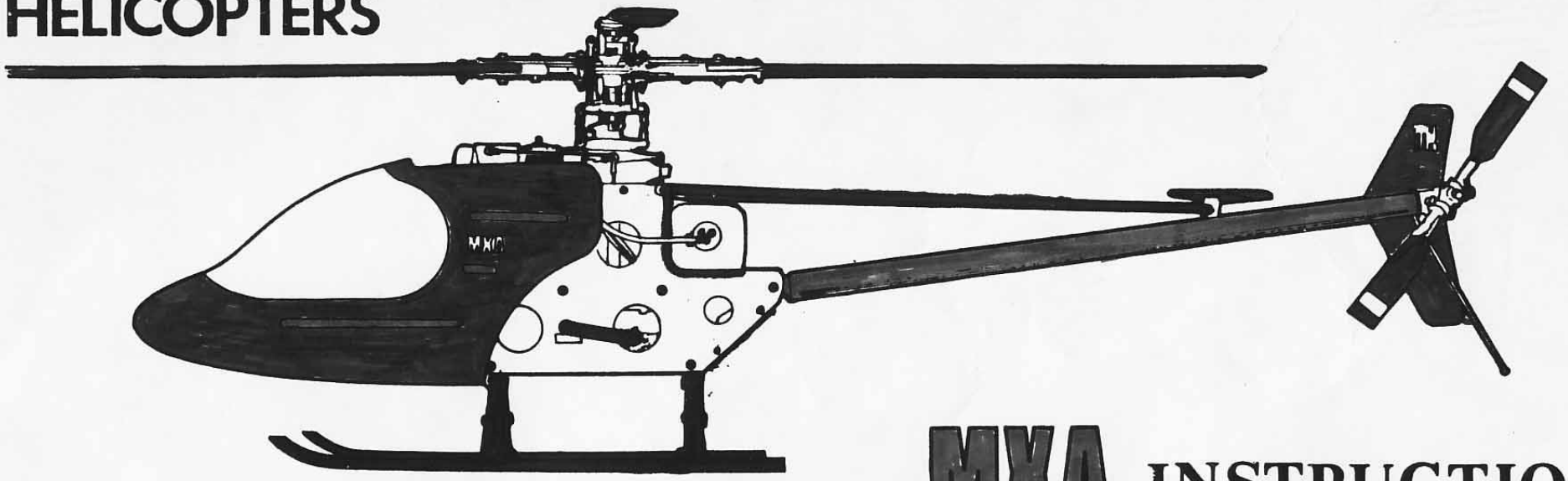
MORLEY HELICOPTERS



MXA INSTRUCTIONS

Dear Customer,

Thank you for choosing 'Morley'. I hope you enjoy making a successful model.

A helicopter is a most fascinating machine and exciting to fly, but it does need care and persistence to become successful and enjoy the model's full performance and capabilities.

The MXA is a very versatile model, being able to accommodate almost any make of engine or radio and 'tuneable' into a stable beginners model or a highly aerobatic and agile flyer.

Because of this versatility you should plan your installation carefully, choosing the options open to you to suit your engine and radio.

However you aim to fly your model, we wish you many happy landings.

SPECIFICATION

MXA - a model helicopter for sport flying.

Rotor diameter	45in. 1143mm
Main rotor rpm	approx 1200
Main rotor	Morley 'AT' collective head
Engine	.40 -.45 cu.in. 6.5 - 7 c.c.
Radio	any four or five function proportional radio system is suitable. Functions - fore and aft cyclic roll cyclic main rotor collective/throttle tail rotor
Fuel capacity	8fl oz (250cc) in tank supplied
Flying weight	7lbs (3.25Kg) approx

MXA ENGINE MOUNTING

1	MXA Engine Plate	4	M3 x 16 socket cap screw
1	Flywheel	4	M3 nyloc nut
1	Fan	2	M3 x 10 Pan head screw
1	14 tooth pulley	2	M3 nut
1	Starter pulley	2	M3 star washer
1	Fan duct	3	No 2 x 3/8 self tapper
1	Fan duct backplate		

Temporarily fit the flywheel, fan and drive pulley to the engine so that it may be placed correctly for belt alignment. Make sure that the inside face of the flywheel is properly against the engine's prop driver. Sometimes the centre hole in the flywheel will require opening up to achieve this.

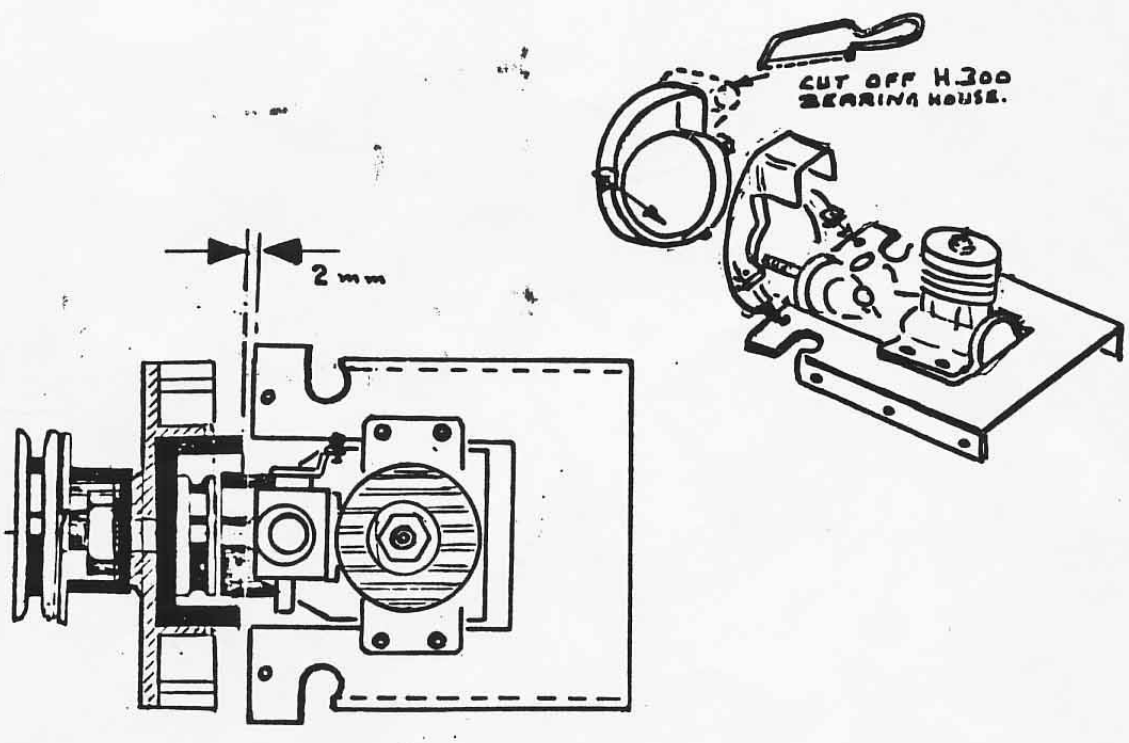
The engine should be on the centre line of the engine plate cut out and with the rear edge of the flywheel 1 - 2mm from the engine plate. Mark and drill for the 3mm fixing screws, and fit the engine.

Remove the fan and pulley from the engine in order to position, drill and fit the fan duct backplate to the engine plate, using M3 x 10 screws, star washers and nuts. Fit a brass ball from the controls pack onto the engine throttle lever and position so that it may be operated from below. Also fit a brass ball on the left side of the duct backplate for the swashplate drag link.

Refit the flywheel, fan and pulley using loctite or paint between the surfaces, especially on the prop driver, since a backfire on starting will undo this assembly unless it is properly tightened and locked.

