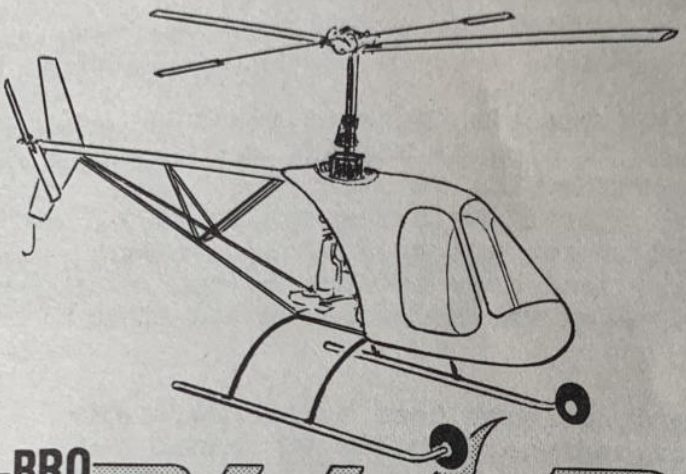
$3.50

ASSEMBLY and *FLYING*

INSTRUCTIONS



DU-BRO *SHARK*

R/C HELICOPTER

designed and manufactured by

DU-BRO PRODUCTS INCORPORATED

wauconda, illinois 60084

U.S.A.

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small gear on it, lubricate it, and install the top cover of the gear case. Don't forget the gasket.

NOTE: There is no bearing on the top of the main shaft in the gear case. The bearing for this is on the plate on top of the standoffs. The baffle is installed in the exhause stack next. Locate the round slotted baffle plate, the 5/32" slotted shaft, 1 5/32" collar, the 4-40 x 3/4" bolt, a 3/32" ID washer, 5/32" brass eyelet, and brass swivel link. Using a pair of long nose pliers, slip the baffle plate (slot up) into the exhaust stack. You may have to file the plate to make it fit. Slide the slotted end of the baffle shaft through the hole in the top of the exhaust stack, interlocking the slots in the baffle plate and the shaft and out through the hole in the bottom of the stack. Slip the 3/32" washer over the split end of the shaft, then flare the end open so that the washer is locked on. Slip the brass eyelet on the top end of the shaft and then the collar. Now thread the swivel link onto the 4-40 bolt and install the bolt in the collar. Temporarily lock in place by tightening the 4-40 bolt.

Bend a threaded Kwik Link rod to fit between the carburetor and the exhaust baffle. The length should be adjusted so that the baffle is fully closed when the carburetor is in low position (about 1/8" opening) and fully open when the carburetor is open. A solder link is soldered to the carburetor end of the linkage and a swivel link clevis is screwed onto the threaded end at the baffle. Travel of the baffle with relation to the carburetor can be varied by turning the swivel link in or out on the screw control arm.

Now is as good a time as any to install the pull starter spacer. This is the 2" piece of black tubing. To install, pull out the starter and wrap it around something so it will not retract. Now pull the aluminum plate out of the rubber handle. Untie the knot. Remove all parts of the handle and slip the tubing on the rope. Now replace the handle parts and retie the knot.

LOWER MOUNTING PLATE

We will build this thing from the ground up, so let's start with the skids. Install the axles using red Loctite. Using the #6 sheet metal screws, install the landing gear struts on the skids, use lock washers. You will note the screws are a little too long, so grind the point off. Now remove 3 of the 4 bolts holding the pull starter on the engine (check the bottom plate to see which 3 bolts should be removed). Now using the longer 1 1/4" 6-32 bolts and #6 lock washers, bolt the bottom plate to the engine. NOTE: The pull starter will be to the rear of the plate (refer to the drawing for positioning). Set the plate with engine on the landing gear. Use spade bolts to hold the rear landing gear to the plate. Put the lower angle plate in place on the front of the plate and bolt it together with the lower plate and the front landing gear.

UPPER MOUNTING PLATE

Before installing the upper plate on the engine, use the 8-32 socket head bolts, lock washers and red Loctite to install the 4 stand-off posts. Also install the bellcrank mounting brackets and bellcranks. See drawings for proper location. NOTE: This plate has 1 3° bend just behind the rear standoff post. Now set the plate on top of the engine. Put the long 10-32 bolts through the plate and into the engine. Before you tighten these bolts, set the assembly on the edge of the table on the front edge of the top and bottom plates. This will insure that the 2 edges are parallel. Now tighten the bolts holding the top plate to the engine. Install the upper angle plate to the top mounting plate. See drawing for location.

