A SUPERIOR FORM OF FLYING

A review of this model from the Schlüter Stable, described here in two parts over the next 6 pages.

PART I
by Len Mount

Introduction

Having had a sneak preview of the 'Superior' in Holland at the beginning of the 1983 competition season, I couldn't wait to take delivery of my first kit when they were released onto the UK market in the late summer.

The name 'Superior' has been well chosen, because of the lavish superlatives one could direct towards this beautifully engineered radio controlled helicopter. Indeed, apart from the staggering quality of all the manufactured parts, every possible effort has gone into making all moving parts fully ball-raced and adjustable including all the control surfaces.

It should also be made clear from the start that this is a new addition to the Schlüter range and not just an update on one or more of his existing models. The 'Superior' is a new breed of R/C Helicopter kit capable of being used in both two and four stroke form with engine sizes ranging from the normal 10cc glow up to a 22cc petrol.

Inside the Kit

Close inspection of the kit reveals the normal numbered bags, which contain the various sub-assemblies of the kit, plus a large detailed plan and a set of comprehensive building instructions.

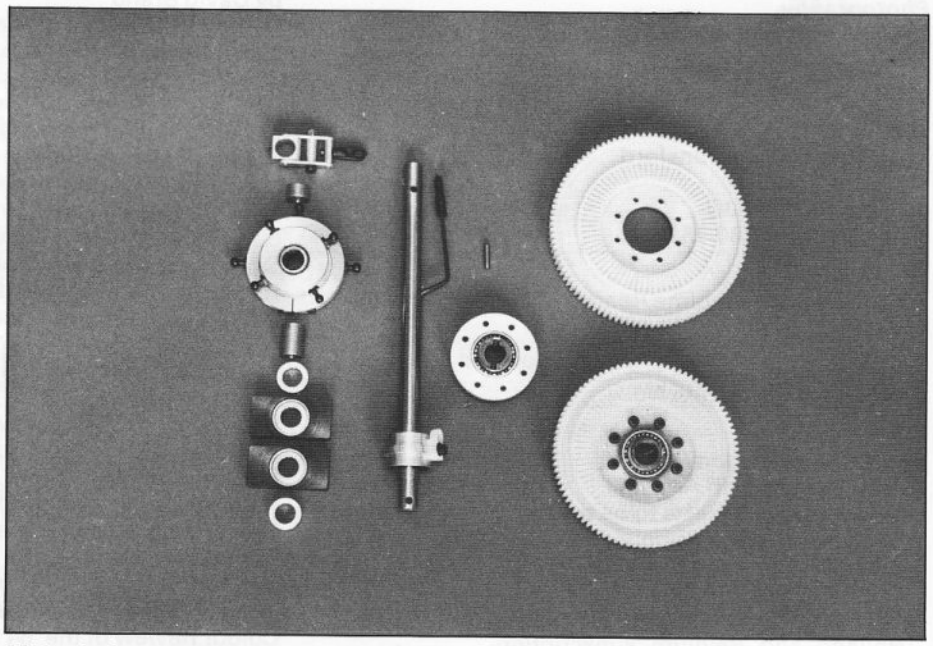
The main side frames which are press formed wider at the bottom end to allow easy access for both engine and fuel tank accept the tail boom in a rather novel fashion with the tail rotor drive gear assembly taking the role of support bracket as well. The Motor is mounted in its usual north/south configuration with the crankshaft upwards and the cylinder head facing forwards and the drive train is achieved utilising the outstandingly reliable Schlüter metal clutch and bell housing.

The drive to the main rotor has a reduction of 9:1, with the facility of the 10:1 main gear, should you wish to run the rotor head a little slower. Another novel feature of the 'Superior' main gear is the ability to be used on both sides, thus allowing the builder to have two bites of the cherry – other manufacturers please take note.

