

G.M.P. LEGEND *Review*



J. D. takes a look at G.M.P.'s new flagship.

It is not exactly every day that brand new flybar-less models come on the market. This type of machine — as an original equipment deal, rather than as an add-on — has not had a very good track record, commercially. However, with the Legend, G.M.P. have entered this, very special market in a very serious manner. The machine is, in fact, a family, built round a core member that is the review version, and is marketed as a model heli — without a flybar, rather than a flybar-less model, a subtle but important distinction. From the first lift-off it was obvious why — but I'm getting ahead of myself.

Layout

The Legend is a pod and boom,

'A-frame' helicopter of conventional layout, designed for 50-60 size engines. However, while the layout may be conventional, there are a lot of features which very definitely aren't!

Clearly, the obvious exception is the lack of fly-bar, but there are others, and one should bear in mind that the whole philosophy behind this machine is that the purchaser may, by selecting from a number of 'building bricks', configure the helicopter of his choice. This may range from a fly-bar equipped machine with a shaft driven tail to a flybar-less model with belt driven tail (as tested) and beyond, but more of that at another time!

The MHW review kit is the

current 'all-up' machine with belt driven tail, flybar-less head and a 60, and that is how we will describe it.

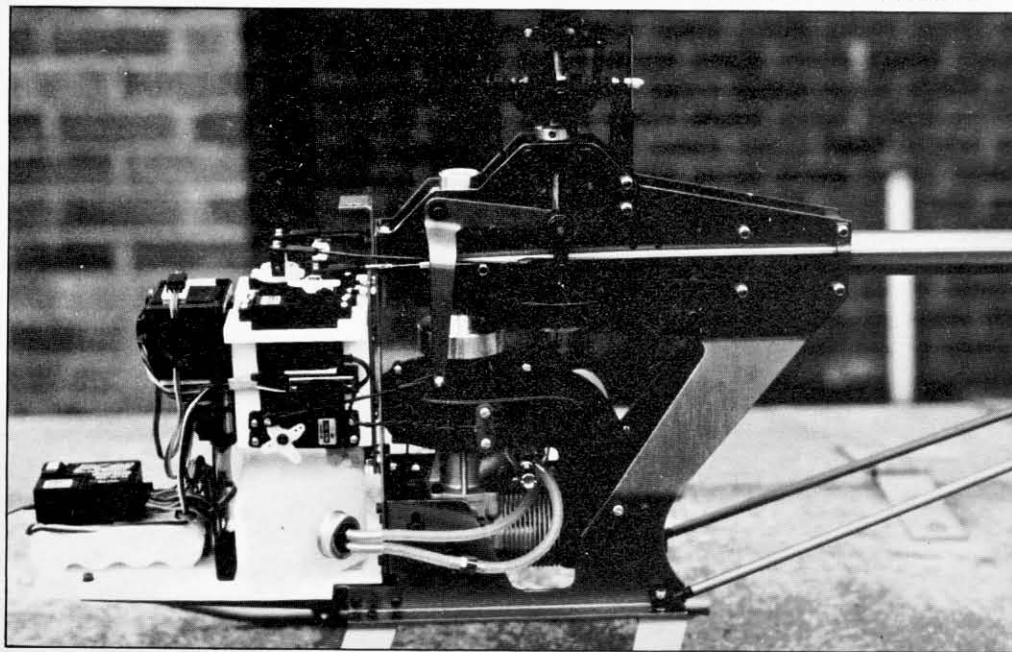
The heart of the machine is quite conventional, and embodies a vertically mounted motor, carried on a one piece metal mount. Main reduction gear is a single stage and drive is taken to it via G.M.P.'s well proven one piece clutch which embodies provision for a cone start. The flywheel/fan assembly differs from previous G.M.P.s in having a fan without a back plate which is integral with the flywheel. This assembly fits to the motor without having to remove the prop driver. This seemed to line up much easier than I remember from previous

types and obviates the need for a puller. However, the motor must have a prop driver no bigger than that fitted to O.S. engines. If you have a Super Tigre you must substitute a smaller driver (the O.S. will fit). Similarly, the pre-drilled mounting block may not fit all engines. My choice of Webra 61 fitted both flywheel and mounting block perfectly, however, if you fit a 50, you must order the correct block to suit.

