A 4-BLADED SCHLÜTER HELI-STAR

Multi-Blade flying based on Schluter parts.

Having seen pictures of Americans and Continentals flying multi-blade sport models and with the intention of eventually building a scale four-blade model, like a Lynx or BK117, it was decided to see if it really is as difficult as it is rumoured to be.

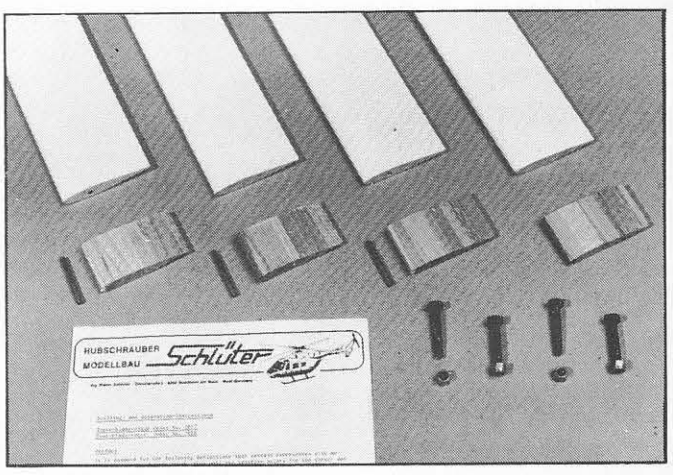
Options

As the Helistar uses a slotted mainshaft with a wire to introduce collective pitch into the system, the first major change is to consider how to convert to a system of cyclic/collective pitch mixing (CCPM) to provide rising swashplate collective. The Schlüter head instructions show a system using Simprop 3 ball, servo top mounted mixers on a modified woodwork setup. The system chosen however is that used on the new 'System 88' models, typified by the Scout 60, where three servos are mounted in a frame and rock in unison to give collective motion. The 45 degrees offset control that this system provides was intended to remove the need for the blade pushrods to lag 45 degrees behind the pitch arms on the head. As we shall see later this did not come out exactly as planned.

The Conversion

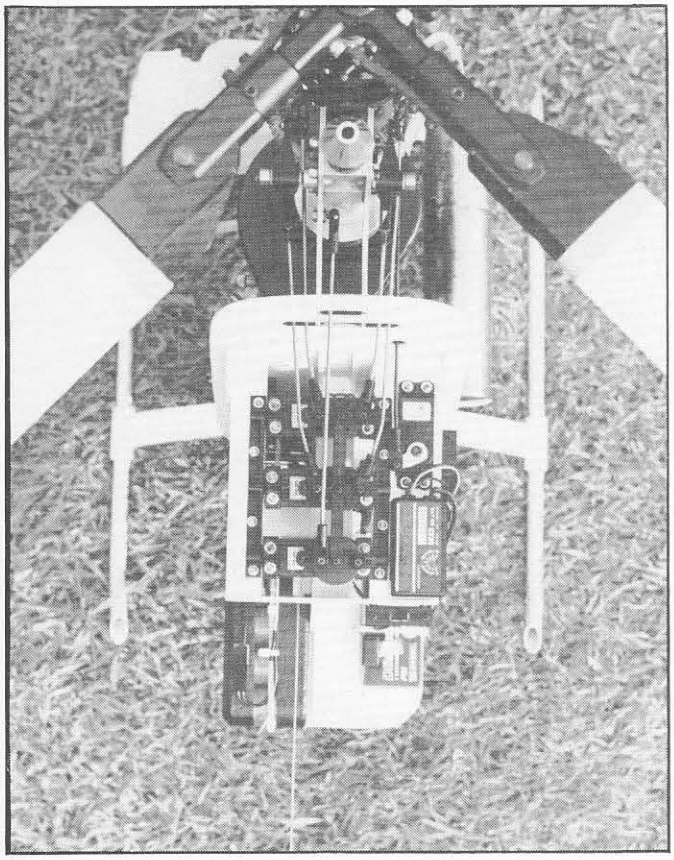
Having studied the Scout 60/ Junior 50 instructions, a list of parts were ordered from the helpful local model shop. As Schlüter designs all use a 20 mm dia tailboom, this makes for a good degree of compatibility, with the central woodwork spine being the same width on all models. Rather than irreversably modify the Helistar woodwork it was decided to utilise the Scout 60 parts which merely require a different rear bulkhead (copied from the Helistar original) and holes drilling to suit. The rocking servo arrangement is described in the parts list as '18 part mixer' (part no. 3440), at this stage it helps to have access to a Scout 60 or its instructions to visualise where all 18 parts go! The woodwork was assembled with the top plate reversed to put the tail rotor servo on the left in the interests of a more direct tail rotor linkage. The pivot pins for the rear right angle bellcranks are fitted in the existing cyclic bellcrank holes in line with the mainshaft, with the spacer on the left side. Two new holes need to be drilled 47 mm forward almost in line with the starter shaft where the front two pivot pins are fitted, with the spacer on the right. The original mainshaft has its head fixing bolt hole above the level of the blades, so a new, shorter shaft was produced from 10 mm silver steel. The exact length of the mainshaft however is not too critical (mine ended up 130 mm between the holes). A small collar is also required to hold the mainshaft up, this was made by a friendly local model engineer and fits with two M3 grubscrews. By now it should be apparent that a large handful of Schlüter ball links are going to be required, some 22 in all. It was decided to make up pushrods from 2 mm silver steel to link the servos to the bellcranks, rather than try to calculate precisely which Schlüter items are needed. The swashplate is also a 'System 88' assembly and has holes for 2, 3 or 4 blade operation as standard. Movement required is somewhat less than normal as none is lost in a washout system. The head instructions call

