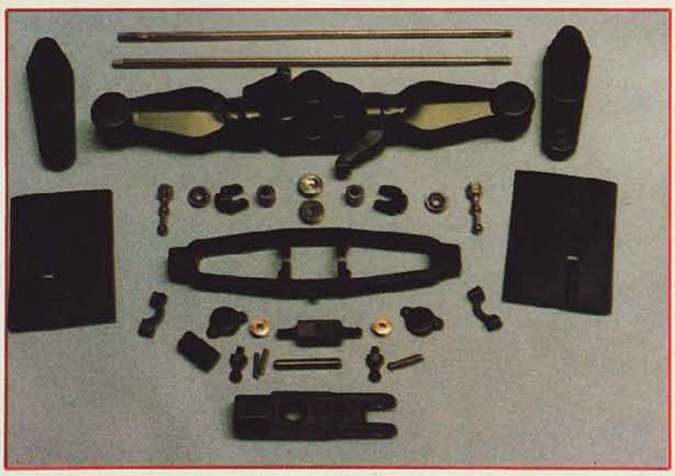
G.M.P. COBRA TEST

Jim Davey takes a long hard look at John Gorham's COBRA.

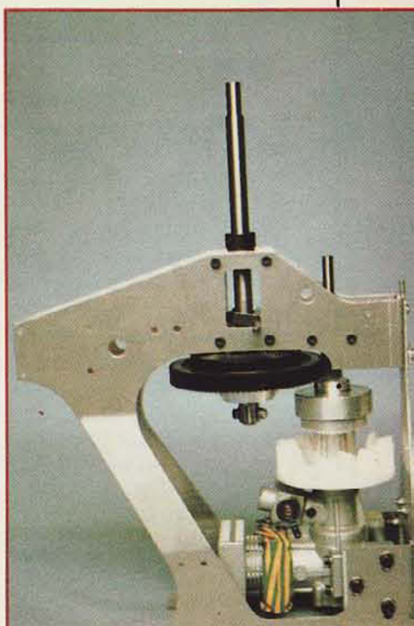
In approaching this review I was acutely conscious that the Cobra has been around for a long time and the whole thing could look a little like yesterday's news. However, after something of a break, the Cobra is becoming more widely available in the UK and developments in other areas add to its topicality. Let me explain that last remark.

For some time, there seemed to exist in some peoples mind, a dichotomy between the sixty size machines and the rest. The rest being somehow regarded as second best or strictly for beginners. We have never agreed with that view and it seems to be dying now, particularly as almost all the manufacturers seem to be getting into the 45/50 size market with machines which, while they are aimed at the entry level flyer, also represent 'no-compromise' sport performance.

The head as it comes out of the box. Yoke and holders are fully assembled — the rest is up to you.



Although the Cobra has been around for some time, it is in that, what is now becoming, very popular size range, featuring Schluter Junior 50, X-Cell 50, Hirobo Stork and probably others that haven't come to mind instantly. By virtue of using a reasonably powerful engine with respect to the rotor size, turning a medium sized rotor quite fast, the degree of depth required in setting up the model so it will fly well is probably less than that required of the 60 sized machine whose pitch curves, etc have to be better matched to the engine power to achieve good rpm control. Thus the model is aimed at the newcomer to the sport, in that it is easier to set up than the larger models as well, of course as being cheaper, but is also capable of aerobatics with little or no modification in the hands of the pilot as he progresses, so need never be looked on as merely a stepping stone to anywhere.



A-frame assembly as lined-up at this point and gear mesh is set.

John Gorham's design guidelines have always been 'simplicate and add lightness' and 'keep it simple, stupid'. He has been enormously successful at creating original machines based around Hirobo parts, but having, very much, Gorham characteristics. So, the box was opened with some interest.

