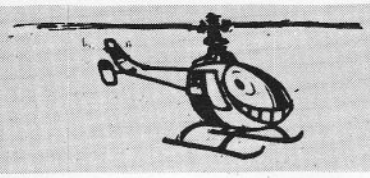


HOVERING ABOUT

I WONDER HOW many readers of the last *Hovering About* caught on to the error that crept in to the almost last sentence, and were amused, or if any dismissed it as something more from these complicated helicopter devices that they couldn't possibly try and understand?

I refer to the CLINICALLY controlled vanes at the rotor tips to give sideways thrust without tilt of the rotor plane. It should have read CYCLICALLY of course, changing the pitch during the cycle, or rotation. I would like to experiment sometime, but I fear it is yet another idea that has to be shelved while other things get done.

Not before time, I am told, I have at last finished the tooling for my new rotor head, production test samples being seen on my own and Warren Bayley's models at the Model Engineer Exhibition.

The 'Puma' had been entered for the M.E. Exhibition, of course, with weeks to go in order to finish it, and then it wasn't. I felt it better to support the Exhibition than not bother, so a lot of the Christmas period was spent making the 'Puma' fit to look at, but it was a little empty with no radio installed. The new rotor head in four-bladed form looked good, though it was a disappointment not to be able to say it had flown. Actually, the rotor head was tried by Bill O'Riordan and John Preston on his 'Jet Ranger', not very scale, though I understand *Bell* did make an experimental four-bladed head once. Anyway, with reservations, the head worked very well, I will be most interested to see the 'Puma' that John Griffiths has made with the *Schluter* four-blader from the *Bolkow,* a performance comparison will be intriguing.

My feeling is that flybarless rotor heads are very critical of rotor speed, variations of speed cause control phase lag (interaction of sideways cyclic on fore and aft cyclic and vice-versa) which make them a bit hairy at times.

An opening here for Peters, Christie and Valentine to design another electronic device (for *World Engines* to produce, like the gyro unit of last summer), that will govern the rotor speed. John Heaton has been very successfully flying all sorts of models flybarless, and demonstrated to me convincingly, but he did have very big weights in the rotor tips and this, because I have a feeling for mechanical things, makes me very uncomfortable. John sensibly keeps the rotor speed down and the weights act as a form of governor, in that speed changes are slow. I append an interesting graph to make experimenters beware. See Fig. 1.

While it may be true that because of its construction the *Morley* helicopter is the most appropriate for the Model Engineer Exhibition, I did wonder what has happened to all the others; I still think that helicopters are the most natural aircraft to have there. Still at least it wasn't left entirely to me to show the viewing public that helicopters exist, a second 2c by Mr. Lorenzetto supported Warren's Special 2c and my models. I was pleased, but let's have more next year.

New Morley rotor head

I could very easily have filled this issue extolling the virtues of this long-awaited item. Principal reasons for a replacement to the existing one are: (1) better scale appearance; (2) parts more easily produced; (3) bolt together for customer; (4) very versatile in use, different control set-ups easily adapted, such as introduction of Bell/Hiller mix and even making four blader out of two two-bladers.

Its innovation is the introduction of an elastomeric (moulded rubber/metal) lead/lag retainer, all the advantages of single bolt blade mounting without the disadvantages. It also has elastomeric torque transference, but that has been done before. Static and dynamic tests are all proving good and the guinea pigs seem to like it, so it will be available very soon.

The Slough Scale Fly-in

People were grumbling that it was cold, true it was, but I still think we were lucky with the weather for this fly-in and contemplating the season ahead I wonder how many summer events will be better supported. At one time, I counted over 60 helicopters and they were still coming, it could have been a record turn-out. The venue and organisation were more than adequate so the result was an event I think enjoyed by all.

John Griffiths of *Slough Radio Control* had persuaded the Slough Radio Control Club to supply their facilities for this occasion that he and I were supposed to be organising. They did so to such good effect that we were both able to enjoy the social side and fly. We even got the odd word of appreciation for not charging, either for the competitions, or for the hot soup. This last went a little wrong, it was meant for the competitors and helpers, but ended up with a great queue of spectators. I was extremely grateful to the young lady who voluntarily took over as chef.

Anyway, the principal innovation of the day was the luxury of having pilots of full size machines to judge the scale competitions. These judges, one from the services and one from *Alan Mann Helicopters,* had between them flown a very wide variety of 'copters and really knew what to look for in realism. Their general criticism was most models looked too fast, smoothness was also lacking by many competitors, but they also criticised the height of flying, particularly the hover. The full size hover low down normally, certainly after lift off, to check trims etc. before moving off in the chosen direction, rotating first to point the right way. Our pirouettes just aren't right.