Finished blades with off-cuts of blades and leading edge weights, weight is positioned at LE to give a better chordwise CG as well as adding to the blade weight in general. Note Schlüter safety bolts.



for 6 mm cyclic and collective movement and to achieve this on the collective servo, the link has to be fitted as close to the mixer drive bar as possible (see photo).

Top view. Note the small radius on the collective pitch servo. Also shown is the whip aerial, a Barneys Model Shop item.



Head And Blades

As received the head is fully assembled and very nicely machined including Schlüter's own special high strength blade bolts and long stand-off pitch balls. The blades are another story, if you have become accustomed to glass 'fit and forget' blades, requiring the C/G correcting steel wire to be glued firmly in the machined leading edge groove and root hole. To avoid having overlapping main and tail blades, the mains were shortened by 30 mm. Then rough balancing was carried out prior to covering with the film supplied. Final balancing starts by adjusting the spanwise C/G so all blades are equal then adding film to the lighter blades C/G to match the heaviest blade. The last few fine adjustments may take some time and patience to get right, but it is well worth the effort. At this stage some form of blade and holder identification, either coloured tape or numbering should be applied which will enable you to put the blades on the head repeatably. The pitch pushrods were fitted upright and the servo throws adjusted to give a pitch range from −4 low to +4 in the hover with a maximum of +7.

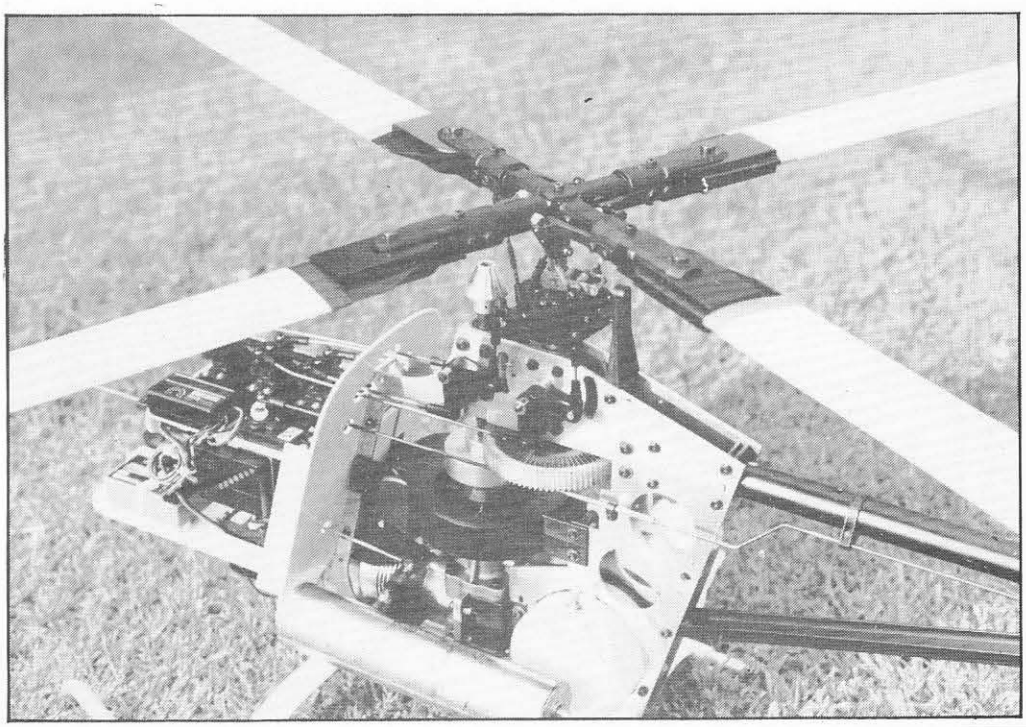
The construction and painting of the woodwork and finishing the blades was done at a leisurely pace, but the conversion proper was carried out in one day, so as not to lose too much flying time. Luckily Sunday morning dawned sunny but fairly windy.... so to flight.