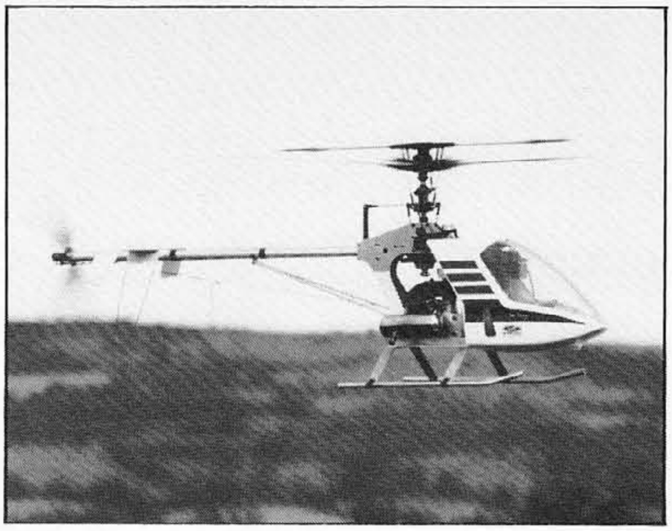
The Model

GMP's Cobra is what might be termed a very conventional pod-and-boom helicopter. It uses the sort of layout that's used in many, many other machines coming from a number of sources. That's not to say that it's a copycat machine. Rather, that it is a conservative middle of the road design that's stood the test of time.

It is of A-frame construction, using stamped aluminium side frames, an aluminium tube tail boom and aluminium undercarriage skids and legs. Servo trays, tail surfaces, tail blades and main blades are all wood, while the head is constructed from cast aluminium parts. The canopy pod is assembled from two vac form plastic parts joining on a centre seam.

The 40-50 size engine sits with main shaft vertical and head to the rear, at the front of the A-frame structure. Drive is taken through a one piece metal centrifical clutch via a single stage gear reduction to the main shaft. The model tested came complete with autorotation unit integral with the plastic main gear. The tail drive is performed by a wire running in a brass tube in the tail boom and is taken from the top of the main gear using a spiral gear drive. The tail gearbox is the standard Hirobo cast alloy unit, which has well stood the test of time.

Moving back to the drive end, starting by the top cone system, now becoming very popular. Control is by the Bell Hiller system using a plastic wash out unit on the main shaft and Bell-Hiller mixing levers integral with the centre flybar system. It is, in fact, a standard Hirobo head, the Custom Head in GMP terms, having some built coning angle. The swash plate is a very nice coaxial or inline item and is of all metal construction. Although the head will be familiar to many, the paddles will not, being much smaller and lighter than the Hirobo items. Main gear reduction is 8:1, meaning that the specified hover rpm of 1500 is achieved at fairly conservative engine crankshaft speed. It is in this 8:1 gearing ratio that the GMP concept begins to show. This 40-50 size helicopter has a rotor diameter of only 49 inches and the tip speed must be kept up by high rotor rpm. This in turn conveys stability and control power at the same time.



Up and away. Steady hover is easily held for the camera and 8 lb all up weight gives spritely performance on the OS46.

The control system is of the moving swashplate variety and this is activated by a fairly simple mechanical mixing system. The simplicity of this system means, of course, that it is quite straight forward to build and adjust but that there is some mechanical interaction between the collective movement and the cyclic controls, which is however, small.

There is sensible use of ball bearings in this model, not only is the 10 mm main shaft supported in dual ball races, but the tail blade holders have not only a single ball race each, but also a thrust race. The main blade holders have two ball races and a thrust race each and the flybar is supported, in pitch change if not in teeter, on two small ball races also. The main rotor teeters on two needle rollers and is controlled in damping by a rubber bush around a 3 mm bolt. The tail rotor pitch control plate is dual ball raced so that long life and smooth tail rotor pitch change are assured.

Assembly

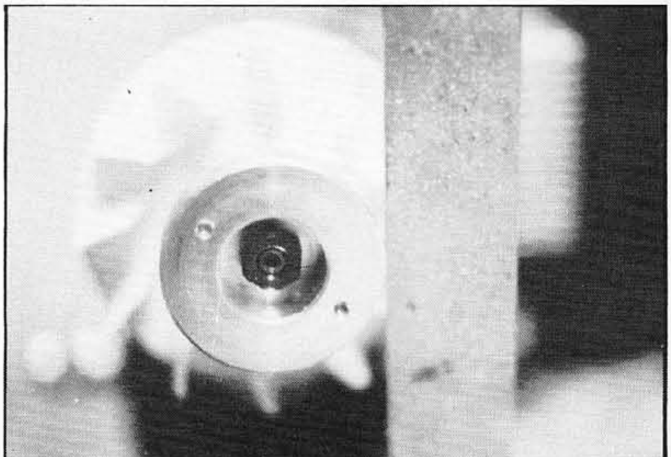
Assembly of the model is quite straight forward, assisted by a first class instruction manual, which includes such nice details as a printed metric ruler on each page, so you may select the correct bolt size unambiguously and quoting actual ball link to ball link lengths for push rods. Each assembly stage is accompanied by a diagram showing that stage and there is also a separate sheet with an exploded view of the entire helicopter on it. It's a good idea to fix this up on the wall so you can take a good look at the wood while you are crashing about in the trees!

