HELI-PAD

by John Heaton

A BEAUTIFUL example of the Kavan *Jet Ranger* recently came into the shop in exchange for a trainer and stood in the window for a couple of weeks before I decided that it would make a very suitable and intersting subject for a test article. The model was very finely detailed, including upholstery, carpets, folding seats, full lighting, dummy pop-out floats and a beautifully moulded undercarriage, but was unfinished mechanically. I am sure that most helicopter enthusiasts are familiar with Kavan *Jet Rangers* but here is a brief description for newcomers. The model consists of a structural glass-fibre fuselage with real windows and a uniquely mounted transmission engine unit. Interestingly this is one of the few helicopter kits with scale blade rotations (anti-clockwise for Yankee jobs). Building one of these Kavans is not the easiest job in the world, there is a multitude of hard ply pieces which have to be cut out and mounted, therefore to make a professional looking job you have to be something of a craftsman. It is not impossible, however, in fact I would say that the task is equal to that of building a conventionally constructed fixed wing scale job.

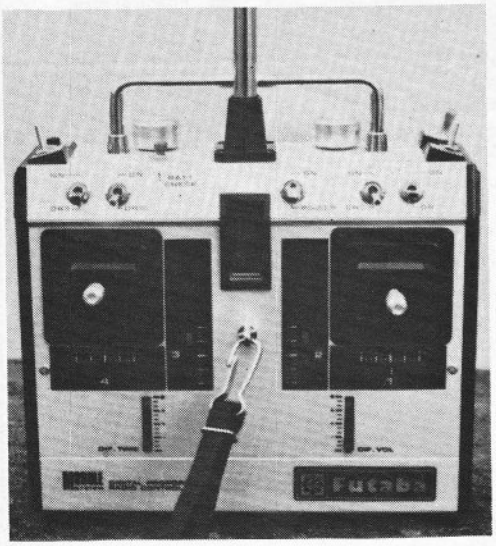
The mechanics are unique in layout and superbly engineered in the usual teutonic way. Servos are all mounted up in the cabin roof which gives a very scale front cockpit. When you assemble the model it should be done in this order — transmission/engine unit inserted first, followed by the cabin roof including mainshaft and servos, then the tail rotor gearbox. Tail rotor drive shaft is quite unusual as it has square sectioned ends for foolproof drive (just like the KKK *Hughes 300),* it goes through an outer tube anchored in a couple of formers and is a very recent addition, judging by the revised assembly manual, which is incidentally very comprehensive. The whole thing went together quite smoothly, although it was a little time-consuming, the whole thing taking about two days. I chose the Enya 60 engine (I had several of these in stock), and fitted it with a special silencer made to fit into the existing space, but which would silence more adequately than the standard item in the kit.

The radio chosen was a J series helicopter set and was fitted in the normal way. The Kavan is designed for a five servo system, which these sets are. The servo reverse switches on this set were really convenient, saving the mental agility necessary when you have to work out servo directions to get the right sense.

The following day dawned bright and clear and I fired the model up. I found that it was very handy to have a starter cone on the bottom of the fuselage, eliminating the fiddle with starter belts. The first run up of the engine revealed no nasties, and she took to the air. Initially, I switched out all the control function mixing and had to cope with manual compensation of an alien torque reaction, most models having clockwise turning rotors. The motor was set up in my normal way, which was to lower the r.p.m. until there was just enough tail rotor correction to be comfortable and leave it at that. On the Kavan you will still have a fairly high *engine* r.p.m. and it uses a 12½ to 1 reduction as opposed to the 10 to 1 found on most machines. Cyclic was very docile and stable, a bit like a Mkl *Falcon* and, if you look closely, you will find the head geometry not all that different. The tail was a little unusual in feel, a little bit like a *Gazelle's* fenestrom, being not quite as hard as most offerings. This, however, is obvious as the tail blades are very small, almost scale sized compared to the vastly oversized and hence crisply responsive Japanese jobs.

J-series checkout

After the initial tankful to sort out mechanical adjustments like tracking, mixture, etc., I started to experiment with the gismos. First of all I cut in the tail/collective mixing and nearly achieved complete torque compensation. Final setting was achieved with two little levers, one which brought in just a twitch of tail on a collective movement, the other to adjust the timing of this switch. It is pointless saying how well the servos worked etc., as they all seem the same these days, but the large, heavy and complicated transmitter does give a sort of feeling of well-being. A pleasant find was that the receiver aerial fitted internally round the front of the



Left: the Futaba *'J' Series* transmitter. Right: fine detailing of the fuselage in this close-up shot of the *Kavan Jet Ranger*.

cockpit and never once caused a glitch at any angle in the circuit. Needless to say, the set incorporates a throttle hold and the usual rate switches, which I find a complete waste of time, sometimes even dangerous unless you tweak them round so that you get 100% in either position. Further features which are of special interest are:

(1) Differential can be put on the collective servo electronically with the knobs on the back of the set, also the throttle trim only works at the idle end which facilitates throttle link up.

