$3.50

ASSEMBLY and *FLYING*

INSTRUCTIONS

DU-BRO TRI-STAR

R/C HELICOPTER

designed and manufactured by

DU-BRO PRODUCTS INCORPORATED

wauconda, illinois 60084

U.S.A.

TRI-STAR

Before actually beginning assembly, we suggest that you take a few minutes to read through the instructions; at the same time sorting and identifying each part. This will save you time during assembly and greatly reduce any chance of encountering difficulty. These instructions have been broken down into basic assembly groups. Use the exploded view drawings for identifying parts and locating their position in the copter.

NOTE: Before we actually start putting nuts and bolts together, let's look at the basic construction and how to hold it together. Most nuts and bolts have lock washers. On some bolts you should use Loctite. You will find small tubes of red and blue Loctite in your kit. Use where noted. The red is for bolts which will not be taken apart; however, they can be removed with heat such as from a small torch. The blue is for bolts which may have to be removed for repair or replacement.

Both red and blue Loctite should be used very sparingly. When putting bolts into nylon molded parts, DO NOT tighten them too tight - just snug them down. They will not loosen. If you tighten them too tight, you may strip the threads and they will loosen and come out. When working on the kit be very careful to do the best job you can and do it right. Keep in mind that to make a helicopter fly, everything must work properly all the time. If something is poorly assembled or improperly installed, your copter will not perform as it should or maybe not at all. So now if you are ready, with screwdriver and wrench in hand, let's have at it.

MAIN FRAME

Start by mounting the small bevel gear onto the 1/4" shaft. The gear is mounted on the end with the indentation for the set screw. Line up the hole in the gear with the indentation, use red Loctite and a 6-32 set screw. Install one of the small 1/2" O.D. 1/4" I.D. bearings in the main frame. See drawing for location.

Locate the large gear with the two bearings installed. This is the gear which will have the clutch mounted to it. The two clutch shoes are mounted to the gear with 6-32 x 3/8" bolts and a steel eyelet. Slip the eyelet through the shoe with the head of the eyelet on top. See drawing. Use red Loctite on the bolts. Snap the ends of the spring together to make a ring and slip it into the groove around the clutch shoes.

Next install the clutch lining into the clutch bell. The lining is pre-cut to the right size, so all you have to do is epoxy it in place. Put a thin film of epoxy on the inside edge of the bell and slip the lining in place. Be sure that the ends meet smoothly and

do not leave an edge which could get caught on the clutch shoe. Clean away any epoxy which may be left in the clutch.

Slip the shaft with the small bevel gear on it through the bearing in the main frame. Then slip on one of the small brass spacers which are 1/4" I.D. and about 1/8" long. Put the clutch bell in place on the gear over the clutch shoes. Then position this assembly so that the gear is to the front and the clutch is to the rear and slide the shaft through the entire assembly. Slip the other small brass spacer on the shaft and then one of the small 1/2" O.D. 1/4" I.D. bearings. Push them all the way into the clutch. See if the gear spins freely on the shaft. You may find that you will have to file away a small portion of the frame at the top. Before locking this assembly in place, we must check to see that the bevel gears line up properly. To do this, locate the main shaft mount and install two of the small 1/2" O.D. 1/4" I.D. bearings. Slip the main shaft through the bearings and using a 6-32 3/8" bolt, one #6 flat washer and blue Loctite to hold the shaft in place. Position the mount in its hole in the main frame just in front of the small bevel gear. You will note that the holes in the frame are offset slightly. This is so that they will not hit other holes in the frame. Do not bolt it down at this time. Slip the large bevel gear down on the main shaft and see how the two gears mesh. You may have to use some of the special washers provided to bring the small gear out far enough to line it properly with the large gear. THIS IS VERY IMPORTANT!

A properly meshed set of gears will have the rear edge of the teeth on the small gear in line with the outer edge of the large gear. If you need washers, you will have to remove the clutch and gear to do so. When checking this gear mesh, be sure that the shaft and small gear are back against the bearing and that the bearing is forward in its pocket against the frame.

Now that you have the proper gear mesh, remove the main shaft and mount from the frame. Using a 10-32 set screw, lock the clutch in place on the flat of the shaft. Be sure to push the shaft to the rear and the clutch bell to the front so that you have no slop.

Next you must locate, drill and tap the holes for the engine. We recommend the Max .40, K & B .40 or Super Tigre .40 as good engines for this machine. To mount the engine, slip the fan on the shaft. The flange should be toward the nut, not the engine. Then screw on the gear and tighten it. Lock it with the nut. Set the engine in the frame and position it so the gears mesh and the washer on the small gear will miss the large gear by about 1/32". This should make the front face of each gear even. Mark the hole location very accurately and drill and tap them for 6-32 bolts. Install the engine and make sure you have just a little slop between the gears. If you goofed and didn't get the holes just where you wanted them, enlarge the holes on the engine so you can move it around to the proper fit.

Install the landing gear so that the frame will stand up as you

work on it. Bolt the two steel legs to the frame with 6-32 x 3/8" bolts and lock washers. Mount the skids to the legs with 3/4" #6 sheet metal screws. You will have to grind the tips off because they are a little too long. Epoxy the skid nose piece in place on the front of each skid.

Replace the main shaft and mount. Bolt it down with two 6-32 x 3/8" bolts and use blue Loctite. Install the large bevel gear and lock in place with set screw and blue Loctite.

Bolt the starter belt plate in place with two 6-32 x 1/4" bolts. Mount the large steel U-shaped frame to the main frame using 6-32 x 1/4" bolts. The two holes which are on one side of the rear part of this frame should be on the engine side of the frame. These holes will hold the engine baffle plate later on.

Now you can install the gas tank. The tank should be a Sullivan 8 ounce slant tank. Mount the tank with the aluminum bracket and two 6-32 1/4" bolts. Mount it with the slanted portion to the rear, then the pick-up tube will only have to cross through the frame to the engine.

You can now install the engine baffle using the two 6-32 x 1/4" bolts and nuts.

The heat sink is next. The two halves are held in place around the head of the engine with the four mounting straps and four 4-40 x 3/4" bolts and small 4-40 nuts. Depending on which engine you choose, the heat sink may fit slightly loose. If so, just file the two edges so the two halves will not come together when put around the head. On some engines that have a slightly larger head, the heat sink halves will simply spread out to fit around the head.

Mount the bellcrank bracket to the frame with two 6-32 x 1/4" bolts. Bolt a bellcrank using a brass bushing and a 4-40 x 1/2" bolt and nut to the side of the bellcrank mount. This bellcrank should have an EZ connector installed on one end. See drawing. Install the second bellcrank on the front of the mount using a brass bushing and a 4-40 x 1/2" bolt and nut. This bellcrank should have the special EZ connector with the large hole installed. See drawing.

This completes the main frame assembly.

TAIL BOOM

Before installing the tail boom, we must first make up the drive shaft. This is done by epoxying one of the slotted steel sleeves on the end of the aluminum drive shaft. The aluminum drive shaft should go all the way through the sleeve. When the epoxy has dried, cut out the slot in the aluminum. Next you must mount the two nylon bearings on the drive shaft. The two bearings should be equally spaced on the shaft with one of the brass spacers on each side to hold the bearing in place. The brass spacers are epoxied

in place with about 1/16" fore and aft movement of the bearing. Now epoxy the other slotted steel sleeve in place. This is installed just like the one on the other end of the shaft. On one end of the drive shaft, epoxy the brass sleeve in place over the steel sleeve. This is now the front of the drive shaft. Slip the pin through the hole in the rear end of the small 1/4" drive shaft which you installed in the main frame. Then slip the front of the aluminum drive shaft over the pin. The pin should now be in the slot and held in place by the brass sleeve.