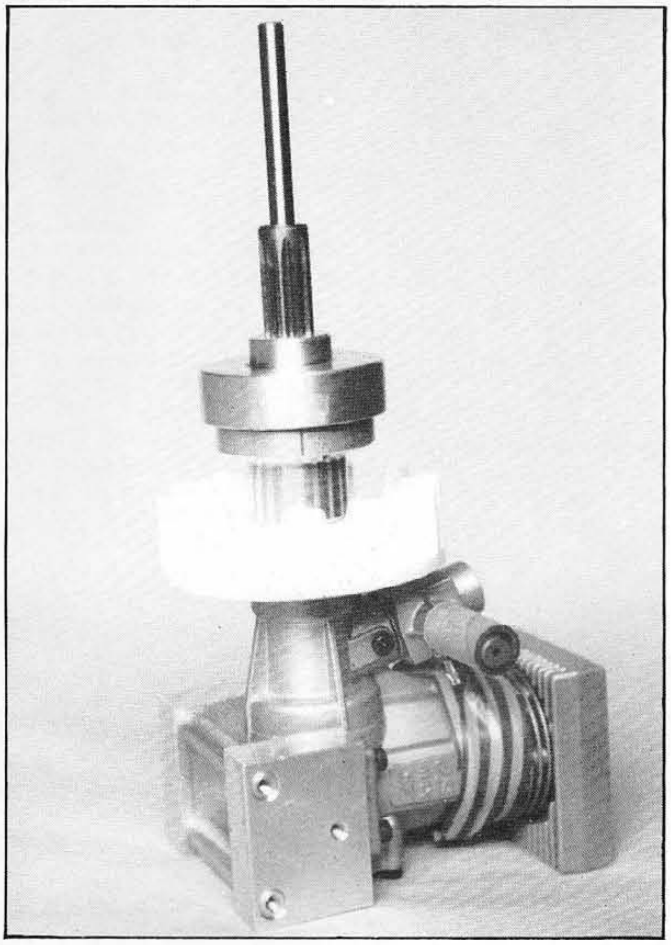
Assembly generally consists of the usual bolting, locking and fitting common to most metal helicopters. The exceptions being the need to construct wooden servo trays and in this case, also cover wooden tail rotor surfaces. The order of assembly specified will work, there is no doubt, although I have to confess that, for my own convenience, I dotted about somewhat, leaving blade balancing and so on until the head was complete. I raise this point because the instructions contain a simple method of achieving a satisfactory blade balance using the pre-assembled yoke and blade holders themselves as the balancing medium. I did not do this because I now final balance heads and blades as an assembly using the High Point system, which I will, maybe discuss another time.

I feel there is little point in doing a blow by blow assembly guide, as the instructions do a pretty good job of that anyway, but I will pick out one or two points which are worth noting.

As a model employing a cone start driven by a shaft through the clutch, the Cobra demands accurate assembly of the clutch, starting shaft and fly wheel onto the engine crankshaft. This can be quite tricky and require a fair amount of patience. I check the runout on the fly wheel and shaft, when doing this sort of thing, by carefully gripping the engine, by one crankcase lug, in a small vice (don't go beserk!) and checking the runout by rotating the engine with some form of vertical measurement, try square if you like, or if you're a real poser, dial gauge, against the edge of the fly wheel or shaft. It's quite normal to have to do a couple of trial fits, rotating the parts between them before you get the thing right. I say it's quite normal, but the Cobra went together first time. I really don't know if this is good machining, good design or sheer luck, but nevertheless it did — trial fits I can live without! Also in this area, it's a good idea to grind flats on the shaft where the cone grub screws locate, to en-

No — not a caption competition! This is the flywheel being checked for run-out against a try-square. One lug of crankcase is held (carefully) in a vice.





Drive assembly is compact. Clutch bell and pinion are supported on ball-races for minium drag.

sure positive grip.

