

Acro Star



Photo TSK Japan

Build manual

Written by Graeme Halliday, TSK UK

This manual is intended to allow correct assembly of your Acro Star model.
It does not attempt to show how to set up the model for any advanced style of flying.

Safety notice.

Please read through the instructions before building. If you are not sure of anything please ask. Model Helicopters can be dangerous if not assembled correctly !!!

Some thoughts for you before you start.

Tools.

It is always a good idea to use the right tools for the job. It makes the job easy. Better quality tools will help to do a better job. And will probably last longer to.

Loctite and screws.

I would recommend that it is better to use stronger Loctite and not do screws up over tight. than to use light Loctite and wind the screws in really hard. Remember you are using high tensile steel screws in aluminium parts. The screws always win.

Gluing up before you build.

There are three parts to be glued together and you may want to do this first, as it will slow you down later on.

Refer to the pages mentioned.

Page 8 Glue the tail gear holder to the boom.

Use 5-minute epoxy for this. It will bond well enough and with a little heat will come off again if need be. Don't forget to fit the screw as well.

Page 10 Glue the pipe ends into the tail boom support pipes.

Again use 5-minute epoxy for this, as you may want to re use the ends in the event of an accident. Smear around the grooves in the joints and insert in the pipes. Ensure proper alignment. (Both ends in line) Remove excess glue before it dries.

Page 12 Glue the clutch lining in.

Use 24-hour epoxy for this. I use Araldite. Remove any excess before it dries. If you use 5-minute epoxy the heat of the engine will soften it and the clutch lining will become loose causing a loss of drive.

Radio Equipment is not supplied with this model

You will need a five channel Helicopter set as a minimum to fly this model.

It will need to include five servos (including three identical ones), receiver, battery pack, switch harness and a gyro.

You will most likely need at least three extension leads of 200mm length or greater.

Optional but a very good idea is an on board battery monitor.

Rotor blades

Blades with a length between 660mm and 680mm are suitable for this model. Selection of the manufacturer is left to the pilot to match flying style / ability.

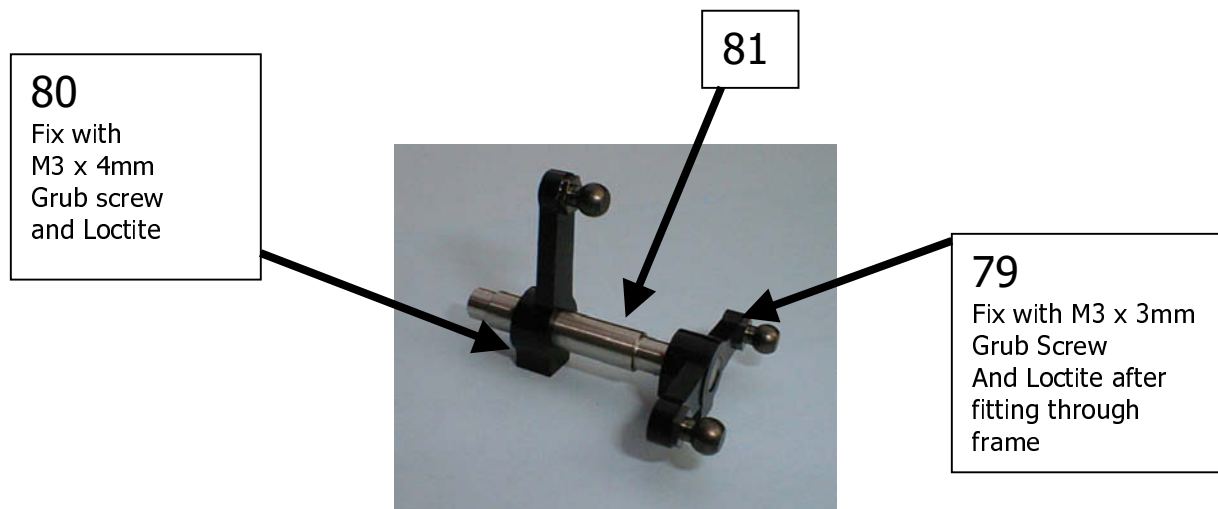
Tail rotor blades are provided in the kit.

Frames

As the frames are stamped out care should be taken when handling. It is possible for sharp edges to have been left during manufacture. If required remove these prior to assembly.

Elevator control lever assembly.

Ensure the control levers are set at right angles to each other. Check by sitting on flat surface. Note that item 79 is not permanently fitted until it is fitted in the frame.



Elevator control lever bearings. Part 104.

The elevator control lever bearings need to be pushed into the frames. This is best done with a drill press and some suitable support for the frames to prevent bending.

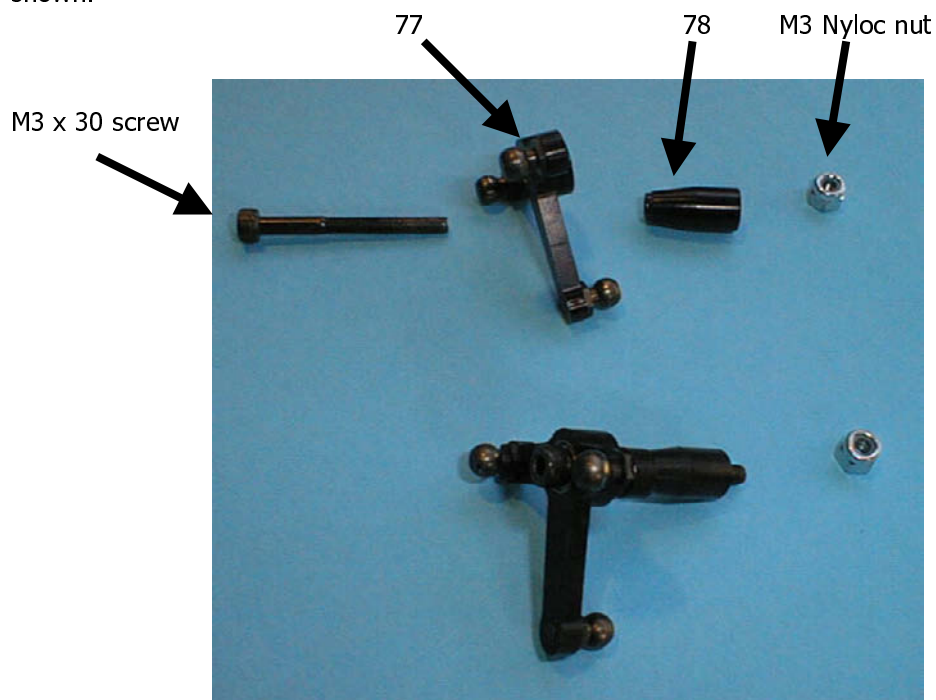
Place a scrap of hard wood on top of the bearing and under the frames to prevent damage.

When fitting remember to make a left hand and a right hand frame

The flanges of the bearings face the inside of the model.

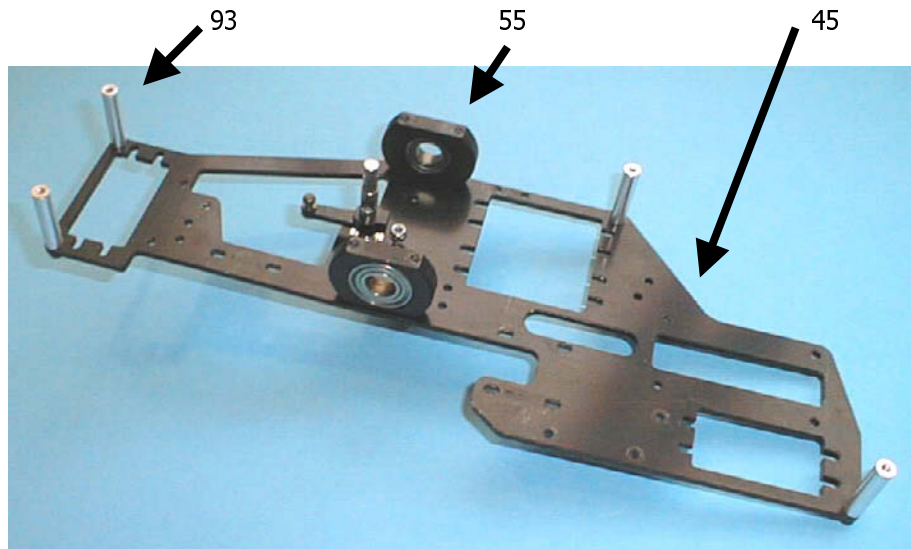
Roll and pitch 'T' levers.

These are assembled in the order shown and then fitted to the side frames in the positions shown.



Upper frame assembly

The frames are assembled as shown below. Elevator crank lever bearings face inwards. Fit the elevator control lever into the bearings. Dry assemble the four spacers, 93, onto the frames using M3 x 8mm screws. Dry assemble the main mast bearings into the frame. Now whilst checking the frames are set square remove each of the spacer fixing screws and apply Loctite and fix in place. Doing it one screw at a time should ensure frames remain properly aligned.



Note,

Left hand side frame not shown.