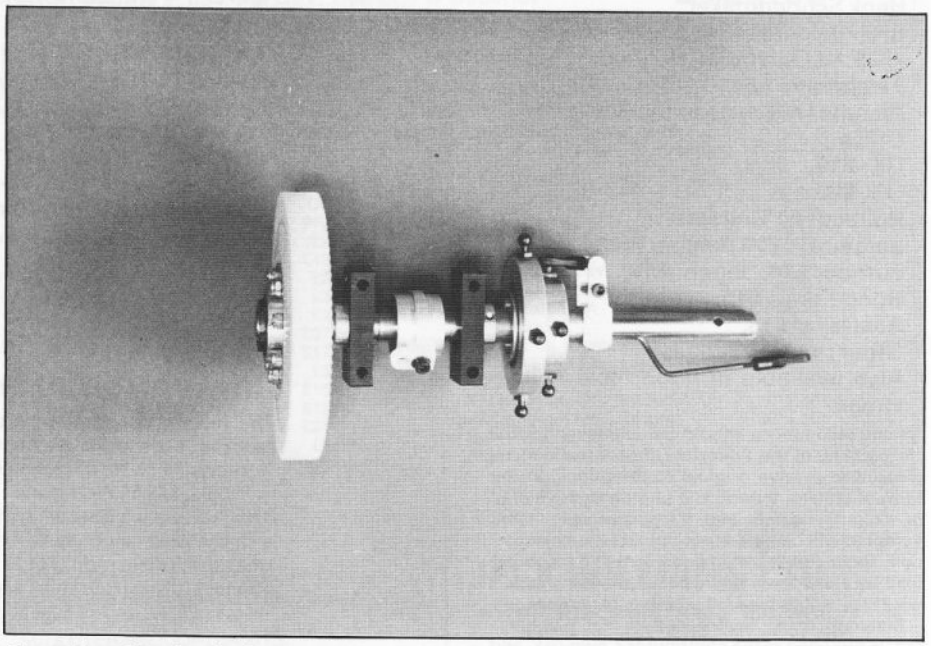
The tail rotor is driven by a 2mm shaft running inside the tail boom via four PTFE bushes, giving an overall ratio between the tail and main rotors of approximately 3.4:1. The tail rotor gearbox itself comes in two halves with the unequal bevel gears being located on bearings running in a bath of grease through to the tail rotor blade holders which are secured on to their respective shafts on two sets of double bearings.

The main rotor head, which has zero coning angle, has been superbly engineered with every moving part being ball-raced. (Even the direct mixing on the Hiller control system now has this unique feature.) The collective pitch control is via a slide ring assembly which is only allowed to move in a vertical plane, giving a very crisp response to all collective movements.

Any modern radio system will fly the 'Superior', but a fifth servo will be required because the model has an autorotation unit fitted as standard.



Main shaft assembly – note collective pitch slider located on shaft.



Completed main shaft assembly with the facility of the main gear to be used on both sides (see text for details).

Construction

The first part of the construction is centred around the side-frames and the cyclic pitch bell-crank sub-assemblies. Great care should be taken when aligning the two separate side-frames, as if this is not done correctly the performance of the model will be severely affected. I found this was best achieved by placing the whole assembly on a flat surface and fixing from that position. While dealing with the main side frames another point to watch out for is to make sure that the plastic spacers used around the fan housing area, should not be tightened too severely as this will cause distortion in the main gear and drive train assembly.

It goes without saying that care should be taken with **all** the rotating parts as any misalignment now in construction will be greatly magnified and cause unnecessary vibration and wear when the model is completed. I have found attention to detail and the use of a dial indicator invaluable for this purpose in making sure all running parts are true for final assembly.

The cabin bulkhead and woodwork were quite straightforward with the only modification required around the installation of a gyro and extra battery. There is plenty of room for this purpose, but I was required to move the tail rotor servo aft of the main shaft to compensate for the shift in the centre of gravity.

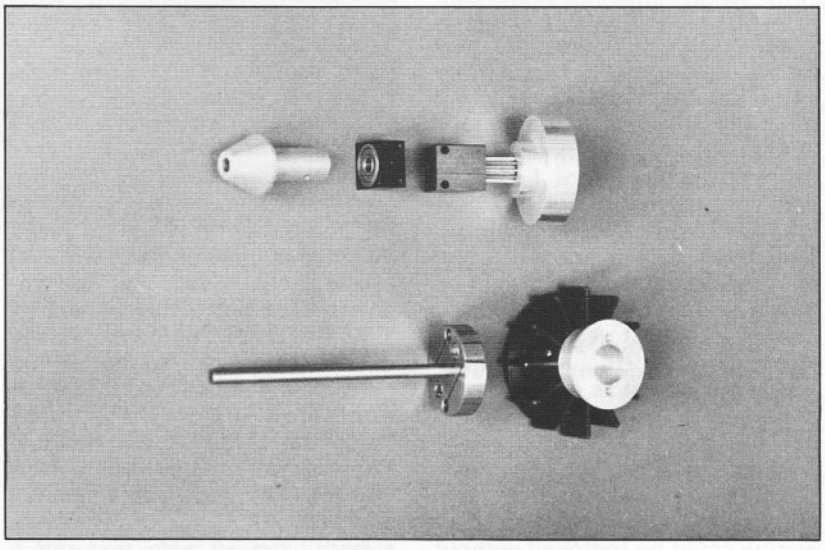
A block of wood is supplied in the kit to ensure the zero coning, however after assembling the kit completely this may be checked again by simply using a ruler to measure the height of each main rotor blade above the tail boom. Any further adjustment on construction can be completed when final setting up is being made because of the unique design of the 'Superior' swash-plate and rotor head.