FRONT MOUNTING PLATE

Install the 6 large J bolts as shown in the drawings, using the 4-40 nuts and lock washers. You may want to cut the hole and mount your radio switch at this time. It should be mounted in the lower right hand corner of the front plate (as you would sit in the seat). Now bolt the front mounting plate to the 2 angle brackets on the top and bottom mounting plates. The servo tray can be made up now and installed on the front plate. This is made from the 3/4" x 3/8" strip of pine. See Drawing. Also you can install the fuel tank. Use a 12 ounce tank. (not included) The radio can be wrapped in foam and strapped in plate with a rubber band the same as the tank.

Now before going on to more assemblies, let's go over what we have at this time and clean up some small things. Du-Bro 2 1/4" wheels (not included) are installed on the axles and held in place with a wheel collar (also not included). You can make up and install the throttle push rod from the carburetor to the servo. At this time you should slip the large bevel gear on the main shaft followed by the large black collar. Now the bearing plate (with the large hole to the front and the flange on the bottom). Bolt the plate to the stand-offs using the 8-32 socket head bolts. (No Loctite - this part will be removed from time to time) and lock washers. Pull the large collar up under the bearing and lock it to the shaft with a set screw, Set on the flat spot on the shaft. Just let the large gear sit there at this time. You can make up the push rods from the servos to the 2 bellcranks. See drawings for positioning.

TAIL BOOM

Begin assembly of the tail boom by carefully pressing the 1/4" ID x 5/8" OD bearing into each end of the bearing block. See drawing. Now slip the small gear and shaft into the bearing and temporarily mount the block onto the top mounting plate behind the large bevel gear. This is just to check the gear alignment. If the rear top edge of the small gear lines up with the outer edge of the larger gear, fine. But if the smaller gear is too far back, remove the gear and shaft and install some 1/4" ID washers behind the gear and re-check. Now that you have the small gear set, slip the large black collar on one end of the brass drive shaft. Slip the drive shaft onto the shaft with the small gear, push the brass drive shaft all the way up to the bearing and lock it in place with a set screw in

the collar setting on the flat spot on the shaft. If you did this correctly, the shaft should spin freely and yet have no end play. Slip the 2 teflon bearings and the 4 brass eyelets on the drive shaft (see drawing) and solder the eyelets in place on the shaft. Leave about 1/16" play between the eyelets and the teflon bearings. Temporarily slip the slotted coupler into the brass drive shaft and slip the front end of the tail rotor gear box into the slotted coupler. Now lay the entire assembly along side the boom to check the length of the brass drive shaft. If the drive shaft is too long, cut or file it to a length which will put the pin, which is in the end of the shaft of the gear box, in the center, lengthwise, of the slot in the coupler. When you have the drive shaft the right length, use a torch to solder the coupler to the drive shaft. Caution: Do not over-heat the brass tubing as it will become soft. Now you can slip the drive shaft assembly into the tail boom. Lubricate the teflon bearings with Lubriplate or STP before installation. (Be sure to have the front of the boom toward the bearing block.) Bolt it to the bearing block using the 2 small 4-40 x 1/8" bolts. Next slip the two tail boom brace brackets on over the boom and set this assembly aside and assemble the tail rotor.

TAIL ROTOR

Begin by mounting the bellcrank bracket to the gearbox with two 4-40 x 1/4 screws, lockwashers, and Loctite positioning the bracket so that it angles forward. Install an EZ connector on the control arm of each blade holder and on each ear of the nylon pitch control head. These must be carefully peened in place, flaring the stud just enough to retain the washer. The stud should be cut off so only about 1/32" is left to be peened over. Several light taps with a small hammer will work far better than a heavy pounding. The EZ connectors must rotate freely.

Mount the two blade holders to the collar with 5-40 bolts, placing the brass spacer between the holder and the collar. Now position the collar onto the gearbox output shaft, the collar whould be out on the end of the shaft, and set screw securely in place. Use red Loctite. Slide a 3/32" ID collar onto the long arm of the tail rotor pitch control rod followed by the coil spring, the small washer and the large flat washer. The large washer will fit in the bearing hole in the gear box.

