COPTER COMPREHENSION

M. Namih explains how to get the best out of your helicopter using modern R/C gear

The Iroquois is stable and responsive to control. It is most suitable as an introduction to a scale model helicopter.

IT WAS THE INTRODUCTION of the *Graupner 'Bell'* '212' that attracted me to model helicopters. Since then I have built and flown a variety of the ever increasing number of kits available on the market. In the process I introduced some modifications to my models to improve their reliability and in some cases their flight performance.

My preference has always been for high tail designs, where the turbulence from the main rotor downwash avoids the tail rotor and hence the reason of choosing the *Hirobo* 'Iroquois' from the growing range of kits available. Upon inspecting the 'Iroquois' I found that many desirable alterations and modifications that I had made to previous models were already incorporated in this kit. For example, the cast alloy tail rotor gearbox housing with the heavy duty helical bevel gears improved this gearbox reliability. The all metal main gearbox cured the oil leaks and distortions experienced in other types of main gearboxes. The set-up of engine to gearbox was excellent as its engine was in an upright position and well forward of the centre of gravity. The reduction drive to the tail rotor was achieved in the main gearbox avoiding the use of very small bevel gears in the tail rotor gearbox. The main blades were strengthened at the root with a plastic holder eliminating the time consuming process of strengthening the blades when used with this single pivot blade holder arrangement.

Accessibility presents a problem with scale helicopters, the removable front end of the 'Iroquois' and the arrangement of all the radio gear within the cockpit area made installation and maintenance easy work. In short, whereas the kit seemed to incorporate all the good points of a good design, it improved and avoided the weaknesses of others.

First put it all together!

The kit comes in two boxes; one containing the finely detailed epoxy fuselage, full size plans, main motor blades and cooling shroud; the other box contains all the mechanical parts. The fuselage is in three parts; the tail, which is to be epoxied to the rest of the fuselage, and the front canopy which has to be bolted on. The wooden structure inside the fuselage was already jig fitted and epoxied in place. This was of a great help in the construction, nevertheless a layer of 'Stabilit Express' epoxy was run over all joints for extra strength.

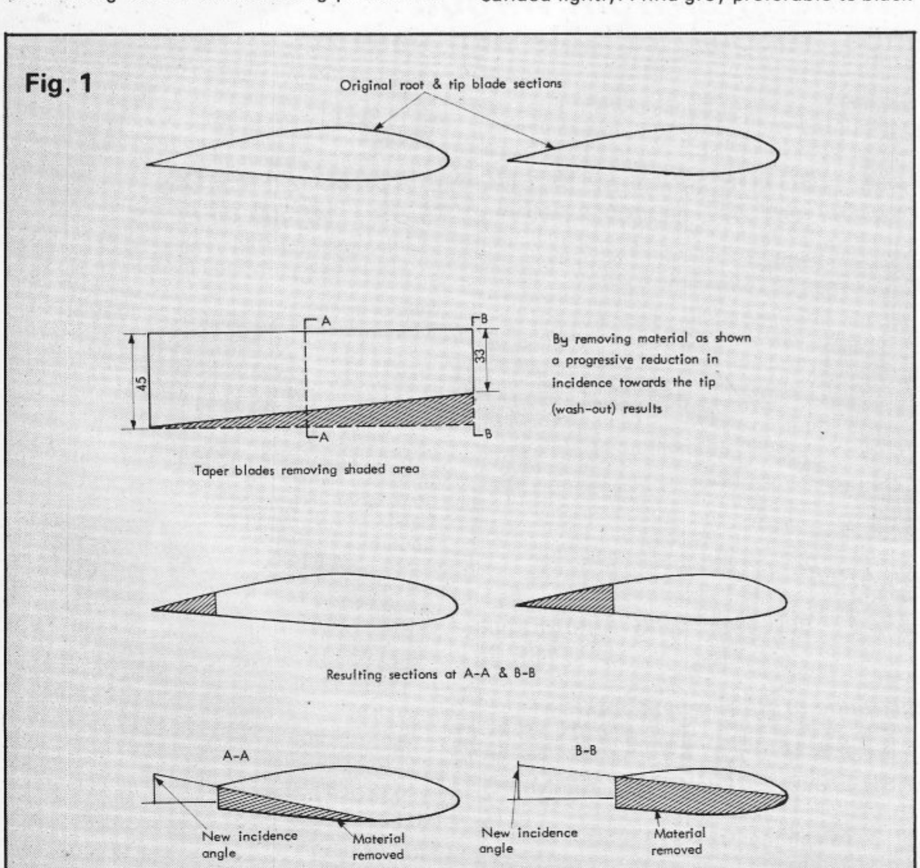
Before brushing the inside with grey primer and sealing it with two part clear epoxy, the tail part and the stabiliser were epoxied in place and the whole fuselage sanded lightly. I find grey preferable to black on the inside as the latter makes it difficult to see inside the fuselage. The model was finished as illustrated on the mechanics box cover, namely dark green with orange. Car primer and paint were used and sprayed on with the excellent *Miller* compressor and air brush. The transfers supplied were placed in position before spraying the fuselage with clear epoxy.