The next point to note in this same area is when the engine is mounted on its mounting block or, in this case, two blocks and two cross tubes, take care to ensure that the blocks and cross tubes will assemble to each other without any float. If you don't, the width of the engine and mounting block assembly will be too great for the space between the two side frames. I guess the engine mounting blocks, which have alternate sets of holes, will fit OS45's, 40's, 50's and probably some of the other standard size engines. If, however, you use the new OS46, as I did, you will have to either, obtain modified blocks, if they are not already modified in newer kits, or you will have to ease the mounting holes in the crankcase (sacrilege) slightly. I have to say that I chose the latter course using a Dremel and tool — very, very carefully! When you assemble the engine and mounting unit, between the side frames, it pays to do this whole thing on a flat work bench. By leaving the various bolts slightly slack, including, note, the four engine mounting bolts and the fittings for the front plate, you can shuffle things around, at this time, so that the bottom edges of the side frames are parallel and flat and the engine is absolutely vertical between them. You can check the latter by using the clutch output shaft and its bearings as a guide. If everything is set up correctly, with the bottom of the A-frames sitting together on a flat surface, the engine vertical, the top bearing of the clutch in its carrier will slide freely between the side frames without any side pressure being applied. If side pressure is necessary, the engine is not lined up correctly. You can assemble the model this way, but if you do, the output shaft must be bent and will continuously be applying side load to the engine. This will not do anything very much good! Having done the assembly this way, you can tighten the front plate in place. Once this is done, the six bolts holding the motor assembly may later be slackened to adjust gear mesh without disturbing the side frame and shaft alignment.

The next thing to take note of is probably the tail drive shaft. In this model, it's a wire drive running in a brass tube supported by three wooden disks in the tail boom. This in itself is fine, as the tube prevents any chance of the wire whirling and doing any nasty things like that. However, the wire is driven by fittings which rely on set screws being tightened down very hard on the wire. Bitter experience over the years indicates that if anything is going to fail, this will. These latest types have four set screws staggered along the length of the drive fitting. This is certainly an improvement over the old two screw type and the trick is to tighten one screw very, very hard. This bends the shaft slightly in the fitting and then tighten down a screw on it from the other side. You then do the other two screws likewise. If you do this hard enough, you do not get a slipping tail drive. I would like to have seen this part of the machine improved to the, now more common, bent wire and collet type of fittings, as it is, perhaps, the weakest point on the model, in a beginners hands.

Still at the tail, when assembling the tail blade holders, ensure that the thrust races are assembled the correct way round — the inner holes in the races are different sizes.

Woodwork

The tail surfaces are constructed from excellently cut plywood and the bent wire skid protecting the tail rotor is epoxied to one of the wooden parts. I chose to do all of this assembly using Flexible Cyano, reinforcing the wood/wire joining with glass cloth. In my kit, the wire supplied was in fact not long enough to make an adequate tail rotor support and I had to change this. Bear in mind that the length of this skid provides really adequate protection of the tail rotor, so don't be tempted to shorten it. I finished the woodwork using Solarlac and the self adhesive transfers supplied in the kit before gluing the assembly to the tail boom using silicon rubber, as specified. Don't doubt it, this method of attaching it really works.

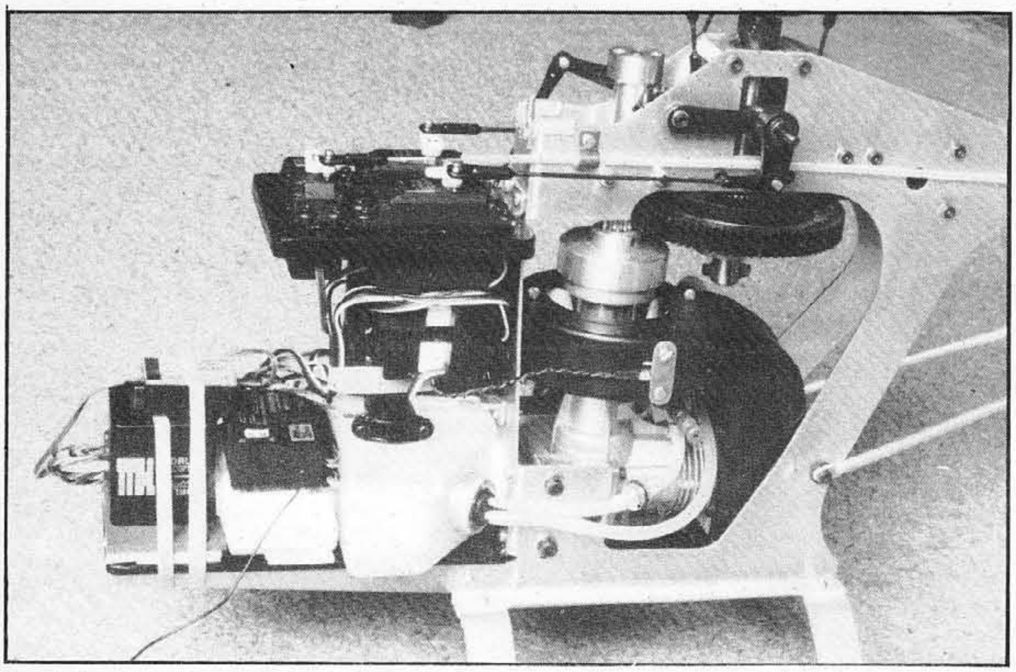
The servo trays are also constructed from die cut plywood parts and the holes in the plywood may need modifying if you do not have 'standard' size servos. It's a good idea to assemble, paint and fit these items before the tail boom goes on as it's a little easier to handle the model then. Be aware, also, that you will almost certainly need to notch the rear of the top servo plate to allow the collective control push rod to clear it. It's a little frustrating if you have painted everything before you realise this. For this reason it's probably a good idea to assemble the woodwork, temporarily fit it to the model and do the control run installation a little earlier than you might have planned to do it, so that you can ensure that these notches are cut before the finishing is done.