Mount the tail rotor pitch control bellcrank to the underside of its bracket, engaging the control rod in the hole in the bellcrank. You will have to enlarge the hole in the bellcrank so the pitch control rod will fit and be free to move. Secure all hardware with Loctite. On the rod end extending from the rotor shaft, mount a 3/32 ID collar, the nylon pitch control head (oriented as shown) and a second collar. Fit the 2 control links (1/16" wire) between the EZ connectors on the blade arms and those on the control head. These control links should be flush to 1/64" extended beyond the EZ connectors. Lock in place with 4-40 set screws. Finish the tail rotor blades (film covering or paint) and attach with a 4-40 screw and nut. It is important that the blade holders, blades and control bushing be properly oriented as shown in the drawings. Be sure that the control arms on the blade holders lead the blades or are in the front of the blades. You can be sure that you have them right, if

when you push on the pitch controlrod and compress the spring, the blades increase in pitch. If they decrease in pitch, you have the arms backwards and they must be reversed. Now slip the gear box into the end of the tail boom rotating the shaft and the blades until the pin in the end of the gear box shaft slips into the slot in the coupler on the end of the brass drive shaft. When the gear box is in place, put a 4-40 bolt in the right side of the boom and into the gear box. (Do not over tighten.) The right or left side is always figured as if you were sitting in the seat. Now mount the tail skid mount using the 6-32 bolts and lock washers. (Do not over tighten.) Slip the skid in place and using the two 6-32 set screws and red Loctite, lock it down. If you are going to paint the fin, do it now before you install it. To install the fin, fit the angle bracket to the boom. Line up the holes and using a 4-40 bolt in the rear, mount the fin to the boom. Use the very small sheet metal screw in front. Also use red Loctite.

The tail boom is now ready to install on the main top plate, so set it in place. Using the two 6-32 socket head bolts and lockwashers (no Loctite), mount the boom to the plate. Mount the bracket over the boom on the back of the plate and at the same time, bolt on the two medium size aluminum braces to the under side of the plate. See drawings.

Now bolt on the long aluminum tubes from the spade bolts on the bottom plate to the rear boom bracket. Use 4-40 bolts, lockwashers and nuts for this. Put the cross piece between the two long tubes. Using 8-32 socket bolts first through one end of the short tubes, then the long tube, then the medium tube and into the cross piece. See drawing. Bolt the other end of the short tubes to the front boom bracket using a 4-40 x 3/4" bolt. Let the bolt stick out the left side of the copter. On the other end of this bolt, thread a 1/8" ID collar, in which you have slipped a short piece of the nylon tubing (which will be used later to slip the antenna into.) This will be a guide for the tail rotor control cable. You should also have a collar such as just described on the outside bolt which holds the side bellcrank on the main plate. See drawings. Now you can lock down all bolts holding the tail boom assembly and install the control cable from the servo to the tail rotor. The cable is made from the length of .020 wire found in the kit. Solder a kwik link coupler on one end of the wire and the piece of 1/16" brass tubing on the other. Install one of the EZ connectors in the hole closest to the center of your servo arm. Now the brass tube end of the cable goes into the servo arm. The other goes to the bellcrank on the tail rotor.

If you are going to use a servo with linear output only for the tail rotor, you will have to go through a bellcrank to reduce the throw. The linear servos move the tail rotor too far.

MAIN ROTOR

Start the head assembly by inserting the bearings into the rotor yoke and the blade hub. Note that both sets of bearings are flange bearings and the flanges go on inside of each part. See drawing. Now position the bearing mount between the bearing in the yoke with a flat washer on each side between the bearing mount and the bearing.

Slip the 10-32 x 5/16" socket head bolts through the bearing and thread them into the bearing mount. NOTE: The bolts may have to be filed just slightly so they will go through the bearing. If so, use a flat file and just go around the bolts once or twice to take off just the very top of the thread. Then check to see if the bolt will slip through the bearing. Use red Loctite on these bolts. Set the yoke assembly into the blade hub with the bearing mount between the bearings of the blade hub. Slip the flybar housing through the bearings and the bearing mount.

Slip the flybar rod through the flybar housing. Put the 3/16" ID collar on the flybar on one side and the flybar control arm on the other. Screw the flybar paddles on each end of the flybar. Note the holes in the paddles are 1" deep, but the threads are only in the bottom 1/4" of the holes. This is to give a shoulder outside of the threaded area. Use red Loctite for this. Also the bottom of the paddles should be parallel with each other. This can be done by setting the paddles onto blocks of wood on a flat table and twisting them until both paddles sit flat on the blocks. At this point, the head should be very free to move on both axes.

The next thing is to set the flybar. To do this, set the head on top of the main shaft of the copter. Put the collar and the control arm next to the blade hub. Slide the flybar back and forth until it will balance level. Very carefully tighten down the set screw in the collar. Check again to see that the flybar is still level. If so, position the control arm so that it is right in front of one of the 10-32 bolts which is through the bearings. With the bottom surface of the paddles level, tighten down the set screw in the control arm. Now the flybar should be balanced level; it should not have any end movement. With the paddles level the control arm should be just in front of the 10-32 bolt head.