You can now slip the tail boom over the drive shaft. Be sure to lubricate the nylon bearings with grease or S.T.P. Push the tail boom into the main frame all the way to the bearing. Also make sure the end of the boom which has two holes in it is to the rear. The tail boom will be held in place with two 6-32 set screws, but do not put them in now.

This completes the tail boom assembly.

TAIL ROTOR

Begin by mounting the bellcrank bracket to the gear box with two 4-40 x 1/4" bolts and lock washers. Install a ball pivot to each blade holder arm. This is done by inserting the ball through the hole, slipping on a washer, then peen over the end. Do this carefully so you do not ruin the ball. You can rest the ball on a flat steel surface as you peen the end. Several light taps with a small hammer will work much better than a heavy pounding. (If you are assembling this for the Hughes 500, see instructions with the body for assembly of the gear box.)

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 gear box output shaft (the collar should 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.

The pitch control head is assembled by cutting off 1/8" from the end of each of the nylon rod ends. Insert the nylon rod ends into the H head and retaining with a 2-56 bolt through the H head and rod end. Next cut two 5/16" lengths of 2-56 stud and start one into each of the rod ends. Thread on one of the nylon ball sockets on the other end of the stud. Screw the ball socket on until it hits the rod end. Then unscrew until the ball socket will line up with the ball on the blade holders when the head is installed on the control shaft.

Many thanks to Mr. Larry Chapman for providing the original manual.

Slip a 3/32" collar on the control shaft and the nylon control head which you have just assembled, followed by a second 3/32" collar. Snap the nylon ball sockets onto the ball joint of the two blade holders. IMPORTANT: Make sure that the blade holder arms are leading the blades. This means that when you push on the control shaft, the blades will increase in pitch and when you release the rod the spring will return the blades to low or negative pitch. Set the collars and nylon pitch head out at the end of the control rod. The outside collar should be flush with the end of the rod. Also the nylon head should be free to spin on the shaft.

Tail rotor blades can now be finished with either paint or film covering and attached to the blade holders with a 4-40 x 1/2" bolt and nut.

Before installing the gear box on the tail boom, slip the tail skid mount onto the boom. Push the gear box onto the boom and while holding the blades, rotate the main shaft until you feel the pin in the gear shaft slip into the slot of the drive shaft. Push the gear box the rest of the way on the boom and line up the holes in the gear box with the holes in the boom. Bolt the gear box in place with two 4-40 x 1/4" bolts. You can now rotate the gear box and boom in the main frame until the tail rotor blades line up parallel with the main shaft. Lock in place with the two 6-32 set screws in the main frame. Do not use Loctite. It is not needed and if you did use it you will not be able to remove the tail boom.

Next mount the tail skid. With a 6-32 X 1/4" bolt and a lock washer, bolt the skid to the gear box and the front of the skid to the tail boom with the mounting bracket.

This completes the tail rotor assembly.

RADIO AND CONTROL INSTALLATION

Trim the flange from each of the two halves of the plastic radio box. Note that one is smaller and will slip inside of the other one. The larger of the two will be the bottom and can be bolted in place with the front steel protector strap. See drawing. A hole should be cut in the lower rear edge of the box for the servo wires to pass through. A small hole should be made in the lower front edge of the box for the antenna to go out. With the box and the steel front brace in place, you can mount the front servo rail using two #2 x 1/2" sheet metal screws. You must drill holes in the bracket for the rear servo rail. To do this, set a servo in place and hold the rear servo rail in the proper location and mark where you want the holes. Drill the holes and install the wood rail using the #2 x 1/2" sheet metal screws.

Now you can mount your servos.

Many thanks to Mr. Larry Chapman for providing the original manual.

First, let's look at what the radio should do. I think the two-stick transmitter is best. This way each thumb has only two things to do. The throttle is normally set up on the left stick and you can 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 backwards 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.

The throttle servo can be mounted upside down so that you have a straight rod to the engine. But if you plan to install the collective pitch head later on, install the servo right side up and bend the push rod to get down to the engine.

The tail rotor servo should be mounted on the far left side. You can make 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. The cable is run through the length of nylon tubing supplied in the kit. Screw a 4-40 stud in the hole in the left side of the main frame and then screw a 1/8" collar on the end of the stud. The nylon tubing will slip through this collar. Let it stick forward about 1 to 2 inches and wrap some tape around the tubing holding it to the tail boom at the rear.

The radio switch can be mounted to the body. The radio box cover can be held in place with a rubber band. Slots will have to be cut in the sides of the top of the box to clear the bolts that hold the lower part of the box in place. When flying without a body, no switch is needed. Just plug the battery into the receiver to turn it on and unplug it when finished.

This completes the radio installation.

I would like to suggest at this time that you go over all you have done so far and be sure that all bolts are tight, that all gears are lined up and that everything turns freely. Also, take

a break, have a can of beer or whatever, and get ready for the last and most important part of the assembly - the main rotor.

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. Next, wash the bearing mount and the two 10-32 x 3/8" set screws in thinner to remove any oil. Position the bearing mount between the bearings in the yoke with a flat washer on each side between the bearing mount and the bearing. Slip the 10-32 x 3/8" set screws through the bearings and thread them into the bearing mount. 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. Remove the 10-32 x 3/8" set screws and put red Loctite on them. Re-install the set screws, this time screwing them in until they hit the flybar housing. Do not over tighten, just snug them down; otherwise the flybar will not rotate freely in the housing.

Slip the flybar rod through the flybar housing. Put the 3/16" I.D. 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 that 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 set screws 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 set screw.

The main rotor blades have been carefully selected at the factory to provide reasonably 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" bolts 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, (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 a 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 one 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 adjustable wrenches and twist the blades until they are both the same pitch and laying on the gauge. See drawing.

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 any 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. If you do use Loctite and it breaks, 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.

SWASH PLATE ASSEMBLY AND INSTALLATION

Using red Loctite, install the front control pin in one of the holes in the lower outer ring of the swash plate. In the same way, install a 4-40 x 1/2" stud in the hole to the right of this hole, which will be the left and right control imput. Slide the shorter of the two brass spacers on the main shaft and then the swash plate

slipping the front control pin into the EZ connector on the bell-crank. Slip on the longer brass spacer followed by the large collar which is the mount for the scissors. Do not lock this collar in place at this time.

The two main parts of the scissors must be bent so that they will fit each other and the collar. Mount the larger part to the collar using the two steel eyelets and two 4-40 x 1/4" bolts. Bolt the two main parts of the scissors together using one 4-40 x 3/4" bolt. NOTE: One side of the large scissors half is threaded and the other side has a clearance hole in it. Slip the bolt through this side, through one side of the small part of the scissors, then thread on one of the brass swivels. Slip the bolt through the other side of the small part of the scissors and thread it into the outside of the large part of the scissors. Lock the bolt in place with the small 4-40 nut. Be sure you do not squeeze the two parts of the scissors because they must move freely at this point. Spread the small ends of the scissors and insert one of the brass swivels and squeeze the ends together again. Thread a 4-40 x 1/2" stud through this swivel and using red Loctite screw it into the top ring of the swash plate. Don't get Loctite on the swivel.