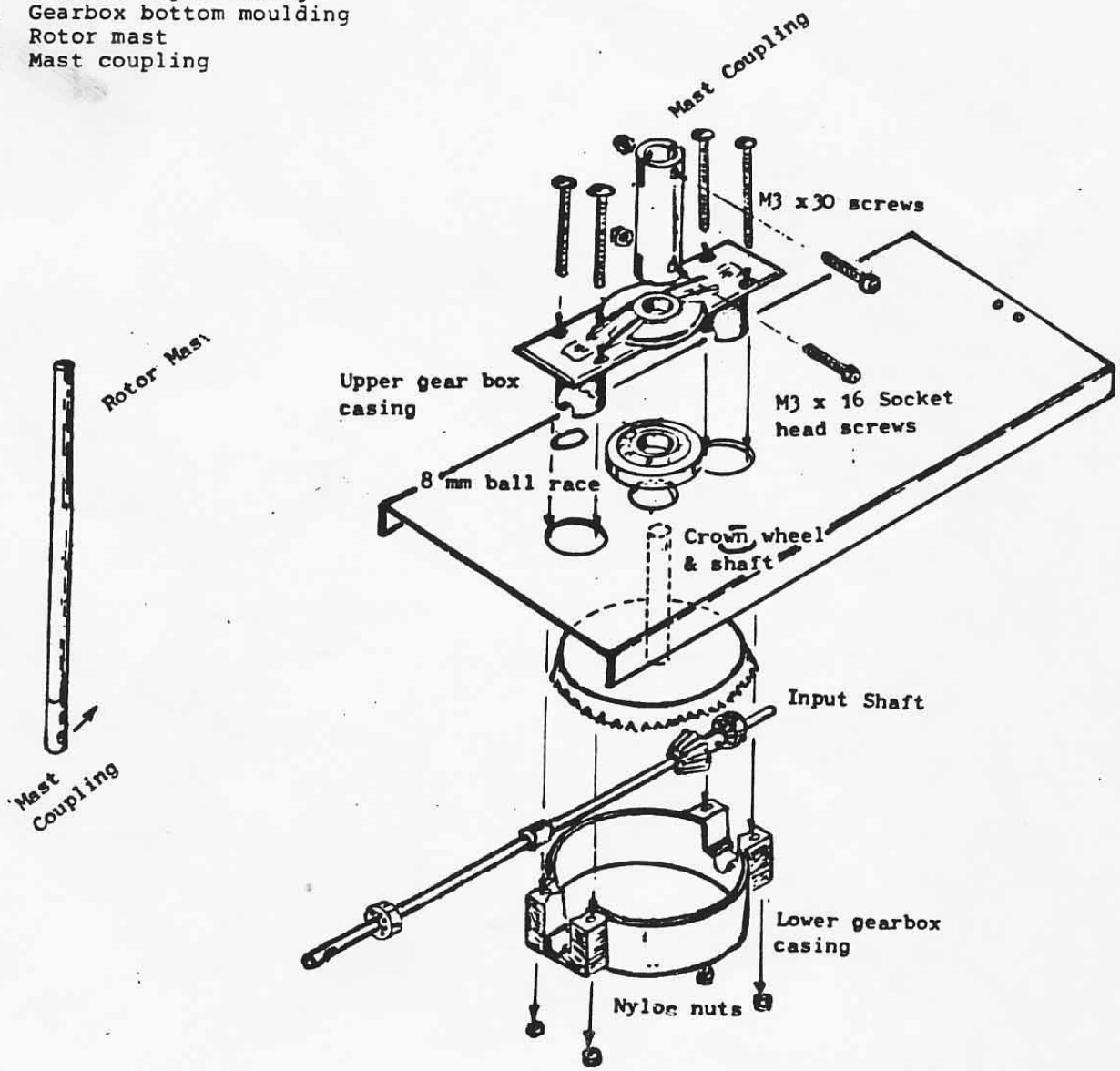
Fit the starter belt 'V' pulley over the engine pulley using epoxy or super glue.

Fit the fan duct onto the backplate, using small self tap screws and making sure it clears the fan and that the throttle lever operates freely.



MAIN GEARBOX

1	Crownwheel & shaft	4	M3 x 30 pan head screw
1	8mm ball bearing	2	M3 x 16 socket cap screw
1	Input shaft assembly (long)	6	M3 nyloc nut
1	Gearbox top moulding		
1	Gearbox bottom moulding		
1	Rotor mast		
1	Mast coupling		



With the crownwheel shaft upwards through the centre large hole in the chassis channel (flanges downwards), slide the 8mm bearing down the shaft until it is seated. The gearbox top moulding is also slid down the shaft over the ballrace, and through the chassis. Make sure the small ballrace seating in the moulding is at the rear, to take the input shaft.

Fill the lower gearbox case with light grease, up to the crownwheel level. Place the input shaft assembly into position and pull the lower gearbox case into place with the four M3 x 30 screws and nyloc nuts. Tighten, but ensure that rotation is reasonably free. It will loosen under load. There is a hole in the wall of the top moulding immediately above the pinion gear for subsequent lubrication with gear oil.

Assemble the mast to the gearbox using the tubular coupling and HT socket head screws and nyloc nuts.

MXA CHASSIS ASSEMBLY

2	MXA sideplate **	6	M4 x 10 pan head screw
1	'U' channel	6	M4 x 8 pan head screw
3	MXA servo mounts	12	M4 thin nut
1	mast support	12	M4 star washer
1	bearing moulding	22	No 8 x 3/8 taptite screw
2	Cabin support pylons	2	No 2 x 3/8 self tapper
1	275mm edging rubber	1	5/16 oilite bearing

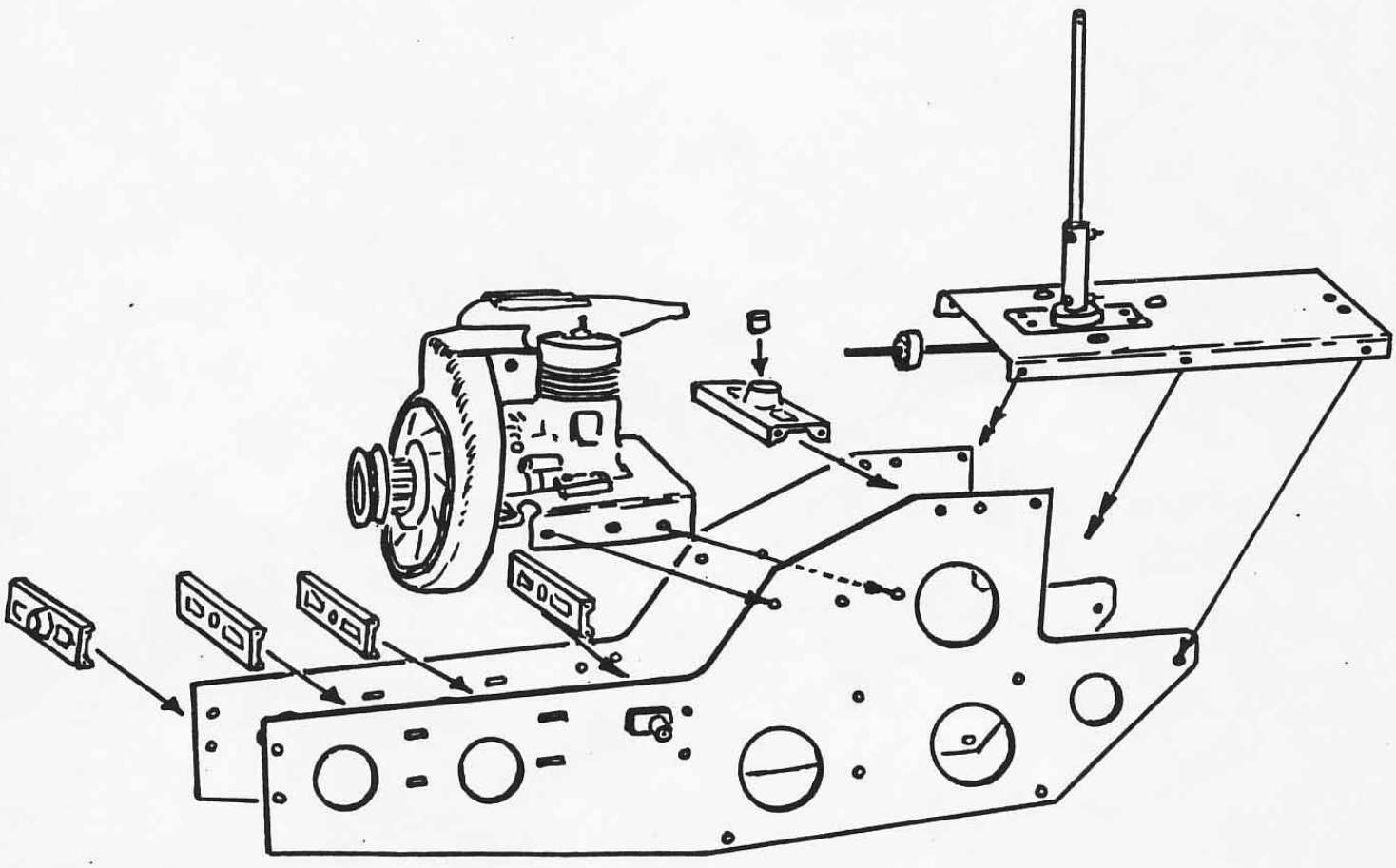
(** not in components pack)

Using the large taptite screws fit the cabin support pylons to the side plates as shown in the diagram. Assemble the side plates together using taptites and the two cross piece mouldings which have raised housings, placed at the extreme front and at the top of the assembly.

Fix the engine mounting assembly (sheet page 3) into position using six M4 x 10 screws and nuts with star washers under.

Similarly fit the gearbox assembly (sheet page 4) with the mast through the top bearing moulding. Slide the oilite bush down the mast and epoxy it into the moulding. Push one of the three cross piece mouldings over the input shaft ball bearing and secure the moulding in place with taptite screws.

The two remaining cross pieces may be placed in position but do not finally tighten the screws until fixing the servos in position later.