Fitting the tail rotor servo is much easier before the frames are joined.

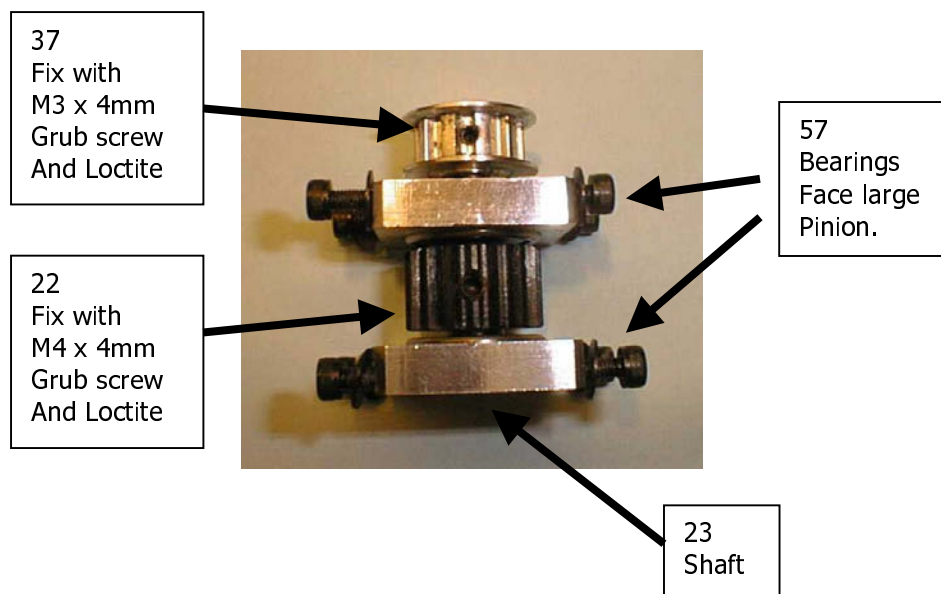
See section on fitting radio for detail of fitting.

Main mast bearings.

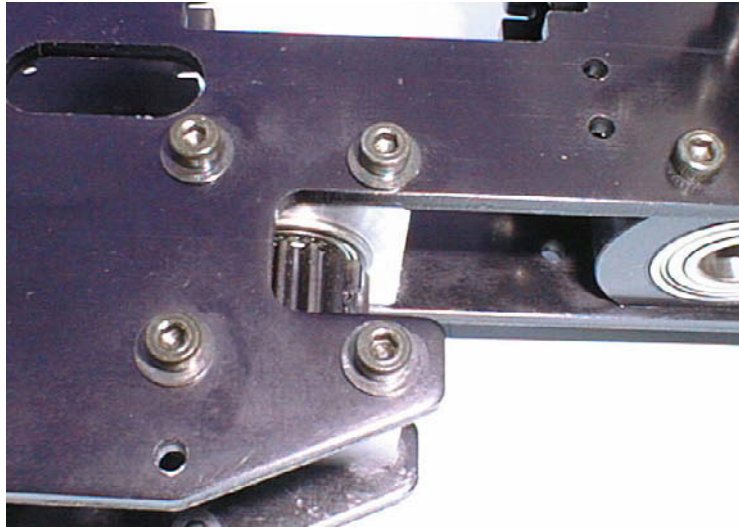
It is a good idea to put the main mast through the bearings when tightening the screws up. This will ensure correct alignment. When finished put the mast to one side for later.

Counter gear assembly.

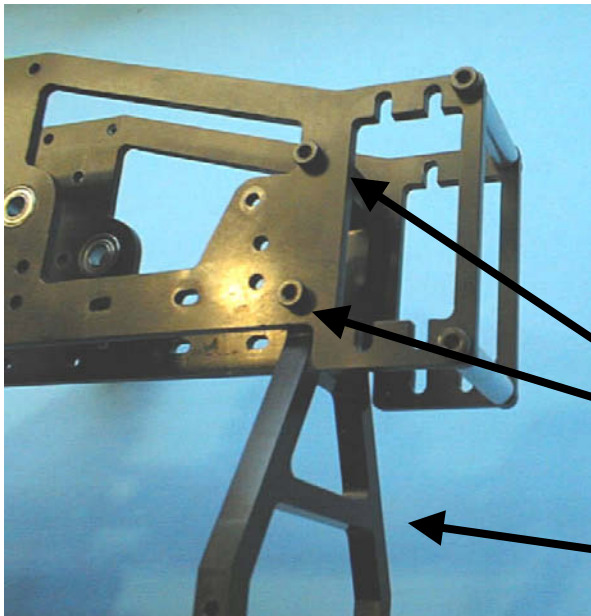
Assemble the counter gear as shown in the photo. Note that the bearings face the large pinion. And that the small pulley is fitted with the grub screw hole as shown.



The counter gear assembly is then fitted into the frames and fixed with M3 x 8mm screws and plain washers. Do not tighten at this stage. The flanged pulley is to the top.



Now add the frame stiffener to the front of the upper frame assembly.

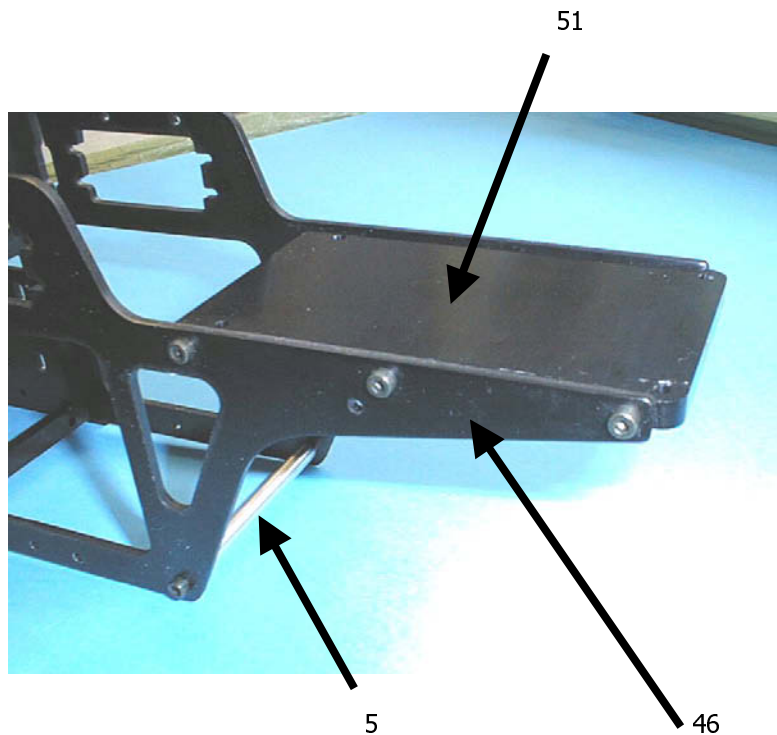


Do not tighten the fixing screws yet. All frames will be finally tightened when fully assembled and checked for alignment.

