

MORLEY HELICOPTERS

MAVERICK XR

**TRAINER & SPORTS MODEL
HELICOPTER KIT
ASSEMBLY MANUAL**



PLEASE READ CAREFULLY DURING ASSEMBLY



INTRODUCTION

The **MAVERICK** design has concentrated on the novice pilot's requirements for a strong, stable and easy to fly model helicopter without compromising the sports and aerobic performance enjoyed by the more experienced flyer.

The model uses a composite construction of light alloy, hardened steel and fibre reinforced engineering plastic parts to create a strong, rigid and quick to assemble airframe. The assembly sequence shown in this manual is the most convenient and should be followed if possible. If a suitable motor or radio set has not been obtained prior to construction some of the stages can be left until this equipment is available.

The kit parts are packed in individual bags and on the main display card. For identification purposes a symbol (*) is used to show when a part is located on the main card rather than a bag pack. The instructions should be used in conjunction with the assembly drawings, the reference numbers shown on these are also the replacement part order numbers. The appropriate fasteners for each component are also indicated on the diagrams, the full-size identification chart will enable accurate selection from the labelled fastener bags.

Listed below are the additional equipment requirements for the construction and final operation of your **MAVERICK** helicopter.

CONSTRUCTION

1.5 mm allen key
2.0 mm allen key
2.5 mm allen key
3.0 mm allen key

— included in kit

Medium size pliers
Small pozi-drive screwdriver
Modelling knife
Scissors
Bradawl or 1.5 mm drill set
'Cyano' or 'Super' glue
Thread locking compound
Light machine or hobby oil

OPTIONAL TOOLS

4 , 5.5 & 7mm spanners
M3 & M4 ball ended hex drivers
Ball link pliers
Blade balancer
Blade pitch gauge
Small socket set

OPERATION

Radio control set (min 4 channel + 5 servos) - dedicated helicopter set with 1000 mah battery pack recommended.
40-53 size ballraced motor

Recommended motors:-

Suitable for training
ASP 46-53 / Super Custom 46-53
Suitable for training & sports flying
O.S. 40-46
Irvine 46 Heli
Rossi 53 Heli
Super Tigre 40-45-51

Custom silencer
Tailrotor gyrosensor
Glow fuel (check engine requirements)
Fuel pump
Fuel filter
Starter motor
Starter battery
Glow plug battery or 12v power panel
Glow plug connectors

The above equipment can be obtained through your local model hobby stockist or direct from Morley Helicopters Ltd. Brand and model types are varied and so if in any doubt ask your stockist for assistance or contact Morley Helicopters direct for recommendations.

ENGINE, CLUTCH AND COOLING FAN

SEE DIAGRAM No.1

This assembly sequence can only be completed if you have a suitable engine ready. The engine mounts and clutch unit are designed to be a direct fit for the popular ASP and SC (Super Custom) range of motors, the 46 & 53 size being the most suitable for training purposes. Other makes of motors can be fitted but some modification to mounts and clutch may be required, silencer fitting may also be effected. The O.S. 46 aero & heli motors can be installed by using the optional crankshaft collet **505** and opening out the holes in the engine mount plates (a modified fan and engine nut are also required PART No. **506/1** and **509**). **NB:** Most types of modern engines can be fitted to the Maverick, in case of difficulty please contact Morley Helicopters for further advise.

Most motors come as standard with a 'prop-driver' attached to the base of the crankshaft, this is usually an alloy component with a deep groove pattern on it and must be removed before attempting to fit the clutch. Below the prop-driver is an alloy or brass split taper collet, on the ASP & SC this must be removed and replaced by part **504***. The throttle control arm needs to be repositioned from the 'factory' setting so that it may be operated from under the crankcase. Slacken the arm fixing nut or set screw and rotate until it points straight down (with the crankshaft pointing vertically) at the 1/2 throttle position, once in place ensure that it is re-tightened. Fit a brass control ball to the arm (the inner hole is best), use thread locking compound on both nuts.

Fit the 'Tufnol' resin fibre clutch liner **501*** into the clutch bell **500*** with 'cyano' glue, the oilite bearing **1004*** is also secured with cyano but is factory fitted. Place the plastic spacer washer **508** over the crankshaft followed by the steel clutch centre pillar **503***. Slide the completed clutch bell over the centre then insert the steel clutch/flywheel unit **502***, note that one side of the central bore is tapered and this must be keyed onto the matching taper of the centre pillar (ensure that all taper surfaces are clean before assembly). Locate the cooling fan **506** over the clutch ensuring that the moulded lugs on the underside lock into the two large holes in the clutch/flywheel face. Place a 1/4" x 5/8" washer over the remaining threaded portion of the shaft and secure the assembly with the original nut supplied with the engine, (do up tightly but do not use thread lock). Once completed check that the plastic clutch bell is free to rotate smoothly under the fan.