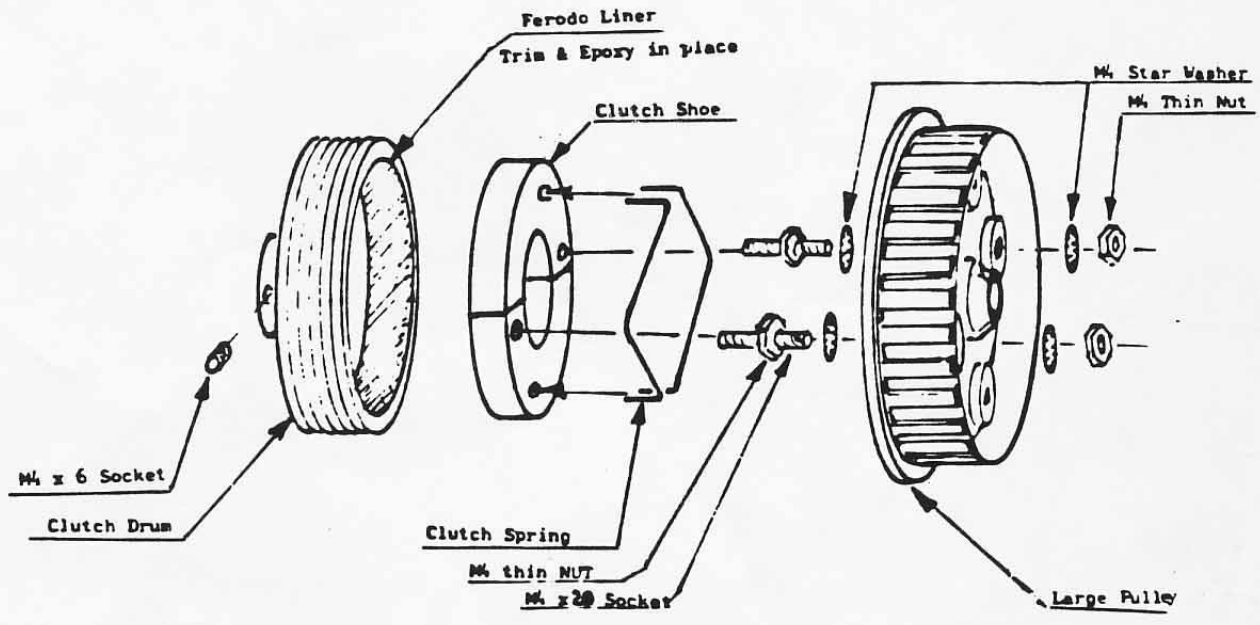
CLUTCH UNIT

1	large pulley
1	clutch drum
1	100 XL 037 drive belt
1	Ferodo liner
2	clutch shoe
2	clutch shoe spring
1	M4 x 6 socket set screw
2	M4 x 20 socket set screw
4	M4 thin nut
4	M4 star washer
1	Set screw key

Carefully cut the Ferodo clutch lining to the correct length to fit inside the clutch drum. Roughen the drum with emery paper or a file and cover it and the lining sparingly with epoxy adhesive, then press the lining tightly into place. Hold in position until set.

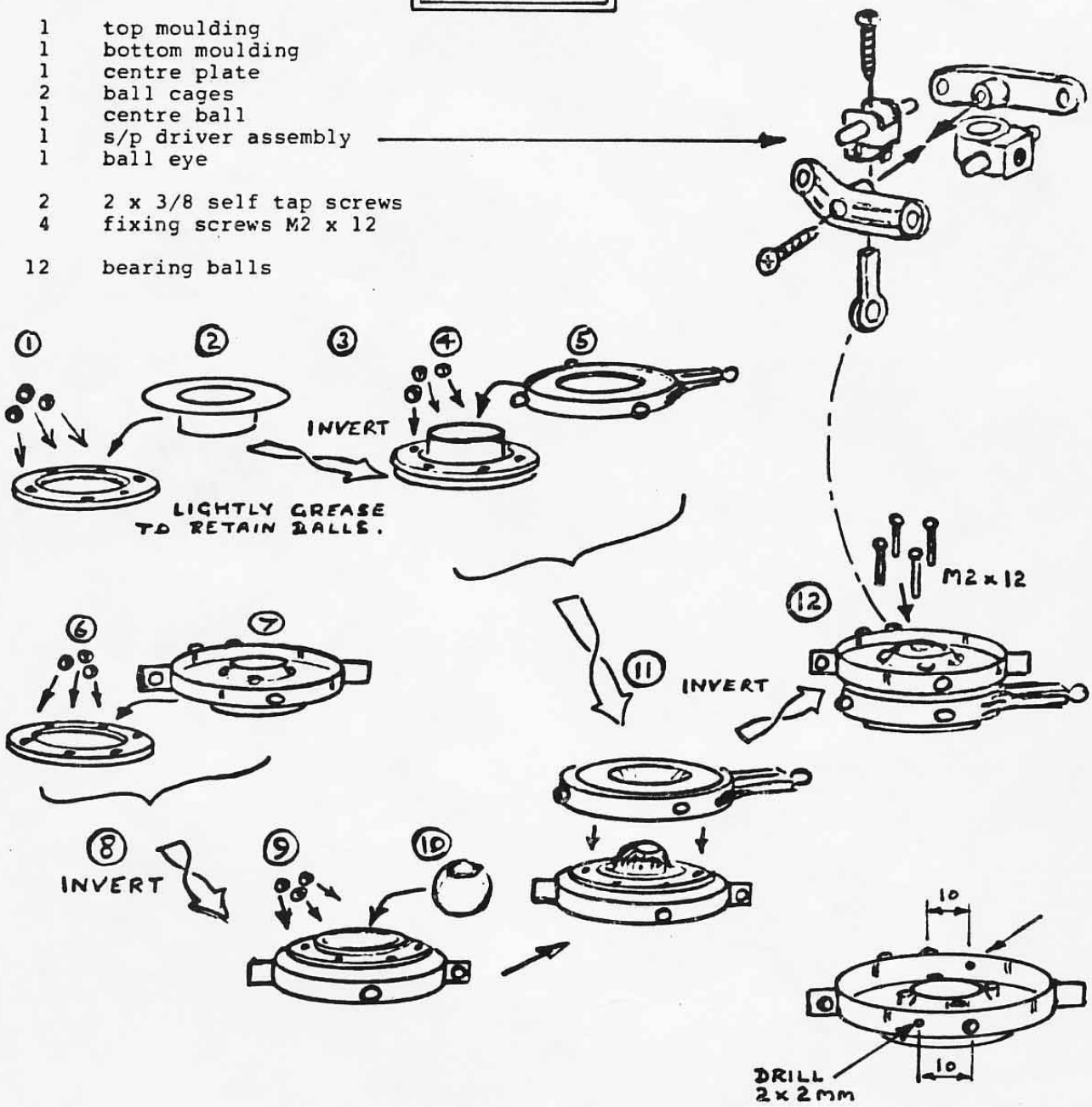
Thread the M4 screws into the clutch shoes and an M4 thin nut one turn clear of the shoe. Locate clutch springs in clutch shoes and add star washers onto screws. Place the assembly into the large pulley as shown in diagram and secure with star washers and thin nuts. Adhesive tape across the shoes is a help while doing this. Check that the shoes are free to swing outwards slightly.

Fit drive belt round engine pulley and slide large pulley onto gearbox input shaft, followed by clutch drum. Align large and small pulleys, and tighten clutch drum grubscrew into flat on input shaft, after applying paint or thread locking compound to the screw only.



SWASHPLATE

1	top moulding
1	bottom moulding
1	centre plate
2	ball cages
1	centre ball
1	s/p driver assembly
1	ball eye
2	2 x 3/8 self tap screws
4	fixing screws M2 x 12
12	bearing balls



Drill two 2mm holes in the side of the top cup moulding in the position shown in sketch, ready for screws and balls from the controls pack.

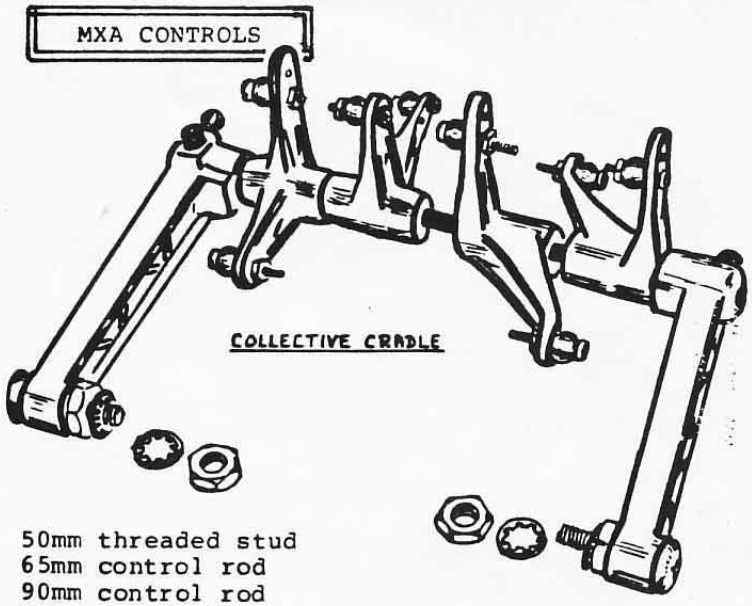
Place three balls in one of the ball cages, and place the bottom moulding over it to keep the balls in position. Invert, and place the remaining three balls in the cage. Place the centre plate over the assembly, and repeat for the second cage and balls.

Sandwich the centre ball between the swashplate top and bottom mouldings and secure with the four screws. Place on rotor mast with long arm to the rear.

Assemble swashplate driver and fit a ball eye to small pivot.

Swashplate rocking movement must be free and the assembly should slide easily up and down the main rotor mast. Slide the swashplate driver over the mast before fitting rotor head but leave locking to mast until later when the correct position has been found.