The mechanical parts were in three separate trays and each tray sealed with a cellophane cover. The top tray contains all the rotor head parts and the second tray contains the main gearbox parts while the third tray contains the rest of the mechanics. It is easy to fit a variety of .60 size engines and align them to the main gearbox due to the adjustable engine sub frame assembly. The engine I chose was the *OS*61 FSRH helicopter version which had a large cylinder head that aided its cooling. The excellent *'Hirobo'* silencer (extra) and the cooling fan fitted directly on the *OS* engine. It is necessary to tighten the fan bolt very hard and using stud lock adhesive as it tends to loosen up during starting with the electric starter.

The 400cc capacity fuel tank supplied with the kit seemed a bit small but after the running in period the engine would run for not less than 18 minutes on a full tank. The cooling shroud was fitted accurately over the engine and around the fan sealing off any gaps around and behind the fan. This was necessary to avoid loss of air pressure from the fan and directing maximum amount of cooling air to the cylinder head.

Fitting the rest of the mechanics, including the rotor head was a straightforward operation and was described adequately in the instructions. These were not very clear at times due to the poor translation from Japanese to English but the diagram and the full scale drawings provided all necessary information.

Fig. 1



Rotor blade modification

The main blades are of high quality laminated hardwood, both main and tail rotor blades have semi-symmetrical cross section. This provided the opportunity for tapering the blades and incorporating a degree of 'wash-out' at the tips. The main blades were tapered from 45mm at roots to 33mm at tips and were sanded on the underneath side only to form the new trailing edge (see Fig. 1). The main blades were shortened by 45mm each by removal of material at the tips at a later stage. The advantages will be described later. The blades were then covered with a *Fablon* type material and were checked for equal weight. It is hardly necessary to balance these high quality blades if you are not tapering them as long as the same size of covering material is used on each blade. A 20mm strip of red insulating tape was fixed to the top of one blade to help in the tracking procedure.

Radio installation

The radio was easy to install due to the good general layout as mentioned earlier. The *Futaba* 'J Series' Helicopter version radio with five servos and switch were positioned

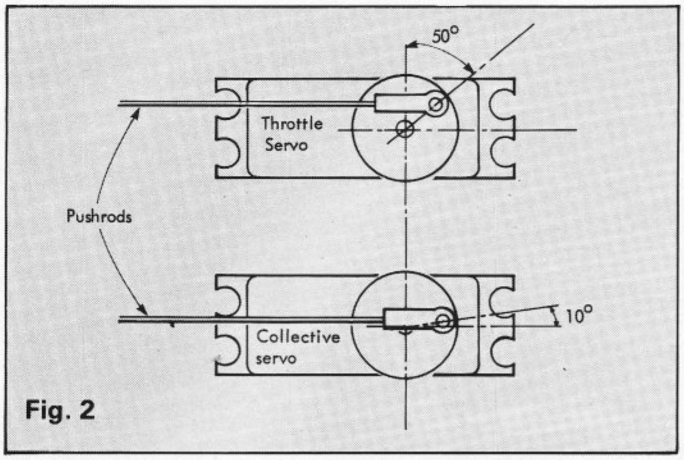
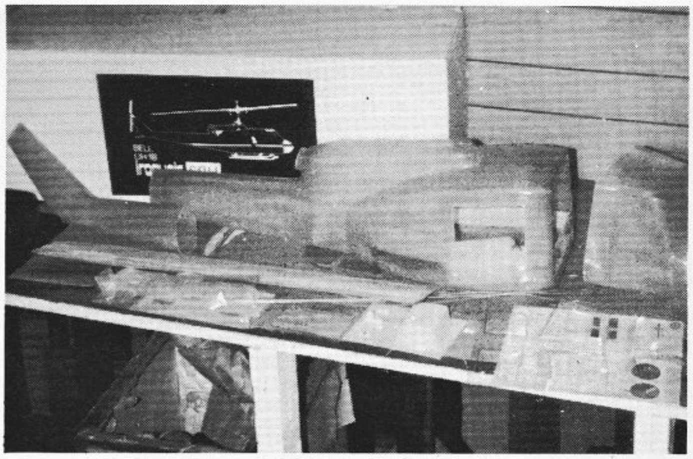


Fig. 2



next to each other on the front shelf in the cockpit area. These fitted neatly in place and were very accessible. Separate servos were used for collective pitch and throttle control. The advantages of this arrangement will be vantages of this arrangement will be described later. All the cyclic, collective pitch and throttle servo arms were in line with their respective levers and installation of linkages was trouble free. Ball link type connections were used on all servos for positive and slop free movements. The tail rotor control link was rendered positive and free from slop by fixing the guide tube at several points to the fuselage.