Make a push rod to go between the bellcrank and the side control of the swash plate. This consists of a brass swivel on the stud in the swash plate, a Kwik Link snapped on the swivel, the very short threaded push rod (it will have to be cut even shorter) and fitted into the EZ connector on the bellcrank. Mount the rotor head on the main shaft using the 10-32 x 3/4" bolt and nut. Rotate the swash plate and scissors until the brass swivel on the scissors is under the brass swivel on the control arm on the flybar. Make a push rod to go between the two swivels. Now to set the scissors collar on the main shaft, hold the scissors directly over the fore and aft control input on the lower swash plate ring. Then rotate the rotor blades so that the tip of the one over the tail boom is about 2" from the tail boom. (The tail boom should be in front of the blade, or if the blades were rotating the blade would not be to the boom yet.) At this point, lock the collar on the scissors to the main shaft with the set screw.

This completes the construction of the mechanical part of the helicopter.

SET UP AND ADJUSTMENTS

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.

Lubrication is very important. Be sure to keep the steel gear on the main shaft lubricated with S.T.P. or Lubriplate. Also the tail

rotor gear box should be lubricated after every 8 to 10 tanks of fuel. (A glue gun works very well for inserting the grease in the tail rotor.) 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.

OK. Now the final adjustments. Let's first adjust that push rod going from the scissors to the flybar control arm. 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 degrees 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 when checked at the same point in rotation.

If the two paddles are not level or at the same angle, adjust the push rod until they are. Let's say that the swash plate is level and the first paddle is angled. When we rotate the head and check the other paddle, it is angled down. To correct this, adjust the push rod until the paddle that is angled down is now level, not angled up like the other paddle. The adjustment should remove only half of the difference between the two paddles because as you adjust one paddle up, the other one is coming down. When adjusted properly, both paddles will be in the same position at any one point of 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 set the blades in their holders 90 degrees to their normal position (set the blades forward of rotation). 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.

Now rotate the blades so that one blade is parallel with the boom or adjust the Kwik Link on the end of the control cable so that the blade will be parallel with the boom. Rotate the blades so that you can see if the other blade is set the same (it should be). If not, unsnap the ball link on the blade holder and adjust it until this blade matches the other one.

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.

One more thing about the main rotor 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 2 to 2 1/2" from boom to tip. Check both blades in this manner bending the blade mount if necessary.

That's about it. Let's put the body together and then the construction will be complete and we can get down to flying this thing.

BODY

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. After the body has dried, remove the clamps and trim the edge down to about 3/16" all around. Cut the windshield out of the piece of clear plastic provided using the template. The windshield can be held in place with Plastic Weld available in most hobby stores. It is made by Plastrut Inc., 1621 N. Indiana Street, Los Angeles, Calif. 90063.

The body is held in place using the four stand offs and 6-32 bolt The long stand offs and bolts go in the rear. The short ones go in the front. No side windows are provided to allow easy access to the servos and the full-size Scorpion does not have side windows. We also suggest that while learning to fly or if you know how to fly, your first few flights be flown without the body. Make very certain that the push rod up the flybar cannot hit the body as it turns. It should have at least 3/8" clearance all around.

HUGHES 500 AND ENSTROM BODY ASSEMBLY

The two bodies are assembled basicly the same with only minor changes and additions. So we will write the instructions as if we were building one body and just make notes where necessary.

Start with the two front halves. They should be separated by cutting them apart in the middle. You have an option here - you can cut out all the windows and install the green window material or you can leave them in and just paint the windows. If you elect to cut out the windows (which I recommend as it will look

much better), you can do so by first cutting out most of the window with a pair of small, sharp scissors leaving about 1/8" left to be cut out. This last bit can be carefully trimmed away with an X-acto knife. Work slowly so you don't slip. After all windows have been cut out, you can sand the edges with fine sandpaper for a smoother looking edge. Now lay the green window material inside of one half and mark off the parts that you will not need. (Do not cut each window out, but leave all window coverings in one piece.) Trim away the parts you don't need. You should leave about 1/2" around the windows when possible. Using masking tape, hold the green windows in place in the body half. Make sure you have it in the right spot so that it will fit perfectly. Now using the Plastic Weld, flow it around all edges of all windows from the outside, then around the green from the inside.

With the windows in both halves, you can now put the two together using lots of snap clothes pins as clamps. Be sure to line up the two sides so that the body will come out straight. Using MEK or Plastic Weld, cement the two halves together from the inside. The bottom portion of the body can be cut out now or before cementing the two halves together. It doesn't make much difference.

For the rear half, trim out each half of the rear section leaving about 1/2" flange around where the seam will be, cut out the bottom section. Clamp the two halves together using MEK or Plastic Weld from the inside. While this portion is drying, (it should dry at least one to two hours for a good seam), you can go back to the front half and trim the seam down to about 1/8" all around. To do this you can use a knife or you can sand it off using coarse sandpaper, or it can be cut off with a Dremmel tool and one of the small cutting blades. Now if the rear portion is dry you can do the same to it. At this time you can fit the rear portion onto the front and using the #2 x 1/4" sheet metal screws, screw the two parts together. Three screws on each side will do the job. For a longer lasting joint, each of the six screw holes should be backed up with scraps of plastic. Two 3/4" square pieces cemented together and then cemented inside the body will work fine.

The tail sections are different, so we will handle them seperately.

First the Enstrom. Trim out and cement the top and bottom of the stabilizer together. Be very careful with the cement on all tail surfaces. Use very little, just what you need. The plastic is so thin that too much cement will destroy it. As the stabilizer is drying, cut out the two tip plates using the template and the heavy plastic. When the stabilizer is dry, cut it in two. Trim the ends square and trim one end of each to fit over the stump portion on the side of the body. The stabilizer should be trimmed so that when both halves are on the body, they form a straight line and are 90 degrees to the body. Now cement in place and cement one of the tip plates on each end of the stabilizer.

You will find two stand offs in the Enstrom kit. These should be mounted to the front frame in the rear holes. A 6-32 stud is Loctited into each stand off with about 1/4" sticking out. This is then screwed into the frame.

Now with the switch mounted in the lower front half of the body, slide the front portion on the frame and bolt it lightly in place on the studs. With the tail rotor gear box removed, slip the rear section on the frame and screw it to the front section. Don't forget to feed the tail rotor control cable out through the exit provided. Also check the balance. You may have to add some nose weight. You will also have to provide a filler tube for your fuel tank. This can be a piece of fuel line coming out the side of the body and you may want to make an extension for your needle valve, so you can adjust it from the outside, although I have never found this necessary using the Max .40 engine. Once the engine is running properly, the needle should not need adjustment.

This completes the Enstrom.

HUGHES 500

Cut out all parts of the tail surfaces. Leave about 1/8" around the edges to be joined and clamp together. Carefully cement together. Remember, use very little cement on this thin plastic. When the parts are dry you can trim the edges closer if you wish.