2	cranked bellcranks
3	straight bellcranks
2	cradle arms
1	90 degree angle bracket (small)
1	tail control rod idler
1	receiver mounting channel
22	ball eye mouldings
1	100mm pivot shaft
1	plastic ball
21	ball end ball
21	M2 x 12 screw
21	M2 nut
1	M3 x 20 plain shank screw
5	M3 x 8 pan head screw
7	M3 nut
1	M4 x 30 plain shank screw
2	M4 x 16 pan head screw
6	M4 thin nut
3	M4 star washer
1	No 2 x 3/8 self tapper



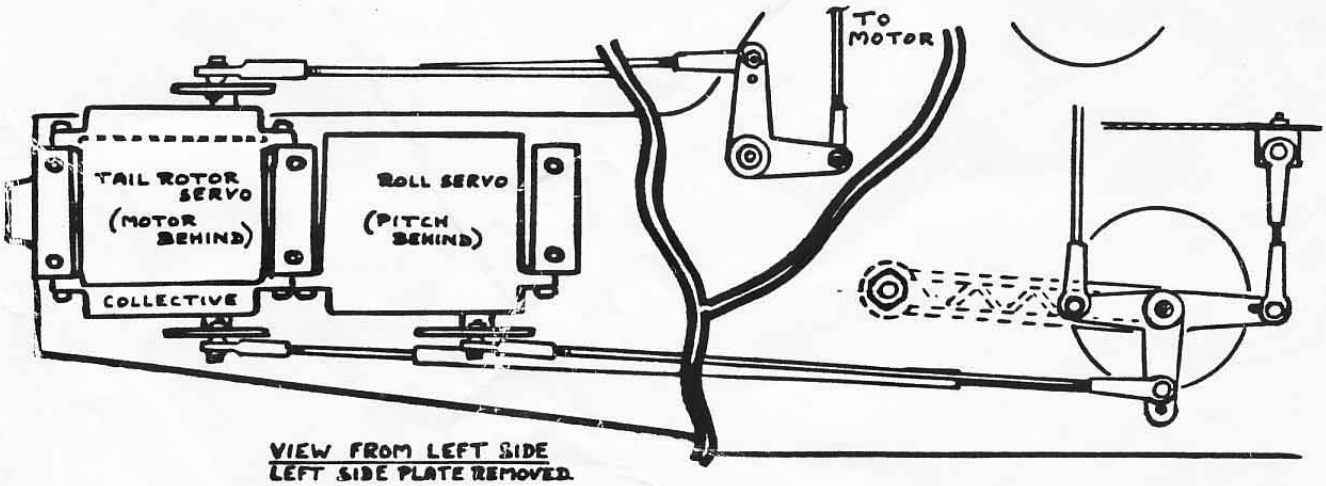
Control rods from separate pack:

1	50mm threaded stud
1	65mm control rod
1	90mm control rod
4	135mm control rod
3	190mm control rod
1	240mm control rod
1	200mm alloy tube
1	340mm control rod (taped to skid pack)

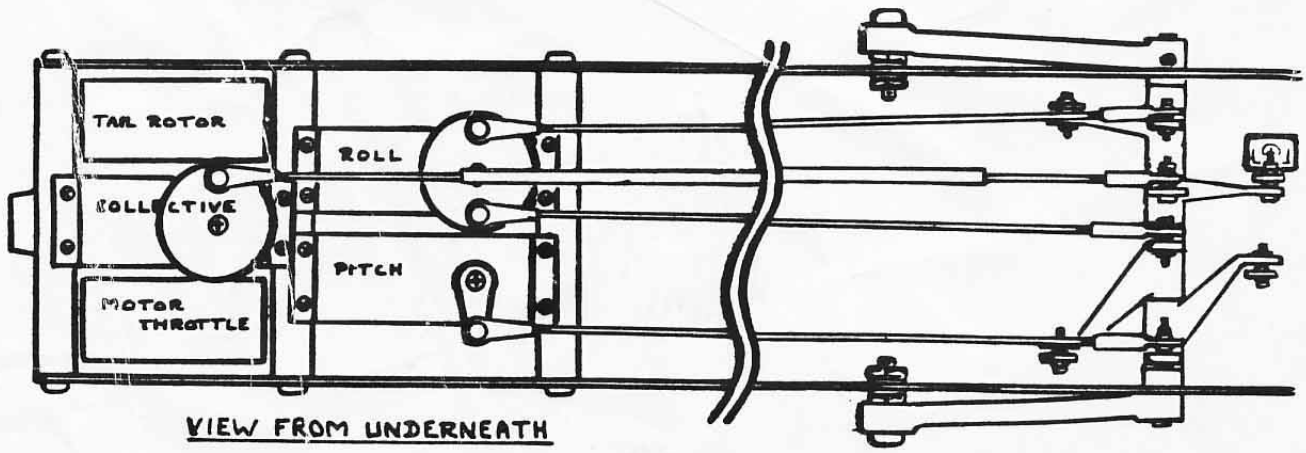
Fit the brass control balls to the bellcranks as in the sketch so that the collective cradle can be pre-assembled. Lightly grease the 100mm pivot shaft and slide the bellcranks onto it. Feed the bellcrank assembly into the chassis. Fit the cradle arms to the pivot bolts and each end of the pivot shaft, tightening the cradle arm set screws when done. The cradle and bellcrank assembly hinges up and down on the pivot bolts to provide collective pitch control.

Fit a brass ball to the small right-angled bracket then drill a 3mm hole in the chassis so the bracket can be installed above the ball on the collective bellcrank. Link the balls with a short control rod made from two ball eye mouldings screwed onto threaded stud. Set up so the cradle arms are horizontal when the collective bellcrank is vertical to the chassis.

Place all the servos in the chosen position, slackening the taptite screws in the mouldings to allow the gap to be adjusted to suit your servos. Drill the mouldings to take the servo fixing screws and secure the servos in position. Retighten the taptites. Always use rubber grommets when mounting servos, and do not overtighten.



VIEW FROM LEFT SIDE
LEFT SIDE PLATE REMOVED

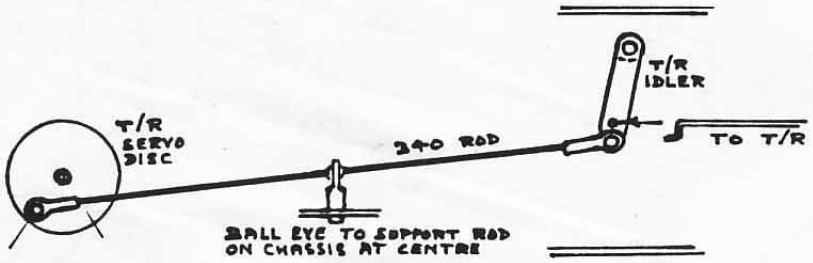


VIEW FROM UNDERNEATH

Make up the control rods by screwing an eye onto each end. Note that the long collective operating rod (240mm) is stiffened by epoxying the alloy tube over it. Check that the 135mm and 190mm control rods are matched for their respective lengths. The 340mm tail control rod will require a supporting ball and eye along its length (see sketch).

Install the engine throttle bellcrank on the M4 x 30 plain shank screw, using a little grease to ensure smooth operation. Fit the throttle control rods.

Drill a 3mm hole in the chassis in front of the tail boom fixing holes to take the idler crank for the tail rotor control rod. Fit the 340mm tail rotor control rod from the servo to the idler crank. Use the small plastic ball and a ball eye to support the long pushrod at a suitable point along its length. Drill a 2mm hole to take the small self-tapping screw, and trim the ball eye stem to length as necessary.



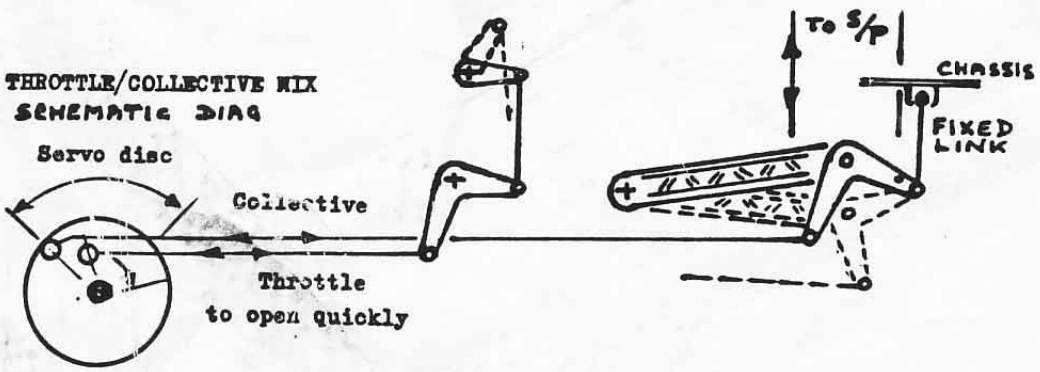
Fit two brass balls inside the cup of the swashplate top, using M2 x 12 screws passing through the holes drilled earlier. Slide the swashplate onto the rotor mast and install the 135mm control rods up to it from the bellcranks on the collective cradle.

Because of the variations possible with this model, using different engines, tuned pipes, gyros etc, it is left to the customer to position and drill holes to fit the platform for the receiver and battery (usually above the pitch and roll cyclic servos or behind the collective cradle) but the Centre of Gravity should be at the mast WITHOUT THE CABIN FITTED. That is, before the cabin is fitted to the model, it will hang with the mast vertical when held at the mast top.

FOUR SERVO INSTALLATIONS ONLY:
If using only four servos, the collective servo should be mounted nearer the side, so that when the motor control bellcrank is mounted lower down it can also have a control rod to this servo. Arrange so that the throttle opens quickly from lowest collective setting. (See sketch).

Install the swashplate drag link between the ball on the top of the fan duct and the ball moulded on the swashplate centre plate, so that the long arm for fore/aft cyclic is aligned with the centre line of the fuselage.

Check that the whole control system is smooth in operation. In particular the movement of the swashplate up and down the mast must be smooth - lubricate with a little grease or oil if necessary. Lubricate all the brass ball joints with a light oil (3 in 1 etc).