The main rotor blades have been carefully selected at the factory to provide reasonable balanced blades. For this reason, we suggest that the blades be lightly sanded and covered with one of the film coverings (Monokote, Solarfilm, etc.), rather than painting. The inboard end, where the holders fit, can be painted. Mount the blade holders with four 4-40 x 3/4" screws and nuts. The straight side of the lower holder is at the leading edge of the blade.

Now using the large 1/4 - 20 nuts, bolts, and washers, install one blade on each side of the blade hub. See drawings. With a straight edge, or I use a straight stick about 3/4" x 1/2" x 36", against one side of the blade hub, set one blade parallel to this stick and

lock it down with 1/4 - 20 bolt. Carefully move the other blade back and forth until the flybar is balanced and sitting level again. At this time, you may find that one blade is heavier than the other and will not balance. If so, use some small nails or brads to pound into the light blade until the blades will balance. If the complete rotor is balanced with the flybar sitting level and the blades sitting level, tighten down the last blade with 1/4 - 20 bolt.

Next check the blade pitch. You will have to assemble the pitch gauge. Be sure to assemble it on a flat surface so that you will get an accurate setting on your blades. To check the pitch, slip the gauge over the flybar and bring it up under the blade. The blade should lay on the tapered edge of the gauge. If not, use the adjustable wrenches and twist the blades until they are both the same pitch and laying on the gauge. See Picture. To complete the head, mount the small spring on top of the bearing mount and hold in place with one of the spade bolts. Put two 6-32 nuts on the spade bolt, then a washer and through the spring and thread into the hole in top of the bearing mount. The end of the spring should be under the flybar control arm and not touching and moving part of the blade hub and yoke. Be sure to keep the nuts tight or the spade bolt will break from being able to move back and forth. Also do not use Loctite on the spade bolt because sometime you will have to replace the spade bolt if it breaks off. If you use Loctite you won't be able to remove the broken end.

Hook the two springs into the spade bolt in the bearing mount. With a spade bolt on the other end of each spring, bolt them to the top blade holders. With the rotor head sitting on the main shaft and the copter sitting on a table, use your transmitter to adjust the springs on the head. To do this, pull up the antenna to the height of one of the blades at the tip. Rotate the blades until the other blade is at the antenna and it should be the same height. If not, adjust the springs by moving the spade bolts in the top blade mount. This will complete the rotor head.

BODY

We will not spend too much time on this since the drawing will explain this very simple procedure. But here are some hints that may make it a little easier.

First cut out the two sides leaving about 1/2" edge all around each half. Cut out the window, the front for the windshield, and the top for the main shaft. Also the rear. Trim the rear so that the edge just rolls under. Using snap clothes pins, clamp the two sides together (use lots of clamps). With a small brush, carefully apply a small amount of MEK (Methel Ethel Ketone) to the inside seam and let set for 1 to 2 hours. Cut out a piece of scrap plastic and cement it to the rear floor of the body. Trim the windows leaving about 1/8" edge all around each window. After the body has dried, remove the clamps and trim the edge down to about 3/16" all around. Slip the side windows in place from the inside and cement in place using Plastic

Weld. It is made by Plastruct Inc. and is available in most hobby shops. Using a small brush, run a small amount in the seam between the window and the body. Trim the windshield and fit it in place. Use the six small screws to hold the windshield in place. (The cement will not hold this.) You will probably need about 5 to 6 ounces of weight in the nose for balance. This can be lead or clay. Hold it in place with the plastic nose former. Drill out the holes in the side of the body for mounting to the frame. Also drill a small hole in front near the nose for the antenna to come out. Mount the nylon tubing which will hold the antenna. To do this, use the 1/2" 4-40 bolt and put it through a hole in the front of the body. Put the 4-40 - 3/4" bolt in the rear of the body and thread a 1/8" collar on the end of each bolt and run the nylon tubing through the collars. After installation, the antenna can be slipped into this tubing.

FINAL ASSEMBLY

Don't stop now - we are almost done. OK get that last can of beer and let's finish this thing.