Slip the top part of the fin over the stub on the body (the top part is the long one). When you have it in place and lined up square with the body, cement it in place. Do the same with the lower half. The stabilizer is mounted a little different. You will note that one half of the stabilizer has the end which will mount to the body angled down. This half also has a dent about in the middle. This is the top half. The bottom half has the end which will fit on the body, slanting up as you look at it in the sheet, before you cut it out. Both of these halves should have the end left on as they will be the only surface to mate with the body. When the stabilizer halves have been cemented together and have dried and trimmed. the stabilizer can be cemented to the side of the body.

Now make a brace out of the heavy plastic about 1/4" wide and cut to length to fit between the top part of the fin and the stabilizer. When you have a good fit, cement in place.

To mount the Hughes body to the helicopter, you must make some changes to the helicopter itself. First the landing gear must be longer. This is done by first removing the landing gear from the frame and bolting on the two steel brackets provided in the body kit. When they are mounted you can bolt the landing gear onto the brackets. This will lower the landing gear about 1 1/4".

Now for the big change, it concerns the tail rotor. If you want

your Hughes 300 to look scale, you will have to turn the tail rotor gear box around so that the blades are on the left side of the body rather than on the right side. You can, however, leave the tail rotor as it comes, but you will have to leave the stabilizer off because it is mounted on the right side.

CAUTION: Do not try to put the stabilizer on the left side of the body, as this will affect the flying of the helicopter. If you are going to put the rotor blades on the left side, proceed as follows. (We will assume that the tail rotor has not been assembled. If it has, just remove the blade hub and all the controls from the gear box.) Remove the snap ring from the gear box which holds the prop shaft in place. (This is the shaft with the hole through it.) Slip the shaft out. You will find the one bearing will stay in the gear box. Good, leave it there. Remove the bearing from the shaft. Turn the shaft around and slip it back into the box short end first. Slip the bearing back on the shaft and into the box and re-install the snap ring. You now have the prop shaft coming out the left side of the box. Install the bellcrank mount upside down so it will stick out on the right side of the box. Now assemble the rest of the tail rotor in the normal manner except for the blade holders.

VERY IMPORTANT: Pay attention as I explain this.When connecting the blade holders to the pitch control head, the blade holder comtrol arms must be trailing the blades. The arms must be torward the trailing edge of the blades. Now this is backwards to the normal set up, but the blades are also on the other side of the body now. Just keep in mind, no matter which way you hook it up, the blades should increase in pitch when you push on the control shaft. Also the blades will be in the holders backwards or with the flat or bottom side out the airfoiled side toward the body. If you do turn the tail rotor around as just described, it will not change any of the flight characteristics.

The tail skid provided with the Hughes 500 body should be assembled and installed at this time. Solder the thre ded rod onto the end of the wire skid, screw a 6-32 nut on the threaded rod, screw the rod into the gear box and lock in place with the nut. Do not tighten too tight because you might strip the threads in the case. If you should damage the tail fins on the Hughes, the entire tail group will be available as a replacement package. So you can just remove the old broken parts and replace what you need to.

Before flying the Hughes 500, be sure to check for balance. You will probably need to add weight to the nose. As you pick the model up by the flybar, the rear of the skids should come off the table about 1/2" before the front of the skids. This is very important on this model. It will not fly well at all if it is tail heavy.

Many thanks to Mr. Larry Chapman for providing the original manual.

Just before you start to try to fly this thing, I would like to try to explain just a little about how a helicopter works. It is very difficult to understand a helicopter and I don't 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 degrees 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 <u>input</u>. Movement of that paddle will start now, 90 degrees from the tail where we started the input control. As the paddle passes over the nose it will <u>actually</u> be at its lowest <u>movement</u> 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 conter-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.

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 a lot 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 fling 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 three 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 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 a lot 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 a lot 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 a lot of practice and time, but it can be done. The helicopter is capable of flying in the wind.

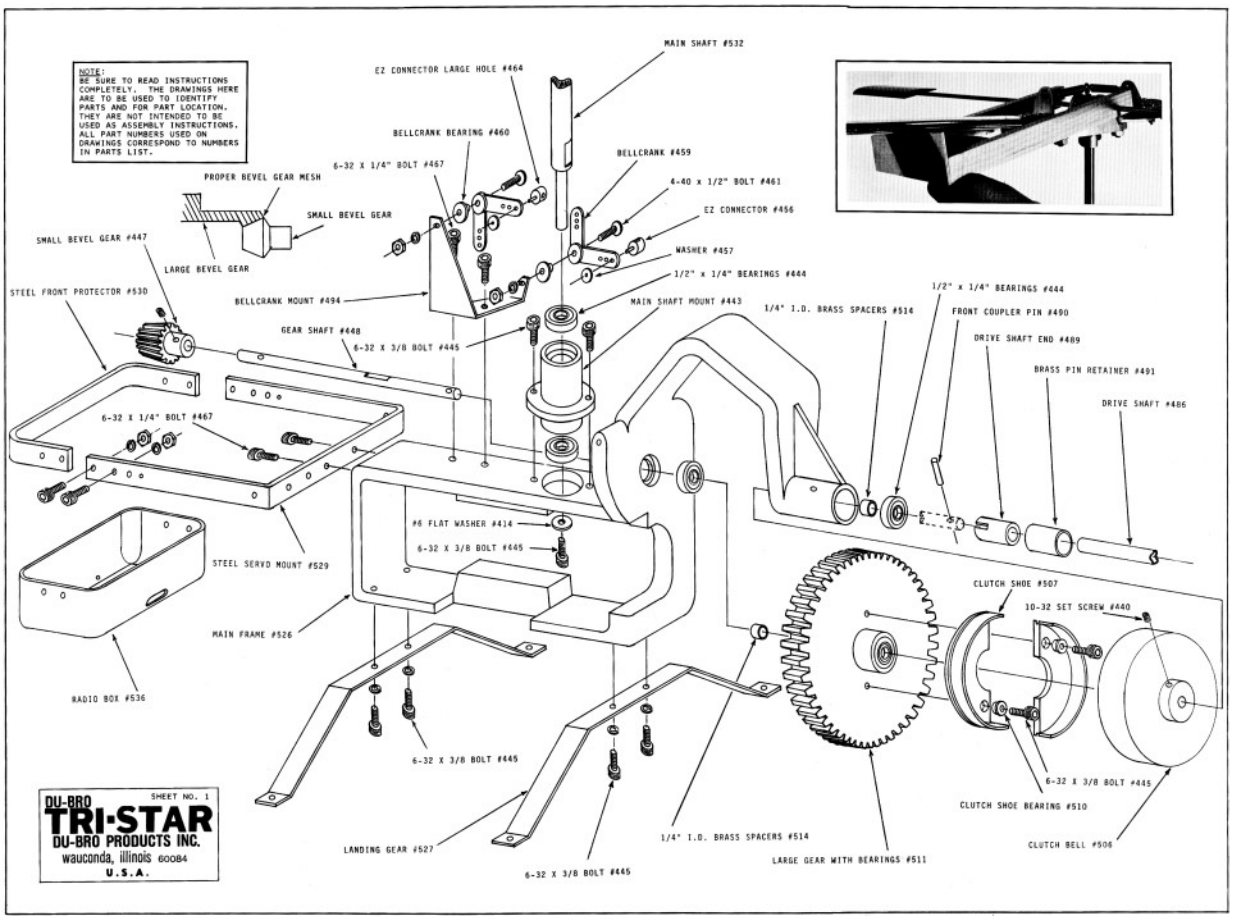
Many thanks to Mr. Larry Chapman for providing the original manual.