NB: Once tightened, the clutch/flywheel will be difficult to remove from the tapered shaft by hand. To aid removal two M4 threaded holes are located either side of centre, by inserting a pair of screws in these holes and winding them down to the clutch bell it can be lifted off the taper.

UNDERCARRIAGE

SEE DIAGRAM No.2

The **MAVERICK** undercarriage main struts are produced from 'acetol' resin plastic which has excellent impact resistance. The units are not intended to be 'unbreakable' but will deform to absorb energy from heavy landings so as to minimise airframe damage.

Fitting the undercarriage to the main chassis base **600*** will provide a stable platform on which to build up the model. The main strut units **611** or **612** (black or white) are fitted with the angle sweeping forward. Press the alloy skid tubes **613** through the strut ends so that approx. 50mm of tube length is left behind the rear strut. **NB.** The skids are a tight fit in the mouldings and can be difficult to slide together, warming the strut ends in hot water will make this task easier. The plastic end caps are a tight press fit and may require a gentle tap to push fully into place.

1st STAGE & TAIL TRANSFER GEARING

SEE DIAGRAM No.3

Slide on the second 3/16" ballrace 1006 onto the tail drive take-off shaft 411 with some thread lock and position into the bearing recesses in the take-off gearcase 410. Fit the alloy tail drive coupling 412 onto the end of the shaft with set screws ensuring that they seat in the flats of the shaft, take care to tighten the set screws gradually each side in turn to prevent any out of true running. The four small set screws that secure the tail drive wire 707 can be fitted but left loose until the tail assembly is fitted.

Slide the alloy bearing spacer tube 4061 up against the tail drive gear on the 1st stage shaft followed by the small 6mm ballrace 1007, seat with locking fluid then fit the rubber O-ring seal 4062 against the underside of the bearing. Press the larger 6mm ballrace 1008 over the end of the shaft against the back of the gear and secure with loctite. Fit the shaft assembly into the underside of the main gearcase/shroud 409 and fill the cavity around the gear with the grease supplied. Fill the tail drive gear case cover 410 with grease and fit the completed assembly taking care to ensure the gears mesh together before tightening the cover screws. NB: The tail drive gearcase must be FILLED with grease (it is best to over fill the cavity and wipe off surplus grease after the gearcase is fitted).

Push the large plastic 1st stage drive gear 407 over the top of the protruding shaft and line up the slot with the hole, press in the steel split pin 408 using a pair of pliers (do not be tempted to strike the pin as this may damage the shaft). The pin should be a good press fit and is held in place with some "cyano" glue. Locate the second stage pinion gear 4012 on the base of the shaft so that the flats can be viewed through the fixing holes, screw in the set screws but leave loose until the assembly is fitted to the main chassis base. Fit the second 6mm ballrace 1008 to the remaining length of shaft below the drive gear.

NB. The pinion gear is also available in steel material with either 11, 12 or 13 teeth, these gears offer an alternative main rotor gear ratio which may suit the power characteristics of different engine installations. Order Part No.s 401/1, 401/2 and 401/3.

MAIN GEAR & ROTOR MAST

SEE DIAGRAM No.4

Place the autorotation unit **405*** in the centre of the main drive gear **400*** and locate with screws and washers, apply thread lock. Take care to tighten the 5 screws in a gradual sequence so as to avoid distortion and out of true running. NB a usefull tip to ensure correct centering of the auto' unit within the gear is to wrap a strip of paper or ptfе tape around the unit making it a firm fit whilst the screws are tightened. The autorotation unit is factory assembled and the special needle roller clutches are pre-greased, do attempt to dis-assemble or add additional lubricants to this unit.

Press in four M3 nyloc nuts into the hexagonal recesses in the lower mast support moulding **414**, then press in the lower mast ballrace **1010***. Insert the main rotor mast **402*** down through the centre of the autorotation unit and main gear and locate the smaller diameter end into the ballrace/holder. The mast has a pre-fitted circlip **403*** which will the auto' unit riding up the shaft.