Plumbing And Electrics

The fuel tank, receiver and batteries are installed on another wooden plate carried on outriggers from the main frame. I retained my tank using servo tape with the 1200 nicad in front of it, with receiver on top and put the gyro in front of that lot. The plate is just long enough to do all this without

any bits and pieces hammering into each other or dangling. In fact a very neat installation results.

The canopy is assembled from two parts of vac-formed clear plastic and goes together well. I managed to find a suitable solvent to do a welding job round the edges, but cyano is advised and will work well. Once the two haves are together, you can trim the edges using either a knife very carefully or one of those little round widgits with sandpaper on



Installation is uncluttered. Gyro/battery checker was a little temporary at this point for gyro testing purposes. Clamp on tailrod has fuel-tube clamp to avoid pinching tube. Charging socket is retained to cooling shroud using redundant holes and a small plate.

them and a Dremel, as I did. While we're talking about the Dremel. I usually cut out this sort of thing from the backing material using a very small cutting wheel on the end of the Dremel, held very carefully. This allows an accurate cut — first time. The canopy is retained to the model using the sort of mounting that only John Gorham would think of. There is simply a grommet in a hole in the top which fits over a small fitting on the top of the frame and a block of wood glued into the bottom which fits between the side frame outriggers. It sounds horrible, but works perfectly. Once satisfied with the fit of my canopy, cut-outs round the control linkages, etc. I finished it by painting the areas that I wanted to paint in white Solarlac, carefully masking off the 'windscreen' and the two little side patches, which allow you to see the fuel contents in flight. Once the white paint had dried, idleness took over and rather than attempt a mask and painting job to decorate it, I used decorating strips cut from Solartirm using a sharp scalpel. The effect is very pleasing and convinces most people that I have done a demon paint job.

On the subject of Solartrim, I wanted to make the tail rotor easy to see, as the tail surfaces are not at the very rear of the model, so don't add as much to visibility as they might. I achieved this, also very effectively, by painting the roots and tips of the wooden tail blades black and covering the bulk of the blade with day glo orange Solartrim. Sounds disgusting, I know, but these tail blades are visible and I mean visible.

Set-Up

Control set-up proceeded exactly as specified in the manual. The lengths of push rods are specified the throws required of the servos are defined, both in terms of angles and also in terms of deflection of the swashplate in linear movement at the balls themselves. Absolutely top marks for that.

