HELICOPTER GYRO SURVEY

DAVE DAY LOOKS AT THE AVAILABLE UNITS

THERE SEEMS TO BE two schools of thought relating to use of gyros in helicopters. One school points out that none of the helicopter pioneers had gyros available to them and, therefore, if you want to fly a helicopter *properly*, you should not use a gyro. The other view is that you need all the help you can get, particularly in the early stages of learning to fly, so why not fit a gyro. Supporters of this school point out that full-size helicopters now use gyros.

The real truth of the matter, as usual, lies somewhere between these two extremes. It is possible to fly a model helicopter with nothing more than a basic four channel R/C system and many people have learned to do so, but the intelligent use of a gyro can ease the learning process and assist in performing the more difficult manoeuvres. No doubt it will soon be possible to equip a model with enough stabilising devices to enable anyone to fly one after a few minutes, but few people would find any real satisfaction in this.

Early Gyros

Probably the first gyro used (and certainly the first purpose-made, mass produced item) was made by the *Kavan* Company. This required modifications to be made to the servo with which it was to be used. At the time, servo design was far more diversified than it is now and results tended to be very dependent on the electronic expertise of the user.

Next on the scene (and still available) was the British *World Electronics* gyro, using SLM mechanics, which featured an adjustable mixing ratio between the control input (usually the tail rotor control) and the gyro. This was quite effective in teaching people to fly but had the disadvantage that when the 'mix' was adjusted to give the maximum gyro control, the pilot was unable to over-ride it. This disadvantage has been overcome in the recently introduced *RCM&E/Century Systems* unit also using *SLM* mechanics, which allows the 'mix' ratio to be adjusted from the transmitter and still gives full pilot control irrespective of gyro authority.

Most of the major R/C manufacturers now produce gyros and we are in a position of being spoilt for choice (see below).

Installation

The gyro unit should be mounted a softly as possible in order to prevent any vibration being communicated to the moving parts. It is necessary that any yawing motion of the helicopter *is* transmitted to the gyro, however, so although it *should* be possible to simply wrap it in foam and stow it in a convenient position, it is usual to mount it on grommets like a servo. Orientation of the gyro relative to the main rotor axis is important and this will normally be indicated in the instructions supplied with the unit. Where there is a separate electronics package with the unit, this will usually be stowed in foam as for the receiver. The exception to this is the *World Electronics* unit which has a gain control installed in the electronics unit case. If you intend to make this adjustable 'in air', it will be necessary to mount the unit on servo rails so that it can be connected to an adjacent servo.

Some units also have a control panel. This should be mounted in some convenient, accessible, position such as the side of the fuselage, etc.

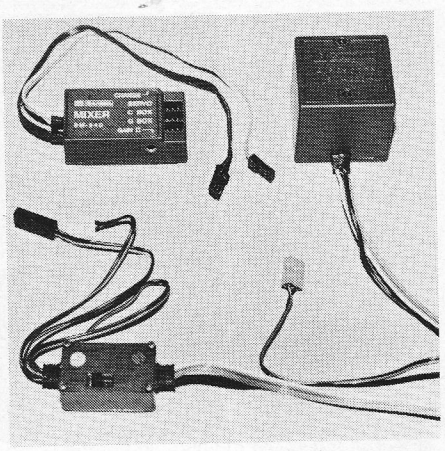
Operation

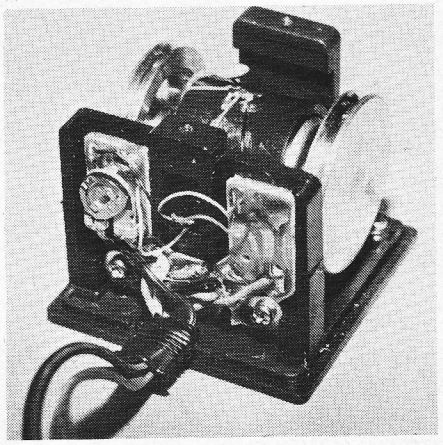
If you can already fly a helicopter, you will find that a gyro takes much of the work out of hovering. Just *how* much of the work depends on the combination of helicopter and gyro and how much time you are prepared to spend on adjustment. All the available gyros will give a marked damping of the yaw response. The best examples, when properly adjusted, will almost maintain a constant heading regardless of throttle variations, pitch changes, etc. Bear in mind that *no* gyro system can maintain heading perfectly since the gyro must sense *some* movement before it can react.