Slide the mast locking collar **404*** over the top of the mast and position loosely with the set screws over the ground flats as high up the mast as possible. Final positioning and tightening of the collar and upper ballrace **1011*** cannot be completed until the assembly has been fitted to the chassis.

NB. Access to the set screws used to secure the mast collar is restricted, an acceptable and useful modification is to drill a small hole (approx. 5mm) in the side of part no.409 adjacent to the set screw position.

FORWARD CHASSIS & ENGINE INSTALLATION

SEE DIAGRAM No.5 & 6

NB :- The undercarriage has not been shown on diagram 5 or 6 so as to aid clarity.

Place the mast and main gear assembly into the chassis base moulding and secure from the underside with four M3 x 10 socket screws with washers, leave loose enough to allow the unit to be moved within the holder until the correct gear mesh has been achieved. (NB: the lower mast support moulding is offset to allow the fitting of different pinion gears, if you have a loose gear mesh try turning the moulding through 180 degrees). Lower the 1st stage gear and shaft assembly over the mast and seat the lower ballrace into the recess adjacent to the main gear.

Fix the left hand engine mount plate **603*** into position and tighten the lower two screws, the top two screws fix the left hand fuel tank support bracket **907** (one of three) and should be left loose until the motor is installed. Fit the right hand engine mount plate **604** with the lower fuel tank & radio switch bracket and tighten. Fit the upper fuel tank bracket into place and leave the two screws loose.

NB. Alternative engine mount plate are available and can be supplied on an exchange basis provided your originals have not been used. Blank plates (not drilled for a specific motor) are also available and are can be better than trying to modify a pre-drilled plate to suit. Call Morley Helicopters for further advise.

Offer the completed engine and clutch assembly up to the mounts and hold in position with screws, washers and nyloc nuts. Before tightening the screws line the engine up so that it is central in the mounts and the clutch bell and fan have clearance between the 1st stage gear, the holes in the mounts are slotted to allow a small amount of vertical adjustment. Once the engine screws are secure pull the 1st stage gearbox/shroud towards the engine so that there is no backlash between the small gear on the clutch bell and the larger 1st stage gear, tighten the two upper screws on either side of the engine mount plates. Check gear mesh once again and repeat procedure if is too tight (notchy) or too loose (backlash between gears).

Place the upper mast support ballrace **1011*** over the mast and down into the recess in the gearcase/shroud hard up against the mast locking collar (use locking compound between the mast and the ballrace). Gently lift the mast assembly and bearing out of the holder and tighten the set screws on the locking collar or tighten through the newly drilled access hole. Slide the small pinion gear at the base of the 1st stage shaft so that it sits firmly on top of it's support bearing and secure by tightening the set screws onto the ground flats, take care not to over tighten the screws otherwise the threads may strip. As a general rule when tightening screws into plastic, wind the screw down until it touches the shaft then tighten a further quarter to two thirds of a turn. NB. if you suspect you have over-tightened the screws and damaged the thread, inspect the moulding carefully for any signs of cracking. Pull the large main gear and pinion gear into mesh and tighten the four screws on the underside of the chassis base, ensure again that the mesh is smooth without binding or backlash. Slide the mast bearing hold down moulding **415** over the mast and secure.

Fit the fan duct enclosure moulding **507/1** to the slotted lugs on the 1st stage gear case/shroud, position approx. 2mm under the fan and secure with the button head M4 x 10 screws, washers and nuts. Fit the swashplate anti-rotation pin guide/slider **304** into position on the cooling fan shroud **507** using thread lock then slide the shroud over the key ways on the gearcase/shroud and fix with two small self tap screws. Fit the two forward radio tray supports **806** to the engine mount plates, the lower fixing point uses a screw with a nyloc nut behind and the upper one has a screw from behind with a canopy mounting pylon **904*** acting as the nut on the outside. The canopy mount pylons should be fitted with thread lock. Position the forward radio tray **807** between the supports and fix from the centre hole first using self tap screws. The tray is tapered and the supports will flex inwards to line up with it, this arrangement helps to minimise any side to side movement of the tray.

REAR & UPPER CHASSIS FRAMES

SEE DIAGRAM No.7 & 8

NB :- Both undercarriage and all forward chassis detail have been omitted from diagram 8 to aid clarity.

Before commencing with the assembly of the side frames it is recommended to take some time to temporarily connect the servos, receiver and battery pack so that the servo arms can be set up to the correct positions. Diagram 7 shows the function and output arm position of each of the five servos when both joysticks on the transmitter are in the central position. The distance of the control ball from servo centre on each of the arms is shown adjacent to each servo, these measurements will give the required amount of control throw with most radio systems and it is not recommended that they are exceeded as this will subject the servo's to unnecessary loads.

