HUGHES 300C

1/8 SCALE
RC HELICOPTER

ASSEMBLY

Instruction Manual

GORHAM MODEL PRODUCTS

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GMP HUGHES 300C

Congratulations! You have purchased the world's simplest and best performing small scale R/C model helicopter.

The history of R/C model helicopters spans just over a short ten years. In that time we have seen rapid strides in technology and performance. We now have R/C model helicopters which can equal their fixed-wing counterparts in every respect, and exceed them in some. Imagine seeing a fixed-wing airplane hovering inverted!

While the pressure of competition between the flyers and the manufacturers has produced very sophisticated and excellent performing machines, we seem to have overlooked one simple fact - that there are very few people, still, who can fly an R/C helicopter. The GMP "Cricket" was developed, therefore, with this main objective in mind: to produce a machine which the learner can build easily, adjust simply and learn to fly in a short time.

Another objective in the design of all GMP R/C helicopters is to produce durable machines which are simple, well engineered straight forward to manufacture, and easy and cheap to repair after a crash. Achieving these objectives produces helicopters which are simple and easy for the beginner to build and fly, but at the same time possessing good flying qualities and inexpensive repairability. What we did not fully realize that we had produced with "Cricket", was an R/C model helicopter with such controlability that it has proved to be very attractive even to the expert as his second or sports machine.

The GMP "Hughes 300C" is a derivative of "Cricket". It retains all of the attractive features of "Cricket" which has endeared it to so many beginners, but the GMP "Hughes 300C" has many new features of its own. Some of these are in the category of making it as scale as possible. Others are to insure continuance of the traditional characteristics of Gorham Model Products - quality, performance and service.

ASSEMBLY NOTES

General

This kit has been prefabricated to the maximum possible degree and you will only need simple tools to assemble and adjust this R/C model helicopter. The design has been very carefully thought out and we strongly urge you not to change any of the design features without duly considering the effect of this on other working parts of the helicopter. The GMP "Hughes 300C" inherits may design ideas from "Cricket" which was more than one year in design and development and this time was used to simplify and improve the design as much as possible. A simple aircraft is usually lighter and more dependable and, for these two reasons, will fly better.

The parts of the GMP "Hughes 300C" are dimensioned in inches. However, there is a universal move in the world now toward the use of the metric system. Tt is also true in the design of small mechanisms, that metric hardware provides a more effective means of fastening parts together than the fractional hardware. Like "Cricket" the GMP "Hughes 300C", therefore, is a hybrid (or combination) of fractional dimensioning and sizing with the technical design advantages of the metric hardware system.

In order to make the best job of building the GMP "Hughes 300C" we suggest that a table top or bench space is cleared and covered to avoid damage to the surface. Always have good light available and you will need the following tools:

A small screw driver with about an 1/8" wide blade

A larger screw driver with about an 1/4" wide blade
A 7/32 nut driver (this fits the 3mm nuts)
A pair of small needle nose pliers
Metric allen keys (provided in the kit)
A socket wrench to fit the flywheel to the engine of your choice

The GMP "Hughes 300C" is a fully pre-fabricated R/C model helicopter. All of the metal parts are completely finished; there is no filing or fitting to do. The plywood is die cut out for you so there is no sawing to do. The blades are finished and sanded and only require covering. However, any R/C helicopter requires careful assembly and adjustment before you can safely begin to enjoy your first flights. Don't try to hurry the assembly. Like "Cricket", the GMP "Hughes 300C" is very simple and will go together very fast. To understand each stage thoroughly will not only produce a better model, but will also mean that you will handle problems better when these arise during the early learning period.

All nuts or metal parts which do not have a nylon insert (that is, a 'lock nut') must be 'Loctited' to the screw. The (L) symbol will be used in the text wherever 'Loctiting' is needed. Both parts must be thoroughly clean of any oil or grease, otherwise the 'Loctite' will not work properly. The R/C model helicopter is a combination of pieces which are either turning, shaking or vibrating and it is very necessary to make sure that all nuts and bolts are thoroughly tightened and locked. This should also be checked every few flights to 'catch' any of those nuts and bolts which may be loosening under the vibration. (Note: the 'Loctite' must be the non-permanent or removable type - otherwise...)