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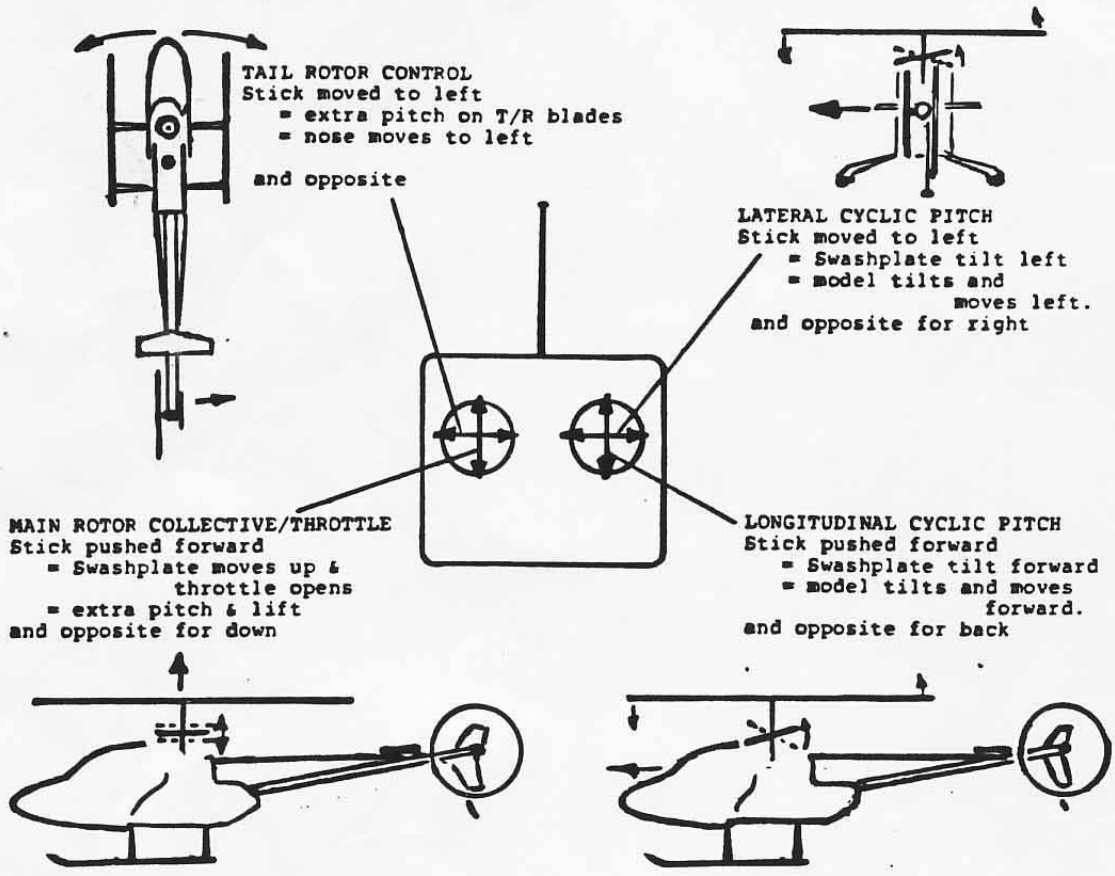


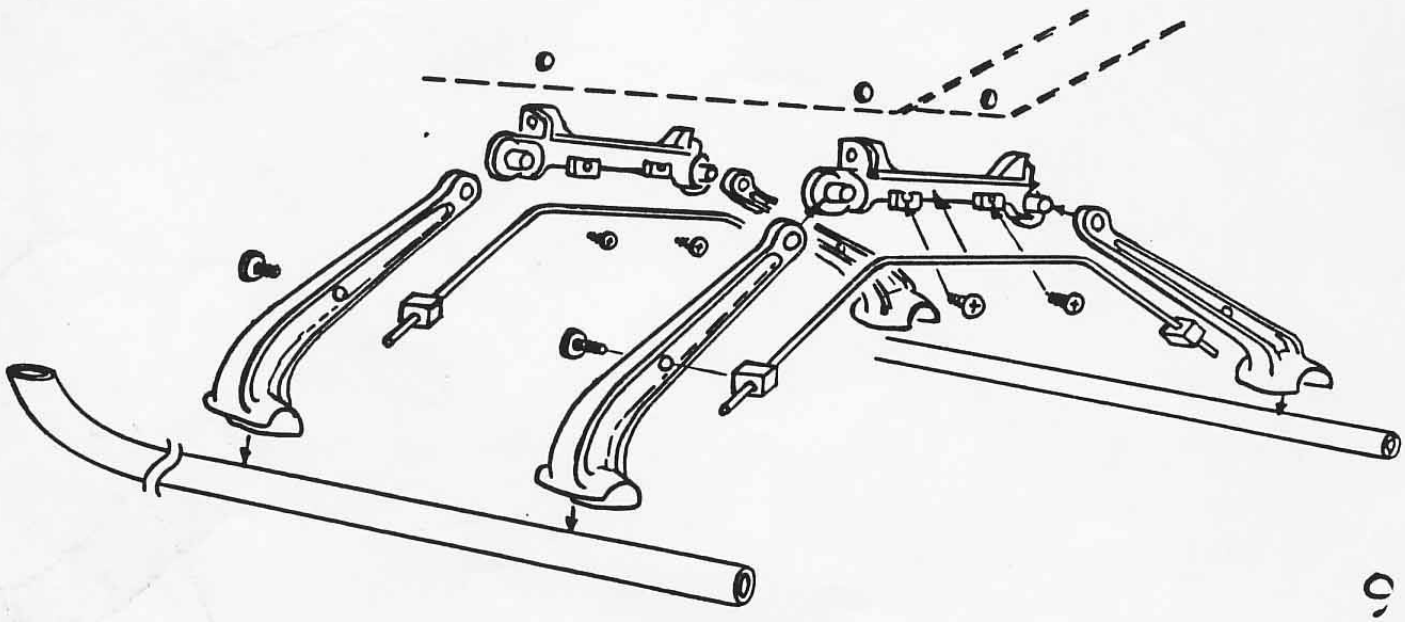
MXA UNDERCARRIAGE

2 skids
2 U/C crossmembers
2 U/C wires
4 U/C leg
4 square collar
4 M4 x 8 pan head screw
8 No 8 x 3/8 taptite screw

Push an undercarriage leg onto each end of the undercarriage cross member and trap it in position with the undercarriage wire which is locked in position with taptite screws.

Feed a square collar onto the wire end until it is wedged into the leg section, and fasten with an M4 x 8 screw through the leg web.

The two leg assemblies should then be fixed in the chassis using taptite screws. The skids must be pressed into the leg mouldings to complete the undercarriage. This can be made easier by warming the moulding in hot water.



MXA CABIN & TAILPLANE

These are formed in ABS sheet. You will require a sharp pointed model knife, a suitable adhesive (super glue or solvent type) and clothes pegs and a pair of pliers.

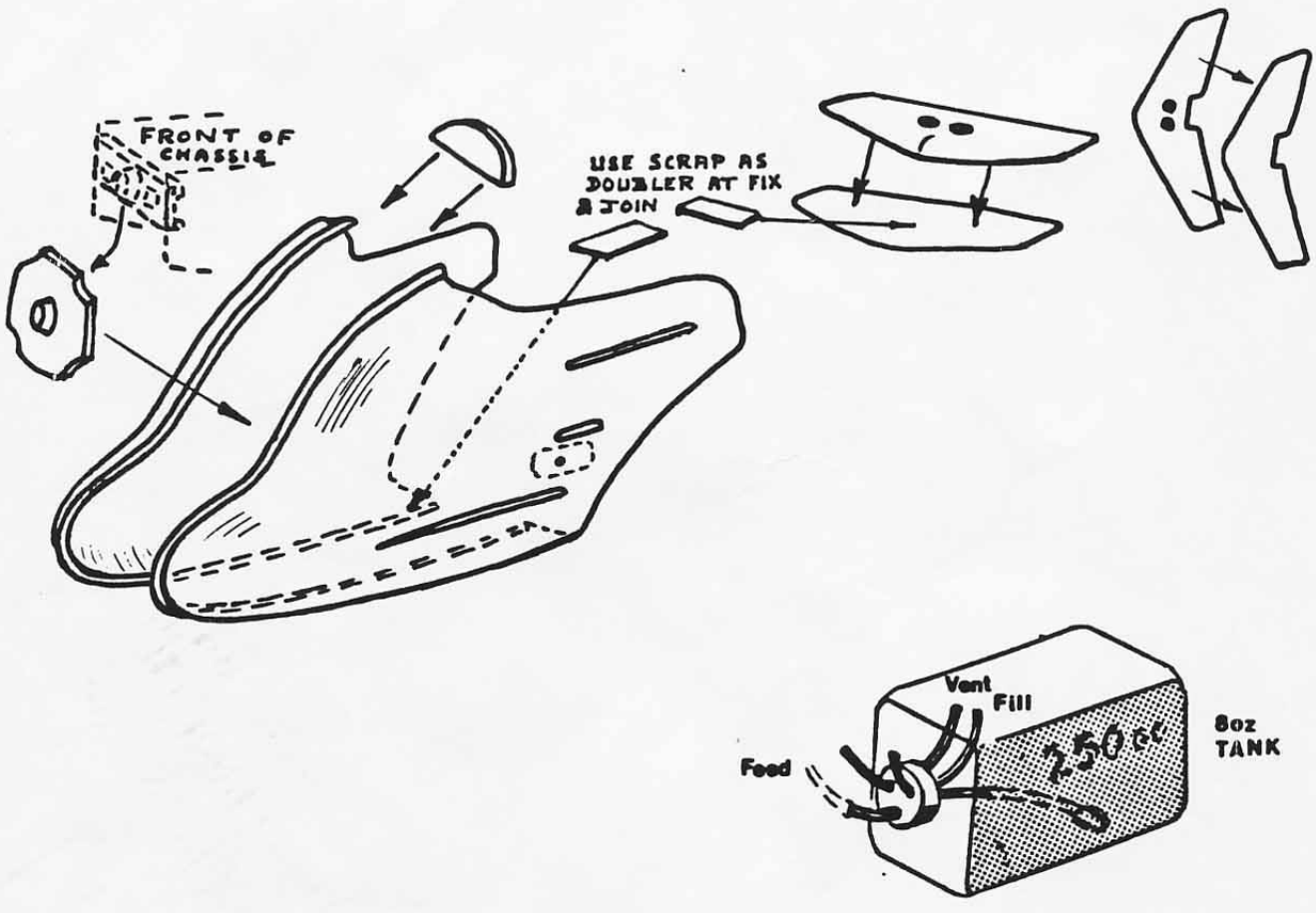
The material is cut by scoring with the knife point and bending the sheet along the scored line. Prepare by leaving the mouldings in a warm room for some time before attempting the cut. Practice on surplus material first.