Fit a brass control ball to the output arm of the throttle servo (use thread lock on ALL control connections) then fix to a pair of upper servo mount brackets **802** using the self tap screws provided with the radio system. Fit the hexagonal brass tail connector **808** to the tailrotor servo then fit into a pair of mounting brackets. NB. the small retaining washer/clip on part no.808 should be secured with a dab of paint or cyano glue. Position the two servo assemblies over the slotted holes in the left & right hand upper chassis frames **602*** and secure with M3 x 10 socket caps and washers. Fit a brass ball to the lower tab on the right hand upper frame as shown in the inset drawing using the brass spacer bush **805**.

Hold the two chassis spacer/tailboom clamps **608** together and insert a short tie rod **610** into each of the upper holes, insert a long tie rod **609** into each of the lower holes. Slide the two upper side frames over the protruding lengths of tie rod and fix in place with screws in each of the upper holes. Fit the two side spacers **607** over the remaining tie rod length.

Fit the control link balls to forward of the two M2 holes on the tabs on each of the larger lower side frames **601***, note that the right hand ball is fitted with small plastic pylon **809** fixed through both holes. Secure the right hand frame onto the main base, tightening the two lower screws. The left hand frame can also be fitted in place but only loosely as it needs to be removed at a later stage to allow installation of the main cyclic and collective control system. With the two lower frames in place the upper frame assembly can be positioned in between and screwed into place. The two points where the frames meet the forward chassis moulding can be secured tightly, the rear ones however are also used to clamp the tailboom assembly in place and so must be left until this unit is fitted.

SWASHPLATE

SEE DIAGRAM No.9

The swashplate assembly comes as a factory assembled unit but does require control balls being fitted to the outer ring **300***. The lower portion of the swashplate is prevented from rotating by fitting the anti-rotation pin **303**, use thread lock on all swashplate fittings.

The central brass swivel ball **301*** that allows the assembly to tilt in all directions can be removed and re-fitted by rotating through 90 degrees and turning until it lines up with the cut out in the underside of the centre moulding **302***. It is advisable to add a *small* amount of grease to the centre ball to help ensure a smooth movement. Place the completed assembly over the rotor mast and leave resting atop the chassis until the control system is installed. NB. the centre swivel ball is the only swashplate item that should be greased, do not be tempted to grease the main ballrace as this will attract damaging grit & dirt.

ROTORHEAD & MIXER

SEE DIAGRAM No.10,11 & 12

Fit a pair of brass control balls to the central flybar operating arm **105** and screw in the M4 x 10 set screws, do not fully tighten these until the flybar is fitted. Slide the flybar **104** through the bearing **1001** (factory fitted) in one side of the flybar cradle & head button **103** (shown in dotted line on flybar diagram), through the flybar operating arm then out the second head button bearing. Using a ruler position the operating arm in the centre of the flybar and tighten the two fixing set screws. Slide a brass flybar operating ball **106*** over each end of the bar and slide down so that it just touches the outer edge of the head button bearing. Check that the operating arm is central within the head button and tighten the small set screws in the balls. Snap over the balls the short double ended control links **107**. Fit a flybar paddle blade **109** to the threaded portion at each end of the flybar, push the moulding on to the thread firmly then wind down until the moulding is level with the end of the threaded portion then a further 5 full turns. NB: The flybar paddles have two possible mounting points, one in each end, one is closer to the leading edge than the other. The mounting point closest to the leading edge is recommended for the novice flyer whilst the one further back will give greater and quicker control response for the sports flyer. Take care not to mix the mounting positions.

Push the tapered rubber dampers **111** into the main centre hub **101*** then slide the feathering spindle **110*** through the head so that an equal amount protrudes both sides. Fit a conical shim washer **122** (black) over each end of the shaft up against the rubbers, ensure that the 'dish' of the washer faces inwards. Fit the main blade holders **102*** (the pivot ballraces **1009*** are factory fitted) to each end of the shaft and secure using the conical safety washer (gold) with the dish facing outwards and the special M5 button head socket screws - **Thread locking compound must be used and screws tightened securely. NB. The direction in which the 'dished' washers, particularly the gold ones are fitted is very important, if they are fitted the wrong way around the collective system will lock up under load and the model will not take off.**

Fit brass control balls to both ends of the upper mixer arms **112**, note that there are two possible mounting points for the inner ball, use the outer of the two for general flying and the inner one if greater collective range is required. Press the steel bushes **115** over the stub axle on the blade holder incidence arm and fit the mixer arm assembly with a single M3 x 25 socket screw, take care to tighten it gently so that a smooth pivoting action is attained. Over-tightening will cause the mixer arm to lock up and will damage the plastic stub axle.