Flying

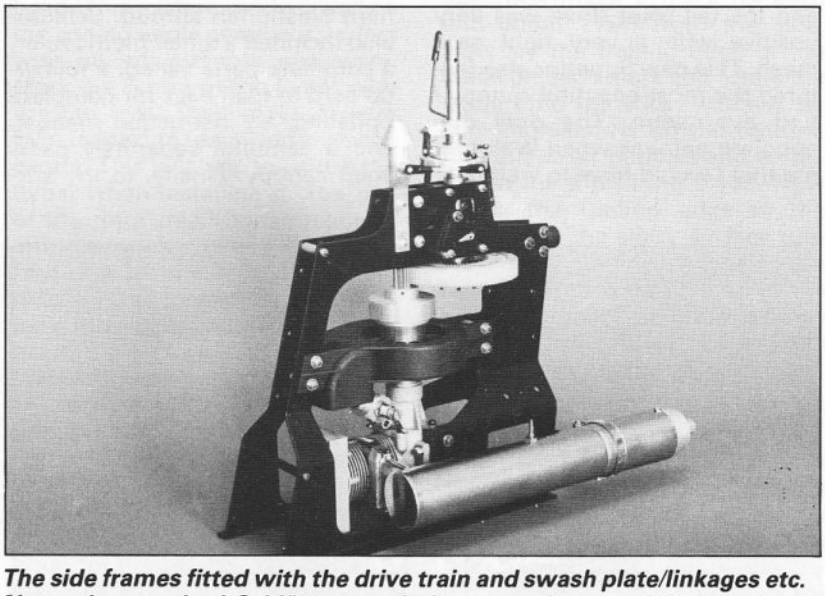
The setting up of the model was carried out exactly as per manufacturer's instructions, with approximately 5° of pitch for hovering flight and –1° for autorotations. As the model lifted off on its first flight, blade tracking and coning angle were perfect straight from the bench and in fact the feel and response were so good that within two or three minutes I was flying circuits.

During the course of the next half an hour with only minor adjustments to engine settings etc. I was able to perform many loops and rolls as per the FAI Schedule. In the hover the model is so stable and smooth with such a crisp tail rotor response that it can be recommended to both novice and expert alike.

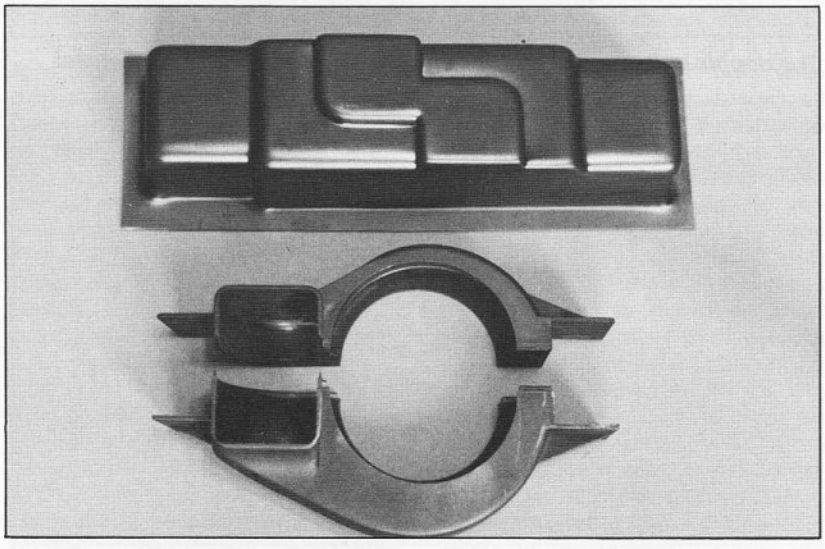
In conclusion, from the opening of the kit through to construction and flying, Dieter Schlüter has produced a winner with this model, and with such a competitive price of **£380 approx.** surely there is bound to be a lot of very happy 'Superior' owners on the helicopter scene this summer.



The ultra reliable Schlüter clutch and fan assembly.



The side frames fitted with the drive train and swash plate/linkages etc. Note: the standard Schlüter tuned pipe gave the completed model an excellent engine performance.



The neat Superior fan housing, very easy to cut out and install.