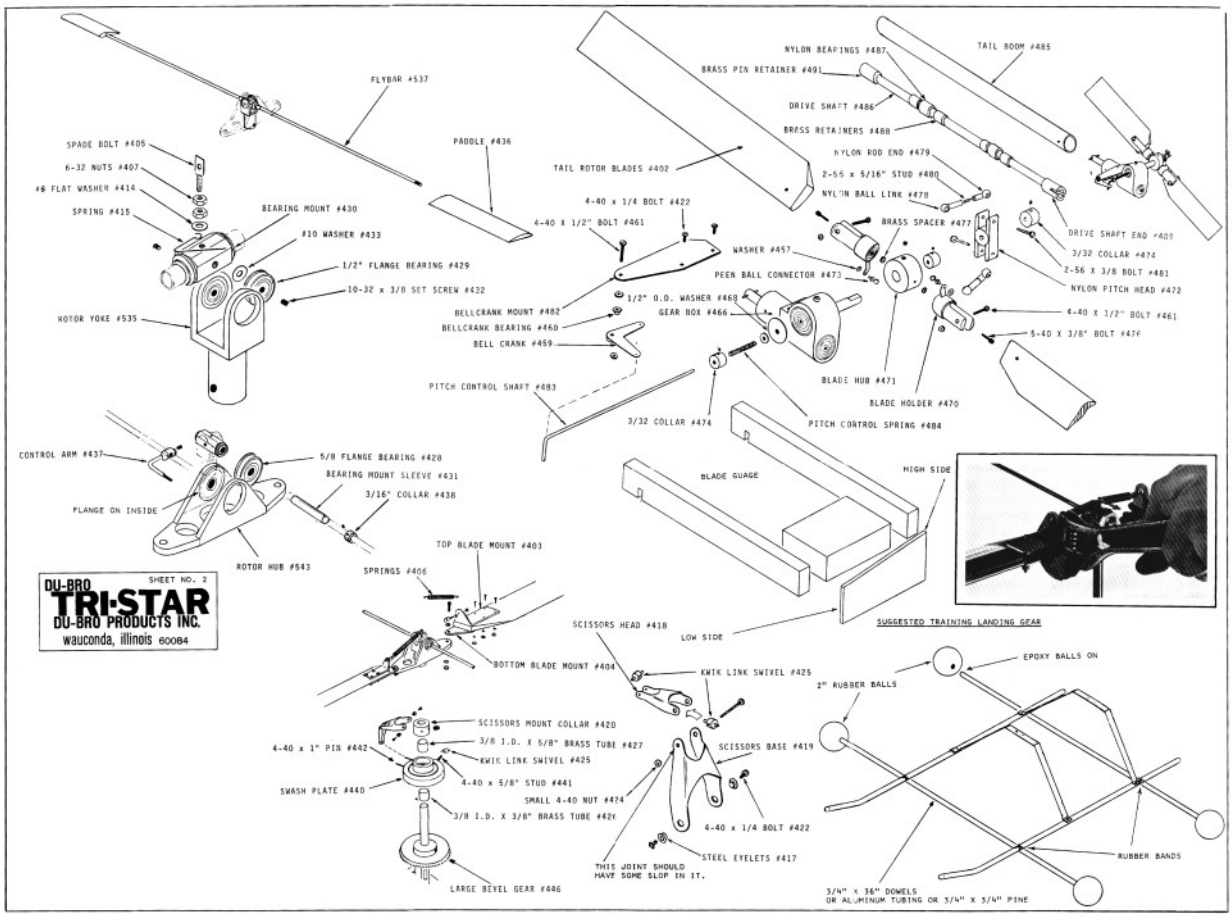
When starting out it is best to take off from a hard surface. When you become more proficient at flying you can take off from the grass. But the take off is done a little differently. You increase the throttle until the copter gets light and the rotor is turning at a good speed. Now open the throttle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

The 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 a soft feel to the controls. When learning and for very smooth flying if you wish to have more control for faster response and more maneuverability, you can drill holes in the flybar paddles. Up to eight 1/2" holes can be drilled in each paddle and then cover the paddles with Mono-Kote.

Many thanks to Mr. Larry Chapman for providing the original manual.





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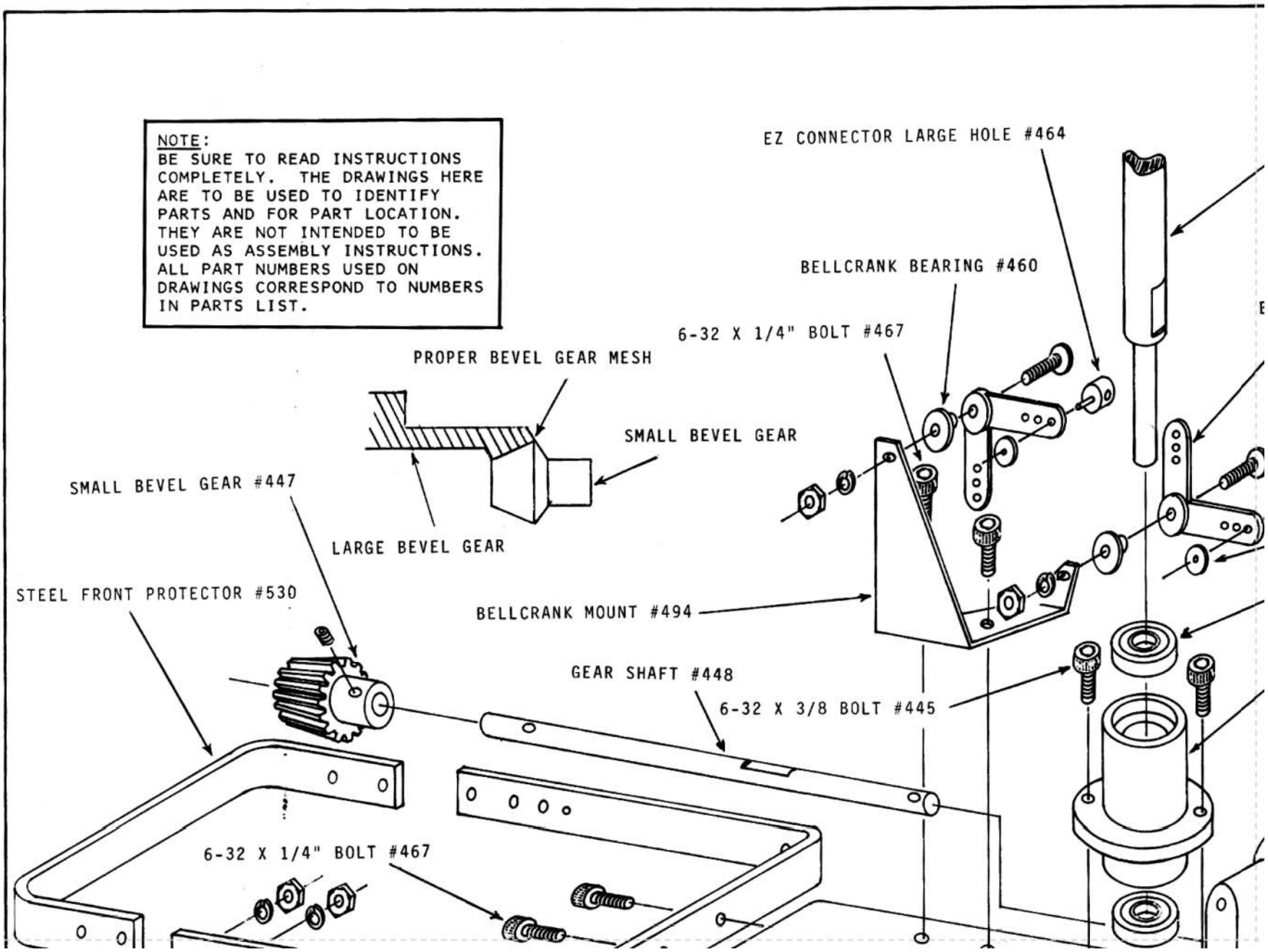