Press the flybar pivot ballraces **1006*** with pre-fitted bushes **117*** into the flybar cradle/head button from the inside edge. At this stage the flybar assembly can be balanced by inserting a screw into each of the ballraces and supporting the assembly each side, the flybar should sit level. If the bar does not balance with the fittings centred, add self adhesive covering film or tape to the lighter paddle to achieve level balance. Position the balanced unit over the two upward extending arms of the head centre and secure the assembly using a pair of socket cap screws with washers., Snap the small end of the flybar control link over the outer ball on the mixer arms, lubricate to ensure smooth movement.

Press fit the oilite bearing **1002** into the mixer slider **114** and secure using 'cyano' glue. Fit a brass control ball to the end of each of the lower mixer arms **113** (the swashplate driver arms **118** and pins **119** are factory fitted). Fit the mixer arm assemblies to the slider using the steel bushes **116** with M3 washers both sides and a socket cap screw, tighten gently and check for smooth rotation.

Slide the completed mixer/slider unit over the main rotor mast and snap fit the two driver arms onto two of the brass control balls on the inner ring of the swashplate below it. Push the complete rotorhead assembly over the end of the mast and line up the fixing hole with the hole in the mast, secure with an M3 x 20 socket screw and nyloc nut. The slider guide pins **120*** (factory fitted) in the underside of the head centre should locate into the slots either side of the mixer slider on the mast below it.

TAILROTOR & TAILBOOM ASSEMBLY

SEE DIAGRAM No.13 & 14

Push fit a ballrace **1007*** onto the tail output shaft **206*** (the longer of the two remaining shafts) using locking compound on the shaft and seat the ballraces into the recesses in the lower gearcase moulding **204***. Repeat this sequence for the tail input shaft **205*** using ballraces **1006*** and fit the two small plastic spacers **213** followed by the female portion of the tail drive coupling **207**, fit to the shaft with set screws located over the ground flats. Fill the cavity around the two gears with grease, also apply some to the inside of the coupling. Bring the upper gearcase **203*** into place over the lower portion and assemble with socket screws, wind in the screws in a sequence gently to avoid distortion. The four screws at the rear of the gearbox can be fully tightened but the three at the front must be left loose to enable the unit to be fitted to the tailboom tube.

Fit a pair of short ball link connectors **BL-1** to the tail control yoke **209** using self tap screws. NB: The tail pitch yoke and slider are shown in exploded view but are supplied factory assembled. Slide the completed unit **211** over the end of the output shaft. Slide a pair of ballraces **1006*** over each of the axles of the tail hub **202*** with locking compound on the shaft and on the retaining screws threaded into the ends (these **must** be fitted with thread lock and washers, do not overtighten). Before the thread lock has set on the bearings fit the tail blade holder halves **201** each side and secure with M2 screws and nuts (use thread lock). NB: The diagram only details one side of the tail hub assembly as the opposite one is a repeat procedure of the first. Fit a brass control ball to the upper arm of the left hand holder and one to the lower arm of the right hand holder (the remaining two arms are surplus but can be used should one be damaged or can be carefully cut off if preferred). Slide the tail blades **200*** into the completed holders noting that the direction of rotation is clockwise, the left hand blade will have it's leading edge uppermost and the right hand one downwards.

Before fitting the tail rotor to the output shaft it should be checked for balance by sliding a thin wire through the centre and supporting it. The assembly should sit level if it is balanced, if however it does not, carefully trim material away from the tip of the heavier blade using a sharp knife until balance is achieved. Once complete, fit the unit over the end of the output shaft and locate with set screws (thread lock) over the ground flats. Snap fit the two ball link connectors on the yoke slider to the two brass control balls on the tail blade incidence arms, lubricate to give a smooth movement. Fit the control bellcrank **208** with steel bush **212** locating the hole on the end of the shorter arm over the plastic ball moulded on the underside of the yoke/slider unit. Tighten the fixing screw gently to avoid binding and add oil to give smooth operation.

