



CARBON 46

INSTRUCTION MANUAL

INTRODUCTION

The **F1 Carbon 46** design is intended as an ideal progression from your first training model and offers superb sports and aerobatic performance at an affordable price.

The model uses a composite construction of carbon fibre, light alloy, hardened steel and fibre reinforced engineering plastic parts to create a strong, durable 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 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 section of the build are enclosed in sub-packs and sizes indicated on the diagrams, the full-size identification chart will enable accurate selection.

Listed below are the additional equipment requirements suggested for the construction and final operation of your **F1 Carbon 46** 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:

Minimum : 5 channel heli system + 5 servos + CCP mixer.

Ideal : Computer heli system with electronic CCP mixing facility. (JR X347/X388/3810/PCM10)

Recommended motors

O.S. 46 FX Heli
Thunder Tiger Pro 46-H

Other Equipment

Exhaust manifold
Tuned pipe
Tailrotor gyrosensor
Fuel filter
Glow plug connector
Battery state monitor

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.

UNDERCARRIAGE - Pack 1

SEE DIAGRAM PAGE No.1

The 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 **F600** will provide a stable platform on which to build up the model. The main strut units **F611** or **F612** (black or white) are fitted with the angle sweeping forward. Press the alloy skid tubes **F613P** 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 **F6111/F6121** are a tight press fit and may require a gentle tap to push fully into place.

1st STAGE & TAIL TRANSFER GEARING - Pack 2

SEE DIAGRAM PAGE No.2

Slide the two 3/16" ballraces **F1006** onto the tail drive take-off shaft **F411** with some thread lock and position into the bearing recesses in the take-off gearcase **F410**. Fit the alloy tail drive coupling **F412P** 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 **F7076** can be fitted but left loose until the tail assembly is fitted.

Slide the alloy bearing spacer tube **F4061** up against the tail drive gear on the 1st stage shaft followed by the small 6mm ballrace **F1007**, seat with locking fluid then fit the rubber O-ring seal **F4062** against the underside of the bearing. Press the larger 6mm ballrace **F1008** 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 **F409** and fill the cavity around the gear with the grease supplied. Fill the tail drive gear case cover **F410** 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 **F407** over the top of the protruding shaft and line up the slot with the hole, press in the steel split pin **F408** 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 by fitting small socket cap screws either side of it.

Locate the second stage pinion gear **F401** 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 **F1008** to the remaining length of shaft below the drive gear.

NB. Metal pinion gears are also available 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 F4011, F4012 or F4013.**

MAIN GEAR & CHASSIS - Pack 2

SEE DIAGRAM PAGE No.3 & 4

NB :- The undercarriage has not been shown so as to aid clarity.

Place the autorotation unit **F405P** in the centre of the main drive gear **F4001** 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 useful tip to ensure correct centring 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 not attempt to disassemble or add additional lubricants to this unit.

Fit both carbon fibre engine mount plates **F603** to the 1st stage gearcase assembly then position the chassis base so that the ballrace on the end of the shaft locates into the recess. Attach the engine mounts to the base moulding incorporating the fitting of the forward frame carbon braces **F605** and the carbon radio switch / glow plug plate **F805**. Fit the forward carbon frames **F604** to the engine frames and attach the alloy spacer **F614P** and carbon brace with spacers **F615P**.

Hold the two tailboom clamps **F608** together and slide a short tie bar **F610** into each of the upper holes, slide the two longer tie bars **F609** into the lower holes. Place the upper carbon frames **F602** over the protruding tie bars then attach this assembly to the upper gearcase moulding. Do not tighten the tailboom clamp screws at this stage. Slide the alloy frame spacers **F607P** over the long tie bars then fit the lower rear carbon frames **F601**, the two lower alloy spacers are fitted with a single screw and nyloc nut.

With the main chassis frame assembly completed, press in four M3 nyloc nuts into the hexagonal recesses in the lower mast support moulding **F414**, then press in the lower mast ballrace **F1010**. Place the main gear assembly over the ballrace and insert the main rotor mast **F402** 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 **F403** which will prevent the auto' unit riding up the shaft. Place the mast and main gear assembly into the chassis base moulding and secure from the underside with four M3x10 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).

Slide the mast locking collar **F404P** over the top of the mast and position loosely with the set screws over the groove as high up the mast as possible. Place the upper mast support ballrace **F1011** 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 then re-fit. Slide the small pinion gear at the base of the 1st stage shaft down so that it sits firmly on top of it's support bearing and secure by tightening the set screws onto the ground flats, 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.