Superb flying ability and, of course, personal full-size experience enabled Dave Nieman to win the scale flight with his *Hirobo* 'Cobra'. Newcomer to the awards lists was John Young in second place with his *Hirobo* 'WH1' and John Griffiths was third with his *Kalt Hughes* 500c, managing a very well-judged engine off autorotation landing at the end of his flight.

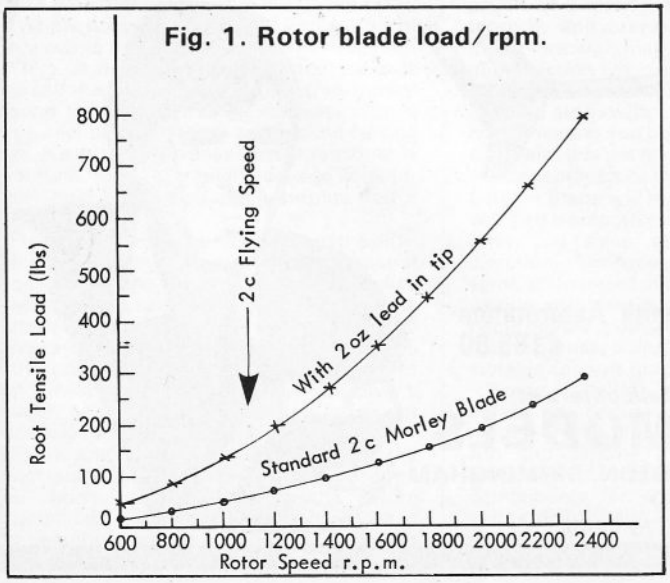
Len Mount with his 'Cobra' won the static concours and Andy Hopkins was second with a 'Jet Ranger,' one of the judges having flown the full-size exact equivalent not long before.

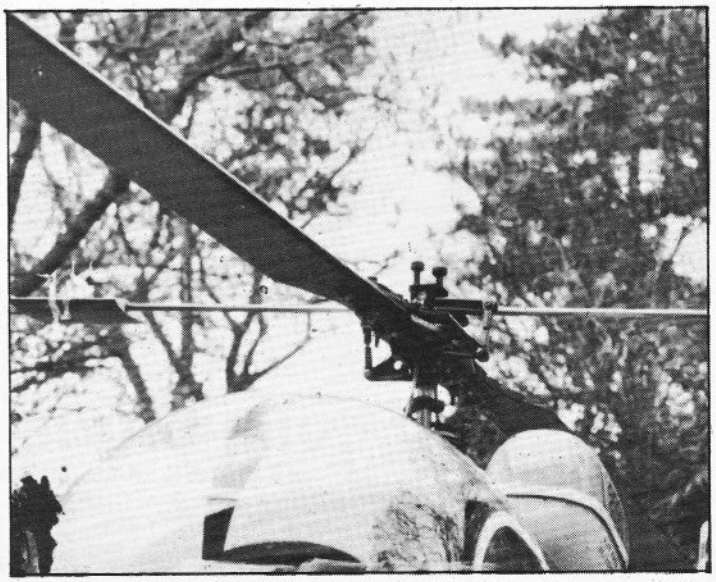
Nigel Brackley had planned the event programme and got it just about right. The large number of scale flight entries caused a slight over-run into the lunchtime 'on the peg' flying, which of course was part of the plan, so the second part of the event still started on time. Item 1 was 'over and under', being paper tapes stretched out at head height about ten feet apart. The intention was to go over the high and under the low ones. John Heaton flying a 'Falcon' in *Hughes* 500 body-shell showed his mastery here with Warren Bayley flying a *Morley* 2c coming second. The next event was skittles and here Warren managed an exact tie with John and was awarded first as John already had a first prize!

By that time it was getting dark and even more cold. Roll on the summer events.

Below: the Morley 2c shown is fitted with a new type rotor head as described in the text. Should be available soon for both kit and scrachbuilders.

Fig. 1. Rotor blade load/rpm.





WITH JIM MORLEY

Above: new Morley head also fitted to Jim's own four-blade Puma. Below: Slough Fly-in good assortment of models, even more arrived later. Inset below: this Mick Harris developed single blade rotor has no thrust ball races, counter-balance weight changes pitch with the blade thus there is no outward force on the bearings.