M3 x 8mm screws

50

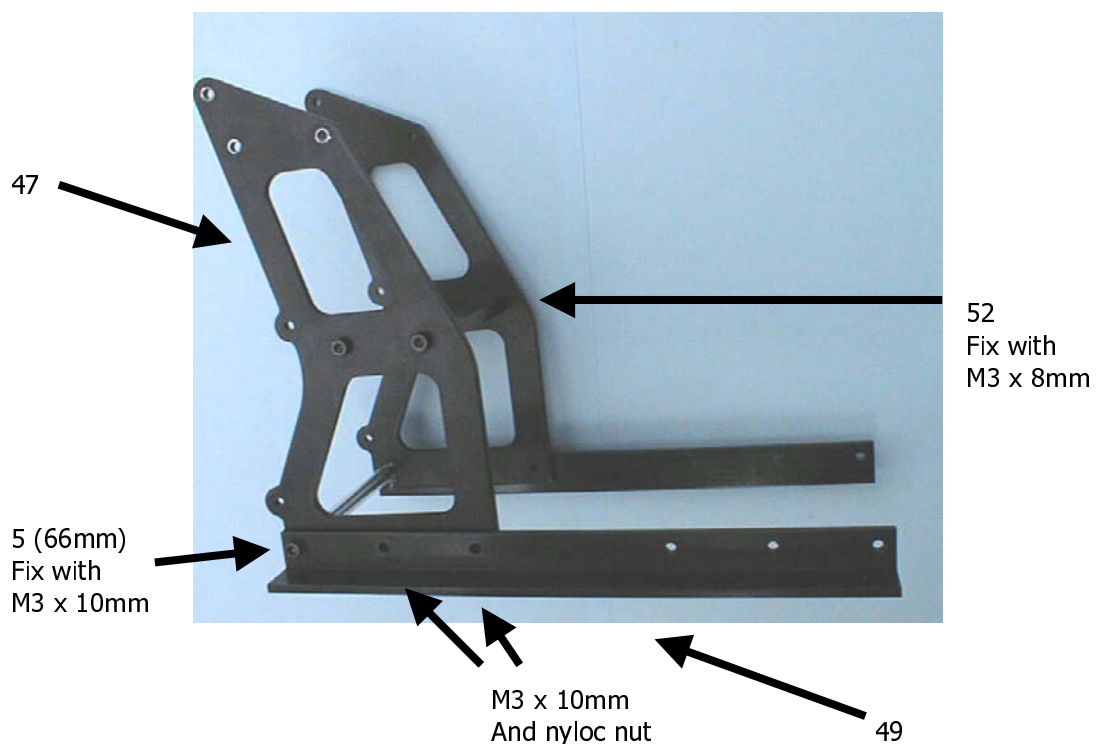
Front frame assembly



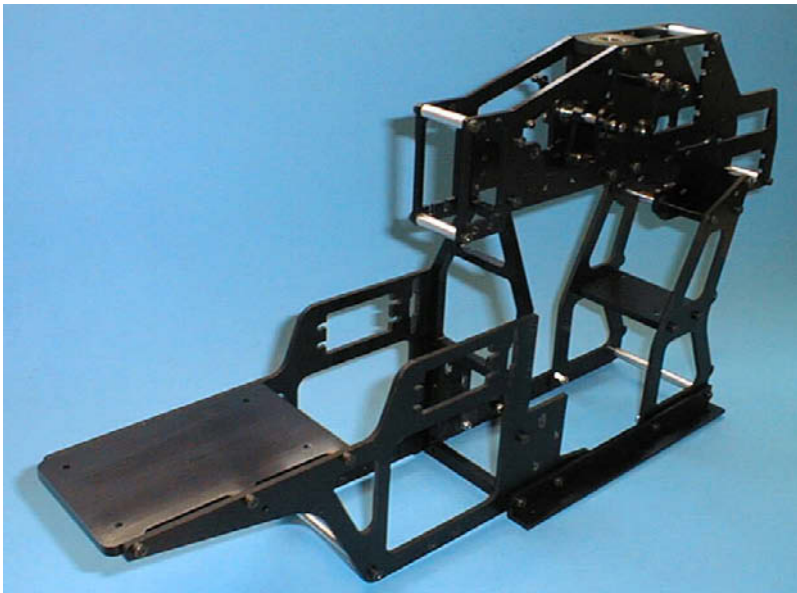
Fit mechanism plate (51) to front frames (46) with M3 x 8mm screws. Do not Loctite at this stage.

Fit 66mm spacer (5) with M3 x 8mm screws. Do not Loctite at this stage
Fix to frame stiffener with 2 off M3 x 8mm screws.

**The rear frames (47), gyro mount plate (52) and lower rails (49)
Do not Loctite anything yet.**



Now attach the rear frame assembly to the front assembly.

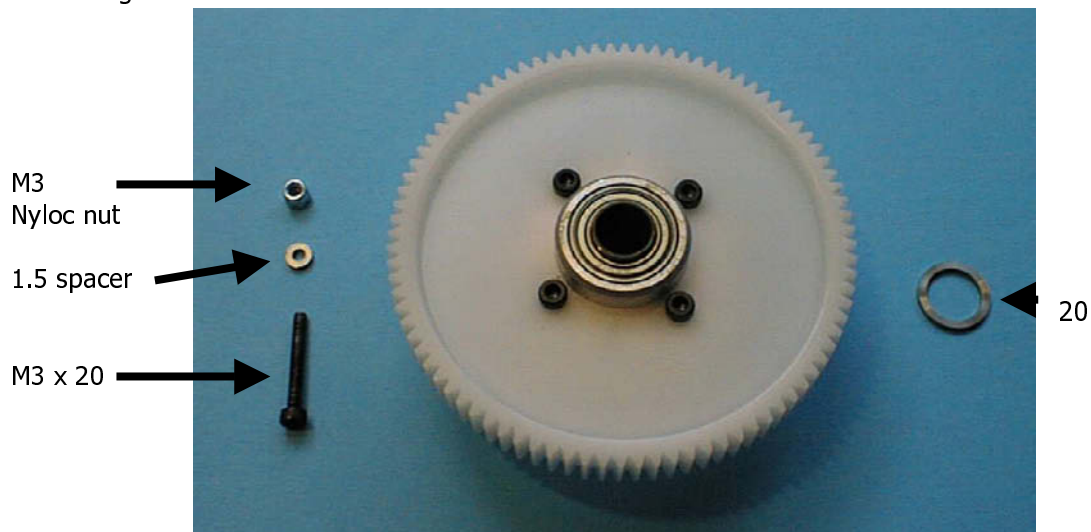


Pass the M3 x 30mm screws through the rear frames, through the 'L' spacers, through the upper frames and screw into the 26mm spacers (93). Screw the front of the lower rails through the front frames and into the frame stiffener with M3 x 12mm screws. Fix the two remaining holes with M3 x 10mm screws and nyloc nuts

Now that the frames are assembled, check for correct alignment and squareness. When satisfied everything is correct, take out each screw in turn and re-fit using Loctite. Now finish off by adding M3 x 10mm screws and nyloc nuts to the rear of the lower rails.

Assembly of main gear (21), and Auto rotation unit assembly (18)

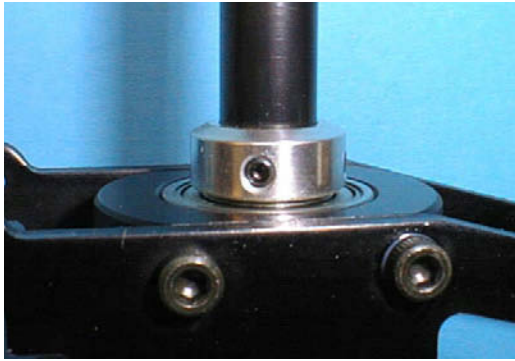
Fix main gear to auto unit with M3 x 6mm screws and Loctite.



Now install main gear into frames.



Fit main shaft through bearings. The hole nearest the end of the shaft is the lower end. Place the spacer (20) on top of the auto rotation unit. Ensuring the spacer is seated correctly. Fit to the shaft using M3 x 20mm bolt, spacer and nyloc nut. Note position of 1.5 spacer.



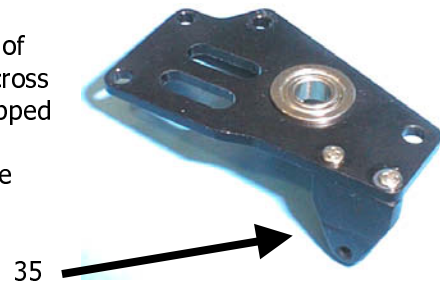
Pull main shaft up tight to bottom of main bearing.
 Fit mast stopper (89) to main shaft.
 Shoulder to the bottom and chamfer to the top.
 Fix with M3 x 3mm grub screws and Loctite.
 Ensure there is no up and down play in the shaft.
 Now adjust the backlash between counter gear and main gear.
 Loctite the counter gear in place when properly adjusted.

Tail rotor gear box assembly

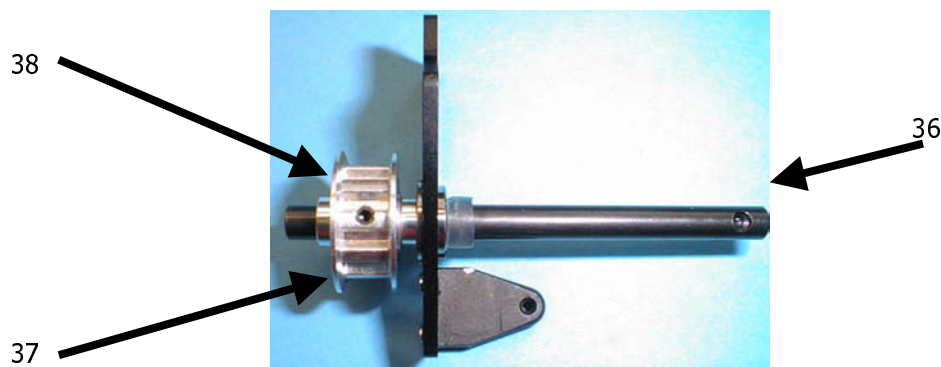
If not already done bond the tail gear holder (28) to the tail boom (26).
 Drill suitable size hole into boom through tail gear holder hole. Fix with M2.6 x 6mm self tapping screw.