Fit the two alloy canopy mounting pylons **F904P** and spacers **F9041P** to the engine frames, secure M3x20sc screws and loctite. Loosely attach the carbon servo brace frames **F806** to the rear frames, the right hand one is a straight screw and nut whereas the left hand one incorporates the exhaust mounting pylon and requires an M3x40 socket screw.

ENGINE ,CLUTCH & COOLING - Pack 3

SEE DIAGRAM PAGE No.5 & 6

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 OS 46 FX helicopter engine or similar. Other makes of motors can be fitted but some modification to mounts and clutch may be required, exhaust fitting may also be affected.

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 complete with drive key before attempting to fit the clutch. Fit a brass control ball to the throttle arm using the brass spacer **F814**, use loctite to ensure this fitting does not work loose. The throttle control arm may need to be repositioned from the 'factory' setting, slacken the arm set screw or fixing nut 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 the 'Tufnol' resin fibre clutch liner **F501** into the clutch bell **F500** with 'cyano' glue, the oilite bearing **F1004** is also secured with cyano but is factory fitted. Slide the brass split taper collet **F505** over the crankshaft followed by the steel clutch centre pillar **F503**. Place the plastic spacer washer **F508** over the crankshaft then slide the completed clutch bell over the centre pillar. Insert the steel clutch/flywheel unit **F502**, 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 **F506** over the clutch ensuring that the moulded lugs on the underside lock into the two large holes in the clutch/flywheel face. Place a 3/8" x 5/8" washer over the remaining threaded portion of the shaft and secure the assembly with the special starter nut **F5096** supplied, (do up tightly and use thread lock). Once completed check that the plastic clutch bell is free to rotate smoothly under the fan.

Fit the alloy mounting blocks **F6066** to both engine lugs then position the completed assembly between the carbon engine frames of the chassis. Fix in place using socket screws, washers and special alloy load washers **F6061P**, 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. When finally tightening the four engine fasteners hold the fan/clutch assembly firmly against the 1st stage drive gear so that there is no backlash between the gear.

Fit the fan duct enclosure moulding **F5071** 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 fan duct "volute" moulding **F5072** to the inside of the duct using the self tap screws and the socket screws that retain the swashplate anti-rotation slider **F304** in place. Slide the shroud over the key ways on the upper gearcase/shroud and fix with two small self tap screws. It is recommended that the two rear tabs on the duct are also secured in place with small self tap screws to prevent high pressure air escaping. Fit the fan duct extension **F5073** onto the main duct using self tap screws, ensure that the cutout for the glow plug allows sufficient access and enlarge if necessary.

Position the forward radio tray **F807** between the carbon front frame supports and fix in place with socket screws, take care not to over tighten as this will damage the plastic. Slide the mast bearing hold down moulding **F415** over the mast and secure. Turn over the completed drive train and check for binding or tight spots and adjust 1st stage and main drive gear mesh as necessary.

SWASHPLATE - Pack 4

SEE DIAGRAM PAGE No.7

The swashplate assembly comes as a factory assembled unit but does require control balls being fitted to the outer ring **F300**. The lower portion of the swashplate is prevented from rotating by fitting the anti-rotation pin **F303**, use thread lock on all swashplate fittings. The swashplate is used on other helicopters as well as the F1 Carbon and so a number of the mounting points around the main ring will remain unused.

The central brass swivel ball **F301** 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 **F302**. 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 on top of 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 - Pack 4

SEE DIAGRAM PAGE No. 8,9 & 10

Fit a pair of brass control balls to the central flybar operating arm **F1051P** and screw in the M4 x 6 set screw, do not fully tighten these until the flybar is fitted. Slide the flybar **F104** through the bearing **F1001** (factory fitted) in one side of the flybar cradle & head button **F103** (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 **F106** 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 **F107**. Fit a flybar paddle blade **F1096** 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 30 full turns.

Push the tapered rubber dampers **F111** into the main centre hub **F101** then slide the feathering spindle **F110** through the head so that an equal amount protrudes both sides. Fit a conical shim washer **F122** over each end of the shaft up against the rubbers, ensure that the 'dish' of the washer faces inwards. Fit the main blade holders **F102** (the pivot ballraces **F1009** are factory fitted) to each end of the shaft and secure using the conical safety washer with the dish facing outwards and the special M5 x 10 button head socket screws - *Thread locking compound must be used and screws tightened securely.*

An optional rotor head thrust race bearing kit (Part No. F1014) is available and recommended for head speeds in excess of 1750 rpm or with blades in excess of 140 grammes.