The main gear incorporates a needle roller type of auto unit, and the 10mm main shaft is supported by ball races carried in metal bearing carriers. In addition to the ball bearings, the weight of the machine, multiplied by whatever 'G' you are pulling, is taken by a thrust race between the main gear and the lower bearing block. This way, friction is kept to a minimum, and the bearings are chosen for their design purpose.

The tail drive is picked off the rear of the main gear by a spur gear which drives a toothed belt from the top of its small stub shaft. The belt runs down the octagonal tail boom, twisting through 90 degrees as it goes, to the tail 'gearbox' which consists of a shaft, supported by two bearings carrier in a pair of

Side view shows final equipment fit and pitch up system. Two part cooling shroud fits Webra 61 without mods. Switch is servo-taped to base of tail servo. Note simple anti-rotation device behind swash-plate.



flat metal plates — very simple.

Moving forward again, the skids are carried by swept forward, aluminium legs and are the standard G.M.P. parts.

The canopy is formed from a very thick plastic material, is fitted by a clever, slide on, arrangement, and retained by a 'cam lock'.

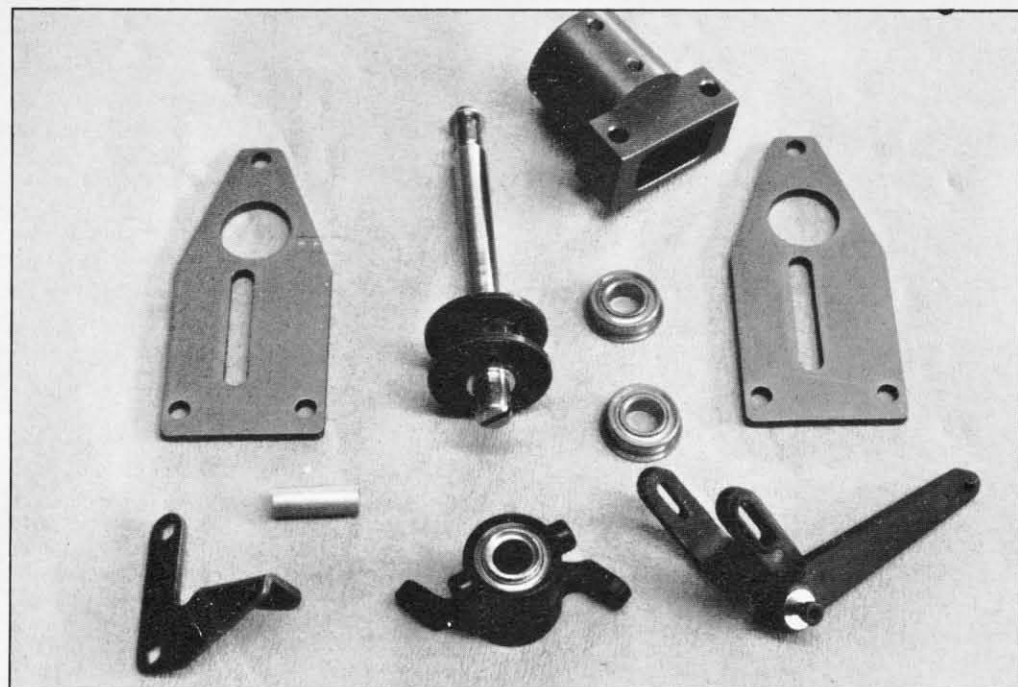
The tail surfaces are pre-cut from 'Magnalite' which is a composite material made up from a balsa core having epoxy glass (I think) outer faces. This is extremely light and very stiff.

All metal parts of the machine proper come anodised in a very subtle shade which I can only describe as silver purple (gun-metal?). Yes, I know that sounds disgusting, but, take my word for it, it looks very smart indeed, but more of that anon. To add to the overall smartness, the washers used throughout construction are finished in black.