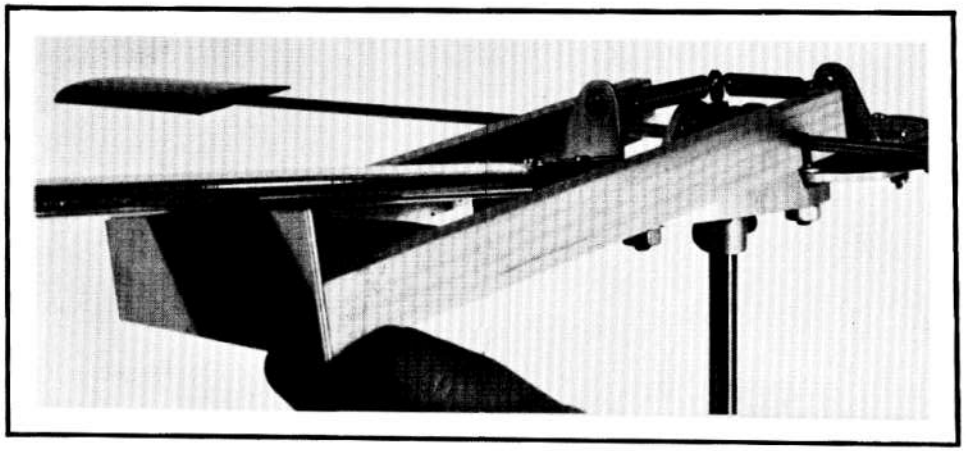

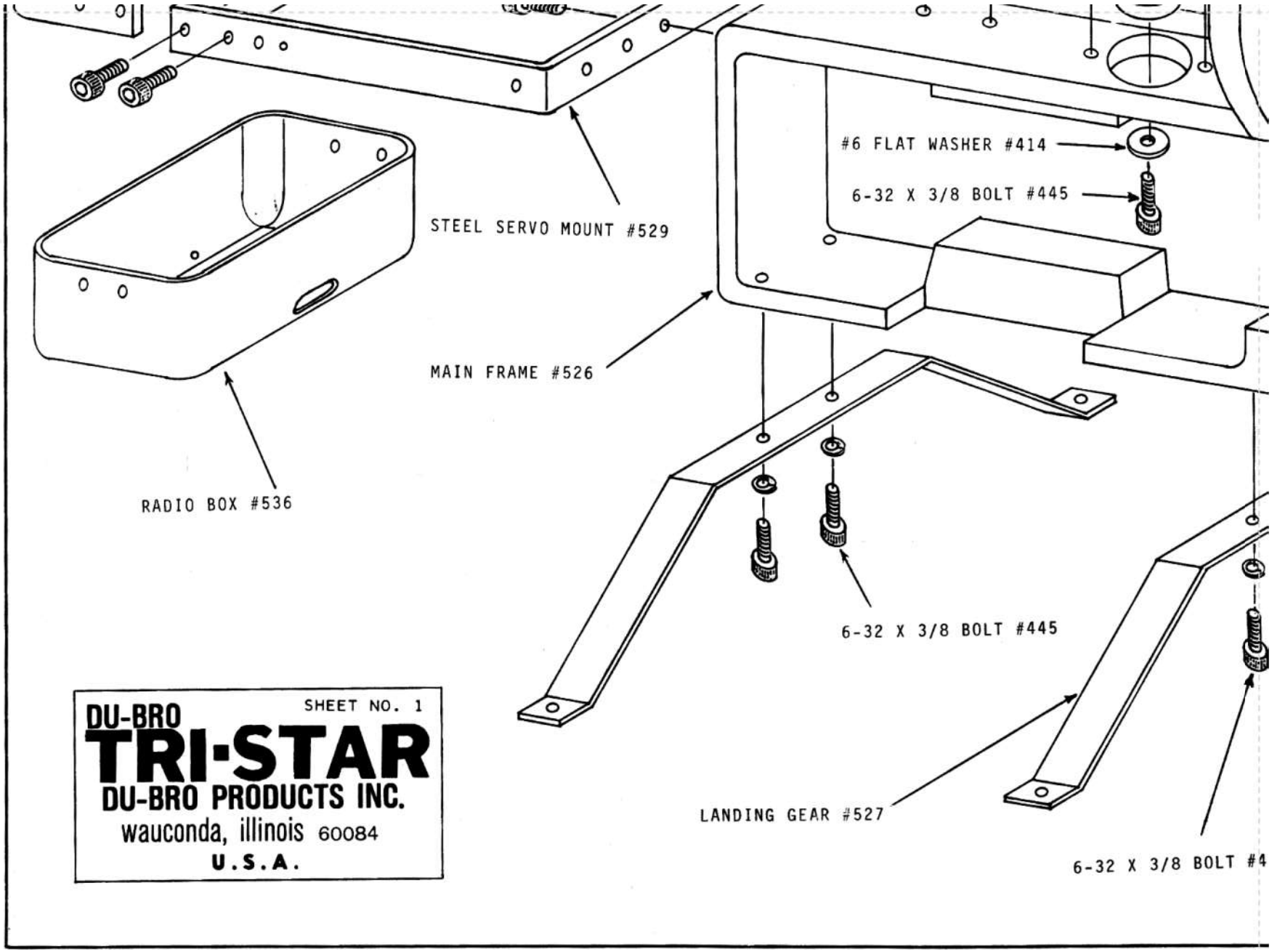

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