For the experienced helicopter flyer, use of a gyro will allow the use of more tail rotor throw, giving better control in windy conditions, while damping the response and preventing control from becoming twitchy. This is a great help when hovering tail to wind, etc.

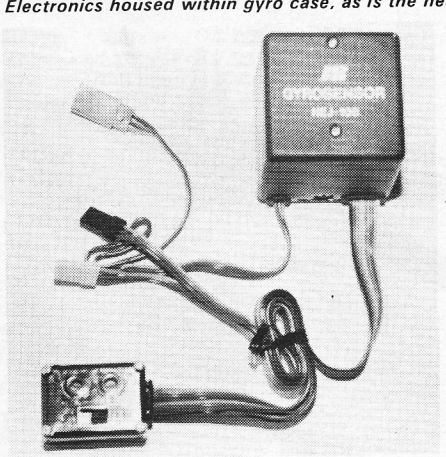
For the beginner, the advantages are obvious. The problem of learning to 'fly the tail' can be largely postponed until the basics of flying have been mastered. This makes the whole learning process quicker and cheaper! At this stage, the finer points of adjustment can be ignored and everything should be set at the manufacturers recommended starting point or turned up to maximum. Only the very best units are capable of being made *too* sensitive and this is indicated by a regular oscillation of the the tail, which, though unsightly, is not dangerous.

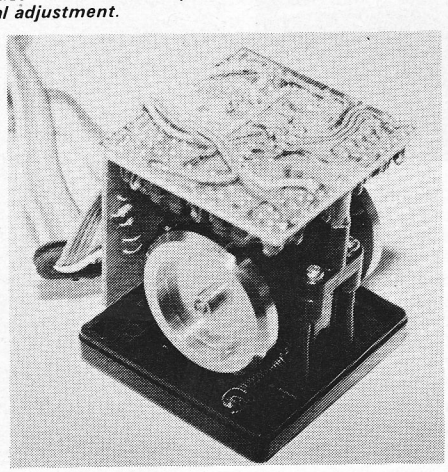
A point worth noting is that gyros generally give a better response on fixed pitch machines. In this case a change of throttle setting effects the system at a slow rate due to the need to accelerate the rotating parts.





Above: **Sanwa** *Gyro System and mechanics. Has separate electronics package and control panel. Potentiometer on mechanical assembly is factory adjusted. Below:* **JR** *'Gyrosensor' and control panel. Electronics housed within gyro case, as is the neutral adjustment.*





Suppliers and Prices

World Electronics, Unit 10, Paramount Industrial Estate, Sandown Road, Watford. Price £39.84.

Century Systems, 111 Gretton Road, Winchcombe, Cheltenham, Glos. GL54 5EL. Prices: Kit £25.00; High Gain Mod. Kit £6.00.

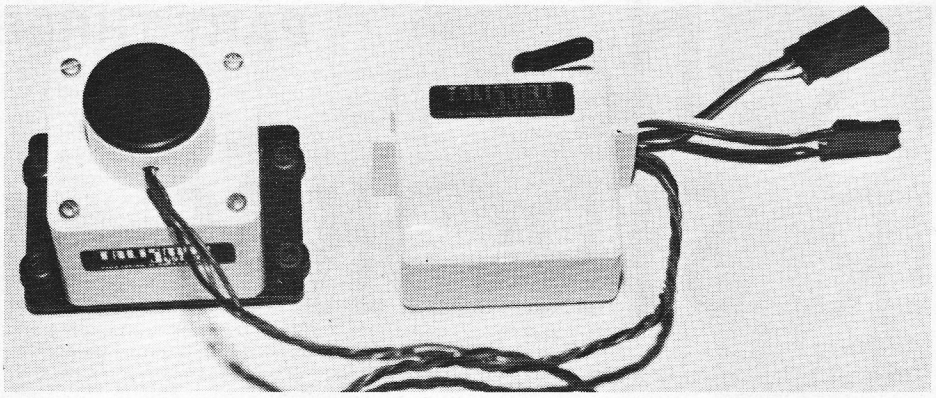
Futaba, *Ripmax Models,* Ripmax Corner, Green Street, Enfield, EN3 7SG. Price: £82.50.