Select the brass drive wire tube **704** (gold colour) and the alloy control wire tube **705** (silver colour) and fit a support moulding **706** to each end (NB: the front support is numbered **1 & 3**, the rear one is numbered **4 & 2**) allowing both tubes to protrude approx' 3mm beyond the support at the main chassis end. At the tail gearbox end fit the support flush with the end of the brass tube, the alloy tube will extend a little way further, glue both ends of both tubes to the supports with 'cyano' adhesive. Slide the assembly down inside the alloy tailboom tube **700**. Fit the male end of the tail drive coupling over the drive wire **707** (the thicker of the two wires) so that the bend in the end locates in the bottom of the cross shape recess (viewed end on) and secure with set screws. Feed the drive and control wires down their support tubes from the tail end, passing the control wire through the opening in the gearbox case adjacent to the bellcrank and locate the pre-formed end into the long arm of the crank. Push the complete gearbox assembly over the end of the tailboom, locate the male and female portions of the drive coupling and line up the hole in the side of the case with hole in the tube sidewall. Clamp the box into place by tightening the remaining three screws and fit the vertical tail fin **701** to the lugs on the side ensuring that it's locating pin lines up with the hole in the tube. Fit the horizontal tail plane **702** onto the tube with clamp **703** approx' 400mm from the chassis end of the tube, check that it is positioned at 90 degrees relative to the tail fin.

Fit the completed tail assembly into the clamps on the main chassis unit feeding the drive wire into the alloy drive coupling and the control wire through the hole in the connector on the servo arm. Lock the control wire in position on the servo with the small set screw ensuring that the arm and the bellcrank are at 90 degrees to the boom. Lock the taildrive wire into the coupling with all four of the set screws. NB: The tailboom should be pushed into the clamps until it stops on the moulded lip and the drive and control tubes protruding past the end locate in the small moulded-in supports. Line the tail fin up to be vertical and clamp boom in place by tightening the four screws either side of the frames. Check taildrive by rotating the main rotorhead.

CONTROL SYSTEM & RADIO SETUP

SEE DIAGRAM No.15 & 16

The control links shown in diagram No.13 are all supplied with the correct ends factory fitted, the exact overall lengths however are *not* set and should be adjusted to the lengths shown adjacent to the part numbers on the diagram. The lengths shown are overall 'tip to tip' dimensions and not centre to centre.

The main collective control arm **800** and the cyclic servo cradle **801** come as a factory assembled unit with the pivot shaft **804** and oilite bearings **1001** in place.

Using the servo set-up diagram No.7 fit the brass control balls in place on the servo discs noting the length and type of fasteners required. Install the two cyclic servos into the cradle (left and right cyclic servo in the lower position and fore and aft cyclic in the upper) using the self tap screws and rubber grommets provided with the radio system. Fit the collective servo at the end of the control arm (note that some servos have a small plastic web between the mounting grommets which may foul on the arm, filing or cutting a small notch in the arm will rectify this problem). Fit a brass ball onto each side of the cyclic servo cradle for the link arms to connect to (use thread lock). NB: For aerobatic flying it is advised that the M2 screws used to secure the brass balls on both the cradle and frame assembly are upgraded to high tensile screws (Part No.M2x12SC).

Remove the left hand lower sideframe from the rear chassis of the model to allow the control system to be installed. Slide the pivot shaft **803** through the bearings in the control arm and place an M4 flat washer over the protruding length of shaft both ends (using a small dab of grease will help to hold the washers in place). Fit an M3 x 8 socket cap screw and washer through the mounting slot in the right hand frame and add another M3 washer over the screw thread on the inside of the frame. Offer up the control assembly to the screw and gently tighten to hold in place. Bring the loose left hand frame into place and attach to the end of the pivot shaft using a second M3 x 8 socket screw with washers inside and outside the frame. Re-fit the four sideframe fixing screws then snap fit the two control arm links **810** into place between the brass balls fitted to the frame tabs and those on the sides of the cyclic servo cradle. By sliding the control assembly within the mounting slot in the side frames adjust the distance between the main rotor mast and the servo disc/arm on the left and right cyclic servo so that there is approx. 3 mm of clearance. Tighten the fixing screws at both ends of the pivot shaft and check for smooth movement.(NB: Re-adjust length of links **810** to ensure cyclic servo cradle is positioned vertically).

