MORLEY HELICOPTERS BELL 47G

This .40 cu.in. power chopper from Morley Helicopters is reviewed by JIM DAVEY.

I have had a soft spot for Bell's 47G ever since I had an extended chance to study one when returning home from a business trip, No, I wasn't flying in it, I was driving down the M6 slowly overhauling one that was, presumably, navigating by means of the AA book. I eventually overtook him just North of the South Stoke turn off — but I digress, I didn't need much persuading, therefore, when the chance came up to review one of the then new Morley kits of that machine. I picked up the kit at last year's Border Counties show (something had to go right that weekend) and duly set about things.

A characteristic pose of the original 'Whirly-bird'. The only thing missing is the pilot!

Worried looking reviewer in background is trying to interpret hand signals of photographer while the model flies itself. This is one scale model where the motor and plumbing is easy to get at! (B.J. photo)

The model is a semi-scale rendering of the ubiquitous machine which in full size form has seen service in just about every country of the globe, from the late 1940s right up to today, with large numbers still in service in a number of guises. A casual glance could confuse it with the earlier Morley Mk II, but there is actually little similarity. The mechanics are drawn from the Mk III series, with changes where appropriate, to accommodate the tail rotor on the right, for example.

The kit comes in a stout box with a clear colour photo of a prototype model — it's well worth preserving this for subsequent study to supplement the instructions. The parts for each constructional stage are bagged together with the necessary fasteners heat-sealed into the corner of the bag. The tail boom (a distinctive feature of the Bell 47G) is fully assembled and enamelled white, ready to fit straight on. Two sheets of vac-formed transparent plastic provide the parts for the 'Bubble', the dummy fuel tanks and some tail surface parts. The rest of the body parts and the tail plane come in the form of a die-cut plywood sheet. Main rotor blades are of conventional composite wood construction with adequate covering material supplied. The standard Morley fuel tank is supplied, complete with fuel filter and silicone fuel line for all the plumbing. One is directed to use the filter as a form of clunk weight, which may not suit all tastes. Instructions are in loose-leaf form, carried in a neat folder. This allows the sheet for a particular stage to be laid out for study when both hands are fully occupied, without the self closing problem of a book. Finally, lurking in the bottom is a sheet of self adhesive vinyl decals provided for a range of possible prototypes.

Mechanics

The motor is mounted on its side, pointing aft, and carries a flywheel and cooling fan bolted onto the output shaft. Primary reduction is performed by a toothed belt which drives the clutch-unit. This is mounted on the rear of the main gearbox, the drive for the tail rotor being taken from this point. The main gearbox is of oil bath type, constructed from glass-filled nylon, with steel gears and ball-race supported shafts. The main rotor shaft is connected to the gearbox with a sleeve which is directly interchangeable with the optional autorotation clutch. The main rotor head encorporates collective pitch control by means of a moving swash-plate system and all parts are in-

cluded to build either pure Hiller or Bell-Hiller mixed control systems. The tail rotor is driven by an open wire shaft, supported at intervals, with universal joints at each end. The tail gearbox is cased in glass-filled nylon with steel gears and a mixture of ball and oilite bearings. The tail rotor itself has hollow moulded blades and a single ball race for feathering.

Controls

The back-bone of the chassis is extended forward into the cockpit and is punched to carry the supplied nylon mounts. This arrangement allows for two servos on either side. Cyclic pushrods are perfectly straight to the mixer, as are the rods up to the swash-plate. The collective rod goes straight back to a 90° bell-crank and then straight again to near the centre of the mixer cross-rod, minimising any twisting due to collective forces. The throttle push-rod has to have a dog-leg and the tail rotor rod has to have a gentle curve past the main shaft. It runs through guides on the top of the boom (masquerading as the drive-shaft on the full-size).

The method of introducing collective pitch to the blades varies, depending on whether or not the Bell-Hiller mixers are fitted. Without them the fly bar moves up and down with the collective movement; with them the fly bar is bolted down to the head and the collective is mixed with cyclic at the blade holders. This in turn requires that a 'wash-out' unit is fitted to allow only cyclic signals to reach the swash plate. The method of controlling fly bar and blades is then geometrically similar to that used on Heims and Helimaxs, etc.