ROTORHEAD & MIXER - continued

SEE DIAGRAM PAGE No. 8,9 & 10

Fit brass control balls to both ends of the upper mixer arms **F112**, 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 **F115** 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 **F1006** with pre-fitted bushes **F117** 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 **F1002** into the mixer slider **F114** and secure using 'cyano' glue. Fit a brass control ball to the end of each of the lower mixer arms **F113** (the swashplate driver arms **F118** and pins **F119** are factory fitted). Fit the mixer arm assemblies to the slider using the steel bushes **F116** 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 **F120** (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 - Pack 5 & 6

SEE DIAGRAM PAGE No.11 & 12

Push fit a ballrace **F1007** onto the tail output shaft **F206** (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 **F204**. Repeat this sequence for the tail input shaft **F205** using ballraces **F1006** followed by the female portion of the tail drive coupling **F207**, 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 **F203** 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 **F211** 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 over the end of the output shaft. Slide a pair of ballraces **F1006** over each of the axles of the tail hub **F202P** 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 over tighten). Before the thread lock has set on the bearings fit the tail blade holder halves **F201** each side and secure with M2 screws and nuts (use thread lock). 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 **F200** 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.

Select the brass drive wire tube **F7046** (gold colour) and the alloy control wire tube **F7056** (silver colour) and position the four carbon fibre supports **F706** along the tubes using the dimensions shown. Secure the supports to the tubes using cyano' glue (roughen the tube with abrasive paper first to ensure a strong joint) Slide the assembly down inside the carbon tailboom tube **F7006**. Fit the male end of the tail drive coupling over the drive wire **F7076** (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. Locate the pre-formed end into the long arm of the bellcrank **F208** then fit the crank with steel bush **F212** 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. 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 the hole in the tube side wall.

Fit the locating pin **F7011P** to the carbon tail fin **F701** then position and fix with the four alloy spacers **F7012P** and button head screws to the mounting lugs of the tail gearbox. Ensure the locating pin engages in the tailboom tube then clamp the gearbox in place by tightening the remaining three screws. Slide the tailboom clamp **F703** over the boom then slide the assembly into the clamps on the main chassis unit feeding the drive wire into the alloy drive coupling, lock the wire into the coupling with all four of the set screws, tighten in sequence to prevent run-out. 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 the boom in place by tightening the four screws either side of the frames. Check the tail drive by rotating the main rotorhead.

Press the stay tube ends **F7091** into the alloy tubes **F7096P** and position on the model between the lower rear chassis and the tailboom clamp. Drill 1.5mm pilot holes through the tube into the end mouldings and secure with small self tappers. Fit the horizontal carbon tail plane **F702** to the clamp with self tap screws and tighten the pinch screw ensuring the plane is set 90° to the tail fin.

CONTROL SYSTEM & RADIO SETUP - Pack 7

SEE DIAGRAM PAGE No.13, 14 & 15

For ease of setup it is advised that all control balls and connectors are fitted to the servo arms before fitting the servos into the airframe. The three cyclic/collective servos all require arms which allow the centre of the brass ball to be approx. 17mm from the centre of the arm fixing screw. The tail rotor servo also requires an arm of similar length but the throttle need only be 14mm. The position of the arm on the splined output shaft of the servo is very important, at this stage the servos should be connected to the receiver and battery and "centred" with the transmitter switched on. If your transmitter has CCP computer mixing as standard it needs to be set to the 3 servo (2 roll)120° setting, servo reversing may also be required to achieve correct control movements. The positions shown in diagram 13 are typical with both transmitter joysticks set to centre (including throttle/collective). With the servos positioned exactly over the diagram, fit the servo arms so as to duplicate the positions shown and fix with the original servo centre screw.

With the servos now set, disconnect the system ready for installation in the model. Fit the two front cyclic/collective servos no. 1 & 2 onto the upper **F800** and lower **F801** servo mounts using the self tap screws provided with your chosen servo (NB: part no. **F800** is non-symmetrical and must be fitted as shown to clear the tail drive coupling) . Fit the completed assembly between the side frames and secure at the top frame and lower carbon support arms. The rear cyclic/collective and tail rotor servos no. 3 & 4 require spacer block **F802** or **F803** fitted, use **F802** (the shorter of the two) for JR/Graupner type servos and **F803** for Futaba type servos. With the spacers fitted, fix the servos between the upper frames using the small screw anchor mouldings with self tappers and socket screws through the lower carbon bracket. Fit the throttle servo into the space provided in the forward radio tray **F807** with self tappers, the servo arm output should be closest to the engine.