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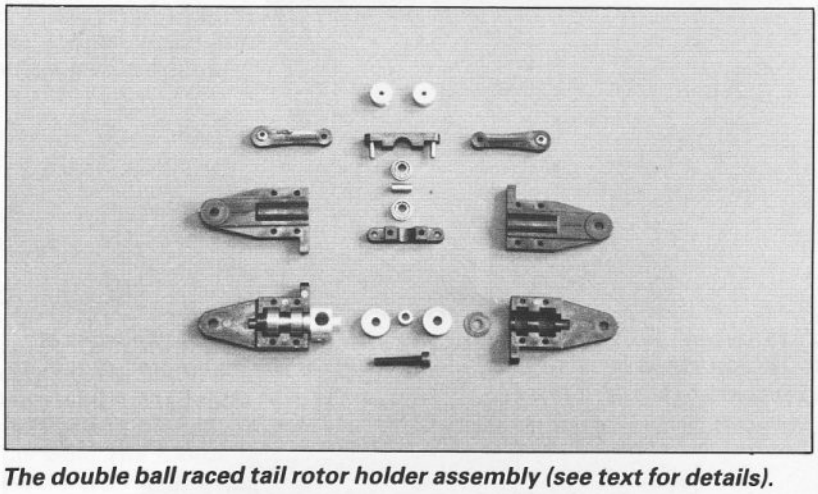
PART II by Mike Johnson

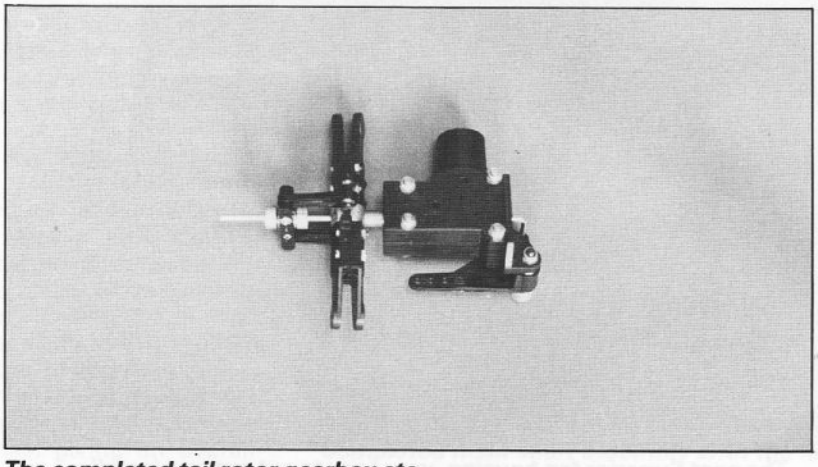
In April of 1983, I had the pleasure of meeting Walt Schoonard from Miniature Aircraft Supply and working at his booth at the MACS Show in Long Beach, California. That was the first time the new Schlüter Superior was showcased on the West Coast and I must say it received a tremendous amount of attention – especially from the competition! Everyone was very excited about this new creation from Dieter Schlüter. This new 'State of the Art' competition helicopter had drawn so much attention that it was sometimes very hard to even get close to the booth. Being a helicopter addict myself, I was especially inspired. My inspection revealed ball bearings at almost every workable location. The head components were very free of 'slop' with a very tight movement. The engine could be removed without taking the whole chopper apart and the tail rotor drive was very positive with a very tight gear mesh. This new Superior also featured the most beautiful canopy I had ever seen. The only disappointment was when Walt told me that I would have to wait until August to get one. Later that afternoon Tony Frackowiak put on a helicopter flight demonstration like I'd never seen. So, for the next few months I built (and crashed) my Heliboys (I have five) to the point that by August my proficiency was climbing rapidly – I was ready for something new. It was then that my friend Jeff Baker from California Helicopter Specialty called and told me he had his first Superior. When he asked if I'd like to build one and write an article for it – well, you can imagine – I jumped at the chance!

When I arrived home and finally opened the box I found all the parts to be mostly packaged in numbered plastic bags, very much the same as the Heliboy. The most striking thing however, was the exploded view. The detail and precision of the drawing was superb. The kit also featured a beautiful decal sheet and a new hard plastic fan shroud. Schlüter also included a small metric ruler, a complete parts listing, a follow-up card to mail back for complete updating, an instruction manual, and a beautiful separately packaged canopy. Finally, to my surprise, a bag of much needed spare nuts and bolts.