Construction

The action begins by assembling the gearbox into a 'V'-shaped aluminium chassis. This is anodised black and I sprayed the rest of the chassis parts and the undercarriage cross beams black with some 'Black Baron' epoxy paint to match it. It pays to deburr the main shaft carefully before attempting to fit the oilite main bearing or you will score it. This must be glued into place to suit the shaft as any bending fed here will cause premature wear. Experience on my Hughes 300 has demonstrated that this bearing will last the life of the machine if fitted correctly. The collective 90°bellcrank is fitted later, but it pays to enlarge the hole for its pushrod forward at this stage. I chose to fit this crank the opposite way from that specified as I prefer to reduce throw through cranks, using a large initial movement at the servo.

Next the motor is installed. I followed the instructions carefully, but failed to achieve satisfactory belt tension or fan to shroud alignment first-time, necessitating a certain amount of fiddling to rectify the situation, so I would therefore suggest the following assembly order:- Slip the clutch pulley onto the shaft and temporarily fit the flywheel etc., to the motor, then slip the belt in place and use it to check for tension before drilling the motor mounting holes. With the motor in place (and the belt removed) offer up the shroud and backplate assembly and drill the backplate for its mounting screws with the face of the shroud correctly aligned to the fan. I found that I had to trim the shroud to clear the undercarriage support rod; once this was done it all fits beautifully. The fan/flywheel assembly self aligns provided the flywheel is drilled correctly to fit motors with large shafts. To avoid subsequent loosening of this assembly, I first put a number of recesses into the back of the fan where it presses onto the flywheel using a ⅛in. drill carefully. I then fit the flywheel using Loc-tite between driver and flywheel and Tamiya Liquid Thread Lock between flywheel and fan. I tighten the assembly as tight as I can and retighten the following morning; this seems to do the trick.

The next job is the clutch, which is straightforward if patience is applied. I put a thin washer between the gearbox and clutch and another inside the clutch to prevent the shoes from rubbing on the aluminium drum. These are not strictly neccessary, but do remove any end-float. The result is a very smooth operating clutch which is also reliable.

If you follow the recommended order, you now do the controls, but I prefer to do these a little later so moved onto the undercarriage and tail-boom. I made a complete pig's breakfast of this the first time — then I followed the instructions with complete success — you have been warned! Two things must be born in mind: firstly the side stay wires have to be carefully bent until their loops line up correctly with their mounting holes and secondly the corner mouldings are 'handed' — get them right and everything just fits, get them wrong and no-way! All the loop ends of the various wire bits are retained with moulded caps and bolts which fit beautifully and allow the bolts to pull square — excellent. The skids in my kit were rather a lot longer than necessary — no problem if you cut them to length before you drill for the legs — it's clear from the drawings on the cover of the instructions.

The next tricky bit is the cabin — you have to stick a number of clear plastic bits together to make up the 'bubble'. I used a mixture of quick and slow cyanoacrylate and a lot of patience. It's a good idea to paint the inside before you add the windscreen or you will have to climb through the doors to do so! Both outside and inside detail is provided, including rivet and panel lines, and patience is rewarded with a very satisfactory pod. The cabin back is fitted to the chassis by two bolts, and, in my case, a silicone rubber bead along the length of the join. The cabin is retained by two self tappers which I replaced with captive bolts as a matter of personal preferance.

The remaining body assembly requires little comment except to say that the dummy tank retention is a clever bit of lateral thinking, and that I stuck on my tail-plane with silicone rubber.

Moving on to the swash plate, which is built-up from a number of plastic mouldings and individual bearing-balls (not a typing error!), it pays to de-flash the mouldings very carefully and relieve the corners of the holes in the ball cages slightly to obtain free rotation. It doesn't come out as free as a conventional metal swash-plate, but runs-in to an acceptable standard and satisfactory life. The original swash plate on my Hughes was looser, but had some play; on balance I would say the latest version is a better product.

Main Rotor

The head has to be fully assembled by the builder, and while the instructions are adequate for anyone with some fitting 'nowse', there are a few pitfalls. The ball bearings have to be pushed onto moulded stubs on the centre-plate and it pays to de-flash these stubs thoroughly and chamfer the corners to give a lead-in. I also filed the outer stub slightly to prevent it from rubbing on the outer bearing-mount. When the blade-fingers are assembled it pays to tweak the fingers slightly so that when the incidence arms are slid into place nothing has to flex. If this is not done the bearings go stiff. I never over-tighten bolts onto plastic anyway, preferring to make things secure using 'Tamiya Liquid Thread Lock'.