Using red Loctite, screw the four 4-40 1/2" studs in place in the swash plate. See drawing. Slip one of the large brass tube spacers on the main shaft followed by the swash plate and the second brass tube spacer. Rotate the swash plate so that one of the three studs on the lower part is forward, one is on the left side, and one is to the rear. Thread on a brass swivel to the stud which is in front and on the left side. Make the two push rods from the bellcranks to these brass swivels. Adjust the length so that with the servo in neutral, the swash plate is sitting level. The bellcranks should have one leg down and one leg back. See drawing. Mount the small steel block to the rear of the bearing plate and assemble the scissors. The best way to describe this is to study the drawings very carefully. As you can see, the smaller of the two main parts has one of the brass swivels on one end. Put the swivel on one side and carefully squeeze the legs together - making sure the swivel can move freely after. For the lower scissors, put the 4-40 bolt through the two main parts with the lock nut on the outside. Thread the brass swivel in the scissors assembly on the rear stud of the swash plate. Then using the two small steel eyelets and the short 4-40 bolts, bolt the scissors to the steel block on the bearing block. Use red Loctite and do not tighten the bolts too tight. This is called the anti-rotation scissors.

Now assemble the upper scissors or the rotation scissors. This is made in the same way only when putting the 4-40 bolt through the two main parts, you must install one of the brass swivels. Slip the large black collar on the shaft and down on top of the brass tube spacer. Thread the brass swivel on the end of the rotation scissors onto the upper stud of the swash plate. Again using the two steel eyelets, small 4-40 bolts and red Loctite, bolt the scissors to the collar. Do not lock the collar to the shaft yet.

Next let's set the large steel bevel gear in place. Use the large set screw and a small amount of blue Loctite. Set the gear just slightly loose meshed with the small gear. See if you can turn the main shaft

all the way around without any binding of the gears. If you feel it is too tight, raise the large gear on the shaft and try again. If no binding, maybe you have too much slop between the two gears. They should be as close as possible without any binding. When you have them set, lock down the set screw on the flat of the main shaft. Lubricate the gears with STP or Lubriplate. Slip the body in place and screw it to the frame with the short #6 sheet metal screws. Set the rotor head on the main shaft and put the 10-32 bolt through the head and main shaft. No Loctite; but tighten the nut down good. Holding the blades lengthwise with one blade directly over the tail boom, move the collar with the rotation scissors until the stud on the swash plate is either over the forward stud or the rear stud of the lower part of the swash plate. The brass swivel in the knee of the rotation scissors should be under the flybar control arm. That is why it could be to the front or the rear. Now lock the collar in place on the shaft with the set screw. Make up a push rod to go between the swivel on the rotation scissors to the swivel on the flybar control arm. To adjust this rod, first check to see that the swash plate is level. Now with the rotor blades lengthwise of the body (one blade over the tail boom, one blade over the nose) adjust the push rod so that one paddle is level. Let's assume you are looking at the paddle on the right side of the copter. The bottom of this paddle should be level. If it is, rotate the rotor head 180° so that the other paddle is on the right side. Now check it, it should also be level. As you will see, by moving the swash plate the paddles will move. So if the swash plate isn't level, the two paddles will not be level. So what you are looking for is an adjustment which will have both paddles at the same angle or attitude. Whether they are level or at some angle is not important. What is important is that they are the same angle when checked at the same point in rotation.

The last adjustment is to the tail rotor. A very easy way to do this (and this will not only give you the proper pitch, but will set both blades to the proper pitch) is to first rotate the blades forward 90° in the blade holders. Turn on your radio and move the stick to the low pitch side. Then while holding the stick all the way over, turn off the receiver. This will lock the servo in this position. Adjust the pitch control links (the brass rods from the blade holders to the EZ connectors on the nylon pitch control head) until one blade is parallel with the boom. Rotate the rotor and set the other blade the same. When you turn on the radio, the blades will move to a neutral position which will be very close. Final adjustment will be made with the trim control on your transmitter. Return the blades to their normal position in the holders.

FINAL SET UP

First, let's look at what the radio should do. I think a two-stick transmitter is best. This way each thumb has only 2 things to do. The throttle is normally set up on the left stick and you get high throttle when you move the stick toward the top of the transmitter. The tail rotor is also controlled by this stick. I prefer to have the tail rotor hooked up so that when I move the control stick to the right, the tail of the copter moves to the right. Now this is back-

wards to an airplane rudder, so if you prefer to hook it up the other way, fine.

The two controls on the swash plate are on the right stick. I think the best way to explain the hook up and operation is to lay the transmitter down next to the copter with the antenna pointing forward. Now when you move the right stick forward or toward the top of the transmitter, the swash plate should tilt down in front. When you move the stick to the right, the swash plate should tilt down on the right side. In other words the swash plate will tip in the direction you want the copter to move. The push rods from the two servos to the swash plate should be in the intermediate holes in the arms of the servos. This will give the right amount of throw. Check the balance of the copter by picking it up by the flybar close to the head with the blades parallel to the copter. As you pick it up from the table, the rear of the skids should come off the table about 1/2" before the front of the skids. You can add ballast to the nose until you get this condition.