I recommend you read all the instructions thoroughly before you start. Open all bags in sequence. As you run out of parts in bag 1, open bag 2, and so on. This will make identification of all the parts easier and will help to keep from mixing up the parts. There is no provision for mechanical mixing so a five channel 'helicopter radio' is recommended. The instructions call for a 60 size engine and due to the light weight and light mechanical drive, I'm sure this engine size will work very well. I used an OS Max 60 helicopter engine which fits perfectly.



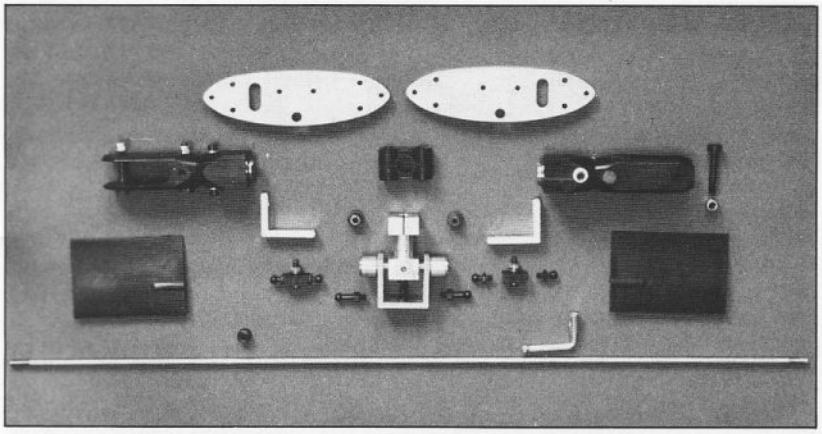
The double ball raced tail rotor holder assembly (see text for details).



The completed tail rotor gearbox etc.

Construction

I'll try to go along step by step and discuss anything that might be a problem. It's a good idea to observe all the symbols and the exploded view. Use Loctite only where shown and do not over-tighten. 'Snug-tight' is generally applicable. The swashplate bell cranks are assembled first. Be careful when inserting the fitted sleeve into the plastic washer; do not over-tighten and be certain everything moves freely. If you can't find both sides of the assembly in drawing E, there is another drawing E for the left side in the middle of the exploded view. In step 2 the instructions discuss the use of a 10:1 main gear; don't worry about it now as the 9:1 is the only gear included in the kit. Notice the gearing on both sides of the main gear. This is a nice feature as it still allows the use of the gear if the top gears get stripped by merely turning the gear over. Some of the parts are already assembled for the main shaft assembly in step 2. Follow the sequence of parts on the main shaft exactly. Do not over-tighten the autorotation clutch on the main gear as it will distort the gear and keep it from running true. While joining the frame sides be careful not to let the main rotor shaft fall out the bottom or you will have to start all over again. Set the frame sides on a flat surface before tightening the screws through the bearing blocks. The indentations on the bearing blocks go inward facing each other. This was not very clear in the exploded view. Push down on the sleeve No. 1275 and up on the main shaft so that the autorotational pin No. 249 is pushed up inside the autorotational gear. Then tighten with Loctite the set screw in the hub No. 1289 after



The nicely engineered 'Superior' rotor head (see text for setting up details).

pushing the hub all the way down on the shaft against swashplate. You may notice a 'ticking' noise when the autorotational clutch is disengaged. This ticking is normal while the blades autorotate. If you have trouble lining up the flat spot with the set screw on the tail rotor drive shafts simply make a mark with a moto tool or a pencil a little farther out on the tail rotor shaft to identify the flat spot. Be sure the main gear and the tail rotor drive gear are meshed correctly and that the tail rotor drive shaft rotates freely when the main gear is turned. After installing the engine fan to the engine be sure the starter shaft is in alignment as shown. My OS Max 60 fits perfectly using the three spacers on each side as provided in the kit. However, be sure the frame sides are 27mm apart as discussed in the instructions. Double check engine alignment and the gear mesh with the main gear. Two vertical plastic fan shrouds are provided in the kit. Choose the one you wish to use and cut out as shown. Be sure the fan shroud does not rub on the engine fan. Now you are ready to proceed to the tail rotor assembly. Be sure the smaller gear with 17 teeth is mounted to the front as shown. The smaller hole in the tail rotor drive shaft No. 380 faces out. I found an error in the instructions at this point. They read: 'Screw ball bearing No. 346 **(should be No. 364)** on hub No. 277'. Now is the time to paint the tail fin, vertical fins and if you wish the tail rotor blades. The vertical fin is already cut out of aluminium and is easily painted with 'Formula U'. The exploded view definitely shows the tail rotor control yoke connected to the leading edge of the tail rotor blades. I questioned this at the time because all Heliboys are connected to the trailing edge. I went ahead and connected them the way shown and it was fine.