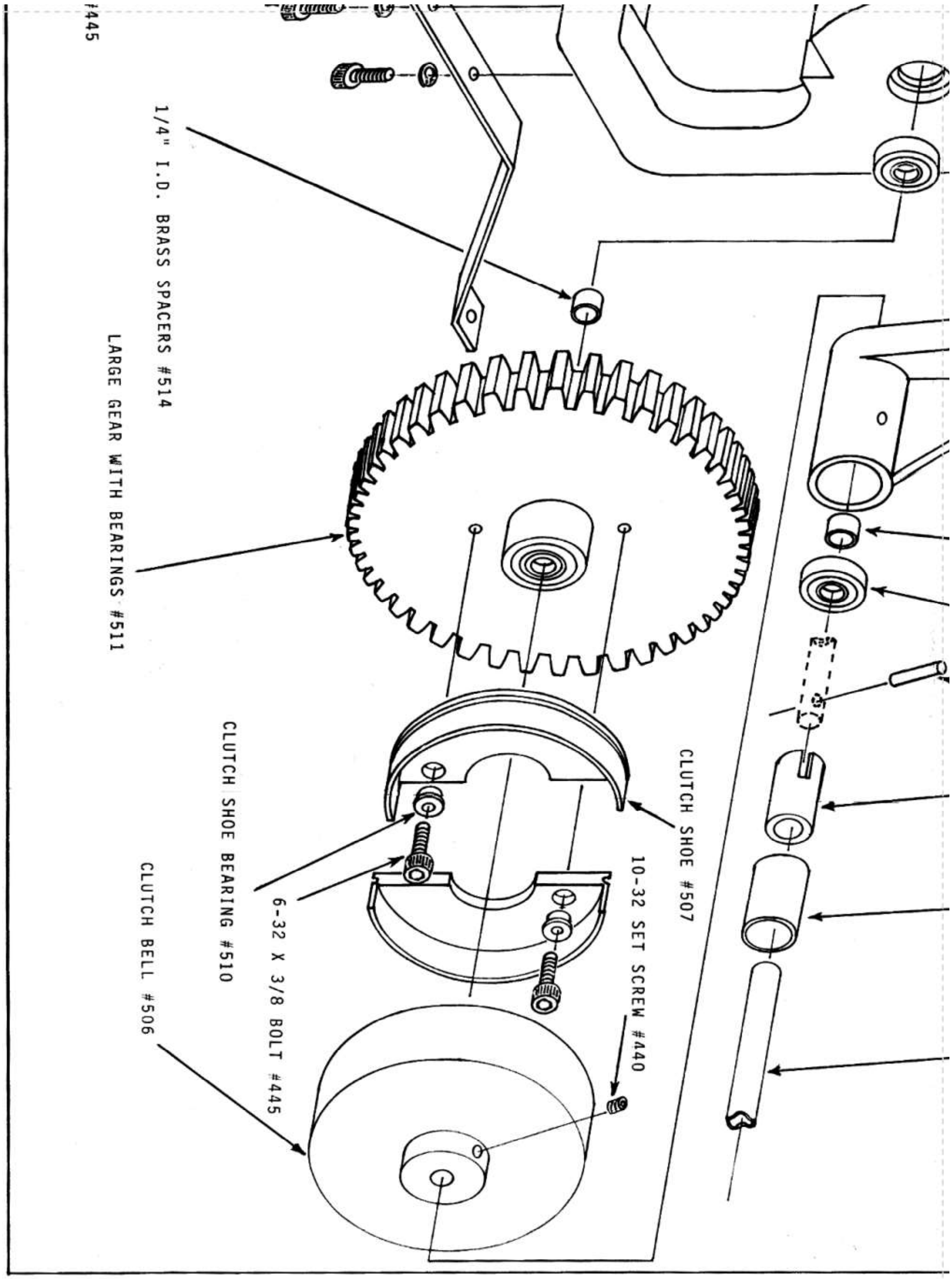
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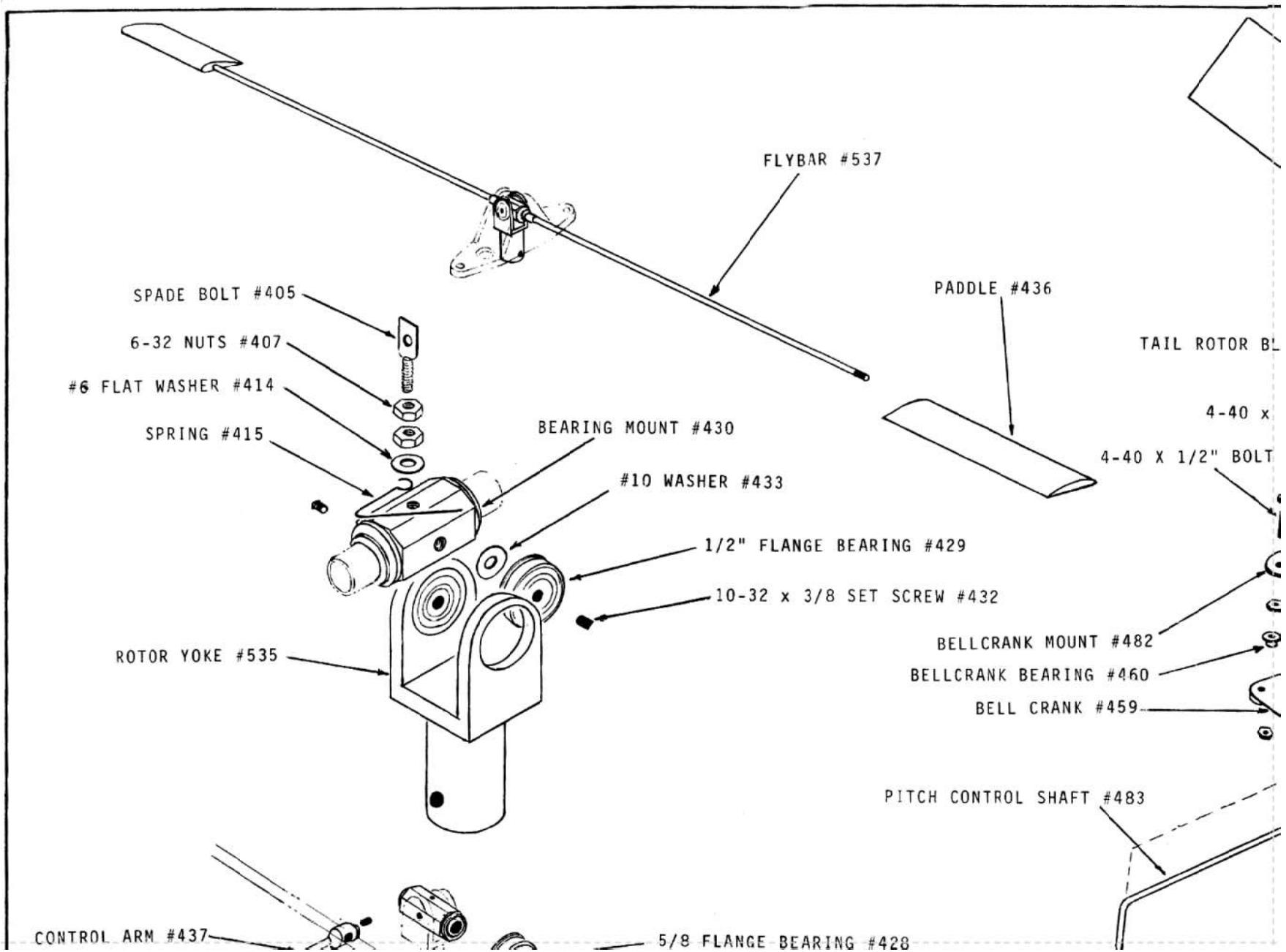