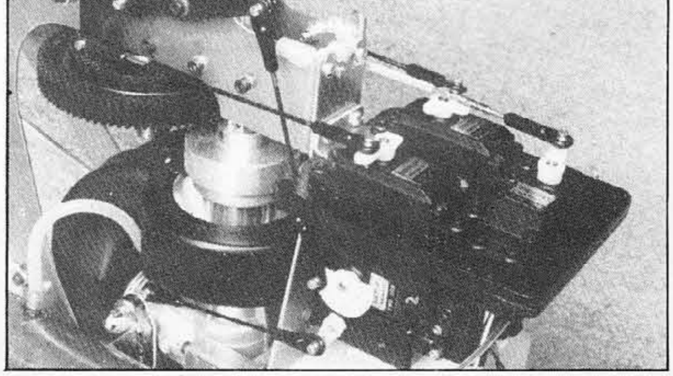
I deviated slightly in that I was using a radio with pitch curve adjustment and I intended to exceed the specified amount of positive pitch to cushion the bottom of autorotations. This meant that I set the pitch range up in a more linear manner than was specified and with more throw and then turned down the top of the pitch range using the pitch curve adjustment on the transmitter. The only quibble I have with the setting up instructions is that the tail rotor throw suggested turned out to be somewhat excessive when I flew the model, at least for this pilot anyway. I will add a few extra words of advice, though. When setting up the collective pitch range, it's worth noting that the top end of the available movement is effectively reached when, if you apply fore and aft cyclic, the ball links on cyclic control lever between the main side frames hit the top bearing carrier. The maximum low of the collective system is defined when, again, if you apply full cyclic, this time the bottom of the swashplate hits the main mast retainer.

Having established this range and I chose to set my collective servo up so that at absolutely full movement I achieved the total. It is then a good idea to arrange things so that the collective crank on the right hand side of the frames moves symmetrically above and below the horizontal position. Note here that horizontal means the rear part of the arm that carries the bell cranks is horizontal. You achieve this by altering the length of the single collective control rod, maintaining swashplate height by adjusting the three rods up to it. This will mean that any unwanted cyclic interactions are kept to a minimum, particularly around the hoverpoint.

Be aware, also, that the two pushrods from the swashplate up to the Bell-Hiller mixers must be absolutely the same length. Deviate from this and you will have a model that will drift in and out of track at different collective settings — you have been warned!

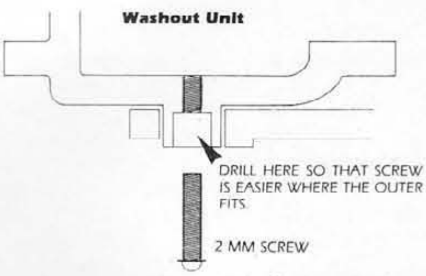
In setting up the head and control system, it also became apparent that those writers who have praised GMP ball links were absolutely right, they really are very good and extremely consistent. With a couple of exceptions, all of the ball link fits were absolutely first class. The exceptions I mentioned are on the head, on the Bell mixing levers. In my particular model, the outer ball was a perfect fit in the ball links but the inner ball was, in fact, quite tight. I corrected this by buffing this ball down, using very fine emery cloth. I also

All linkages are direct. Note that servo tray has been notched for collective rod and cut fuel tube siliconed to top of frame as canopy cushion.



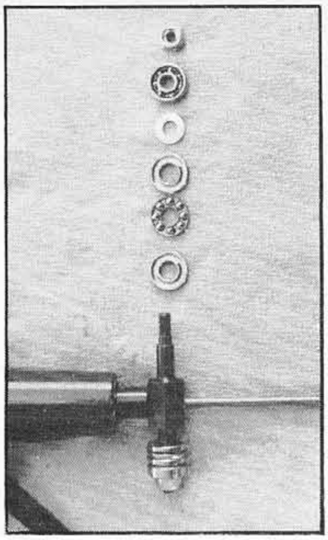
found that the balls on the inner of the swashplate were quite a tight fit in the ball links too, so I used the same method here to result in a smooth drag free assembly.

The other area where I chose to do a little rework was the washout unit. I have found in the past with this item, which is the standard Hirobo part, that when you insert the two small screws which link the two moving parts of this unit, they cause the shoulders to expand in the plastic arm causing the whole assembly to tighten up. The trick, here, is to drill out the screw hole in the outer half of these shoulders where they pass through the outer arms, so that the screws really only fit in the inner half. The drill size should be just under clearance for the 2 mm screws. This does not cause any problems but it does remove the drag. With a bit of luck there will be a diagram in this article which will show what I mean.



Summing up the control linkages, the simplified pitch up system results in straight, direct push rods everywhere and the whole thing works extremely well. Possibly the only reservation one might have is that the pitch up levers are supported in plain metal bearings in the chassis and in the pitch up arms. These will probably show signs of wear over a period and could well be replaced by ball races, long term. I believe standard ball race parts are available for the after market for this kind of modification.

The tail rotor pitch control is carried from the servo down the tail, outside the tail boom by straight wire running in a nylon tube. This is very smooth and direct. The only area to have a care with is the last few inches where it swings away from the tail boom to the bell crank under the gearbox. If you are not careful, you either get a rather tight turn here, or a fair amount of unsupported length. I built a small stand-off from plasticard to obtain the most direct push rod run.