Snap fit the collective pitch servo control link **811** between the servo arm and the fixed ball on the tab positioned on the frame above the servo. Fit the two left/right cyclic links **812** between the servo disc and the swashplate then fit the fore/aft control link **813** between the servo arm and the remaining ball on the rear arm of the swashplate. Above the swashplate, two control links **814** run from the inner swashplate ring to the remaining brass balls on upper mixer arms. The flybar operating links **815** have custom end links which give a straight control run to the flybar operating arm. The final link **816** connects to the throttle arm, depending on the type of motor it may be necessary to form this rod to clear the engine mounts, lengths will vary from engine to engine, adjust to obtain full movement of the throttle. Once all the connections have been completed check the control movements with the radio system switched on.

Before finalising the radio installation, check that all control movements are correctly orientated, listed below are the movements relative to joystick functions.

LEFT - J/STICK When stick is pushed forwards swashplate moves up the mast and throttle opens.

LEFT - J/STICK When stick is moved left, tail rotor pitch increases, pitch slider moves in along shaft.

RIGHT- J/STICK When stick is pushed forward, swashplate front tilts downwards.

RIGHT - J/STICK When stick is moved left, swashplate left side tilts downwards.

All of the above control responses will be reversed with opposite joystick movements.

The receiver can be installed in a choice of positions, either in the space below the collective/cyclic system or on the front radio tray. Some receivers may be too large to fit neatly in the rear position and will need to be installed forward, servo extension leads will be required. Whichever position is chosen take time to ensure a neat installation with all servo leads routed away from moving parts and held securely, small cable ties are provided for this. Use thick double sided tape and elastic bands to secure and to protect against vibration.

Gyro (if fitted) should be mounted with self adhesive foam tape on the top of the front radio tray and the battery should be fitted with elastic bands to the underside of the tray. The switch can be mounted in the cut-out in the right hand lower fuel tank bracket as can a remote glow plug connector (recommended to avoid canopy removal when starting).

FUEL TANK

SEE DIAGRAM No.17

Assemble the three tank cap components **906**, cap, rubber bung and end plate using an M3 nyloc nut and socket screw, do not tighten. Push fit the brass **FEED** pipe from the outside of the cap and the **PRESSURE & FILL/DRAIN** pipes from the inside facing out, slip a short length of silicon tube (pre-cut) over both. Fit the longer piece of silicon tube with the brass 'clunk' weight on one end over the **FEED** pipe then insert the completed tank cap assembly into the neck of the main tank. Adjust so that the fill/drain and pressure tubes are just touching the inside top of the tank then tighten the centre screw to expand the bung.

Remove the forward screw on the upper right hand fuel tank bracket and pivot upwards to allow the tank to be installed in the chassis. Place the rubber strips **908** in the grooves in the tank top and base and pass between the first stage and main rotor shafts until the cap fits up against the single left hand tank bracket, secure with a single M3 x 8 socket screw. Locate the two right hand mounts in the rubber strips and replace and tighten the upper mount screws. As a further security, both right hand brackets have hooks for an elastic band fitment.

Using the remaining length of silicon tube complete the line from the feed tube to the nipple on the engine carburettor (an in-line filter should also be fitted). If the motor requires a pressure feed connect the pressure pipe to the nipple on the exhaust silencer. Fit a short length of silicon pipe to the fill/drain tube and place a screw in the end to prevent the pressure from escaping, (if a pressure system is not being used at least one pipe must be left open to allow tank venting).

CANOPY AND DECALS

SEE DIAGRAM No.18

Using a **sharp** pointed blade knife score a line approx. 4mm away from the edge around the outline of both the white ABS canopy halves **900** then carefully bend and tear the material away from the score (if it does not tear cleanly then make the score line deeper). Once the outline has been cut some of the inner material must be removed, a moulded trim line should be visible on the canopy and should be re-defined using a pencil to aid clarity when cutting, use the score and tear method to remove this material. Line up the two halves and hold in position with tape or clips around the flange and join using 'cyano' glue, once set, the flange can be sanded down to be less obtrusive. Reinforce the internal join line by gluing in pieces of scrap material. NB: it is important that both the side and belly air scoops are cut out to allow cooling air from the fan to escape from within the canopy. If engine overheating is apparent after running the model, the D shaped opening in the underside of the canopy can be enlarged to improve air circulation.

Fit the rubber mounting bushes **905** into the canopy sides and the forward mounting bulkhead, use some 'cyano' to secure. Position the bulkhead within the nose of the canopy and fix with No 2 x 1/4" self tap screws and glue. Cut out the clear PVC canopy window **901** approx. 2mm away from the moulded cut line then test fit and re-trim as required to obtain a clean fit on the canopy. Use a bradawl or small drill to start the fixing holes then secure the window with self tap screws.