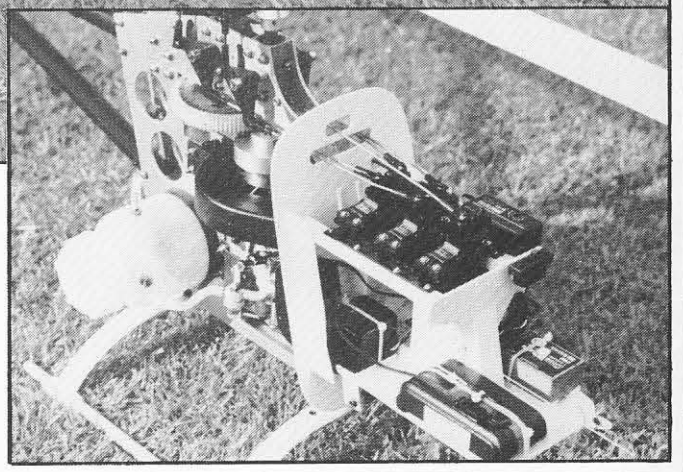
Flying

As no changes had been made to the engine set-up the Enya 60X fired up as usual. Bringing the rotors up to speed resulted in no lift off, but feeling out the cyclic made me wonder what I had done to a nice accurate flying Helistar. A bit of experimenting proved that the phase of the cyclic response was 45 degrees clockwise to that required, ie. to get forward movement the stick had to be moved forward and left diagonally. This was fairly easily corrected by moving the upper swashplate round 45 degrees in an anticlockwise direction and lengthening the pushrods to compensate, at the same time adding a little extra pitch that it seemed to need. Now we seemed to be getting somewhere, at least when you give forward stick you get a result approximating to forward movement. Initial worries about tracking all those blades proved unfounded. Careful setting up with a pitch gauge on the bench meant only minor (1 or 2 turn) adjustments were required after which the tracking tape was removed to cure the flicker effect it caused. From here on just follow Herr Schlüters instructions and go back to basics while you learn the different style of flying required, as he says do not be sidetracked into flying flybar stabilised models, I would say at least while learning as it is not really any harder, just different.

Having got to the stage of flying fast circuits with the model in two blade form and gentle circuits out in front it came hard to go back to hovering gently for several flights. When doing lazy eights a noticable characteristic also mentioned in the instructions, is the tendency to rear up rather sharply when stopping, but this is soon overcome with the development of a different flying style. After two or three flying sessions the opportunity arose to meet up with Martin Briggs to get some help with the finer points of setting up and comment on the flying characteristics. Martin, having flown the model before in two blade form, was surprised to see that it had apparently grown two extra blades, after a few minutes experimenting was soon flying circuits even including a couple of tentative autorotations. Now having completed some 16 flying sessions, which must amount to about 5 hours total airtime, I am beginning to appreciate the smoothness and

This view shows the head, its linkages and the revised layout for the bellcranks (Scout 60) and tail rotor pitch push rod position.





stability provided by four 140 g blades turning at approximately 1800 rpm.

Thanks are due to; Jack Williams (Schlüter agent) for the prompt supply of parts via Barneys Model Shop, Kings Lynn, also MB (who?) for the unwitting loan of the Scout 60 instructions. □

Highly polished appearance due to Mr. Sheen and Solarfilm products. Tail is kept nicely in line by a KO (GMP) gyro and NHP carbon fibre blades.

Radio room is Scout 60 grafted onto Heli-Star backplate. Servos react like a well trained regiment.