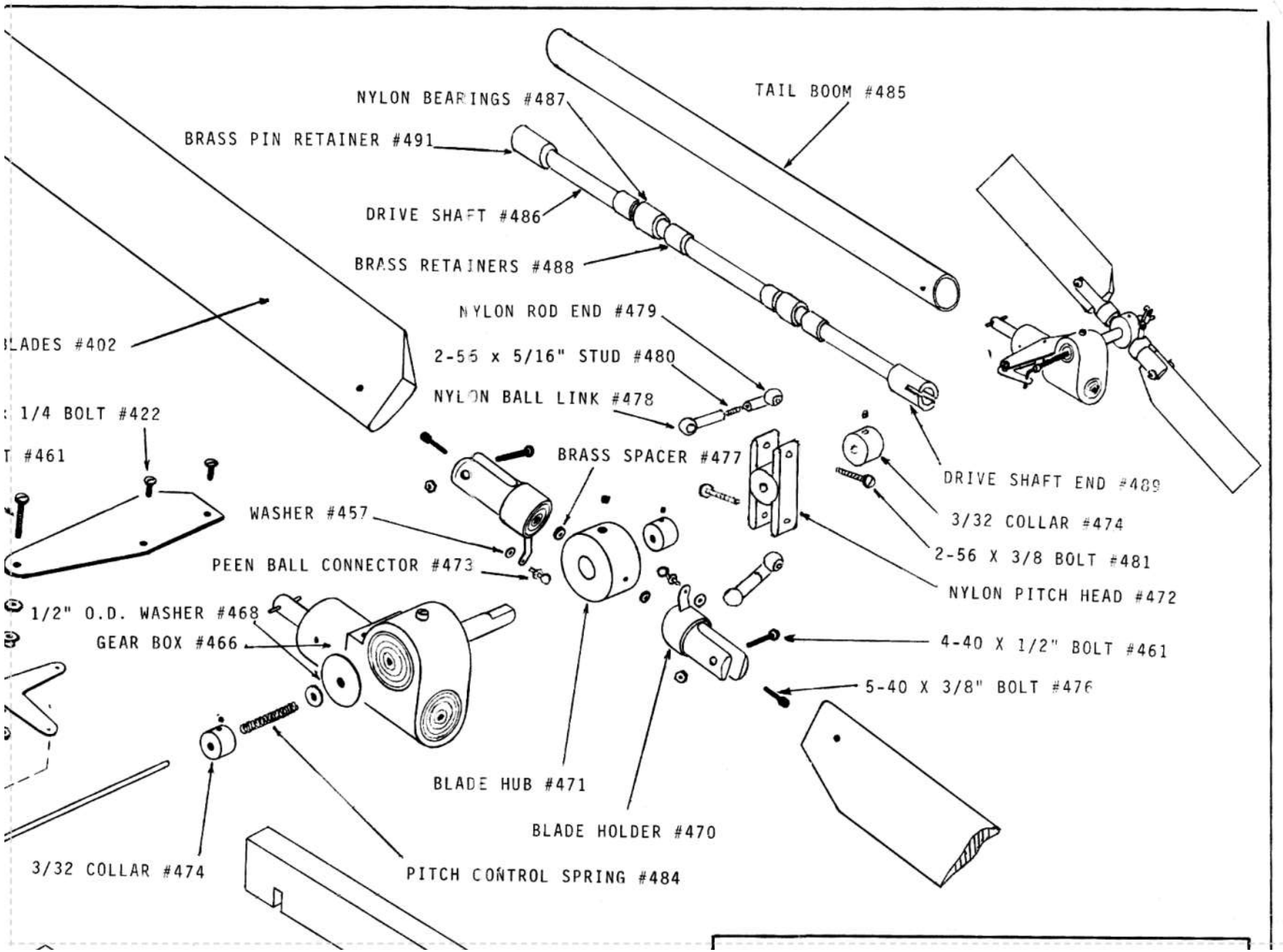

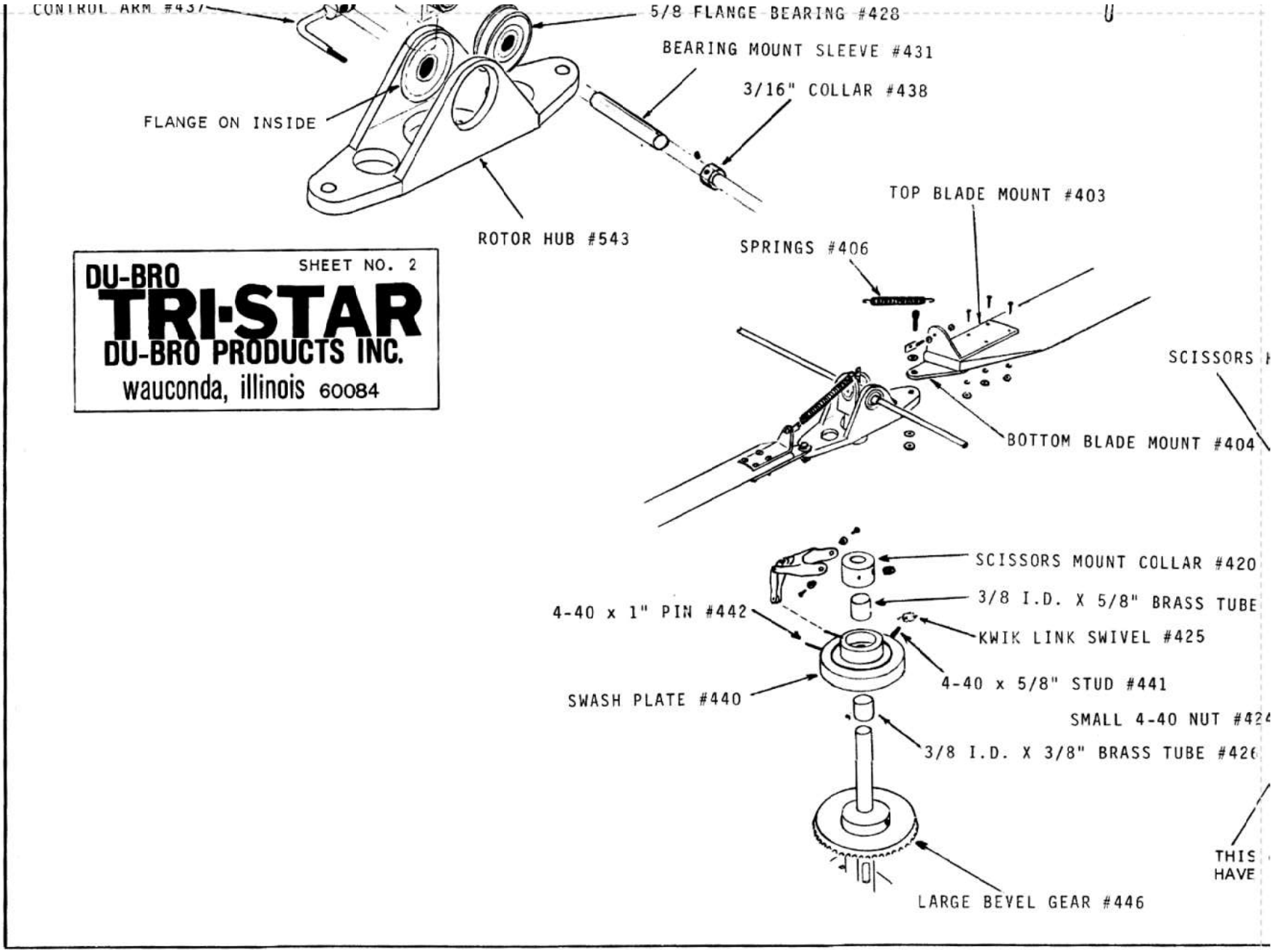

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