The material is first scored well clear of the desired line and then bent to break off at the cut. Then scribe a score at the finish line (on the cabin this is some 5mm from the nose shape on the flat, and where marked round the engine bay). The tailplanes are cut at the edge as no flat edging is necessary.

The remaining surplus is then 'bent' off using pliers at the finish line. Clean up with a sharp knife.

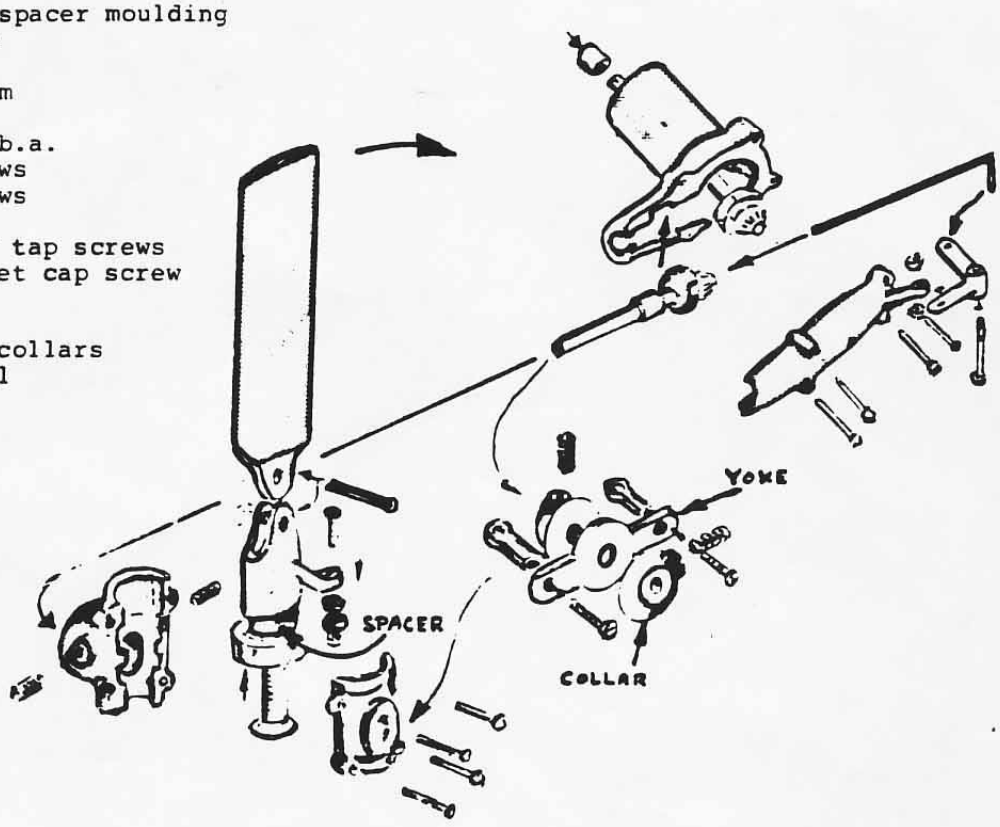
Glue the two halves together holding them in position with clothes pegs until the glue is set. When dry glue in the cabin bulkheads after using the chassis as a jig to ensure that the bulkhead is at the correct angle to align with the forward cross spacer.

Drill fixing holes through the three parts and paint as desired.



TAIL ROTOR

1	gearcase moulding	
1	gearcase back moulding	
1	input mitre gear and shaft	(each with ballrace
1	ouput mitre gear and shaft	and oilite bush)
2	blade	
2	blade mount	
2	1/2 hub and spacer moulding	
1	control yoke	
2	eye end	
2	ballrace 6 mm	
2	csk screws 2b.a.	
4	M2 x 16 screws	
6	M2 x 12 screws	
12	M2 nuts	
2	2 x 3/8 self tap screws	
1	M3 x 20 socket cap screw	
2	M3 nuts	
2	control rod collars	
2	ball end ball	
2	split pins	



Gearbox.

Remove the oilite bush and push the input shaft (i.e. the smaller of the two shafts) into the case as in the diagram. Place the output shaft in position in the case. Fill case with light grease and attach back moulding using M2 x 16 screws and nuts. Push the second oilite bush along the input shaft into the gearcase. Check for free rotation.

Tail Rotor.

Place the ballraces on the countersunk screws followed by the moulded spacers and, with paint or locking compound, screw tightly into blade holders. Fit ball ends to the pitch control arms of the blade holders using M2 x 12 screws and a nut on each side of the arm. Slot the blades into the holders. Refer to the diagram for correct installation. Spread the split pins fully after inserting through the blade root and holder.

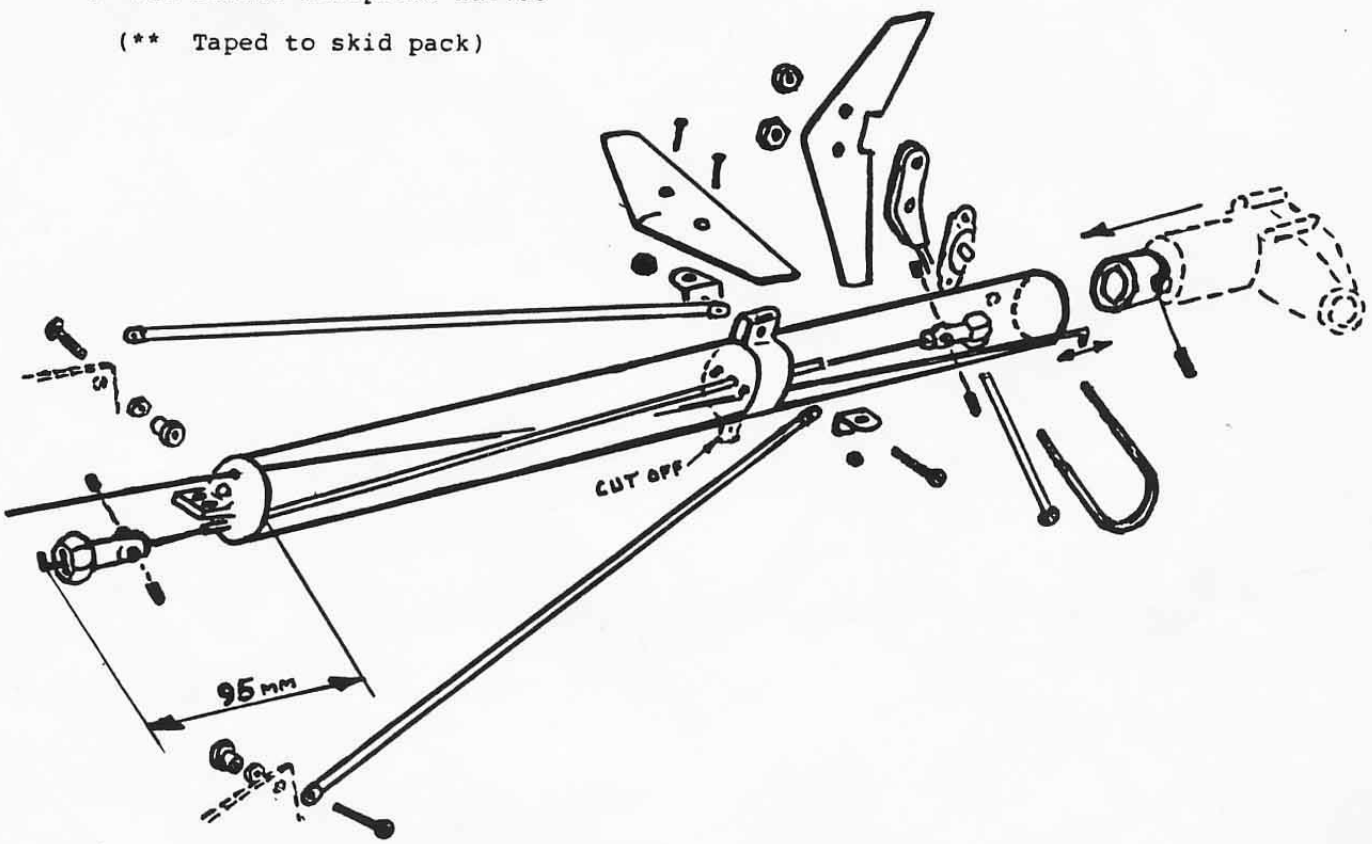
Clamp the ballraces between the moulded hub halves and draw halves together using M2 x 12 screws and nuts. File small flats on the output shaft of the gearbox to seat the set screws, and fit tail rotor hub to output shaft. Note that the outer surface of the hub should be flush with the end of the shaft. Cut the pitch control rod from 18 g. (1.2mm) wire and bend as shown. The wire passes through the centre of the shaft and moves the pitch control yoke which is positioned between two collars.