MAINTAINENCE

Lubrication is very important. Be sure to keep the steel gear on the main shaft lubricated with STP or Lubriplate. Also the tail rotor gear box should be lubricated after every 8-10 tanks of fuel. (A glue gun works very well for inserting the grease in the tail rotor.) Don't forget the clutch. This will not have to be done very often. Just when you feel the clutch grabbing when you start the engine. Always check for loose nuts and bolts. If you should develop a shake in the copter, stop flying until you correct it, as this could cause all kinds of damage if allowed to continue.

PRE FLIGHT

If all adjustments have been made carefully and the copter is balanced properly, you are now ready to run the engine for the first time. Install a glo plug (not included) in the engine. A Fox long reach idle bar is very good. For best results, use a fuel with about 10% nitro content. K & B 500 works well and in some cases even better when mixed 50-50 with K & B 100. Never use over 15% nitro as this will cause the engine to overheat and lose power and can cause damage to the engine. Set the needle valve on the carburetor at 8 turns out. This is the average for best running. It will be some place between 6 and 14 turns. It should be noted that no fuel filter should be used on this engine and be sure to use the large size fuel tubing. OK. Fill the tank and tie or clamp the copter to a table or bench so you can run it wide open and still be under it to adjust the carburetor. Prime the engine by opening the carburetor and putting your thumb over the opening and then give the pull starter a good pull. Close the carburetor and connect the battery to the plug. Never start the engine at any setting other than idle. Hold the rotor head with your left hand and pull the starter. When the engine starts, get out of the way and release the rotor. Advance the throttle to about 1/2 open and let it run about 1/3 of the tank at that setting. Open it up all the way and screw the needle valv in until the engine begins to slow. Then back out the needle until the engine picks up and holds. That's it. Shut it off. Fill the tank and you are ready to learn to fly. This engine should not have a muffler. It is not as noisy as a model engine.

INTRODUCTION TO HELICOPTER FLIGHT

Just before you start to try to fly this thing, I would like to try and explain just a little about how a helicopter works. It is very difficult to understand a helicopter and I do not pretend to know all about them myself. But maybe if you understand just a little, it may help.

First, when the copter is hovering it is sitting on a column of air which is like you standing on a ball. The copter will not just sit there. You must control it to make it stay there. It always wants to slide off of the ball and that makes it go in some direction. The control you use to keep the copter on that ball is the control on the main rotor. As you move the control stick on the transmitter, the swash plate tilts and it in turn tells the blades to tilt. So if the copter is sliding backwards, you move the control stick forward, the swash plate tilts forward and the rotor disc (that is what the rotor blades look like when running) tilts forward so the copter moves forward. Pay attention and I will try to explain how the blades tilt. Let's assume that we want to go forward. We move the control stick, the swash plate tilts forward or down in front. This is where it gets hard to understand. Set the rotor blades parallel with the body - one blade over the tail. You will see in this position that the paddle on the right side of the copter is tilted down. (The paddle and rotor blade on the right side is the advancing blade. The one on the left is the retreating blade. This is because on this copter the blades rotate in a counter clockwise direction when looking down on them.) Also, you must keep in mind that on any rotating body, the movement is 90° from the input. The paddle on the right side is at its greatest control input now. It started to change from level as it passed over the tail, is now fully down and will start to go up until it reaches the nose. That is input. Movement of that paddle will start now, 90° from the tail where we started the input control. As the paddle passes over the nose it will actually be at its lowest movement point. So now rotate the head so the blade which was over the boom is on the right side. So far we moved the control stick, the swash plate tipped. The flybar paddle has tipped down as it goes past the nose. But so far nothing has happened to the blades. But now you can see if you hold the flybar down in front and look at the blade on the right side, it is angled down. Now the same thing will happen to the rotor blades that happened to the paddles. That blade will start to move down and by the time it gets over the nose it will be at its lowest point. At this time the entire rotor disc will be tipped forward and the copter will move forward. All controls on the main rotor - or swash plate - are the same. The same thing will happen no matter which way you move the stick. It just happens at a different point of rotation of the rotor.

The tail rotor serves to keep the body from rotating due to torque and to steer the copter. It works very differently from the main rotor. The tail rotor changes pitch collectively which means that both blades increase or decrease pitch at the same time. The main rotor blades have cyclic pitch which means that one blade increases and the other decreases at some point each cycle or revolution.