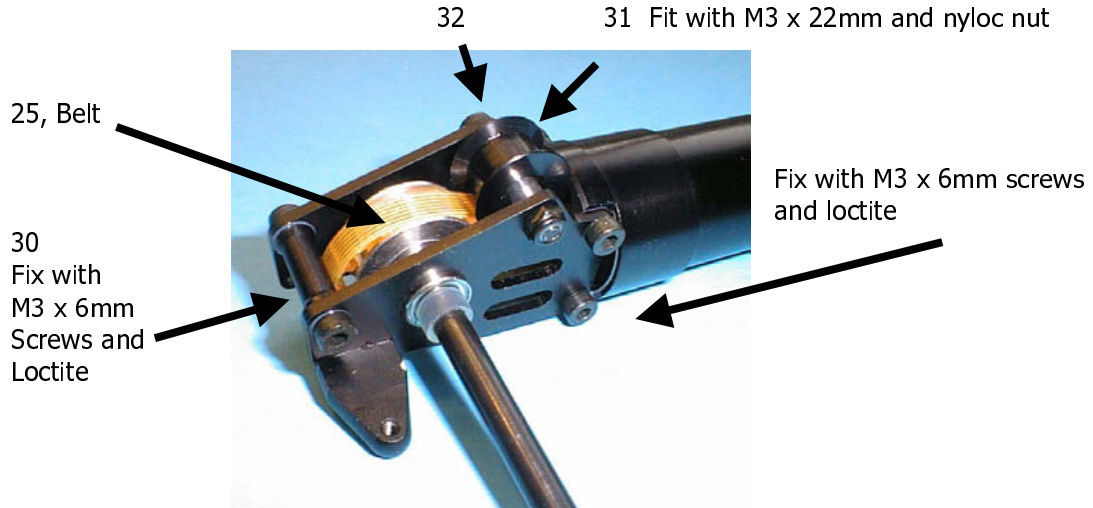
Fit the tail lever mount (35) to the right side plate (Part of 29) Note bearing flanges face inwards. Use M2 x 6mm cross head screws. It would help if the holes in 35 were re-tapped with an M2 tap prior to assembly. The black anodising makes the hole tight and there is a chance of turning the heads over.



Build up tail rotor shaft (36) and pulley (37).
 Note orientation of pulley on shaft.
 We recommend changing the M3 x 4mm grub screw supplied for one 6mm long.
 (See separate packet supplied with UK Kits)
 Grub screw must fit into hole in shaft.
 Cut a piece of fuel tube 5mm long. Fit onto shaft to prevent over travel of pitch collar.

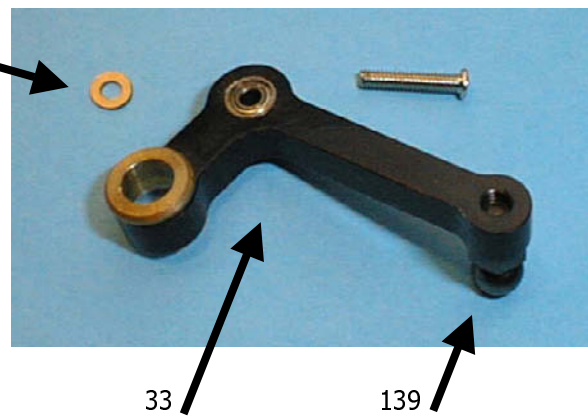
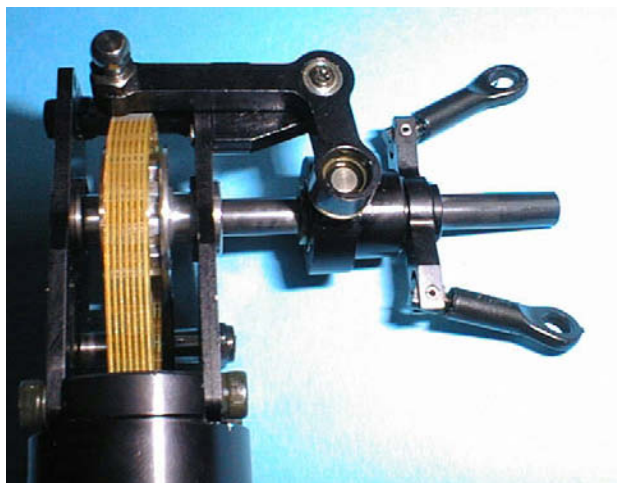


Build up the rest of the gearbox



The parts of the Tail lever

Use Loctite on the ball (139).

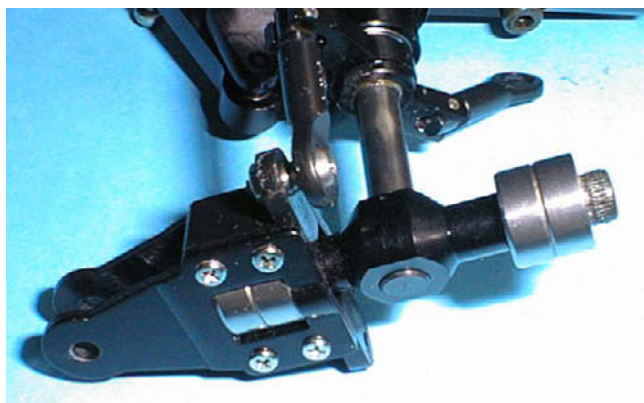


The M2 x 10mm screw fits through the tail lever (33) and then through the 3-2-1.5 washer (90)

Then is screwed to the bottom of the lever mount. Fitting the pitch collar assembly (39) at the same time.

Screw the ball joints, (126) between 1mm and 2mm from the end. Adjust to track the tail blades.

Assemble the Tail hub.



Fit the bearings (143) to the hub (116) with M3 x 14mm screws and Loctite.

Be very careful not to over tighten these screws, as damage to the bearings will occur. The bearings should be free to rotate with no play in the assembly.

Fit the ball joints to the spacer blocks using M2 x 8mm screws, nuts and Loctite.

Tapping out the M2 holes in the blade grips, (144) will help during assembly. Press with fingers the blade grips onto the bearings. They are a tight fit, do not try to relieve the holes as this will introduce play into the assembly.

Fit the spacer blocks in place and fix with M2 x 10mm screws and Loctite.

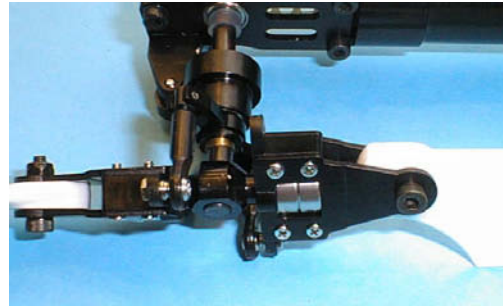
Fix the hub assembly to the shaft with an M3 x 4mm grub screw.

Ensure the grub screw locates in the hole in the shaft.

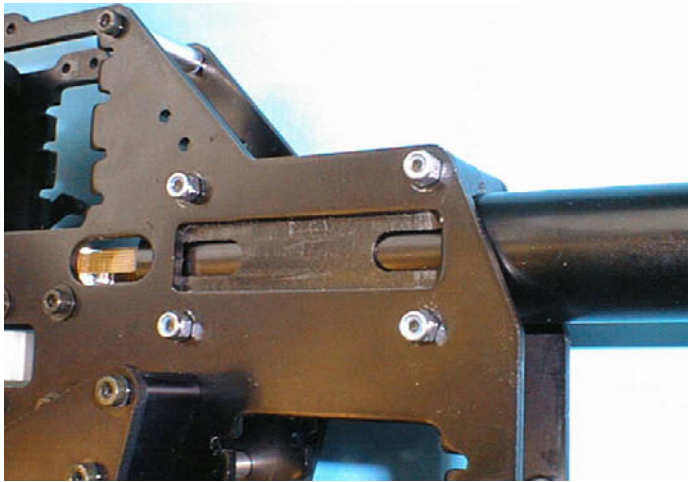
Fit the tail blades, (1), with

M3 x 12mm screws and nyloc nuts.

Ball joints are on the trailing edge of the blades



Tail boom installation.



Wrap the boom with a layer of tape (If required) where the boom support blocks (27) will fit. Feed the belt, with no twists into the boom. Place the blocks around the boom and fit between side frames.

At this time point the tail rotor upwards.

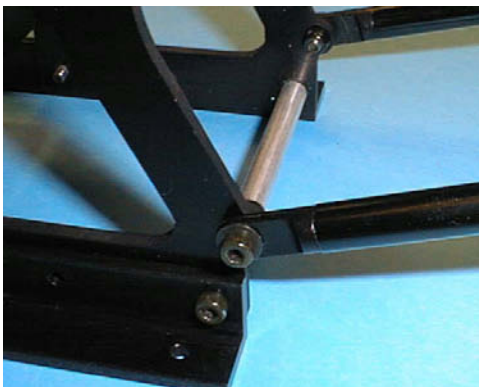
Now twist the boom assembly a quarter turn clockwise as viewed from the rear.

This then sets the tail rotation correctly.

Set the belt tension as required and fix the boom supports in place with M3 x 35mm screws and nyloc nuts. Ensure the tail rotor shaft, and main shaft, are at right angles to each other.

Boom support tubes

If not already done glue the Noiseless ends, (113) into the pipes, (112) with 5 minute epoxy making sure the ends are in line with each other.

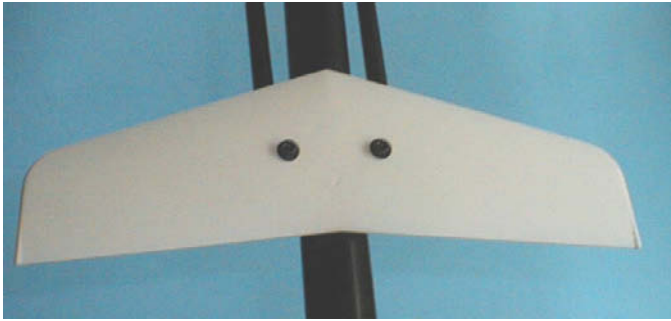


The front of the boom supporters is fitted to the frames with M3 x 10mm screws, plain washers and nyloc nuts.