Each ball eye is fitted to the yoke with a self tap screw. The bellcrank pivots on a 3mm bolt on the arm from the gearcase back, again with a nut both sides of the arm.

MXA TAIL BOOM

1	End moulding	1	430mm brass tube **
1	Joint moulding	1	140mm alloy tail skid
1	350mm boom tube **	1	2mm x 100 wire clamp
1	175mm boom tube	4	M2 nut
1	gearcase lock saddle	2	M2 x 12 screw
1	tailskid moulding	3	M3 x 16 pan head screw
2	Hex ball plug	3	M3 nut
2	Hex ball socket	6	M4 x 6mm socket set screw
2	Aluminium boom stay tube **	2	M4 x 8 pan head screw
2	tailplane mount bracket	2	M4 thin nut
2	elastic band retainers	2	M4 star washer
4	vac-formed tailplane halves **		

(** Taped to skid pack)



Feed the 16g (1.6mm) tail drive wire through the 430mm brass tube and both through the lower hole of the boom end moulding. Add the long boom tube and fix with contact adhesive or super glue.

Feed the 18g (1.2mm) tail control wire through the smaller hole at the top of the boom end and out of the other end, then feed the boom joint moulding over both wires and tube so that the tailplane bracket is on top, and fix with adhesive.

Push and fix the short boom tube onto the joint with the tail gearbox location hole to the right. Careful alignment with the front of the tail boom is essential for correct tail rotor alignment.

Slide a hex ball coupling plug over the drive wire at the rear, ball rearwards, then bend the end at 90 degrees. Pull the hex ball plug back over the bend and secure with two M4 x 6mm set screws.

File a small flat on the tail rotor gearbox input shaft, and put a hex ball socket on the shaft secured with an M4 x 6mm set screw onto the flat. Locate the assembly into the tail boom with the plastic lock saddle. Push the drive wire from the front to engage the coupling you have just assembled, then fit the second hex drive plug as shown in the sketch. LUBRICATE the couplings with a dab of grease. Fit hex drive socket on the main gearbox output shaft.

Assemble fin and tailplane to tailboom. Attach the tailboom end to the rear of the channel in the chassis using M4 x 8 screws and nuts, and fit 450mm aluminium stay tubes from the tailboom joint to the fixing holes above the tank position in the chassis using M3 x 16 screws. The small moulded retainers are fitted over the excess screw threads to take the elastic bands which hold the fuel tank in position.

1 top plate moulding
1 head plate
1 mast top moulding
2 bearing mount pairs
1 set of 4 finger plates
2 teeter rubber
2 drag damper rubber
2 blade mount
2 incidence arm
1 flybar cradle (zig zag)
2 cradle extension
1 cradle carrier
2 cradle carrier spacer
2 flybar operating arm
2 flyblade
2 mixer long rocker
2 mixer short rocker
1 mixer slider
8 M2 x 12 screw
8 M2 nut
4 M3 x 16 cap head screw
2 M3 x 20 cap head screw (plain shank)
4 M3 x 20 cap head screw
4 M3 x 20 pan head screw
2 M3 x 30 cap head screw
4 M3 x 30 pan head screw
8 M3 star washer
16 M3 nut
2 M4 x 10 socket set screw
2 M4 x 25 cap head screw
2 M4 nyloc nut
6 ball end ball
2 square brass collar
2 3mm oilite bearing
1 50mm threaded stud
4 37mm control rod

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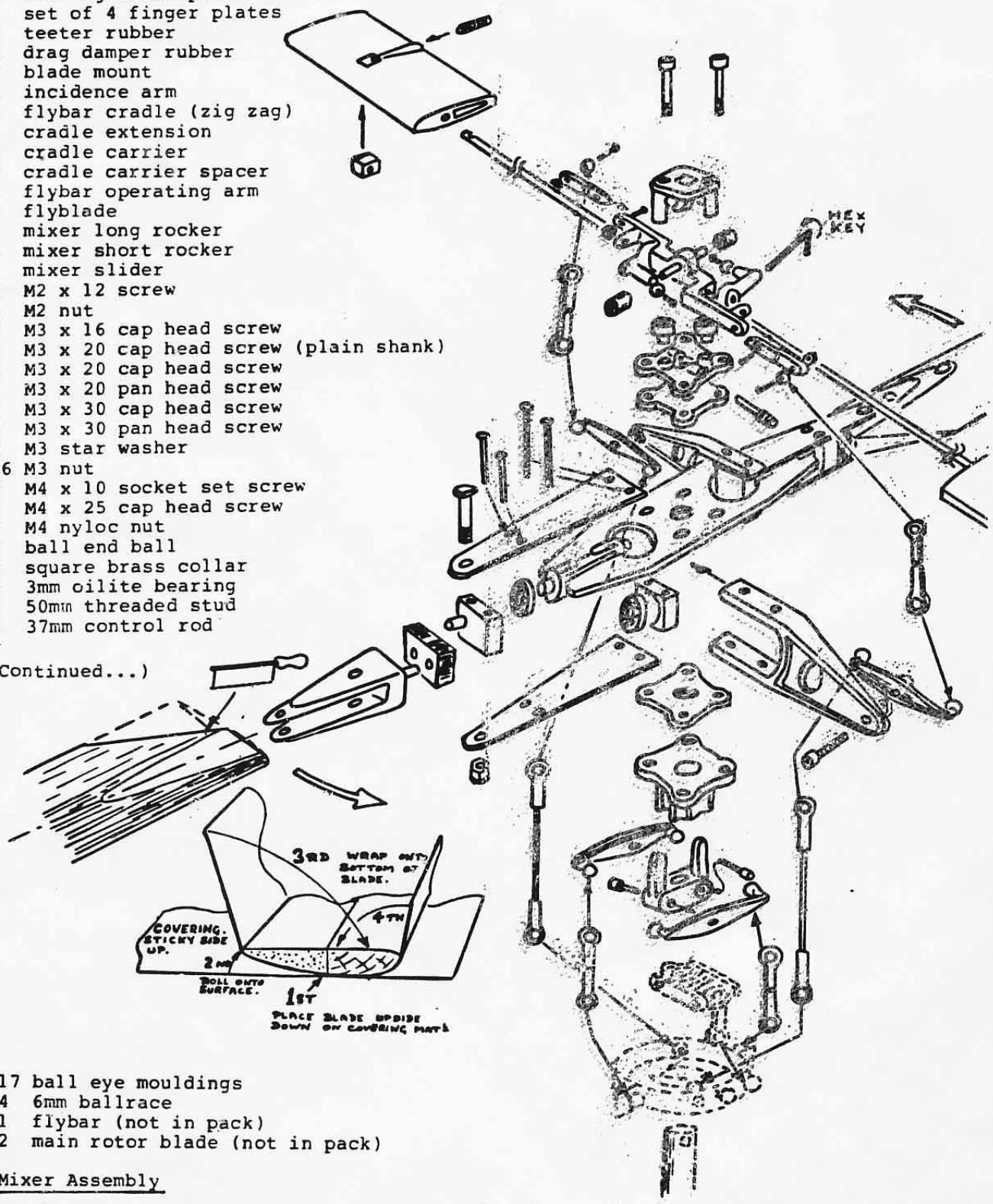

17 ball eye mouldings
4 6mm ballrace
1 flybar (not in pack)
2 main rotor blade (not in pack)

Mixer Assembly

Cut the 50mm threaded stud into four equal lengths and fit a moulded ball eye to each end of each stud.

Pass an M3 x 20 cap head screw with a smooth shank through the holes in each side of the mixer slider as in the sketch. The smooth shank acts as a pivot. Thread the screws into the long rocker arms, allowing it to cut its own thread in the plastic. The arms must be allowed to move freely but without slop.

Slide the mixer slider onto the rotor mast with the fork fitting upwards to go into the grooves in the side of the mast top moulding. Connect the outer arms of the long rockers to the swashplate using the two of the short links.

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Insert an M3 x 16 cap head screw through the pitch control hole in the two rotor blade incidence arms, and fix with M3 nut as shown in the sketch.

Push the four ballbearings onto the stub axles moulded into the rotor head alloy plate. Note the word 'TOP' is marked on the stub axle. Fit the outer moulded bearing block to the outer ballrace with the moulded stud to the trailing edge (anti-clockwise rotation). Assemble two steel fingers onto the block using M3 x 20 pan head (cross head) screws, star washers and nuts. Fit the inner bearing block over the inner ballrace, between the steel fingers. Push the moulded incidence arm over the fingers and fit using 2 M3 x 30 pan head screws through the inner bearing block followed by star washers and nuts.

Push mast top onto mast. Remove rotor head fixing screw from inside the top plate moulding. Sandwich the headplate between the two teeter rubbers and between the mast top and top plate moulding. Assemble using four M3 x 20 cap head screws threaded full length and M3 flat nuts. Make sure the nuts are pulled home but the teeter rubbers should be only lightly clamped. Replace screw in top plate moulding, through mast.