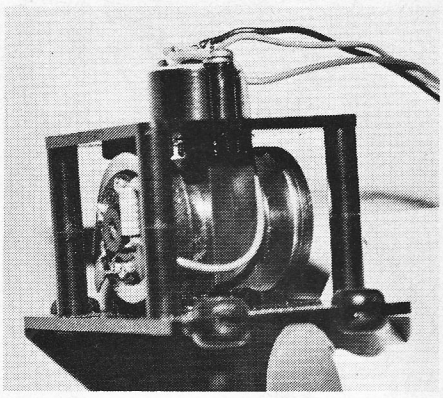
Sanwa, *Irvine Engines,* Unit 2, Brunswick Industrial Park, Brunswick Way, London N11 1JL. Price: £39.95.

J.R. *MacGregor Industries Ltd,* Canal Estate, Langley, Slough, Berks. SL3 6EQ. Price: £69.00.

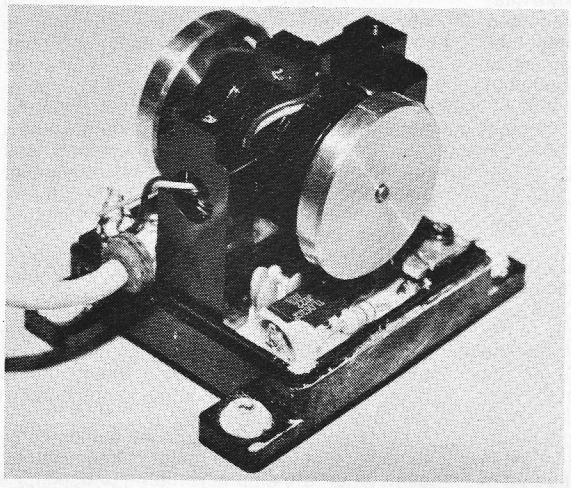
Watson, *Watson Industries, Inc.,* 304, Melby Road, Eau Claire, W1 54701, USA. Price: $169.95.

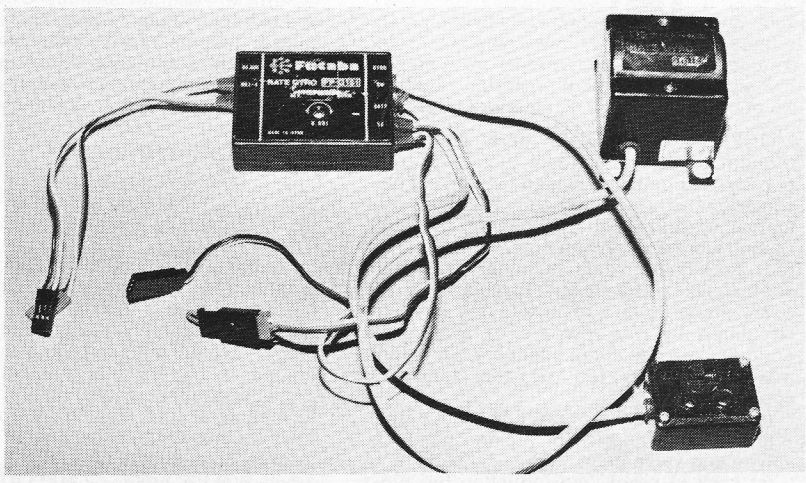
Our thanks to *Slough Radio Control* for their assistance in compiling this feature including providing examples of the *Futaba* and *Sanwa* units for photography.





Above: **World Electronics** *and* **RCM&E/Century Systems** *Gyros are essentially similar in outline since they use the same mechanics. Note that only one flywheel is used, whereas all the other systems use two flywheels. Below:* **Futaba** *'Rate Gyro System' has servo reversing switch on main electronics case. Screened cable used for interconnections makes for neater installation.*





With a collective system, pitch changes can be made instantly with a corresponding sudden swing of the tail. here the correct amount of collective/tail rotor mixing will have a better effect than the fitting of a gyro alone.