The tail rotor is geared to the main rotor so that as the main rotor goes faster creating more torque, the tail rotor goes faster to compensate for the torque. So the tail should stay at some point at all times, but it will not because of changing loads. If you change the throttle too fast, the tail swings and you must control it by changing pitch. The torque from the engine turning the main rotor counter clockwise, turns the body clockwise. So we set the tail rotor to pull the tail counter clockwise when we increase the pitch, and we use the torque to let the body turn clockwise, so that we now have complete control of the tail in either direction. If you can understand this maybe it will help you to understand what you have to do to learn to fly this copter.

NOTE ON ROTOR BLADES

The blades in this kit are the same length as in our Hughes 300 kit. The longer blades were found to work better on all engines when hovering. However, you may find that when flying around the field and coming in for landings that you are having trouble getting the throttle low enough to settle. (This happens with engines which have more power than you need.) In this case, you should trim off from 1" to 2 1/4" off the tip of each rotor. (Then rebalance.) If you do trim the main blades, you may also want to trim the tail blades, you can take off up to 1/2" from each tip.

One more thing about the rotor blade assembly is the coning angle or the amount that the blades are raised at the tips. This is not too important but both blades should be the same. To check them, rotate the head so the blades are lengthwise of the copter and holding the rotor head, bend the head down against the springs all the way. At this point the blade over the tail boom should be about 3 to 3 1/2" from boom to tip. Check both blades in this manner bending the blade mount if necessary.

ENGINE POWER PROBLEMS

If after you have run 3 to 4 tanks of fuel through your engine, you cannot get off the ground, here are a few things to check. All these things are very important and can make great difference. The main blades should be covered with Monokote or equivalent. By now the entire drive system should be free enough so that when you spin the main rotor, it will rotate at least 3 - 4 complete revolutions. STP or Lubriplate should be on all gears. You should be using a good 10% nitro fuel. The needle valve in the carburetor should have been tried in several different settings. You should have the proper pitch in your main blades. This is normally the setting that the blade gauge gives you. But in some cases at different altitudes or different climates the blade pitch may have to be changed to get top performance. So try increasing or decreasing the pitch. If you set the blades so that the trailing edge of the blade is about 1/16" off the gauge, this will decrease the pitch about 1-2 degrees. If after trying all the above things you cannot get proper operation out of your engine, notify us at Du-Bro Products, and we will take care of the engine for you.

FLYING AND FLIGHT TRIM

When you are ready for the first flight, we suggest the training landing gear which is shown. With it you should be able to get off the ground without breaking anything.

First of all you should understand a little about flying a helicopter. You will not learn how to fly it overnight. It takes alot of practice and patience. There is no such thing as an expert. With a helicopter everyone is a beginner. Even if you have been flying airplanes for years, you are a beginner when it comes to flying a copter.

You first have to check and adjust trim controls. Do this by advancing the throttle slowly until the copter lifts. It should lift straight up. Once off the ground, the tail should stay in position without holding control. If not, cut the throttle and adjust the trim until the tail stays straight when you lift off. Also, if the copter moves forward every time you try to lift off, move the fore-aft trim control back slightly. The same for side control. Not much trim control is necessary to make a difference. Now that you feel that the trims are set, lift off and using only the tail rotor control, try to keep the copter pointing in the same direction. The tail rotor control is the hardest control to learn, and you must be able to control the tail before you can use the other controls with any accuracy.

The tail will swing as you increase or decrease power due to the torque change. The faster you change power, the more kick you get on the tail. So you will want to make your throttle changes as smooth as possible.

If, after a few tries, you seem to always give the wrong tail control or the control feels backwards, reverse the servo and don't try to fight it. All early flying should be done not more than two feet off the ground, so watch the throttle. Before you are ready to fly higher you must be able to control all four controls at the same time and in coordination with each other. Now if you are able to hold the tail a little bit, try the main controls. If the copter tilts and moves forward, move the control back to straighten up, the same for left and right control. At first you will probably over control and the copter will go in the opposite direction. You will just have to practice and get the feel of it. When starting out just try to hover or keep over the same spot. Do not try to move forward or in any direction. That comes later. For right now, just keep practicing.

We should mention that up to now, and for sometime to come, you should fly the copter when there is no wind if possible. The wind just makes flying that much harder and you have enough to do right now without fighting the wind too.

When you can hover or generally stay over or near one spot for an entire tank of fuel, which is about ten minutes, you are ready to try some forward flight. Again, let me say you should be doing all your flying at less than 3 or feet altitude. When starting to make forward flight, do so very slowly. Just bump the stick a little until the copter starts to move forward, then watch to see that it does not move too fast. The moving of the main control stick will control the speed of the copter, not the throttle as on an airplane.