At this time the instructions call for the construction of the rotor head. The packaging of the rotor head was beautiful with all the parts laid out in a separate box. The parts for the rotor head are beautifully machined with extensive use of ball bearings. Upon construction, notice that one end of lever No. 1555 is counter-sunk and one end is threaded. The counter-sunk end goes into the slot of the blade bearing shaft No. 1550. There is a hard block provided for alignments of the rotor head. This system worked well as the coning angle came out perfect with no adjustments necessary. Mark the centre of the flybar with a moto tool. Then make a mark two inches to each side of the centre. This will help to centre the flybar when installing it. The rest of the rotor head construction is straightforward. It is probably best to leave the ball links off the head until all the servos are installed and you are ready to set up the head.

Now you are ready to assemble the servo tray. The plywood parts pop out easily and require only a light sanding. Be sure to save the small half round piece that is removed from the back plate for use as a gyro tray. Cut out the five holes for the servos and pushrods being careful to obtain the correct positioning for all servo linkages. Finally, the servo trays can be painted using your own discretion. I sprayed all the pieces before assembly with Pactra white primer (sm-2). This fills all the grain and sands quite easily. After all the pieces are sanded then assemble them as shown with Super Jet or Epoxy. Then the whole assembly can be painted with Formula U. The instructions call for mounting the gyro and receiver switch harness on a side piece. I mounted them on the back plate so I wouldn't have to cut any holes in that beautiful canopy. This did not present any problems as the switches were easily accessible.

Use a sharp exacto knife or razor blade to 'score' the canopy on the outlines shown. Save some of the scrap plastic for reinforcement. Now paint each side before assembly with your paint scheme. Again I use Formula U as it is very flexible and adheres well to the plastic. The sides can be glued together with Super Jet and the joint can be reinforced at your discretion with small plastic strips about 3/8in wide and 1in long.

The blades are fully assembled. Be sure the blades fit into the blade holders. Sand the centre reinforcement blocks down if needed. The blades should fit into the blade holders so that they can swing freely without slop. The centre section should be cut to an angle as shown to allow the blades to swing back if they strike an obstacle. I used Super Jet on the centre section of the blades to strengthen the balsa. Simply apply and rub into the grain with a plastic bag. The centre sections can be painted if you wish. Now cut the covering material to the correct length. Completely strip the backing off and lay the material on a level surface sticky side up. Then make a mark on each end about 1½in from the side. Now lay the trailing edge of the blade on each mark and rotate the blade onto the sticky surface. Be sure the seam is on the bottom. Rub out all air bubbles and wrinkles on the top of the blade. Now rotate the trailing edge of the blade onto the sticky surface rubbing out the wrinkles. Finally, the leading edge is completed in the same manner. Be sure all the wrinkles are rubbed out and the blades are smooth.

Setting up the helicopter

Balance the rotor head with the blades attached as shown. Place a ¼in piece of coloured trim on the light blade tip to use for tracking later. Now balance the blades using the extra trim included. Place all balancing trim on the bottom of the blades until they balance perfectly. Now install the rotor head onto the main shaft and insert the main rotor bolt with washers and tighten. Install all servo pushrods to the swashplate and collective. With all the controls centred the swashplate should be perpendicular to the shaft from the front and the side. Centre the flybar and install both paddles. When the swashplate is perpendicular to the main shaft the paddle control arm should also be perpendicular to the main shaft. Adjust the length of the pushrod until this is accomplished. Now install your head lock and use a clothes-pin to secure a short piece of music wire 90° to the flybar. Now install your pitch gauge on each paddle. Set to 0°. Use the music wire to sight