Adjustments and controls

All the units currently available feature some sort of adjustment. This can range from a simple control of the mix between stick input and gyro output (which may or may not affect the overall control) up to adjustment of throw, direction, etc. Most systems allow the mix ratio to be varied from the transmitter.

World Electronics. The first generally available unit (and still available) it uses the *SLM* mechanics and has one adjustment only for varying the mix between gyro input and control input. At one extreme this gives total gyro control, while at the other extreme it gives total transmitter control. This adjustment can be operated by an additional servo to give 'in flight' variation.

Century Systems/RCM&E. This also uses the *SLM* mechanics and has 'in flight' variation of the mix ratio by plugging directly into an auxiliary channel. This can be either a proportional channel giving a continuous variation or a switched channel which will give two pre-set rates.

Two controls on the gyro electronics enable you to preset the maximum amount of gyro control available and to centre the servo to allow for variations in pulse length on different R/C systems.

When used with the more 'twitchy' helicopters it has been found that the original circuitry will not allow sufficient gain to give adequate yaw damping unless the control on the gyro electronics is turned up to the maximum. In this case, there is insufficient control available from the transmitter to reduce the gyro effect. *Century Systems* now have a circuit modification available to cure this problem. An alternative solution is the modification to the mechanics shown in the August '82 'Hovering About' column.

This unit can be constructed from the article in the January '82 RCM&E or can be obtained in kit form from *Century Systems*. As with the *World Electronics* unit, gyro motor power is taken from the receiver battery.

Futaba. Essentially similar in operation to the *RCM&E* unit described above, the *Futaba* 'rate gyro system' has a separate control panel with a switch allowing you to turn the system off without interfering with the normal operation of the rest of the R/C equipment. This panel also incorporates two controls, giving two preset mixing rates which can be selected by the transmitter 'retract' switch or other switched function. The main electronics are contained in a separate box which incorporates the servo neutral adjustment and a servo reversing facility.

Advice on initial setting up is contained in the instructions and this will ensure that the total beginner will have a system that works well enough to allow him to acquire the necessary experience to decide whether further adjustment is necessary.

In common with the *SLM* unit already described, the *Futaba* unit uses a feedback potentiometer to sense the gyro movement. A separate battery may be used for the gyro unit if desired.

Sanwa. Here the instructions make it quite clear that a separate battery *must* be used for the gyro. Another difference is that the positional sensing is by means of an infrared LED and a light sensitive resistor, which should appeal to all those who distrust feedback potentiometers!

The control panel of the *Sanwa* unit contains an On/Off switch, the neutral adjustment and the main sensitivity adjustment. Here again the main electronics are contained in a separate box and this also houses the auxiliary sensitivity adjustment and another control labelled 'change'. The purpose of this is to preset the point at which the gyro sensitivity changes from 'main' to 'auxiliary' when used on a proportional channel. This is merely a minor convenience, when used with a helicopter but, if the gyro is used for, say, roll stabilisation of a fixed wing aircraft, the sensitivity could be changed at a given point on the throttle channel. Thus a tricky scale model could be set up to give automatic roll stability on the landing approach.

Servo direction can be changed by use of a special, optional, connector.

J.R. This unit has all of the electronics contained within the gyro case and position sensing is by means of a hall effect transistor — a form of proximity switch. A neutral adjustment is fitted in the main box, while the separate control panel has an On/Off switch and two potentiometers which set the upper and lower limits of the sensitivity range which can be continuously varied from the transmitter, by means of a proportional channel. If used with a switched channel, this will select either the upper or lower limit as required. Where no auxiliary channel is available, the upper limit adjustment simply sets the sensitivity, with the lower limit adjustment becoming inactive.

When used only with the *J.R.* 8-channel helicopter radio, an additional feature is available. This is known as 'gyro sensing' and provides a facility where the gyro is in full operation over a limited region either side of neutral on the rudder stick. When the stick is moved outside this area, the gyro is switched out and the stick has full control. This feature can be switched in or out via the eighth channel.

Gyro motor power is taken from the receiver battery.

Watson Stabiliser. Not yet available in this country, this is an entirely solid state device using vibrating crystals. It is quite expensive and originally cost about the same as a complete, top quality, R/C system, although this has since been reduced to about half this figure.

It has adjustments for gain and neutral position and is similar in operation to the RCM&E gyro.