The forward radio tray provides ample room for the battery and receiver, the battery should be installed on the tray underside with double sided tape and elastic band and the RX on the upper surface. Because of the delicate nature and cost of receivers it is recommended that the RX is fitted into the optional armoured protection box (Part No. ACC/BBOX). Install the switch harness into the carbon switch plate, this plate also provides a convenient position for a remote glow plug socket (Part No. ACC/GPLS). Using small cable ties and servo extension leads where necessary carefully route the four rear servo leads down the right hand side of the airframe away from the exhaust system. Take care not to allow any leads to press on sharp edges or to hang loosely from the airframe, a tidy and methodical radio installation will help ensure a reliable model.

Two mounting positions are available for the gyrosensor, either on the rear platform above the tailboom clamp or on the front radio tray. The rear mount is the most desirable for the best angular sensing and provides a constant temperature environment particularly for solid state sensors.

Set the control pushrods **F809** & **F810** to the lengths shown (measured end to end) between the three cyclic/collective pitch servos and the control ball positions on the swashplate. Connect the tail control wire to the small hexagonal connector, position so that approx. 5mm of wire protrudes through and secure with an M3 x 6 socket set. Ensure that the small starlock washer is firmly pressed on the back of the tail connector, a small amount of cyano or paint on the remaining pin length will add security . Connect the throttle control link **F813** between the servo and the carb' control arm, adjust length to suit.

With these settings the swashplate should rise and fall evenly with collective control and should tilt as normal with cyclic operation. Use the ATV controls to give approx. 15° swashplate tilt in each direction. NB most CCPM equipped transmitters will automatically default the servos to 60% travel when CCPM is selected.

Set the remaining rotor head links **F811** and **F812** (NB: links 812 do not have regular shaped end fittings) to length and connect between the swashplate and head mixing arms. The rod end mouldings are a tight press fit over the brass control balls, fitting and removal is made considerably easier by using a set of ball link pliers (Part No. TLS/PLS).



ROD LENGTHS ARE MEASURED TIP TO TIP

FUEL TANK - Pack 7

SEE DIAGRAM PAGE No.16

Assemble the three tank cap components **F9071**, cap, rubber bung and end plate using an M3 nyloc nut and socket screw, do not tighten. Push fit the brass FEED pipe **F907** from the outside of the cap and the alloy PRESSURE & FILL/DRAIN pipes from the inside, slip a short length (15mm) of silicon tube over the ends of both. Fit the pre-cut 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 **F906**. Adjust so that the fill/drain and pressure tubes are just touching the inside top left and right corners of the tank then tighten the centre screw to expand the rubber bung and secure the cap assembly.

Place a rubber mount **F908** into the recess in each side of the tank and hold in place whilst the tank is positioned between the two rear lower side frames, secure using socket screws and washers, make note of the use of a locking washers, do not use loctite as this will make removal difficult.

Using the remaining length of silicon tube complete the line from the feed tube to the nipple on the engine carburettor (a high flow in-line filter is recommended - Part No.ACC/HFF). If the motor requires a pressure feed connect the pressure nipple on the exhaust silencer to the pressure pipe of the tank via two short lengths of silicon tube and the remaining short brass tube routed through the carbon servo bracket. Fit the remaining length of silicon pipe to the fill/drain tube and place the open end over the brass pipe plug/retainer fitted to the right hand side carbon servo bracket.

CANOPY AND DECALS

SEE DIAGRAM No.17

Using a **sharp** pointed blade knife score a line approx. 5mm away from the edge around the outline of both the white ABS canopy halves **F9006** 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.

Fit the rubber mounting grommets **F905** into the canopy sides and the forward nose mount **F9036**. Position the nose mount in the front of the canopy and secure in place using cyano' glue (NB position inside the moulded step not on the outside - some material will need to be trimmed away to allow the grommets to be accessible). Cut out the clear PVC canopy window **F9016** 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. NB: Only fit the screen with the canopy mounted on the model. The canopy may touch the top edges of the fan duct, at this point fit the small length of sponge tape to protect the two surfaces.

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.

Cut out each of the decals using **sharp** scissors. Before application, the canopy 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.18

Using a slow set two part epoxy glue (**Minimum 30 minute set time - 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 blue and magenta coloured tip tape from the decal sheet to each tip in the same way as the white film. The coloured 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 servo travels and arm sizes shown should provide the model with a basic sports set-up on which to build, the swashplate should have approx. 15° of tilt in all directions and the pitch range of the main rotor should be approx. -4° 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, the 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 pre-flight 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.

For a novice pilot to try and operate the model without any guidance from an experienced model helicopter pilot is **strongly discouraged**. 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

NOTES

MH-DESIGN

ENGLAND