Rotor Heads

The black finished, main rotor head uses the familiar, Hirobo sourced, cast blade holders, but the hub and yoke are original. Blade holders are supported by dual ball bearings and a single thrust race each. The head comes fully assembled, including the ball joints which are spaced off the blade holder by two spacers, allowing the degree of delta offset to be adjusted to suit the pilot's needs or even the weather conditions.

On each side of the hub are mounted two mixing levers



Component parts of the tail-rotor 'gearbox'.

which reduce the movement reaching the blades to half that of the rods coming up from the swash-plate. At first sight, it is difficult to understand the rationale for going this way, after all, won't reducing the swash-plate movement have the same effect? One advantage of the layout is that a fly bar head may be substituted without changing the control movements, of course, but one can't help feeling that there could be rather more to this than meets the eye.

The tail rotor head uses the

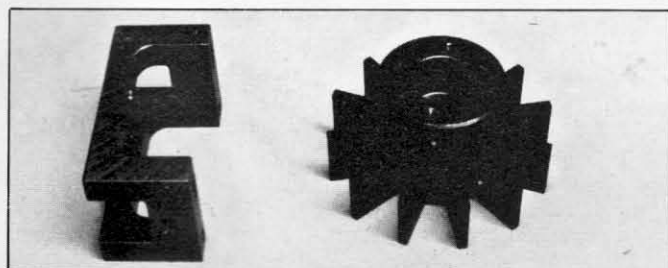
top of the range plastic blade holders with moulded plastic blades. Each holder has two ball races and a thrust race, for complete support of the blades.

Controls and Avionics

The servo installation in the Legend shows a bit of lateral thinking. All servos are mounted onto a wooden module which comes pre-assembled and cut to suit the current 'standard' size servos. If you are using something a little different you could

have a problem here, but the current Futaba, JR and Sanwa equipment should be O.K. This module, complete with servos, can be removed from the machine by undoing four nuts at its rear, and a couple of bolts at the front. The front support stay for this module incorporates a tray for your gyro and a space into which the smaller control units will also fit.

The receiver and battery pack are carried on a plate in front of the servo module in the nor-



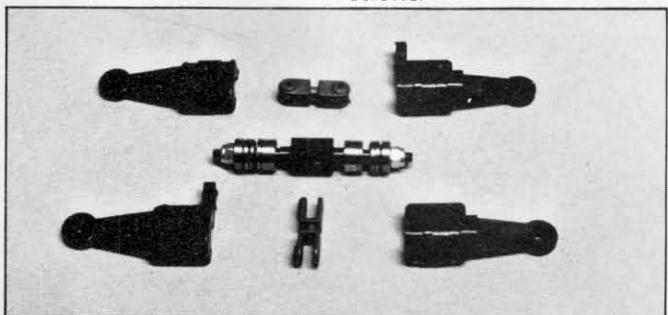
The one piece motor mount and the new type fan/flywheel.

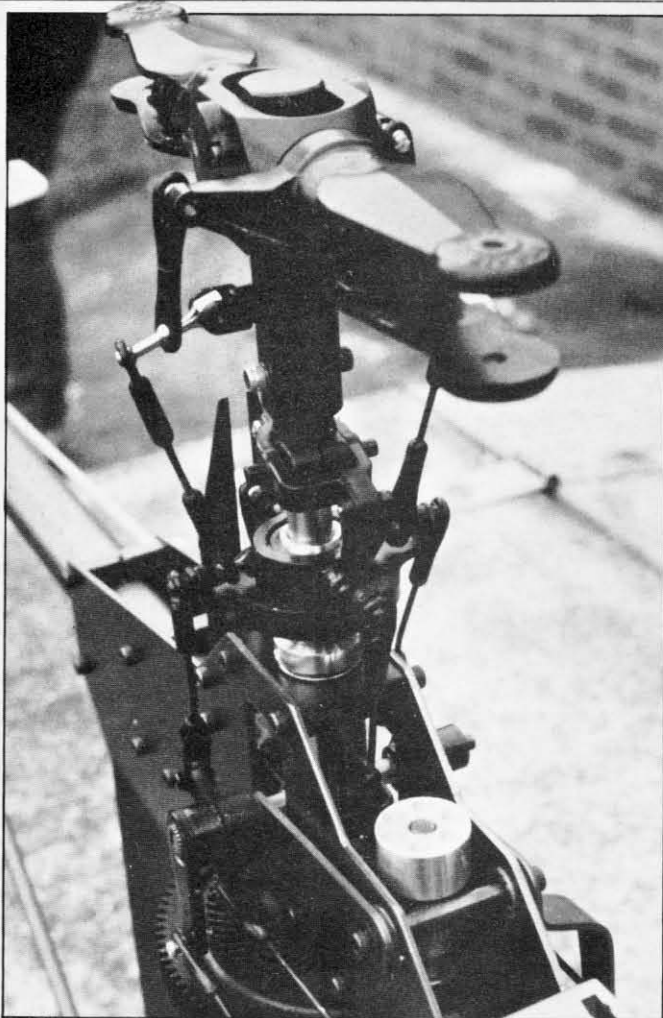
The tail rotor before you assemble it. Note double-ended links which are fitted by special shouldered screws.