As you get the feel of forward flight, let's try a few simple turns. When you are flying as you are now or down low and moving very slow forward, all turns must be made with the tail rotor control. So move forward and at the same time give a little left tail rotor and the copter should swing around to the left. Sounds easy, doesn't it? Well, keep practicing and soon you will be able to fly back and forth in front of you or stop and hover at will. It is still not a good idea to fly more than 4 or 5 feet up. Up to this altitude if you get in trouble you can just cut the power and drop down without hurting anything. Above that altitude you must fly it back down or crash. And speaking of flying back down, it is about time to start working on landing because you are getting ready to climb higher. As you will find out, going up is easy, but coming down seperates the men from the boys. This maneuver is one which you will have to work into very slowly and get the feel of it. I will try to explain as best I can and then it is up to you. There are three ways to get back down after you have gotten up there. One is to let down slowly over a spot more or less straight down. The second is to fly down by moving forward and descending, which is by far the hardest but the right way. And the third way is to crash. This is the easiest way but the hardest on the copter. To start with, use the first method and try not to use the third.

OK. Here we go. Assume you are 20 feet in the air. For heavens sake don't start that high, but use the same procedure and work up. Hold the copter in a hover and very carefully back off on the throttle watching very closely for the copter to start descending. As soon as it starts to come down, advance the throttle a little, not too much or you will go back up. Just enough to slow down the descent. Practice this maneuver in gradual steps going a little higher as you improve. I would say that if you were up 20 or 30 feet and start down too fast and you think you are losing control, open the throttle all the way and climb back. If you caught it in time you can save it and try again.

To land or come down as you're moving forward is difficult but very satisfying to be able to do so. To start with let us say you are up 20 to 30 feet. You should be able to set up a descent that would put you on the ground safely in about 50 feet of forward motion. This will give you some idea of how steep to come down. OK. Here we go. You are up 30 feet and moving forward. Keep the same forward speed and very carefully back off on the power and watch for the descent to start as before. But this time you should not need to put power back on unless of course you slowed down too much. So just watch the descend to see that it isn't too steep. Assuming you are coming in alright, as the copter nears the ground, pull back on the forward control to slow the forward speed and at the same time put on power to slow the descend. When you are good, the copter will stop in a hover about one foot from the ground and then you can let down to a soft landing.

When you have gotten this far it is time to start flying in more wind. As everything else in flying the copter, do this in slow steps. You will find the wind is like another control. It's there and it isn't. If it is a steady wind it is better because it is always there. When flying in the wind you are using your controls alot more than in calm weather. For instance, as you are moving up wind you need less power to keep from climbing, and going down wind you need more power to keep from settling. Remember your forward speed is airspeed, not ground speed we are talking about. If the wind is blowing 10 m.p.h. you are going 10 m.p.h. in a hover. Also the tail rotor is much harder to control in the wind. For instance, if you are hovering and facing into the wind you are holding forward control to stay over one spot. Now if you wish to turn right, you move the control to the right and the tail swings into the wind. It takes more and more control to bring it around into the wind until the body is directly cross wind. Now the wind is coming from the left side of the copter. At this point (if you haven't lost it already) you are holding left stick to stay over the spot and alot of right tail rotor control. Now continuing the turn you will use less tail rotor control as the tail comes around into the wind. At the point where the tail is directly into the wind the controls have again changed. Now you are holding back control to stay over the spot. Also the tail rotor is at its most difficult position to hold because if it moves either left or right and the wind catches it, it will swing around very fast unless you catch it. It takes alot of practice and time, but it can be done. The helicopter is capable of flying in the wind.

When starting out it is best to take off from a hard surface. When you become more proficient at flying you can take off from the grass. But the take off is done a little differently. You increase the throttle until the copter gets light and the rotor is turning at a good speed. Now open the throttle and get off the ground and out of the grass quick.

Another thing to watch for is when you are flying out away from you and the copter is 100 feet or more from you, you should not go into a hover because it is very hard to tell which way the copter is facing and what it is doing, so you can't tell what controls to give it to keep it upright. If you should find yourself in this situation, push the stick forward and start moving so you can tell which way is forward.

This copter is capable of very fast forward flight and can handle high wind conditions. But only after much practice. The controls have been designed to give very fast response to cut down on lag time which is good. But it makes it harder to hold in a dead hover. If you would like to have smoother hovering, you can cut down on the control movement.