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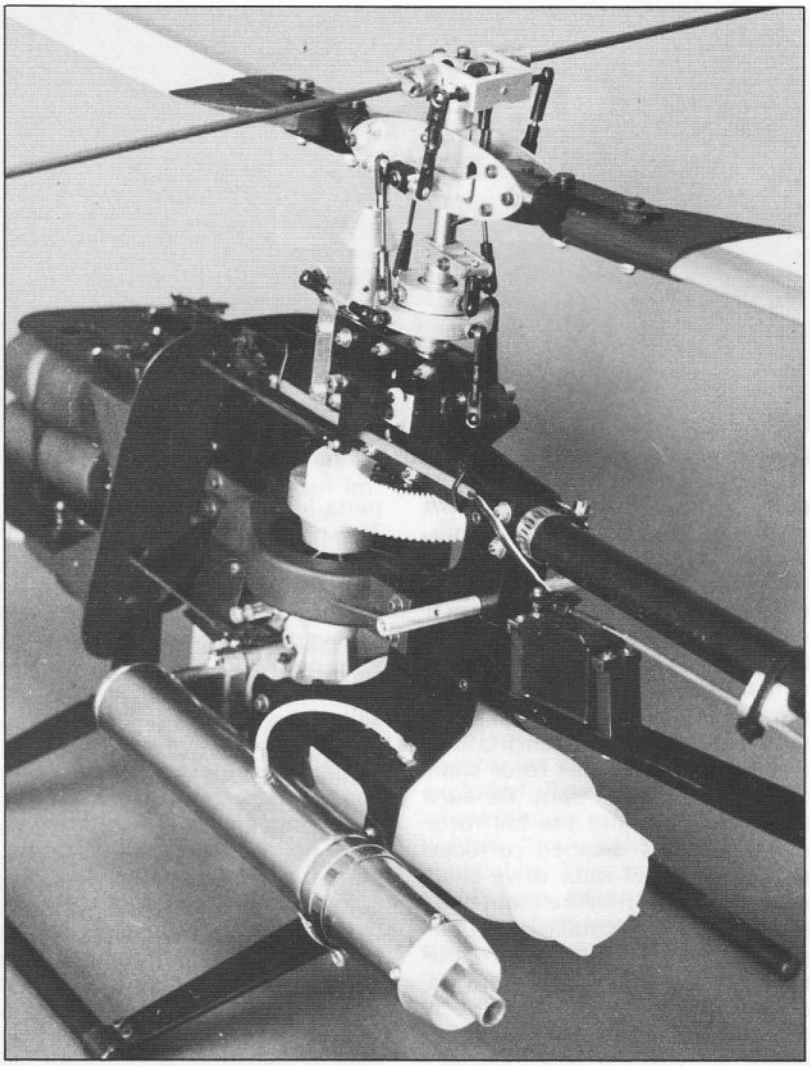
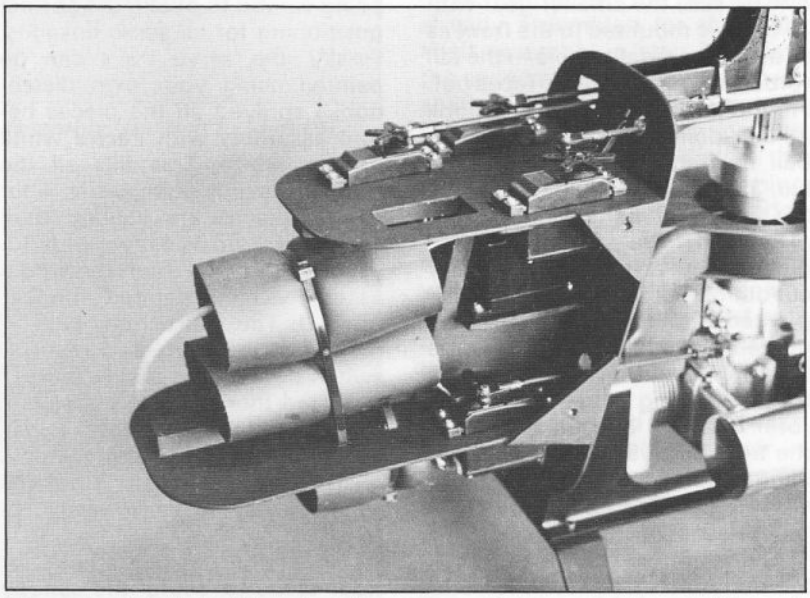
the pitch gauge. Now centre the collective arm in the middle of its travel and connect it to the collective servo with the collective stick on the transmitter at exactly half. Be sure you have equal throw-up and down and don't forget the pitch trims on the transmitter – they should be set for maximum servo travel at this time. The smallest movement of the servo at the end of its travel should still produce movement in the collective arm. Now connect the collective pushrod to the upper collective arm. When the collective stick is at half and the lower collective arm is at half the upper collective arm should be perpendicular to the main shaft. The upper collective arm should now have equal throw-up and down. Now assemble a bottom pushrod and install it from the swashplate to the mixing lever so that the mixing lever is straight with the collective arm as shown in drawing 'C'. Now assemble the other bottom pushrod to the **same length** and attach it on the other side. Once these two pushrods are adjusted they should not have to be touched again. Now with the head lock installed and the pitch gauge fitted to the coloured blade, assemble the upper pushrod so that when the transmitter collective stick is at half the coloured rotor blade is at +4°. Push the transmitter collective stick to high and set the high pitch trim pot so the rotor blade is at +6°. Bring the collective stick all the way down to the low position and set the low pitch trim pot so the rotor blade is at −2°. Now assemble the other upper control rod to the **same length** and install it on the other side. If you've done everything correctly both blades should read −2° at low stick, +4° at half stick, and +6° at high. Be sure the blade holder bolts are tightened so that both blades have equal tension in the blade holder. Now is a good time to check the coning angles. Simply set your transmitter antenna to the same height as one of the main rotor blades. Then merely rotate the other blade around. Both blades should be at the same height.