Where you start. The Legend box and the four instruction manuals and excellent decal sheet.

Pre-assembled main rotor head, with top links already fitted.



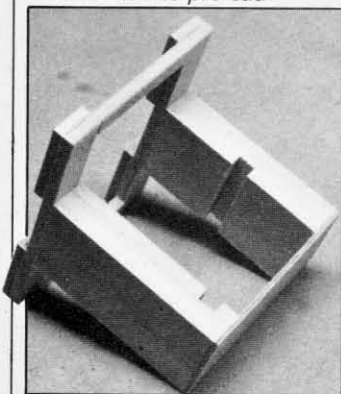


Head in place clearly shows 'reducer' lever on head. Note that reviewer has replaced cone starter with 'Helimprovements' adaptor.

mal way. This plate is somewhat wider than normal, however, because of the slide-on canopy fitting, so you must be aware that the full width cannot be used, or you won't get the canopy on! Fit the battery and receiver fore/aft and all is well.

The pitch-up system is similar to the Mk II Shuttle in its basic arrangement, and is fully ball race. One really nice feature is the way in which all lateral play

Pre-assembled servo tray has slots for cables pre-cut.



in the cranks may be taken out, the side load being taken on thin teflon washers. Four point fixing of the swash-plate is provided in a novel way. The fore/aft motion is introduced in the conventional G.M.P. manner from a 180 degree bell crank, but the left/right uses two, 90 degree cranks, one on each side. These are driven by two rods from the roll servo. In order to overcome the geometric inconsistencies that this induces, what looks like a mixer is fitted to the roll servo. However, this has no second input, rocking slightly as the collective is raised. The result is a very precise swash-plate control, with just barely perceptible collective/pitch interaction and no collective/roll interaction. The one slight fly in the ointment is the need to have a very slight bend in the roll rods to clear the main frames.

The linkage from the in-line swash-plate to the head, is, of course, very simple, there being no mixers, wash-outs or other garbage to confuse things, just those two reducers mentioned above.

The rod to the tail rotor runs

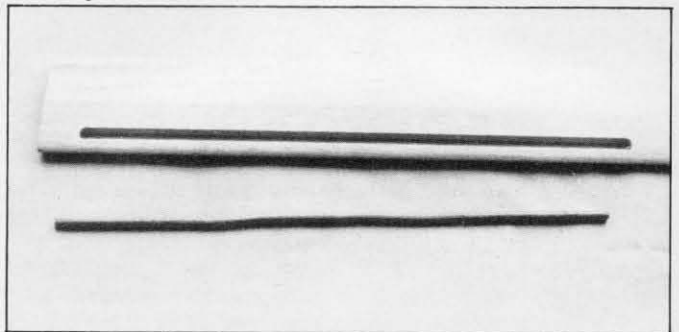
down the side of the boom in a nylon tube, retained by pre-bent clamps, anodised to match the rest of the metal work.