(2) There are a host of incidental items such as roll and spin buttons, dual trims, press for battery state, direct transmitter-receiver lead for no RF-output testing, and, no doubt, some which I havent't discovered yet.

I was extremely pleased with the set, my first step into state-of-the-art gismos. Now all I need is a gyro to really start flying with the whizz-kids.

Back to the model

I ran about six tankfulls of fuel through in the hover to become thoroughly sure of the model and engine, and then went into circuit work. Very normal and, with all the servo mixing, showing very few of the normal asymmetric trim changes. Realism was fantastic and handling very smooth and uneventful, in fact, that night I took her to pieces to check and found nothing amiss. One modification which was made, which I feel the mechine warrants, was to fit a set of lifting section blades in place of the symmetrical ones supplied. These new blades really do improve the performance of the model. It hovered effortlessly on half throttle (compared to three-quarters before) and as the whole machine settled down, it began to run sweetly. As the day progressed, I really began to enjoy flying this machine and became very confident with it.

That very same evening I had one of the most pleasurable flights I had ever had. Imagine an absolutely still winter afternoon with the dusk and mist setting, and the *Jet Ranger,* lights flashing, flying in gentle circles hands off, then gently reduce collective to make an approach from way out with the landing light shining really brightly, gradually arrest the descent and gently lower her on to the model heli-pad as darkness falls, engine running down and light still flashing.

If I can analyse the machine against others:

Advantages

(1) Very scale looking; (2) Properly designed tail drive doesn't flex; (3) Rubber mounted engine is kinder to servos, etc.; (4) Cone on crankshaft for starting; (5) Engine completely contained in mounting box keeping oil and mess in one place.

Disadvantages

(1) Difficult to build; (2) Engine hard to adjust; (3) All maintenance difficult.

The nicest aspects are its good looks, rubber mounted engine and transmission (nice to know the more damaging high frequency vibes are not getting to the radio), scale detail and the extreme ease of cone start. Most unpleasant aspects really boil down to having to work the engine harder or rather rev it harder than necessary due to low gearing and high weight. Mind you, that does make the task of achieving a constant rotor r.p.m. much easier as the motor is working near the top end of the power curve and therefore cannot rev. much more if the motor system is badly adjusted.

There are some quaint mistakes in the instructions such as arranging the throttle differential so that the carb is fully open at ¾ stick and the last ¼ only gives collective, while we know that raising the last ¼ will increase power demand and there is no more to come. I was, however, pleased to see that they arranged the collective mode in the same manner as I prefer (forward for low).

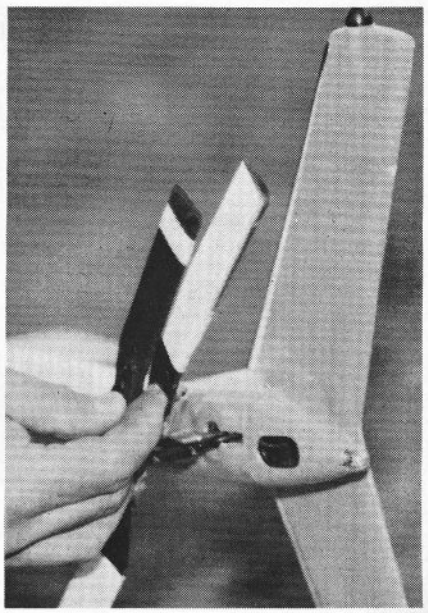
There was a trend some years ago to make all kinds of modifications, but I think none of these made any improvement on the scale *Jet Ranger.* The most popular of all these modifications was to completely rework the mounting system so that the servos were mounted on pillars and in turn fixed to the rigidly mounted engine and all vibrated away merrily, in one swoop negating the best feature on the machine; namely the flexible mounting of the mechanism. There have also been many modifications to the collective pitch-up mechanism, but I personally see nothing wrong with the standard system. Mechanical reliability is of an extremely high order, but it needs careful assembly. The clutch is superb, one might even say over-engineered. Flying characteristics for gentle scale type flying are as good as can be achieved with any model but for pattern type competitions, the tail rotor is not powerful enough to handle things like nose-in circles in a stiff wind. I guess the scale blades just do not have the bite. This is not really a criticism, as this is a scale model and flies in a very scale-like fashion.