Fit the boom supporter pipes to the horizontal stabiliser mount, (43), using M3 x 8mm screws, plain washers and Loctite

Secure the stabiliser mount to the boom with M3 x 8mm screws and Loctite.

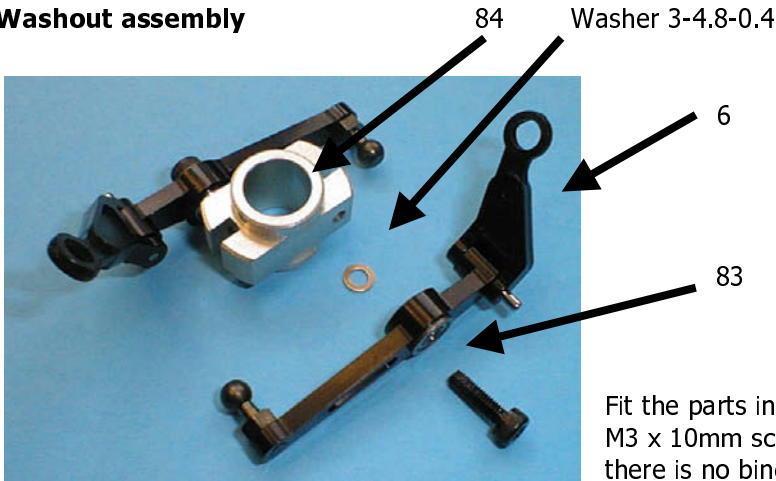


Fit the horizontal stabiliser, (110) With M3 x 8mm screws, plain washers and Loctite.



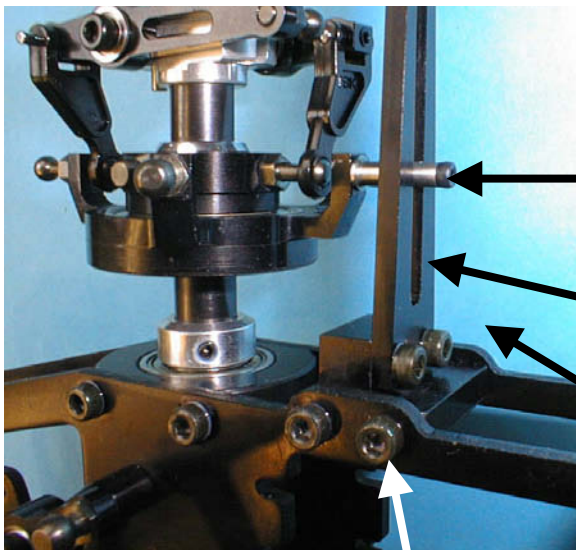
Fit the fin mounting clamps, (44) to the boom with M3 x 8mm screws and Loctite.
Fit the fin, (110) to the mountings clamps with M3 x 8mm screws, plain washers and Loctite.
Ensure the fin is mounted vertically.

Washout assembly



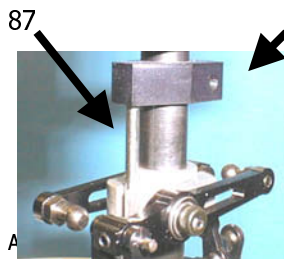
Fit the parts in the order shown, fix the M3 x 10mm screws with Loctite. Ensure there is no binding when assembled.

Fix the link joints to the washout arms with M3 x 3mm grub screws and Loctite.



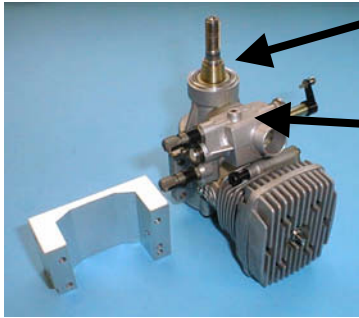
M2 x 14mm note
Note flange on tube is against the swash plate.
Fix with Loctite.

54
M3 x 6mm screws and Loctite



87, 85, 53, fix to frames with M3 x 8mm screws and Loctite
Snap the link joints onto the longer pair of ball joints on the upper half of the swash plate. Fit the washout stopper onto the mast but do not tighten up until ready to set up pitch range.

Engine fitting.



15, tapered collar

On the OS 60 SX models the Phillips head screw in the front of the Carburettor needs to be removed. Replace it with the supplied M3x3mm grub screw. Secure with Loctite. This allows the fan to fit.

When using an OS 60 WC (Or LX) engine, it was found that the washer supplied as a spacer on the crankshaft needed to be removed prior to fitting.

Dry assembly of your chosen engine will check this.

Ensure the fan mount does not foul the crankcase of the engine.

It is important that the engine is correctly fitted to the engine mount. (2) Fit the engine to the engine mount using M4 x 15mm screws. No Loctite yet. Ensure the engine is upright using an engineers square but also make sure the engine is fitted in the middle of the engine mount to ensure the in line shaft will run true in the frames. Any misalignment here may cause problems with the one way bearing and may generate vibration in the model. When the engine is true Loctite the screws one at a time to prevent the engine moving.



Fit the fan (115) to the fan mount (14) using M3 x 8 cross slotted cross slot screws and Loctite. Fix to engine with Nut, Washer (TPW8) and Loctite. Check for correct alignment. Now fit the clutch (12) to the fan mount using M4 x 10mm screws. Achieve better than 0.05mm run out, (check with dial gauge). Then remove screws one at a time and re-fit with Loctite.

Fit ball joint to throttle arm, using M2 x 8mm screw, Nut and Loctite.

Clutch bell assembly

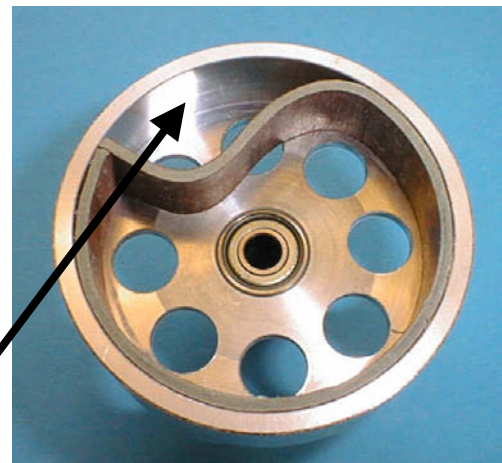
Cut clutch lining (13). cut to 145mm long.

Mix up some 24 hour curing epoxy.

Smear the inside of the clutch bell (10) with the mixed epoxy. Slip the clutch lining in as shown and then push into correct position, ensuring no 'bumps' appear especially at the joint.

Do not use 5 minute epoxy for this job as the heat of the engine will soften it and the clutch lining will then spin in the bell housing.

Glue on this face only



Now leave until the glue has cured properly.

Starter coupling. 17.

It has been found on early production models that the starter coupling needs to be checked to ensure the 5mm diameter hole is clear of burrs. This can be checked by pushing the in line shaft (16) right through the coupling. If it will not pass through, it is easy to clear the hole with a 5mm diameter drill. If this is not done the coupling can not be pushed right down onto the frame mounted bearing. There should be little or no end float in the clutch bell when assembled into the bearing.

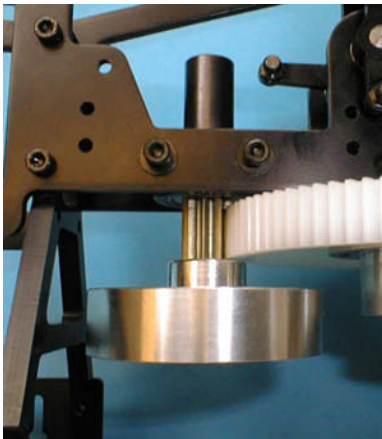


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17, fitted with M4 x 4mm grub screw and Loctite.

Light oil on the in line shaft during the assembly will also help.

Install clutch bell assembly into frames

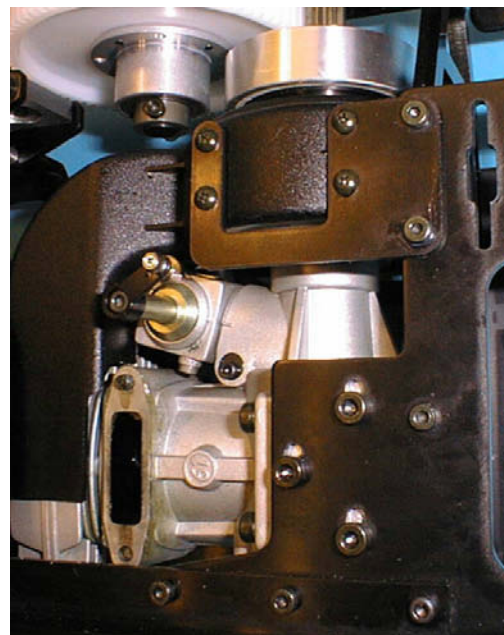


The clutch bell assembly is fitted into the frames ready to align with the engine assembly
Fit with M3 x 8mm screws and plain washers. Do not tighten yet.