Tail rotor pitch change is introduced by an inboard slider which is ball raced. This is operated by a plastic crank which is carried on a plain bearing, but is slop free. This all results in very precise tail pitch control, matching the others.

Instructions

Instructions for heli kits have been reaching a very high standard over the last few years, and this kit is no exception, but a certain degree of novelty has been introduced. Rather than presenting a single, consolidated, manual, the Legend has no less than four separate vol-

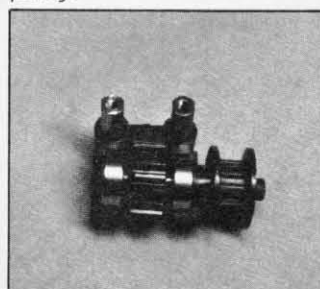
Blade end and weight before assembly.



umes contained in a handy wallet. These cover construction, setting up, blades and flying. Having a separate one for blades makes a lot of sense in this machine, as the handling characteristics are totally controlled by the blades — no fly bar here to cover a multitude of sins!

The suggested order of construction is logical, but I would suggest that the woodwork is finished and painted early so that you still have it dry and ready when you need it. The mechanical assembly is rapid, and it can take as long to deal with painting as it does to assemble the rest of the machine. By the same token, the canopy

Tail drive belt 'pick-off' gear and pulley.



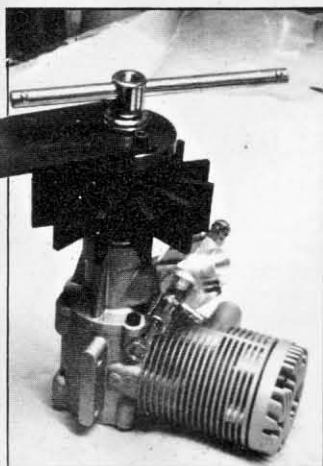
can be worked on 'in parallel' with the rest of the construction to save time, with no disadvantage.

The quality of description and clarity of drawing is good and there should be no excuses for mistakes to be found here. However, there were a couple of mistakes in my instructions. These were associated with the sides of the tail 'gear box' — the slots should be above the centre line — and the C.G. — which is not mentioned! The former is obvious, as you cannot fit the pitch control if you follow the manual and the latter comes out at the front of the shaft naturally, and this is where Len Mount recommends you fly it. I understand that later editions of the instructions have been corrected, so these problems should no longer arise.

Construction

Although this is a full spec. machine, construction presents no difficulty. I broadly followed the manual apart from painting the woodwork early so that I would not be delayed later. In fact, I would have gone further had I realised that the canopy fitting requires a bit of fiddling that will involve trimming the radio plate slightly to allow the canopy to slide on to the correct point. The canopy is constructed from four moulded parts that have to be cut from a backing sheet. This material is quite strong, but may shatter if you try to cut it cold (also, try to crash in warm weather — joke in bad taste!). I cut mine using a Dremel with a small milling tool and trimmed the assembly later using a saw and large milling tool — much quicker and more accurate than hand tools if you can lay hands on one.

Returning to the construction proper, assembling the power plant involves doing up the prop nut very tight, and I was pleased to see that G.M.P. now include a special tool for this which allows you to get some



Fitting the fan/flywheel to the motor. Note use of proper socket spanner (wrench).

real leverage without risk of wrecking the fan. Next you must line up the starting shaft, and I can only echo the instructions in saying that this must be done right. Mine only required a tweak of the shaft and it was all true. It's worth mentioning at this point, that I like to leave the engine mounting bolts slightly loose during the process of lining up the side frames, so that I can fiddle everything to achieve a perfect line up. One bit that is often forgotten is the need to ensure that the crankshaft is centred in the frames, and parallel with them. This way there is no bending load induced by the clutch bearing — it all lasts longer this way! Incidentally, at this point, the main shaft bearings are fitted; get the thrust race in the right way up — the small hole goes down and is almost tight on the shaft.

The next point that is worth spending a bit of time on is the control system. With care you can get all of the end float out of everything which is not only very satisfying, but also reduces the opportunity for vibration induced wear.