After having flown the *Ranger* for a few days in differing conditions, I began to feel that the machine may have some potential as this year's competition model. My 212 is now better than ever after her Slough crash, but I feel it deserves a rest as it performed faultlessly at all the events last year (winning quite a few trophies), plus demonstrations most weekends at fetes and, the most difficult of all, teaching me complete mastery of model-facing-me orientation last spring. I could handle a helicopter well enough to avoid crashes in any situation, but I didn't have complete *mastery* of all attitudes, so I just practised for two hours every day with the model facing me until I felt completely at ease. Having learned this I discovered a new manoeuvre, a pirouetting circle, and could do nose-in circles with ease.

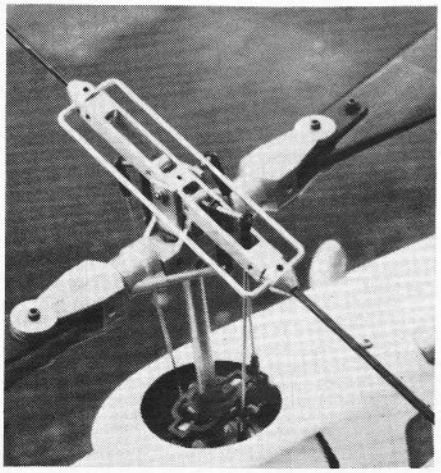
I set about adjusting the *Jet Ranger* for top class competitions. Obviously mechanical reliability is a must and, having kept a watchful eye on the mechanics during the initial learning period on the machine, concluded that this was excellent. The first thing to improve on was the tail control power. I made up some 1 inch longer lifting section tail blades which transformed tail response, as I now had sufficient tail power to pirouette against torque in a stiff wind and, more importantly, did not have to rev the engine excessively. I next turned to the cyclic response, as it was apparent that the geometry could be improved. The main thing was the lack of Hiller effect due to the mixing ½ lever fulcrums being well inboard, and therefore movement of the flybar had very little effect on the main blades. This makes things rather untidy with pitching up tendencies a bit like a flybarless head, as airspeed builds up. This is, after all, not really surprising as most of the cyclic steering is direct as there is so little Hiller effect. The route that most people used to go i.e. wood paddles, hard teeter rubber and silliest of all, changing the scale horizontal stabiliser for a symmetrical one, did not get to the root of the problem. Wooden paddles made it twitchy and non-linear, so much so that I was unable to fly the machine. Hard teeter made it cyclic in a series of lurches and, of coure, changing the horizontal stabiliser makes no difference at all. I simply shortened the mixing levers and redrilled the fulcrums further outboard (in fact I copied the geometry of a *707*) and, hey presto, it worked perfectly.

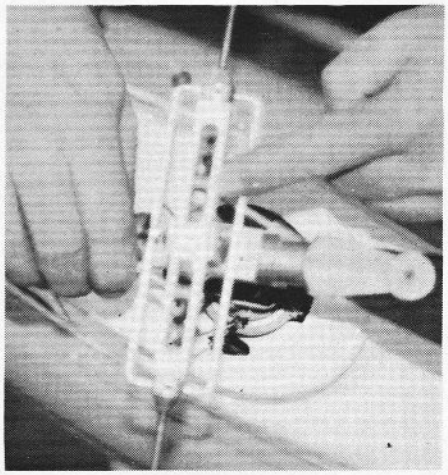
All that remained to do now was to fine tune the throttle/collective geometry to achieve a nice constant r.p.m. Pitch starts off about three degrees positive and finishes way beyond ten, the pitch gauge goes up to .1. I would think the instructions are a figment of someone's imagination, as it is supposed to lift off at three positive pitch on symmetrical blades.

Performance is now very satisfactory and one useful feature of the J series with its trimmable collective pitch facility is to set the model up as you think best for competition or stiff wind conditions with the pitch trim switched out, and for very gentle flying for sport or calm conditions, switch the trim in and adjust it to provide a couple of degrees more pitch. The r.p.m. then lowers and the model cruises around extremely quietly and smoothly. If you want to liven it up a bit, switch back to initial chosen r.p.m. Natty eh!



The modified tail rotor blade compared with the standard one still on the model.





Left: original mixing lever in the head. Compare this with the modified pivot position as seen in the photo right.