Rotating wing aeroplanes

This heading is prompted by colleague Peter Russell's item in *Straight & Level* January issue, 'Free-Wheeling Helicopters'. I have to admit to having been impressed by the Autogyros at the Slough meeting. Both John Heaton and Roy Sturman, flying *Kalt* 'Robin' and *Micro Mold* Wallace respectively, put in some very impressive flying, whereas previously I had not been interested.

As a helicopter man for a long time, there is no doubt a lot of prejudice, considering 'Autogyroing' very second best, and not nearly as versatile as a powered rotor device. Thus I was intrigued to see Peter's column and found it most interesting. Interesting, because it shows a train of thought led into by fixed wing flying, which is that Autogyros, are simpler and safer than a helicopter because they do not need the engine running to land, and nearly all fixed-wing pilots accept that the engine will stop on them. Be fair, I'm saying nearly all, not the top flyers, as the average chap just doesn't bother that much with his engine and the chances of it stopping, either before — or because it runs out of fuel, are very high indeed. This also explains the obsession for autorotation by a lot of people considering helicopters for the first time.

The very simple 'free-wheeling helicopter' autogyro may be easy to fly because it doesn't stall, but it also doesn't really take advantage of having a rotary wing to enable jump take-off, or really controllable landings. It's a good job that they can be light and take a lot of knocking about. Now Peter, in S&L, mentioned a sophisticated autogyro at Old Warden being quite complicated and having a lot of helicopter parts in the controllable rotor head. This he thought would make it require a good deal more skill than the *DB* 'Autogyro' and whereas everything else Peter says is true, I doubt this. Complications, if that's what they are, are not added to make things more difficult, and a swash plate and fly bar are really less complicated than high power servos, especially if you have a model with the same rotor/airframe weight ratio as the full-size autogyros with direct control or tilt rotor heads.

Another really worthy, or even essential complication, is the rotor spin-up, if not from the engine then from a wheel. In this way the take-off run is of almost bearable length. We are going to see more autogyros, there is a lot of scope for development.

Beginners department

I am obliged to Mr. M. Namih for the following very useful notes to help those in the early stages. I feel compelled to say, though, that what may be right for one model is not necessarily so for another, when it comes to throttle/collective mixing and the possible combinations of relative actuating rates. Engines are so different on their torque/power relationship one make from another, that really the only way is to experiment and to find what you like. Having autorotation decides your choice of course, demanding a lot of collective movement at low throttle. Mr. Namih writes:

"There are still many people who think that setting up and flying a model helicopter is very difficult, although recent popularity of model helicopters have shown that many modellers including beginners have been able to enjoy flying model helicopters within a period of one flying season. Very little has been written about them to help the modeller with some of the common problems experienced in flying R/C choppers. Engine overheating is one of these problems.

With the introduction of some excellent models on the market, the performance and reliability has increased tremendously, and, to such an extent that the ordinary modeller can enjoy this part of the hobby with little effort. Building these kits is made easy and should present no problems. Setting up and adjustments can cause problems for the beginners. Enlisting the help of an experienced modeller can short circuit many of these problems and achieve successful flights in a short period of time.

Engine Overheating in Model Helicopters

Most helicopter modellers have experienced engine overheating at one stage or another. In most aeroplanes the engine is mounted at the front and in most cases is well exposed, thus keeping the engine cool at all times. Furthermore, the engine is running at maximum rpm at full throttle with the propeller supplying adequate ventilation.

In a model helicopter the engine is either buried deep in the fuselage as in most scale models, or, under the main rotor gear in a trainer type helicopter (bubble and stick). In this instance, the engine relies on a cooling fan and shroud to direct air to the cylinder head of the engine for cooling.

During flight the model helicopter engine is under load throughout the rpm range. Maximum power is required during take-off, hovering and landing, while medium throttle setting is required for forward flights. In windy conditions, the throttle is continuously adjusted during hovering to keep the helicopter at a fixed height from the ground. If not set properly, the hard continuous use of the engine in a model helicopter can lead to overheating. There are many reasons for overheating and some are described below:

1. The simplest cause of overheating is due to the needle valve set too lean to gain maximum power. It is preferable to run helicopter engines on a rich setting. Remember that the fuel residue conducts heat away from the engine as it escapes through the exhaust.
2. Excessive collective pitch causes the engine speed to drop and causes overheating. Leaning out the mixture exaggerates the problem. Also it is important that collective pitch should taper off at maximum rpm as engine power decreases while collective pitch is increasing. In this case, the helicopter starts to sink and the

engine rpm drops as the throttle is fully opened. This is the most frequently occurring cause of overheating and can easily be cured by removing the excess pitch. The relationship between throttle and collective pitch is very important and can be adjusted by varying the position of the ball-joint on the throttle/collective pitch servo disc. More throttle travel is required for less collective pitch towards the top end while constant relation is required at the lower end.