When you are assembling the servo tray, you will not be delayed, because you will have read this review, and pre-painted the woodwork! However, I found it useful to loosen the four screws holding the front stays, then assemble the woodwork, servo front support and mount plate, and then retighten these screws — this way there are no fights between the various parts!

Talking of thinking ahead, it's also wise to pre-paint the tail surfaces. These have square edges as they come, and, because of the composite con-

struction rounding these off isn't that easy. However, you can add an edge that you can round using $\frac{1}{16}$ balsa, worked around the curves, using slow cyno and accelerator. Cyno the edge and add accelerator to the strip and go to it. With a bit of care you get a roundable edge which is not permanently attached to your hands!

The canopy construction has been mentioned above, but it's worth repeating here that you may have to trim the cabin floor to get a smooth fit — easy with a razor plane or coarse file. The canopy is retained with a cam lock, and mine undid itself as soon as the engine started — not surprising as there is no positive detent. This is easily fixed by removing the mounting plate (#9512) laying it over a block of wood and thumping a recess in the underside using a large blunt screwdriver and a hammer — crude but highly effective! This way the ears on the cam lock drop into the recess and stay put — a very small recess will do — don't go mad. I also laced a bit of wing seating tape on the mounting plate and added a sleeve of thin wall tube to the cam lock — this way it all snugs down well. All in all this is just about the nicest canopy retaining that I have ever handled. When the canopy is in place it feels like a part of the model not just a rain guard.

The fuel tank is the standard Hirobo/G.M.P. item and looks a little lost in the space provided. Particularly for 60 use, a bigger unit would be nice, and I believe G.M.P. are looking into that. In the meantime, by a fortunate coincidence, we have had a letter from Chris Anson of Kirkland, WA. Chris has been flying his Legend with a tank he located in the Hobby Lobby International catalogue at \$8.50. This is the GR236 and sports a 14 rather than 9oz capacity — thanks Chris. We will try to locate a U.K. equivalent and let you know.

Blades

These are an important part of any model, but with a flybar-less machine, they are all you have to play with to produce the desired handling characteristics — no fiddling around with flybar weights on this machine. O.K. I know that it isn't quite that simple, teeter restraint and delta offset being involved too, but I'm sure you understand what

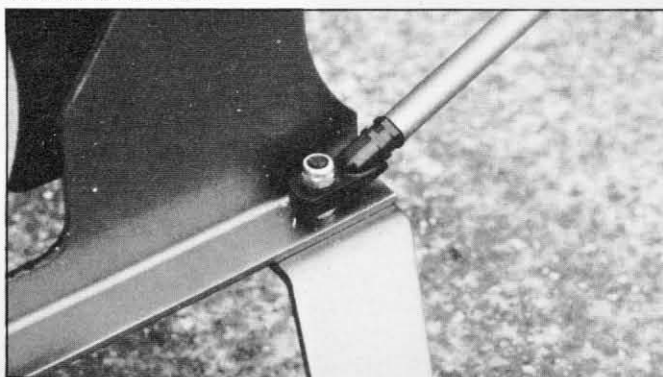
I am saying. G.M.P. take the blades very seriously — a whole manual devoted to the blades is serious — and you had better too!

The blades themselves are wood, with balsa trailing edge and heavy wood leading edge. Wood root reinforcement is already fitted, with an aluminium bush pivot. They are of bi-convex section (semi-symmetrical) and have a finished chord of 54mm. There is a groove machined under the leading edge that takes an approximately 10in long lead rod — sorry about the mixed dimensions! Heat shrink covering is provided. Full details are given in the manual on assembling and choosing the weight for you blades to suit your own flying style. I was quite content to accept that the model is capable of extremes of hot dogging, so I went toward the top weight, following John Gorman and Len Mount's advice. My target weight was 173gm, and to achieve this I found I had to add a little more weight than that provided. I toyed with the idea of using bronze powder loaded epoxy in the slots (as well as the lead) but, in the end, decided to use strips of lead flashing cut to achieve the desired 'dry' weight and slid around to achieve a match of C.G. This worked a treat, no further balancing work being required.