Tail rotor head with one set of bearings fitted. Part of thrust race with larger hole goes nearest centre.

Blades

The main blades are composite hardwood leading edge and balsa trailing edge and are manufactured to a high standard. They come very much over length — presumably one size fits all GMPs. You have to saw them down to the correct length so be very careful here that you get them to the same length. The root fittings are plastic, the standard Hirobo in fact. However, there are detailed instructions for beefing up the roots with glass fibre prior to attaching the plastic fittings, which should result in an adequately strong root. Self adhesive covering material is supplied.

Flying

It's an old, but reliable, adage in aviation circles that too many unknowns aren't a good thing. For example, a new airframe and a new engine aren't a good idea — together! In this test we had both of these, but also a set of blades that weren't the original fit either. I had some cobra length and section blades to hand and planned to use the pair from the kit in a later exercise, which would have required some of their extra length, I bring this piece of non professionalism to your attention for a number of reasons:—

a. A salutary tale resulted,

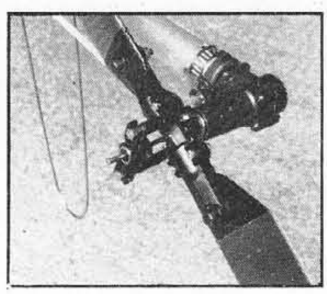
b. Not everybody's reviews are simple and

c. We're all human, after all!

But I digress, so let's get back to the story.

The OS fired up instantly, so after a tankfull with the blades off and at low throttle to settle things in, we were ready for flight. The first lift-off was uneventful and the model was within one half turn of track as built. Everything went well and I was doing autorotations at the end of this first session — which speaks volumes for the model. Over the next couple of sessions it became obvious to me that I was losing my touch, as I just couldn't settle down in the hover and it also became obvious that the track was not holding. It took a borrow of a pair of cut down G-Blades from Martin Briggs for the penny to drop (note to foreign readers; what drops for you?). A rapid check indicated that blade CG was way back — remember that these were *not* the blades supplied in the kit and something needed to be done! Next time out with a decent set of blades and we had rock steady hovering and straight flight on imaginary rails in the sky!

Tail rotor assembly is neat and has ball-raced pitch change plate with pivoted links — precise.



I have made two adjustments from the recommended set up. I have increased the maximum pitch somewhat, as the motor was overspeeding at full power and changed the throtttle differential slightly, to obtain a wider throttle opening at mid stick. As specified, it was not possible to get the hover set up correctly without running the main needle rather too lean. If you are fitting an OS46 too, it might be an idea to follow suit if you don't have a radio with a hovering pitch adjustment. Set like this the model hovers at 1500-1600 and drifts up slightly in forward flight — an ideal training set-up. I haven't done any aerobatics yet and will move the collars in before I do.

Autorotations are fine, particularly so if you have a bit of weight in the blades, as I now have. You can't expect the penetration of a bigger machine, so you have to be a bit more accurate with where you start, but no problem. The only thing to be aware of, here, is that there isn't much vertical tail area — once the tail rotor has stopped the model wants to follow the rotor round to the right — no problem if you are ready for it.

Finally

My only reservations about the model, mechanically, are the use of plain bearings to support the pitch-up system and the undercarriage mounting. The side frames are quite thin and any landing that causes the legs to flex must also flex the frames — a better arrangement would be nice here — I may fit some angle under the legs, by their mounting bolts, which should force the flex outboard. No doubt many people will fit plastic legs anyway.

The use of wooden servo trays has been criticised in this and other models, but as Luke Papanicola said, if you plant it, wooden trays break before your servos do! He has a point there!

On the flying side, after the slight false start due to my own short cut with the blades, I am very pleased with the Cobra and am building up hours rapidly. It runs very smoothly and is particularly comfortable in forward flight and is easy to see, making it ideal for getting into circuit flying.

The kit builds up easily into a very attractive machine — the final appearance has drawn appreciative comment whenever it has been to the field. Everything is very accessible and seems well designed for the job. There are a number of nice little twists in the design, stemming from John Gorham's design philosophy. In short, I like it and look forward to a long happy relationship. We will return to this model in future Model Helicopter World issues as we have a number of plans for it — reflecting the sort of life it might get in other pilots' hands.