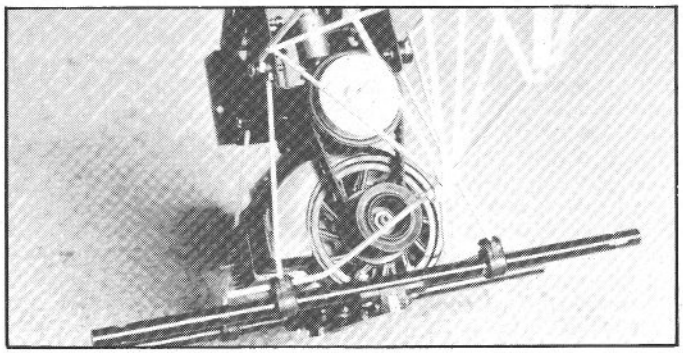
Teeter is provided by clamping the head plate between rubber sheets with pressure controlled by four bolts.

The builder is given a choice of control-systems on the head, and I chose to fit the mixing system as I much prefer the more solid feel that this provides. Everything went together with no difficulty although fitting the paddles was a bit of a game, necessitating some work with a Swiss-file to ease the holes, and some relieving of the retaining grub-screw holes.

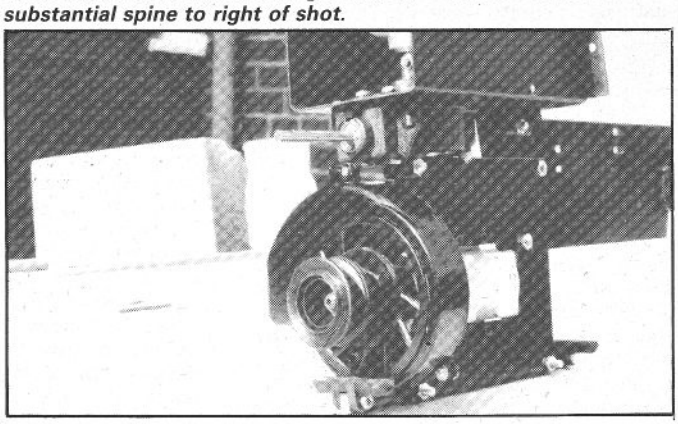
Morley ball-links now have brass balls and the ones supplied had a good, consistant fit, an ample number being provided to complete all the linkages. However, their

Engine side of basic frame, note the bracketry holding it all together, and the cooling duct arrangements.

Undercarriage cross-beams and the boom on. Note the angles adopted by the braces from the chassis to the beams. The excess length of the two triangulating wires was trimmed later.



Basic frame with motor and gearbox in — servos mount on the substantial spine to right of shot.



bodies are longer than the old types, and it is therefore necessary to shorten them for some of the control-rods on the head or it is not possible to achieve the correct lengths.

Radio Installation

If using four servos this is very straightforward, although, if a 500mAH nicad is used, you might need nose weight. I wanted to use five servos, a gyro and a 1.2AH nicad, which turned out to be almost as simple. I bent up a bracket to hold the nicad, bolting this to the front of the spine using the supplied bracket and using cable-ties to retain the nicad. Cyclic and collective servos went on the mounts provided, with the throttle servo secured to the spine using foam tape in front of the collective servo. The tail rotor servo is mounted upside-down on two ali. brackets trapped by the same bolts that hold the collective cradle. This then drives the push-rod by the most direct route. One of the new Century Systems Hall Effect gyros is bolted to the spine where the tail rotor servo would have gone. The receiver is slipped into a foam tube and banded alongside the cyclic servos — with the pod on it sits on the floor and just touches the sides. It is the only load the pod has to carry. With this lot on board I needed just ½oz. in the end of each skid to convince myself that the C.G. was in front of the mast centre line.

Setting Up

The instructions offer a suggested starting point for control throws and pitch settings which would suit the Hiller controlled version; with the rotor head mixers fitted it's necessary to considerably increase the swashplate vertical travel. I started at about 14mm total. To achieve this requires careful adjustment, and this can be made easier by some judicious trimming of the washout slider at the bottom, and both top and bottom of the driver mount. Of course, the actual throw needed will depend on the power of the motor fitted, but since, due to a sudden rush of blood to the head, I fitted an OS40 FSR ABC, (it was the only 40 in the shop honest!) I suspected that I would need all the pitch I could get. Otherwise I followed the printed word.