I will confess to deviating from the manual in two places. Firstly I covered the blades with Fablon — I'm afraid I just can't come to terms with heat shrink, though everyone else seems to! Secondly I chose to cyno a couple of layers of thin glass cloth around the roots for a bit of insurance — I'm not saying that this is essential, but I am a very careful man!

The all-up weight of the re-

Neat fittings for tail boom stays self tap into stays which have an internal thread cut.



view machine, less fuel, was a couple of ounces short of nine pounds.

Finishing

I painted the canopy and tail surfaces in white Polycote and finished the model off with the vinyl stickers provided. Combined with the strikingly coloured metal work, this produced a very attractive result in a very short time.

Setting Up

Fitting servos and controls is very easy, helped by full size drawings of all push rods and the well thought out manual. The very simple pitch gauge initially produced a mirthful reaction, but it finally dawned on me (my brain hurts) that by setting the model absolutely level by placing a small bubble gauge on the mast top as a reference you are in business. After levelling the model, you place the bubble gauge on top of the pitch gauge and then arrange a transmitter aerial or similar as a zero reference. Having thus established a datum you can make precise measurements very easily. In case you are wondering if the reviewer is suffering from too long in the hot sun (England in December?) remember that there is no flybar to act as a reference — O.K.? My only doubts at this time were whether there would be enough tail pitch to hold station in the hover. However, I was running out of excuses fast, and it was time to fly.

Flight Test

Initial hops took place in my back garden — not recommended, but as needs must. You will, no doubt, be aware that flybar-less models have a reputation for being a bit squirrely if the revs are too low. The first lift off was at very low revs, as the motor (brand new) was running very rich. My initial reaction was 'I ain't got it' and put it down quick. Realisation

rapidly dawned that, in fact, I had got it, but it was much more docile than I expected and I wasn't being positive enough. The next few minutes hovering around convinced me that I was going to enjoy this machine, and I forced myself to land and check it over before heading off to the field.

By this time the wind was up and choppy and things were generally nasty all round. However, two tanks full running with an assortment of slow circuits felt so normal it was almost silly, and incidentally confirmed my suspicion that a bit more pitch was needed on the tail in the hover. By this time I was happy to lift the model off from a slope with a quartering wind so you might be getting the idea that it's pretty comfortable!

The next flying session proved that we, at MHW really test our models realistically! There is a growing bank of statistical evidence that whenever I fly with one particular friend, my engines play up — this was no exception! The flying sight was a patch of grass next to some buildings and circuit flying necessitated going out between the buildings and

a fence before turning and flying around. A return was along the reverse route. After a bit of hovering around, pirouettes and hovering circles had convinced me that the Legend was a pussy cat in this mode I moved out to some circuit flying. On the last climb out I hit the go button and the motor quit cold (there was another motor running — ain't there always!). Anyway, the enforced auto didn't have a chance and all I could do was get it level and slow it at the last minute. The result proves that not giving up 'till the ground hits it is sound practice. The skids were flattened, the canopy split, the servo module cracked at the joints and front stays a little bent. It flew the next day, after a good clean of the fuel system and some serious cyno work!

Conclusions

Well, it's clear that I haven't done nearly enough flying to explore the full envelope of this machine, so I will be returning next time with a further flying review, but I can make some remarks right now.

I am quite prepared to believe that in the right hands the

aerobatic potential of the machine is enormous. I also believe that there is a large potential market for the machine who would buy it to have a flybarless machine, either to be different, or for the potential in scale bodies. This market may well be wondering 'Can I handle it'. To this market I say a resounding 'Yes — rest assured, you have flown flybar equipped machines with trickier handling!'

The kit itself is first class and builds up beautifully. There would appear to have been no short cuts in the mechanics and I would anticipate a long reli-

able life from this one. The most demanding bit of the assembly of the lot is building the blades which requires care and patience rather than any particular skill. However, my spies inform me that a special set of glass blades may soon be available for the man who would rather go that way — just any old set is definitely not advised!

The final appearance is particularly effective, the light canopy (light grey is advised in the instruction), and anodised metal work combining to give a delightfully different effect. In short, I like it.



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