It is necessary for the throttle to be opened in advance of the increase in collective pitch. This was achieved by placing the ball link on the throttle servo disc at say 50° from servo centre line, while positioning the ball link on the collective pitch servo disc say at 10° from servo centre line (Fig. 2).

This intentional differential ensures high engine rpm at all times during flight. The maximum throw available at the swash plate was quite sufficient to provide the necessary collective pitch travel even with this differential set-up.

Setting up

This is an unavoidable and lengthy part of any model helicopter project, the assistance of an experienced helicopter flyer could save many headaches and minimise problems. Firstly all alignments were checked between engine, main gearbox, tail rotor gearbox and main shaft. Misalignment causes vibration and failure of parts such as snapped tail rotor piano wire drive shaft and early wearing out or breaking of clutches etc. Also any weight imbalances in the rotor parts were checked. All moving parts were checked both mechanical and control parts, for free operation and security.

The engine, which was run-in from new in the helicopter, was firstly run using one tank full of fuel at very rich needle setting and with the main rotor head assembly removed. This provided the opportunity to check radio and other mechanical parts etc. without any risk. The rest of the engine run-in period was carried out in hovering flight.

During initial tests the tracking of the blades proved to be a problem. It was discovered that too little pitch was used causing one blade to go into negative pitch making tracking impossible. The prevailing strong wind and the lightweight of the helicopter required little pitch angle and power for take off. For this reason the blades were shortened to increase the rotor disc loading hence requiring increased rpm and pitch angle. From then on the main rotors tracked beautifully. The model balanced slightly nose heavy when lifted at the main shaft and without the addition of any ballast weight. This improved further the stability during flight.

The *Futaba* helicopter radio provides mixing facility between the tail rotor control and collective pitch/throttle control. The amount of mixing is controlled by various levers to give precise compensation of main rotor torque. The mixing that was set up enabled the throttle to be opened fully and instantly without even a twitch at the tail end of the helicopter.

One of the other good features of this radio that was made use of is the matching of the collective pitch movement to the engine power curve. The top end range of movement of the collective servo can be varied by the operation of two knobs situated at the back of the transmitter. This feature provided smooth control of power and lift during flight and hence increased further tail stability.

As mentioned earlier the collective pitch to throttle ratio was set so that high engine rpm was achieved at all times during flight so that the tail rotor speed is kept constant as far as possible. Also the engine was run on the rich side at all times to provide reliable running and avoid overheating. The clutch would disengage easily at low throttle and 'high' trim and the engine would stop at 'low' trim. It is possible to check mixing while the engine is running by switching on the throttle hold at low throttle. The collective pitch servo is operated normally without increasing engine rpm. Another useful feature of the radio.

The proof of the pudding

This is the most exciting part and for this reason one has to proceed with care. The rate switch on both cyclic and tail rotor were switched on initially to reduce all control movements. The excellent stability effect of the flight bar system soon made this unnecessary and maximum servo throw was used in hover and forward flight. In forward flight the advancing main rotor blade creates more lift and the helicopter tends to steer to the right. This can be offset by the use of the aileron trim switch on the transmitter which moves the swash plate in opposite direction to a predetermined and adjustable position.

Once the mixing and tracking of blades was set up properly, flying the 'Iroquois' was a dream. Facing the wind, the throttle control was advanced gently, the rotor speeded up, marked by the characteristic whooshing noise. Gently but surely the 'Iroquois' was hovering gloriously a few metres in front of me. The back cyclic stick was eased forward to neutral position and the forward trim made the nose dip slightly and the helicopter was moving forward gracefully. A slight right bank was introduced followed by a gentle left bank with left tail rotor control introduced as required. The helicopter was now moving across in front of me and started to turn towards me. A full left hand circle was completed slowly and once on my right hand side, back cyclic was introduced while shutting the throttle slightly to avoid the model rising higher. The throttle was slowly increased to attain hover position without losing altitude. Meanwhile always remembering to watch the nose of the helicopter.

The tapered rotor blades prevented rotor flutter during turns and during transition from forward flight into hover. The lack of this flutter meant that the blades were not stalling around the tips, and that less vibrations were transmitted to the helicopter from the rotating disc. This also applied to the tail rotor disc and increased the stability of the tail.

Radio controlled model helicopters provide the challenge and excitement in having total control of a flying model in all directions. If the kind of activity described interests you try the *Hirobo* 'Iroquois 60' and one of the new generation helicopter R/C systems, perhaps this will help you discover new enjoyment in the R/C hobby.

Top of page: epoxy glass fuselage as supplied. Left: general view of finished model. Noted tuned pipe exit via jet duct. Right: Futaba 'J Series' helicopter Radio Tx. Text explains method of setting up this transmitter for best results from your helicopter.