The throttle hook-up, when properly done, will mean a smooth throttle collective response and a constant blade speed. Remember, a constant blade speed means a constant tail rotor speed which assures a smooth and constant tail rotor response. The idea is to have 50% throttle throw in the lower half of the throttle stick but only 25% in the upper half. There is a supplemental instruction sheet included in the kit which discusses this in great detail. Be sure the throttle is set up correctly as this will ensure a smooth flying helicopter. Also be sure the engine will die on low stick – low trim.



The almost completed 'Superior' fitted with a Webra 61 Helicopter engine. Also note the position of tail rotor servo (see text for details).

A long piece of blue and yellow nyrod is included in the kit. Be sure none of the yellow pushrod protrudes out of the blue outer casing when connecting the tail rotor linkages. This will assure a very rigid tail rotor system. When the throttle stick on the transmitter is at half, the rudder servo should also be in the middle of its



The completed bulkhead and servo carrier – note the position of Gyro/battery and receiver etc.

Len Mount seen flying the completed 'Superior' at his local club field.

Just one of many of the Superiors that are flying around.

throw. At this point adjust the tail rotor control arm so it is also in the centre of its throw. All tail rotor adjustments are made by moving the collars in and out on the control shaft. After centering the tail rotor control arm bring the throttle/collective lever to low. Now swing both tail rotor blades around so they almost touch. Adjust the collars on the tail rotor control rod so there is about one-quarter inch right throw between the tail rotor ends. This is a good place to start. The final adjustment can be made with the helicopter running. By the way, if you look at the helicopter from the rear, a left motion of the tail rotor control rod will produce a right turn if the tail rotor control yoke is connected to the leading edge of the tail rotor blades and a left turn if connected to the trailing edge. Finally, test for a smooth action of all tail rotor linkages and be sure the tail rotor blades are rotating in the right direction. If you are using a gyro be sure it is going in the correct direction. Move the rudder stick to the right and observe the throw of the rudder servo. Now turn on the gyro and move the helicopter nose to the left. This should produce that same right servo travel. If it does not you will have to reverse the gyro or reset up the tail rotor system.

Initial trim and flying

After double checking all nuts and bolts to be tight and that all linkages are securely snapped on the balls, start the engine at idle. STAND BACK! Let the blades rotate. Slowly bring the throttle up until the helicopter is light on the skids. **At a safe distance** observe the coloured tip on the end of the blade by viewing the blades in the horizontal plane. Which blade is high? Now adjust the upper collective control rod on the **uncoloured** blade one turn at a time up or down until the blades track in the same plane. Don't adjust the coloured blade as this was adjusted with the pitch gauge in the shop. Now that you've tracked the blades it is time to set up the tail rotor. Stand back and apply power until the helicopter rises off the ground. How much rudder stick are you holding to maintain a nose straight attitude? Now adjust the collars on each side of the tail rotor control yoke as necessary until the rudder trim is centred and the nose stays straight at the hover.

Assuming that your collective trim was centred when you were originally setting up the collective, you should be able to speed up or slow down the head speed by adding or deleting pitch using the collective trim. My Superior flew best with an 1800rpm head speed.

After hovering one tank of gas as a last check it is time to fly a circuit. Power on and fly straight ahead into the wind. You'll find the helicopter extremely smooth in its reactions due to all those ball bearings. A little right cyclic and back on the stick and the helicopter will make a nice turn to the right. Kick in some right tail rotor to tighten the turn. Power down and keep the helicopter moving forward for a nice smooth approach back to the hover. After a few flights with my new Superior I found my learning curve rapidly ascending due to the 'Superior' performance of the machine. Rolls, loops and autorotations were no problem and at the time of writing of this article I am working on inverted flight. I am also installing some Superior mechanics in a DC Labs Hughes 500, which should be a remarkable machine. All the superlatives I learned in eight years of college cannot describe the performance of the Superior. I'm sure you'll enjoy it as much as I do. See you in the winner's circle. Have SUPERIOR flying!