When fitting the engine, make sure that the lower silencer fixing screw is in the engine. It cannot be fitted after the engine is installed without removing the lower rail again.

Bolt the engine in place using the M4 x 10mm screws.

After aligning the engine and clutch bell assembly with the frames and ensuring correct gear backlash, remove the screws one at a time and apply Loctite and re-fit.



Fitting the fan shroud (24)

It will most likely need to be trimmed to fit around the intake of your selected engine.

Dry fit each half to the engine to see where any trimming needs to be done.

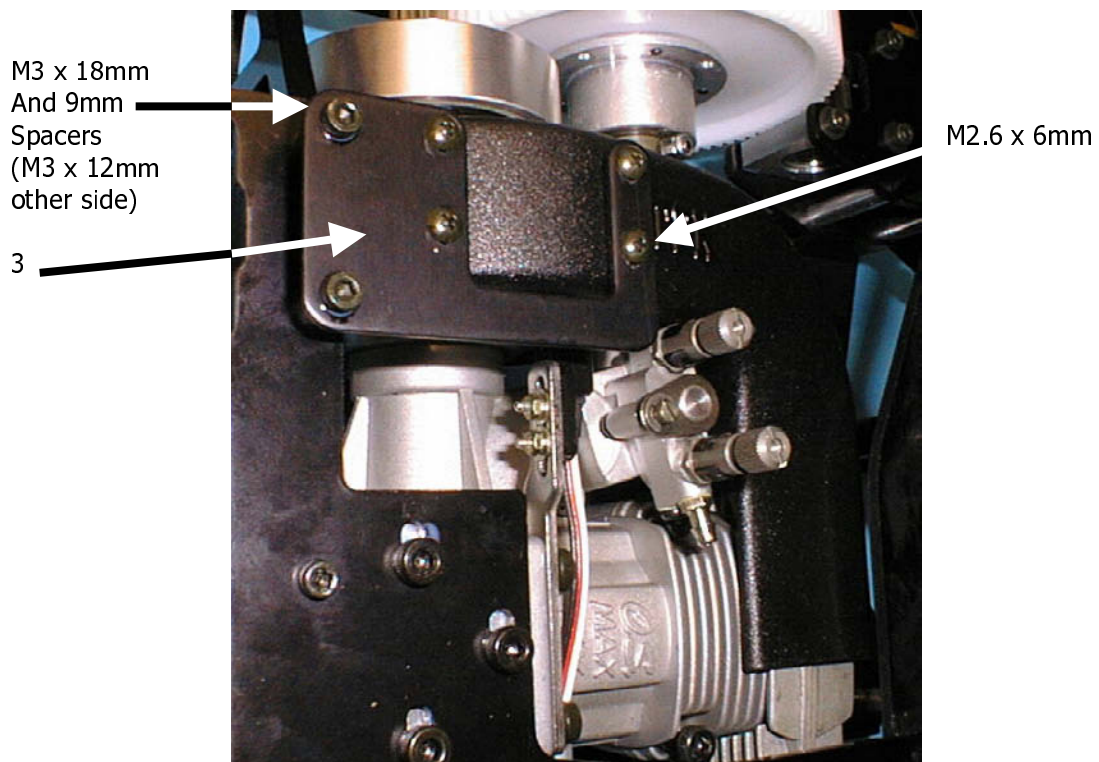
The bottom of the fan area would need to be trimmed to allow use of a governor. The magnet will not be close enough to the sensor to give a correct reading.



When you are happy with the fit assemble the two halves of the fan shroud using M2.6-12 self tapping screws. Now fit into the frames. Removal of the gyro plate will help here.

Add the fan casing stays, (3) and 9mm spacers (one side only). Fix through side frames into stiffeners with M3 x 12mm or M3 x 18mm screws and Loctite.

Fix the fan casing to the stays with 2.6 x 6mm self tapping screws. Adjust position to ensure fan is free to rotate without fouling casing.

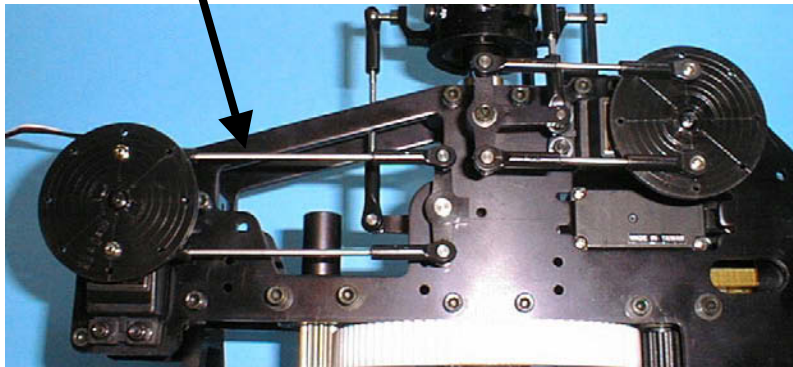


Installing the radio.

Follow the manufacturer's instructions for fitting of vibration mountings on servos. (grommets and ferrules.)

Fit the servos into the model in the positions shown. And with the servo output shaft at the end shown. Use M2.5 x 12mm screws, plain washers and nyloc nuts.

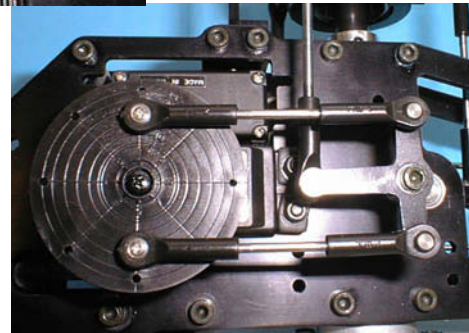
Links A



Aileron servo and links B

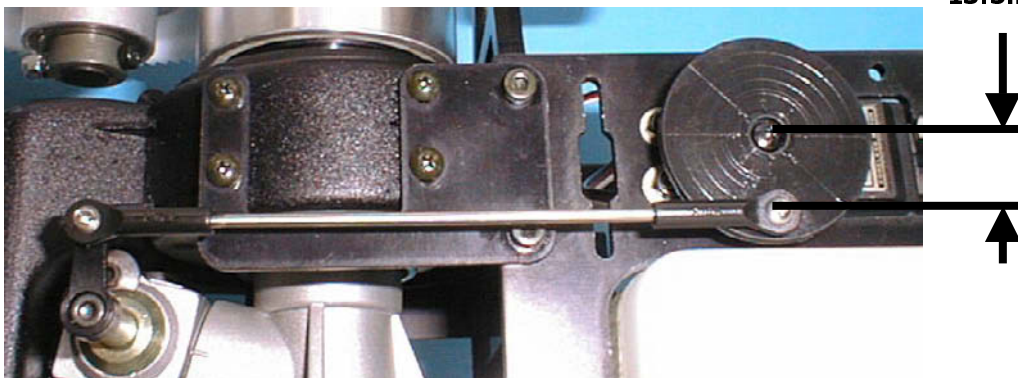
Pitch servo links B

Elevator, Ball joints behind disc



Tail rotor pitch

Throttle (Fitted behind frame) Link G

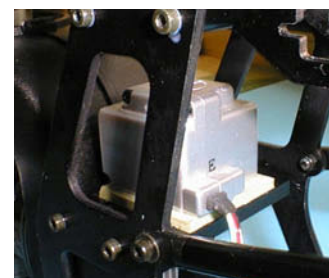


13.5mm

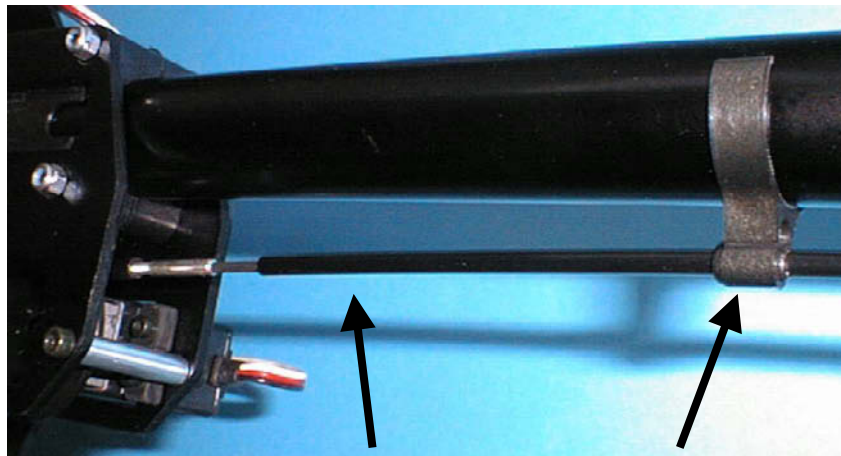
Fit the ball joints, (141), to the servo discs as shown. Each ball is 13.5mm from the centre of the arm.