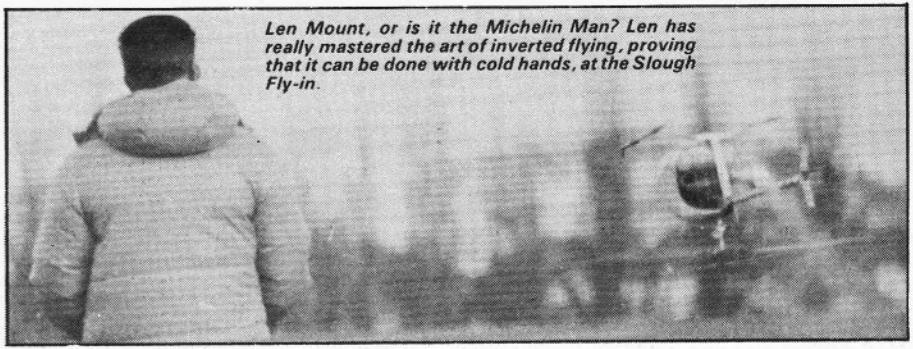
3. Vibration. The other cause of overheating is the loss of power due to excessive vibration. The cause of the vibration could be imbalance in the rotor head or bent transmission shaft either at the main rotor or tail rotor. Such vibration must be eliminated since it also causes loss of control. The main rotor blades and tail rotor blades must be carefully checked and balanced. Bent shafts must be replaced. Other parts such as bushed bearings and ball-bearings should be checked for wear and smooth running as power can be lost through these parts also.

4. Underpower engines or excessive weight causes overheating. Many helicopters require the top end range of engine capacity and power. The helicopter must be flown at a power setting below the maximum so that extra power is available to arrest fast descent, or, during the transition from forward flight to hover. Some modellers try to increase the power output by leaning out the mixture and this exaggerates the overheating problem. It is a characteristic of this phenomenon that the helicopter will fly satisfactorily for the first half tank until the engine overheats and from then on it will not fly for more than say a minute at a time.

5. Inadequate ventilation causes overheating and it is desirable that the engine should have a cooling fan. The air from this fan (centrifugal type) is directed to the cylinder head by a shroud or cooling cover. It is important that the pressure around the fan should not drop due to leakage. The two part shroud on some helicopters should be fitted without any gaps where air may leak out. It is also important that the shroud outlet would be free from blockage and hindrance to ensure easy free flow of air around the engine.

6. Worn-out engines can cause overheating. The fuel air mixture pre-ignites in the combustion chamber due to low crankcase pressure. Many hours are spent in hovering model helicopters. The engine experiences more wear and tear than normal. Over 20 gallons of fuel were used in one helicopter during which time the engine had two sets of pistons, rings and liners. An engine which had been heating will wear out more quickly.

7. Fuel can be a cause of overheating, but to a much lesser extent than the above causes and should be the last resort to be tackled when confronted with overheating. Fuels with synthetic additives burn cleaner in the engine and leave less deposit on the surface of the engine than castor oil based fuel and hence enhance the cooling of the engine.



Len Mount, or is it the Michelin Man? Len has really mastered the art of inverted flying, proving that it can be done with cold hands, at the Slough Fly-in.

The engines available on the market were basically designed as aeroplane engines and to my knowledge there is not yet an engine designed specifically for helicopters. However, most aeroplane engine manufacturers supply helicopter versions in which a larger cylinder head is used to improve cooling and the crankshaft is designed to accommodate the cooling fan rather than the propeller. A different type of carburettor is fitted to some of the helicopter engines to improve throttling characteristics throughout the rpm range.

Finally the choice of silencers can be important in avoiding overheating and loss of power. The ideal silencer is tuned pipe with an expansion chamber at the end of the pipe section. The noise level is kept low while power output is not affected. However, it can be difficult to fit tuned pipes to some helicopters, one problem is that the weight of the pipe extending backwards necessitates the addition of lead weights in the nose to balance the helicopter. The power gained by using tuned pipes instead of ordinary type silencer is offset by increased weight of the model."