Finishing Off

Somehow the thought of a military colour-scheme did not appeal to me (Oh no, not another 4077th 'Korean Angel' complete with stretcher), so I cast about for a civil version which might take my fancy, with little luck until I found inspiration in an old RC Model World in the form of a piece by that eminent aviation historian, Roy Garner...

It seems that Baron Manfred von Heircutt, of Midnight Canaries fame, had a son who fought in the Spanish civil war. This son introduced one Julio Alcazar Domingo to the art of flying. As time went by young Julio used an autogiro to impress ladies (of whom he was more than fond) and occasionally make good his escape from Mothers, Brothers and irate Husbands. After WWII things became too hot for him in Spain and Julio moved to Italy, where he earned a good living as a Ski instructor, offering particularly attractive rates to rich widows, eventually purchasing an Agusta-built 47G on the proceeds. His exploits in this earned him the name 'Dangerous Dago' or 'Gonzo' after the Muppet. Julio's chopper carried his personal registration, which, in Italy became:- I-MJAD. Since I share the same initials as Julio, I could hardly choose any other as my prototype...

The little painting required (Julio's machine had a white tail-boom), was done with a mixture of Humbrol matt and Black-Baron, with the Humbrol topped off with Ronseal satin. The lettering was done with a mixture of Letraset (expensive) and felt-tip pen (cheap).

I finished-off the skid and cross-piece ends with the rubber plug method from the January Hoverpoint.

Contact!

Out into the back garden with the blades off for the first run, and a bit of anti-climax. The motor ran sweetly and the machinery seemed to be happy so I fitted the blades and tried again. After leaning the motor slightly the model took to the air and hovered steadily. The only trim error was the tail, surprisingly. This clearly had too much pitch and in the end I needed to set it up so that at full right there is some pronounced –ve on the flat bottoms. Tracking needed no adjustment at all and the model ran absolutely rock-smooth.

I have since done quite a lot of flying, and my initial impression of a very smooth little model has been reinforced. The machine is steadier than the Hughes from this stable and would appear to be a naturally smoother runner. Handling is what you would expect from a Bell-Hiller controlled model with moderate weight paddles — solid and accurate. Response to cyclic commands is immediate without being at all fierce and trim settings are responded to accurately. Although I'm sure that the model will fly O.K. without mixers, I can't see the point in saving yourself so little work, expecially as the parts are in the kit anyway. Tail rotor control is fine, the extra length of this model over the Hughes seems to make it less twichy in yaw, with the gyro switched out. With the gyro in, or course the tail control becomes completely docile. The tail rotor would seem to have adequate power for all normal requirements; unusually I have not yet flown the model in a really high wind, so I can't comment on its ability to handle a lot of cross wind. In forward flight there seem to be no bugs; cyclic feel is normal, but you do have to pay rather more tail than you might expect, probably because there is very little fixed tail area.

Oh yes, the rate of climb with the fitted motor is just a bit O.T.T. and the revs start to build up at anything over ¾ throttle. Hover is at ½ throttle and the fuel seems to last forever. Any decent ball-raced 40 should have enough power to fly it.

Conclusions

Looking back over this review I seem to have been a bit hard on the building side. This was not the intention, in fact the model builds quite quickly, but the techniques are a bit different, and the instructions not that easy to follow in places. Once it is taken on board that plastic parts sometimes need a bit of trimming, and a bit of bent-wire engineering is required then there are no problems. My comments merely point out those points where I had to raise my consciousness level above 'auto'. I still feel that the diagrams in the manual could be improved a bit.

After a fair bit of running the tail fin is showing signs of distress around its mountings. The thin vinyl sheet of which this is made doesn't seem to like the cold weather that I've been flying in. I am replacing mine with one made from very thin-fibre glass board but .4mm ply would do as well. It also occurs to me that if I had used a more resilient glue and not glued the mounts rigidly to the boom, I might not have had the problem at all!

I wouldn't recommend it to a rank beginner on the basis that a replacement tail unit is not cheap, though it might well be repairable if clobbered. On the flying side there are absolutely no problems, it just does what you tell it, and what more can you ask. If you have progressed to the stage of reliable hovering and fancy something a bit scalish without breaking the bank then you should have no difficulty with either building or flying this one. The photos show the appearance better than I can possibly describe, and I've nothing more to say than that I like it.

The Morley Bell 47G is available from Morley Helicopters, 39 Priors Park Road, Bath, Avon BA2 4NG at a cost of £169.50.