Smear a small amount of grease on each of the rubber bushes to ease fitting then test fit the canopy on the model by lining up the two front pins on the radio tray then pulling over the two rear pylon mounts. Check the canopy for clearance and re-trim if required. Note: if the custom **MAVERICK** tuned silencer is not being used it will be necessary to cut away the left hand canopy side to allow fitting of 'standard' type silencers in conjunction with a 90 degree adaptor plate.

Cut out each of the decals using **sharp** scissors (alternative colour schemes are available - see spares list). Before application the canopy and tail surfaces can be polished to give a shiny surface using an automotive polish such as 'T-CUT' or similar. Dry fit the decals and mark positions with a soft pencil then remove the backing and apply, smoothing out air bubbles. Decals can be removed for repositioning if required but will be impossible to remove without damage after a couple of hours, fuel proofing is not required.

The clear window is manufactured from PVC and will accept most commercial canopy tint sprays and dyes designed for model use, alternatively, a light spray from the inside with aerosol paint can be used to give a 'tinted' appearance.

MAIN ROTOR BLADES

SEE DIAGRAM No.19

Using a slow set two part epoxy glue (**do not use the 5 minute type**) fit the lead blade weight strips into the routed slots near the tips of the blades. Half fill the slot with glue before inserting the weight then add more glue over the top to ensure that it is fully surrounded by glue. By sticking a piece of masking tape over the glue while it sets the correct blade surface contour can be preserved. Once fully hardened sand away any surplus glue, then sand using a fine grade paper the entire blade to obtain as smooth a surface as possible.

Press fit the brass bushes into the mounting holes in the reinforced blade roots and strengthen the tips of the blades by soaking some 'cyano' into the soft balsa wood (tips only). Use paint or varnish to protect the root of the blade (from where the taper starts) then cover the blade using the self adhesive white plastic covering. Follow the stages shown in the diagrams closely and fully smooth the material down to avoid air bubbles, try not to peel the film off for re-positioning as this will damage the wood grain. Trim away surplus length of film from the tips using scissors then apply the 'day-glow' orange and green tip tape to each tip in the same way as the white film. The 'day-glow' tips are used to show blade tracking accuracy when the model is being flown.

The blades come factory matched to within one tenth of a gramme for weight but it is strongly advised that the finished blades are balanced accurately before use. The easiest method of balancing is to use a commercial balancing jig as shown, enabling one blade to be matched against the other by adding a small strip of tape or covering film to the lighter blade until the balance beam sits horizontal. If a balancer is not available a long bolt passed through both blade roots to fix them together can be used as a simple balance jig. Time and care taken at this stage will ensure a smooth running model and will reduce general wear and fatigue of the airframe. Fit the completed blades into the holders on the rotorhead and secure with the M4 x 35 socket screws and nyloc nuts, adjust the tension so that the blades can be pivoted smoothly back and forth within the holders, they should not be loose enough to swing under their own weight and it is important that both blades have the same amount of tension.

SETTING UP & FLYING

The set up of the model is assuming that the flyer is a novice, more experienced pilots can adjust the set up to suit their type of flying. The servo travels and disc sizes shown should provide the model with a basic starting point on which to build, the swashplate should have approx. 15 degrees of tilt in all directions and the pitch range of the main rotor should be 0 at bottom stick, 4 at mid stick and 8 degrees at top stick. The model should lift off at between 1/2 and 2/3 throttle/pitch setting. A pitch gauge is a useful piece of equipment that will help when setting up. Check the CG with the fuel tank half full, model should hang slightly nose down when supported by the flybar.

Any model helicopter is a complex and potentially very dangerous machine and should be operated only in a wide open space where model flying is approved. Structural integrity is vital and to this end a strict preflight check of all fasteners and parts should be carried out and damaged parts should never be re-used, this is particularly important with rotor blades. If you have **ANY** doubts about your machine, do not fly.

Trying to operate the model without any guidance from an experienced model helicopter pilot is **NOT** recommended. Either return to your point of sale for assistance or enrol in the local flying club (third party insurance can be obtained through clubs) where guidance can be given. A number of useful publications have been written about learning to fly model helicopters, many valuable points can be learned from these and are well worth purchasing for reference. Morley Helicopters recommends 'Ray's Complete Helicopter Manual' (**Order No. BOOK2**) as an invaluable source of reference for both novice and experienced modellers.

SAFE FLYING IS NO ACCIDENT