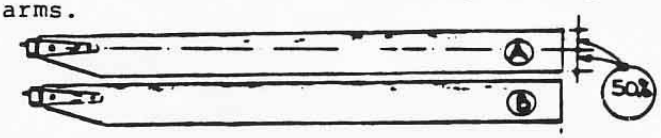
Fix the extension arms to the flybar cradle 'zig-zag', and fit a brass ball to each end using M2 screws and nuts.

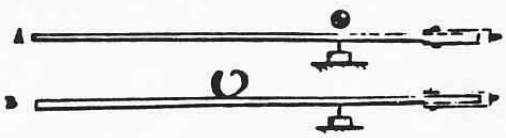
Snap the cradle into the moulded carrier and then push in the oilite bearings over the small pivot shaft. Pass the fly bar through the cradle, threading in the operating arms as required. The unit is fixed to the rotor head top moulding using 2 M3 x 30 socket cap screws passing through the moulded spacers and into the brass threaded inserts in the moulded top plate.

The flyblades are fitted to the flybar as in the sketch with the M4 x 10 socket set screws passing through the rear of the flyblade into the square brass collet, and fitting into the deep grooves at the end of the flybar. Note that the trailing edge of the flyblade is square and not sharp. Fit a moulded ball eye to each end of the 37mm pushrods and use them to connect the flybar operating arms to the inner balls on the mixer/rocker assembly.

Thread a small rocker arm onto the M3 bolt on each incidence arm, and use the two remaining short connecting rods to link the ends of the 'zig-zag' cradles to the long arm of the small rockers.

Thread ball eyes onto the 37mm rods and use to connect the brass balls you have fitted inside the swashplate cup to the short rocker on the incidence arms.





Cut away the balsa at the blade roots to taper the blades, and if necessary flatten the top of the blade where it fits into the moulded holder (holder peg to the front). Sand the blades lightly to smooth the surface then cover with the self-adhesive vinyl supplied. The overlapping edges should be under the blade trailing edge 'downwind' - (see diagram).

The rotor blades must be in static and dynamic balance. To achieve this is simply a case of making sure they have the same weight, and that the centre of gravity of each blade is at the same point.

If the blades are of equal weight but differing C. of G., add covering material or electrical tape to move the balance point of one blade out towards the tip, and a similar amount of material to the other blade to bring the balance point towards the centre. Try and get the balance equal to within 1-2mm.

If the blades are of unequal weight and balance point, add covering material to the lighter blade in such a position that it will also move the balance point to match the other blade.

Insert the blades in the blade holders and position so that a line from the two holes in the holders would extend to a point 50% back from the leading edge at the blade tip. This gives the correct amount of blade lead. Drill and fit the M3 x 16 bolt and nut, then drill for the larger 4mm retaining bolt and fit. Place the rubber drag dampers in position and push the complete blade assembly in place between the rotor head fingers using M4 screw and nyloc nut to secure.

Paint or tape one rotor tip red and the other white or yellow. Check that each tip in turn is the same height above the boom. This is static tracking and is very important.

Assemble the fuel tank as in the diagram and fasten on the seating behind the engine with light rubber bands. These must not be tight or engine vibration will cause foaming of the fuel.
Secure the radio receiver on the vertical surface of the chassis, on the opposite side to the fan duct, with a strap or servo mounting tape. Lead the aerial out to the rear but so it hangs clear of the tail rotor.
The hole above the engine is intended for glow plug access only. Use a long glow clip from below or a remote plug and cable during engine starting.
Have you got lubricant in the gearboxes? Occasionally lubricate the main gearbox with oil through the hole in well at rear of gear case.

Main Rotor

Precise trim can vary widely according to many factors, including model weight, engine power, air temperature, humidity, height above sea level, type of fuel used, glowplug condition, engine condition, etc. However, a reliable starting point is to set the bottom surface of the main blades to zero degrees with the engine throttle closed. Total vertical travel of the swashplate on the rotor mast should be 11-14mm while throttle moves to open.

The model will move in the direction of tilt of the main rotor disc, which is controlled by the tilt of the swashplate. Tilting the swashplate down at the front will result in the rotor disc also tilting down at the front, and the model dropping its nose and moving forward from the hover. The same goes for left, back, and right, and any other angle - the rotor follows the tilt of the swashplate and the model moves in that same direction.

An angular movement of the swashplate of about 15 degrees in each direction (total 30 degrees) is sufficient for ample control without over-sensitivity.

Tail Rotor

With the tail rotor control a suitable setting is for the flat surface of the blades to be at right angles to the pitch control rod (i.e. pitch is zero degrees) when the transmitter control stick is pushed fully to the right (with Tx trim at neutral). It is most important that the tail control pushrods move freely. In particular watch for binding at any point as this can seriously affect stability and control.

Engine

Have you got lubricant in the gearboxes? Occasionally lubricate the main gearbox with oil through the hole in well at rear of gear case.

The carburettor must be set rich enough to keep the engine cool, yet lean enough to provide ample power. With the rotor collective pitch set as specified above the engine should be set to a rich two stroke mixture.

The rotor head should be held while starting the engine with the throttle just open. The centrifugal clutch will not drag at a correct idle speed. Open the throttle by pushing forward left hand stick if you have installed according to the drawing. Some people prefer to fly other modes. This will speed up the rotor head and apply collective pitch. Rotor speed is important on any model helicopter and too great a deviation can cause aggravating problems.

At about half stick the rotor should be spinning fast and tracking correctly - the coloured tips enable you to see this. If incorrect throttle back and increase pitch on the lower blade by adjusting the length of the link rod between the short rocker arm and the flybar cradle. If in order, advance the throttle/collective to the point where the model is decidedly light. Note that moving the cyclic stick will tilt the rotor.

If there is a shake on the model, stop the rotor and add an extra band of covering material to one blade (15mm wide for minor shake, 50mm for vicious), try again, if worse put it on the other blade. The fly blades may also need dynamic balancing in this way.

When tracking and balance are sorted out the throttle/collective may be advanced to the point of lift off. Powerful oscillations of the whole model are caused by too low a main rotor speed. The answer is to reduce collective pitch by lengthening the push rods between the flybar cradle and the rotor incidence arm. Incidentally, a great excess of collective pitch will cause the clutch to slip and heat up, and the tail rotor will be unable to cope with torque because it is running too slowly. Also in this condition the engine is working very hard at low rpm of the cooling fan, so this is a dangerous condition to stay with.

If the engine screams and the model shows a reluctance to lift off then more pitch is required relative to throttle. If it lifts off but is very twitchy and sensitive on the controls again increase pitch to slow the rotor. Lift off is best at about 2/3 to 3/4 of full throttle stick movement. Main rotor should be turning at approx 1200 rpm, equivalent to 4900 at the tail rotor.

Oscillations can also occur with any two bladed rotor head if the teeter is reduced by excessive tightening. Try to adjust so the rotor head plate is held firmly but not solidly between the rubbers.

Similarly with the tail rotor. If the model tends to revolve at the point of lift off increase or decrease the tail pitch setting by moving the collars on either side of the yoke.

The model is now ready to fly.

FLYING

There are a great many technicalities concerned with the flight of a helicopter, only the essential reactions will be described here.

Start by standing about three paces to the rear and three paces to the side of your model which is pointing into wind and on level ground. This is the best position for observing the attitude of the model and to be able to control the hover.

Increasing throttle/collective to the point of lift off will indicate that the model wants to go in one direction or another. Ignore this but apply a control (the cyclic control is as if you had hold of the model by the rotor top) to correct the movement. You can trim out the tail at this stage. Repeat until you are confident that your reactions will give a control in the right direction. Many beginners are confused by the apparent tendency of helicopters to leap off in random directions when they are about to leave the ground. Correct control inputs to counteract this have to be learned.

A touch more collective and the model will clear the ground. If at this stage it persistently goes in one direction the trim may be adjusted, either on the transmitter or by adjusting the length of the control rods to the swashplate. Repeat until confident.

When the model is one metre clear of the ground (out of ground effect) control will be easier but a miscontrol will be more disastrous. If flying from rough grass then Morley floats can be an advantage, other training aids are more trouble than they are worth but the Morley string method may help.

A light extension to the tail boom is fitted to make an attachment for a 3 metre length of cord clear of the tail rotor. An active and understanding anchor man holds the other end with the model pointing downwind. The model has forward trim set and the pilot stands to the left of the anchor man, who raises and lowers the string with the model. In this way the pilot learns the response of the model two controls at a time instead of having all four to worry about. This method has been tried, it works, and is recommended.

When you find that height control (do not let the model go above head height) and lateral control are an automatic reaction, then the forward trim is removed and the fore and aft cyclic becomes operational. As the string goes slack so the tail rotor control is needed. Persist until you find it easy. Try to get used to settling the model down - landing - rather than slamming the throttle shut when in the right place else you may chop the tail boom.

Now you can hover! Which you need to do to land. Follow this with slow flights forward, backwards and sideways until you can place the model at any point you want, and can keep it there.

The next stage is a circuit, which is easy, but coming out of forward flight back to the hover is not always so. On a calm day a slow and careful circuit is just a hovering circle. Note that the controls are used to change the attitude of the model to position it as required, and not 'held' in any particular way. Note also that in forward flight a lot less power is required - this is caused by the addition of translational lift due to the extra air going through the rotor, and is what can give rise to trouble in stopping.

To slow down, gently reduce collective and adjust cyclic to keep the model level. As the model slows the power will need to be increased to stop sink. When the model is stationary slightly reduce power to stop a vertical climbout. You can then settle it down.

Happy Landings