid travel position.

Having started your approach, you will find the throttle has to be almost fully closed before the model will begin the lose height and you may find it necessary to do another circuit while you get the hang of it. However, you must keep enough power on to ensure that the model keeps moving forward and be careful with the up elevator to avoid a zoom. As you approach the ground, start feeding in up and apply a little power to maintain speed. If you get it right (I *did* once!), The model should touch down slightly nose high with full-up elevator applied. Close the throttle immediately and the landing roll should be negligible.

It is not advisable to taxi the model on anything other than smooth ground or in very light winds.

Going round again

If you land in the manner just described, don't be tempted to do a touch and go since the rotor rpm will be low and a very long take-off run will be required. It is possible to overshoot and go round again from the landing approach but do not just open the throttle and expect to resume flying. The rotor revs may be lower than the take-off speed and the freewheel on the spin-up mechanism may re-engage and convert your Autogyro into a helicopter. If you are very quick with the rudder (and everything else) you might make it, but rather you than me.

In this situation, open the throttle gradually and smoothly, and all should be well.

Some other hints and tips

The tail tilts to one side for starting and clearance is a little marginal for application of a starter (more so if flick starting). Elongating the slot in the tail boom helps a lot.

I have heard from at least two sources that some negative incidence on the rotor blades helps the take-off. I tried 1/2 degree negative with some improvement, but more than this will almost certainly cause a rolling effect in forward flight, so proceed with caution.

If, like me, you view the Velcro attachment of the pilot with suspicion, use servo tape to attach him to the nacelle top and Velcro to hold him to the bulkhead. A lump of balsa through the neck helps to stop him loosing his head in a crisis.

Attach the release loop and stake the model to the ground before starting the engine. You have more than enough to do afterwards.

Run up the motor and check that all is well without the main rotor fitted. Clutch operation can be checked in this condition and you are more likely to remember that the propeller is between you and the needle valve.

Rotor rpm prior to release is approximately 500 rpm on the review model.

Finally - a caution

Please remember that you have a 60 motor turning a hefty propeller right in the middle of your model. If you are careless when adjusting the needle, your fingers will contact the front of the propeller, not the rear as is usually the case.

When the motor is running, return the tail to an upright position carefully and tighten the clamp screw slowly and methodically, remembering that you are inches away from the propeller.

If in any doubt about anything, stop the motor before proceeding further.