With the throttle stick at mid (hovering) position the balls on the servo discs should form a line parallel with the mast, as in the pictures.

Install the gyro as per manufacturer's instructions on the mounting plate. Wrap up the receiver, battery and any other electronics in foam and fix to the mounting plate. Fix switch in desired position.



Build the tail rotor pitch linkage



121

120



127

119

Screw a rod end, (127) about half way onto end of the Rod joints, (19). Slide the three bushes into the Guide outer holes, (120). Slide the outer of the pitch control rod (121) through the three bushes. Ensure that the rod joint will slide onto the inner of the pitch control rod. If it will, apply a couple of drops of thin cyano acrylate to the rod joint (In the end). Push the pitch control rod inner into the rod joint. Be careful, as the cyano will be forced out of the small hole in the side of the joint. Remove any excess.

Wait until the cyano is fully cured.

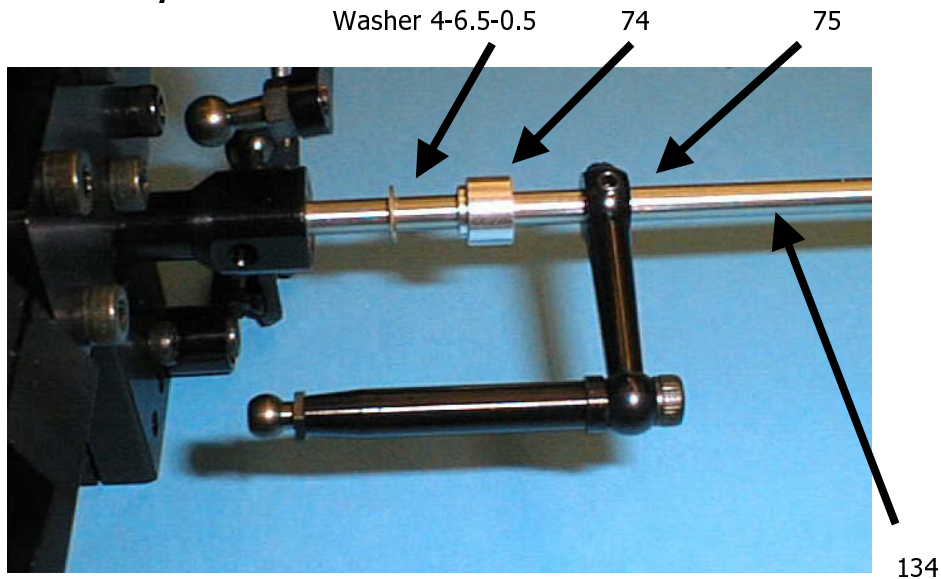
When satisfied fit the assembled inner onto the tail rotor servo. Now slide the outer onto the inner. Push up until there is just enough clearance to allow full travel of the servo. Position the guide to give good support.

Temporarily fix the position of the outer by taping to the boom. Remove the inner completely. Cut the outer at a suitable position to allow full travel of the pitch crank with rod joint in place. Now replace the inner. Cut the inner to a length suitable to allow proper engagement of the rear rod joint. Better to cut a little long and have to screw the rod ends on a little further. Note the pitch crank should be perpendicular to the boom with the servo centred. If you are happy with the position, fix with cyano as before.

Now remove the tape from the outer rod and fix the guides to the boom with cyano around the inner surface of the guides. Apply a drop of cyano to the bushes in the guides to fix in place.

Check for proper and free movement of the linkage.

Fly bar assembly.



Assemble the components of the fly bar as shown. Apply Loctite to the M3 x 8mm screw and fix the two parts of the control lever together. Apply Loctite and fix the ball joint in place. Slide the parts up against either side of the see saw assembly. Measure and make sure the bar is positioned so that the protruding parts of the fly bar are of exactly equal length. Line up the control levers so that they are exactly opposite each other. They should line up with the screws that are the see saw pivot. Now Loctite each of the M3 and M4 grub screws that fix the control levers in place.

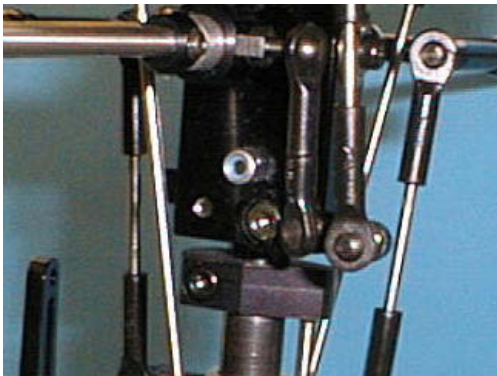
Now fix a piece of tape 25mm in from the end of the fly bar (Both ends). Screw the paddles onto the fly bar equal distance each side. Do not screw on further than the tape. Ensure the paddles are correctly aligned with the control levers. Each paddle and the control levers should now be in the same line.

The rotor head.

Although this comes pre-assembled it would be wise to ensure that all of the screws are thread locked. Simply try and undo all of the screws with a little pressure. Any that are loose will have to be taken out, have loctite applied and then re-fitted.

Refer to page 18 of Japanese manual for breakdown of parts if required.
Remember it is better to dismantle the rotor head now and check it, than to have it disassemble itself in the air !

Fit the rotor head to the main mast using an M3 x 18mm screw and nyloc nut.

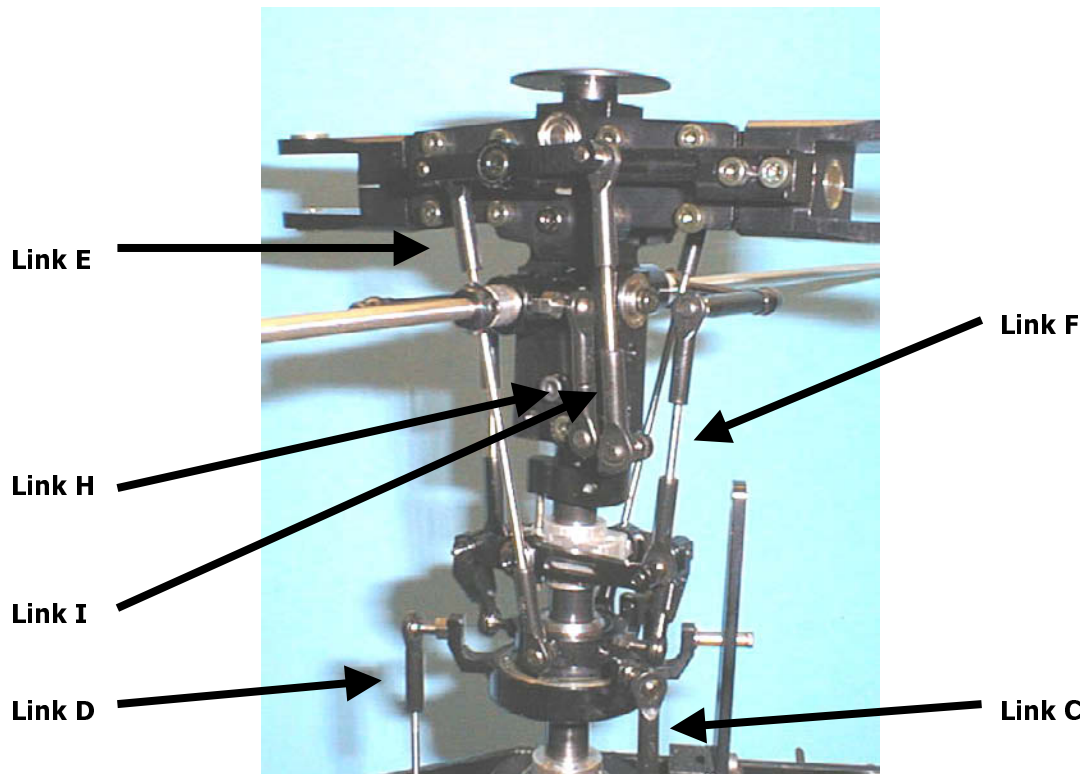


Note correct position for the fixing bolt.

The fixing bolts for the head mixing arms are clamp bolts, these should be removed, Loctite applied and then refitted. This will relieve some of the load on the M3 x 18mm fixing screw.

Note when fitting rod ends onto ball joint, the TSK logo must face away from the servo disc. The 2.3mm rod ends do not have the logo so the side with the smaller hole should face away from the servo disc.

Fitting the other way round stretches the link and will result in a sloppy linkage. Make up the rods as shown in the table below. Note the rods should be adjusted during fitting to suit your radio installation and desired flying style.



Note the rod ends for the 2.3mm diameter rods (C and D) do not have TSK on them.

Refer to page 15 for other link fitting pictures.

Link Ref	Rod Size / length	Rod ends	No of rods required	Length Ctr to Ctr	Where fitted
A	M2 x 70mm	Long with logo	2	90mm	Elevator servo to bell crank
B	M2 x 35mm	Long with logo	4	58mm	Aileron / pitch servos to bell crank
C	M2.3 x 25mm	Long NO Logo	1	50.5mm	Aileron bell crank to swash plate
D	M2.3 x 50mm	Long NO logo	2	72mm	Elevator / pitch bell crank to swash plate
E	M2 x 80mm	Long with logo	2	110.5mm	Swash plate to pitch arm mixer crank
F	M2 x 35mm	Long with logo	2	60mm	Washout base to fly bar control lever
G	M2 x 90mm	Long with logo	1	108mm	Throttle linkage
H	M2 x 12mm	Long / short with logo	2	27mm	Head mixer to see saw arm
I	M2 x 25mm	Long with logo	2	56mm	Head mixer to blade grip mixer crank

Fuel tank (114)

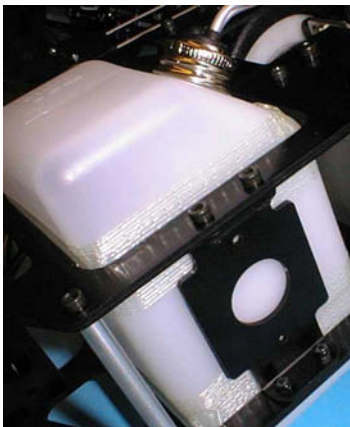
Assemble the tank pipes as shown in the photograph.
Make sure that pipes are not kinked during bending. Use of tube bending springs will help here. (Available from most model shops)
Use of a little oil will assist pushing the pipes through the rubber bung.



Fit the assembly into the tank and do up the cap tight. Not so tight as to distort the bung and cause a leak. Now fit to the model.

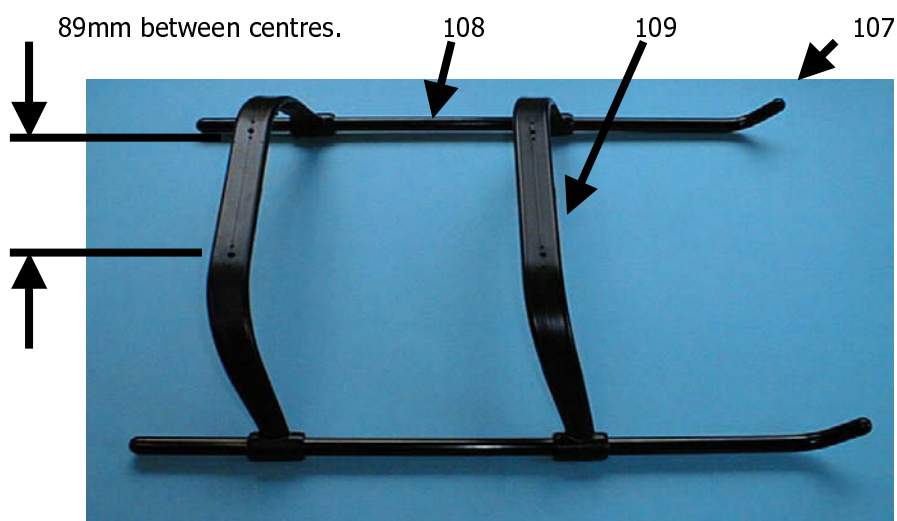


Add double sided tape to the mount plate. Fit to frames using M3 x 8mm screws and nyloc nuts.
Note tape wrapped around tank to protect from edges of frames.



4

Skid assembly (106)

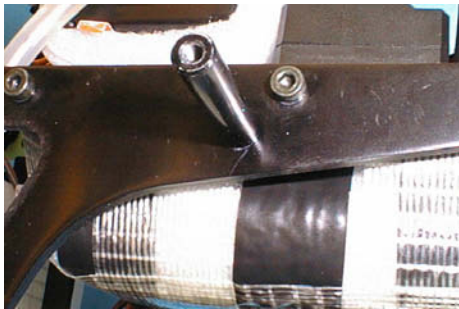


Drill two holes, 3.5mm diameter, in each brace 89mm apart, where the indents are marked.
Push the skid pipes through the braces.
Add the M3 x 4mm grub screws but do not tighten yet.

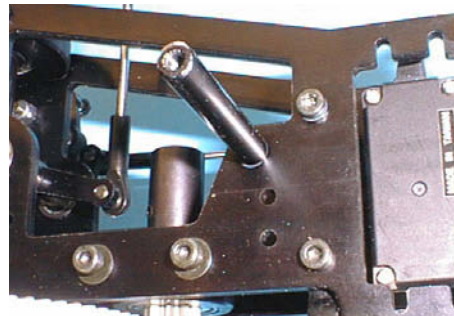
Glue the pipe ends into the pipes with thin cyano acrylate. Remove excess before drying. Bolt the skids to the model using M3 x 15mm screws, plain washers and nyloc nuts. Now adjust the skid pipe positions to suit your preference. Tighten the Grub screws to lock the skid pipes in place.

Canopy mounts

Install the mounting posts



Front 28mm long
Fix with M3 x 8mm screws and loctite.



Rear 40mm long

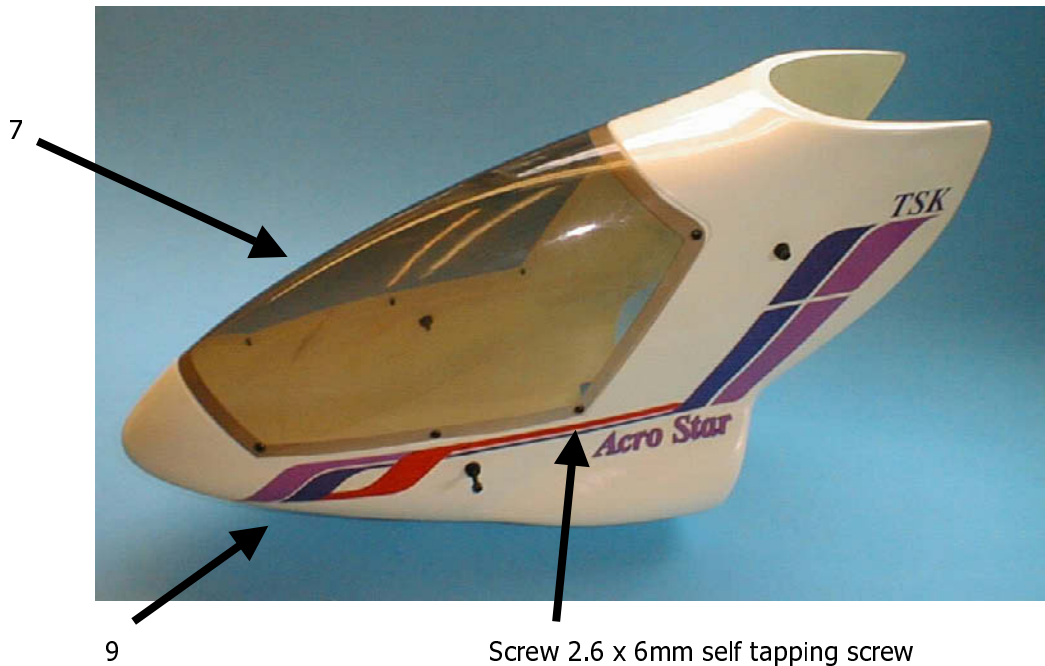
Canopy. (7)

Do not drill out the grommet positions as marked on the canopy. They are incorrectly marked.

Offer up the canopy to the model, the lower edge of the screen is supposed to be parallel with the surface you are building on. Make sure it is far enough forward to clear the starter coupling access. When you are happy with position, mark and drill rear fixing holes. 6.5mm diameter. (Measure twice, drill once) put a grommet in the hole and fix to model using M3 x 12mm screws and plain washers. Now mark and drill out front grommet positions. 6.5mm diameter. Fit grommets here and fit canopy to model again.

With the canopy screwed to the model check the fit of the screen. If you are happy with the fit, Hold the screen in place with some tape. Drill pilot holes through the screen and the canopy. Now remove the canopy and drill the pilot holes out to clear the fixing screws. A slightly loose fit will stop the screen cracking. Fit the screen to the model. A small amount of epoxy on the inside to retain the screws may help prevent loss.

Fix stickers as desired.



(TSK UK recommends that the M3 x 12mm are replaced with M3 x 16mm long screws. These will then bottom out in the spacers and should compress the grommets to a satisfactory amount. This in our experience helps to prevent loss of the screws during flight.)

Radio

Set your transmitter to use a 120° swash plate set up.

The pitch settings below are for guidance.
 These are not suitable 3D flying,
 Adjust to suit you own style of flying

Flight mode	Normal	Idle up 1	Idle up 2	Auto rotation
High pitch	12°	7° - 9° (1650 – 1750 rpm)	6.5° - 8° (1650 – 1750 rpm)	12° - 14°
Hovering	5° - 6° (1250 – 1350 rpm)	4° - 5°	4° - 5°	4.5° - 5.5°
Low pitch	-3°	-3°	-4°	-3° - -5°

Maximum recommended main rotor rpm not to exceed 1800 rpm

Don't forget to tighten up the wash out stopper after setting your required pitch range, Make sure the guide pin does not disengage the slot in the washout mixer base at either end of pitch travel.

Time to charge the batteries and go flying

TSK UK

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