The building notes which follow are structured in a sequence which enables you to build the GMP "Hughes 300C" in the most simple and fast manner. Try and be patient and only open the bags in the sequence called for, except of course, for the hardware bag which must be opened at the beginning, and the necessary nuts, screws, bolts and washers taken out as required by each stage. You will need two other items as well as the GMP "Hughes 300C" kit. One is the engine and the other is the radio.

The Engine

The "Cricket" was designed to fly with a 0.19 to 0.25 cu. in. Schneurle ported engine and it does. The GMP "Hughes 300C" is a little heavier than "Cricket" so, while it will still fly well in a scale like manner with a 0.25 Schneurle, you can use larger engines if you wish (up to a 0.40 cu. in. engine). We expect a variety of engines to be used and so we have designed the engine mounting blocks in a very unique manner to accommodate most well-known engines so there will be no fitting to do in this respect either.

"Cricket" was designed to operate without a forced air cooling system. This was done deliberately to keep it simple and to get the maximum output of power to the rotor head where it could do "Cricket's" engine is mounted by two solid aluminum blocks to a thick main structural plate. This way some of the heat generated by the engine is conducted into the main helicopter frame which then provides an effective 'heat sink'. Convection (or air flow) cooling is also provided by mounting the engine in such a way that the cylinder head projects into the airflow of the main rotor blade system and also the forward flight air flow. To further improve convection cooling "Cricket" uses a "heat sink" mounted on the engine cylinder head. The heat sink is fitted so that it is in line with the forward line of flight airflow, projecting just outside the cabin profile. Now, with the GMP "Hughes 300C" design, several different design factors applied. First the "Hughes 300C" is heavier than "Cricket". Second it has a very wide cabin which "blankets" out the airflow to the engine cylinder head. For these two reasons the GMP "Hughes 300C" is fitted with a forced air cooling system as well as retaining the heat transfer effect of heavy block engine mounts. No heat

sink is needed with the GMP "Hughes 300C".

Radio

Since weight is one of the primary enemies of efficient flight and the GMP "Hughes 300C" is a very small helicopter, it is naturally best to keep the radio installation as light as possible. The normally available 4 channel radio will do fine. You do not need any special receivers. Most 4 channel receivers available will fit well into the space provided. So far as the servos are concerned it is preferable to use the now widely available 'micro' servos in order to get a compact radio installation and also to reduce the airborne radio weight. However, the GMP "Hughes 300C" will operate with servos as large as can be fitted into the servo tray arrangement. With the larger servos you may have to cut the openings along one edge to permit fitting of the servos. We have not found any radio interference problems with the GMP "Hughes 300C" and a number of different radios have been used successfully.

The flight battery pack can be any size between a 220 ma hour to a 550 ma. hour capacity but if you wish to preserve the whole cabin area free of radio equipment then a "flat" battery pack should be used. This can be divided into "two and two" sections to facilitate fitting under the cabin floor.

Details of the radio installation is covered later in the "Radio and Controls Installation" section of this manual.

Now let's start building the GMP "Hughes 300C". When the basic assembly has been completed you will find sections in this manual which will guide you through the setting-up phase and a separate leaflet will provide instructions on how to commence learning to fly.

BUILDING THE CABIN

The cabin of the GMP "Hughes 300C" is made of a special clear plastic designed to resist fuel and the vibration experienced in a model helicopter. The mold for the canopy for this cabin has been carefully designed to be as scale as possible and it leaves only the painting and finishing up to you to produce a very realistic looking model. Many of the modern R/C helicopters such as the "Cricket" have been designed so that the canopy halves can be very easily put together, utilizing a flat flange bent out at right angles to the canopy shape. While this provides easy construction it would not be in keeping with the full scale appearance which we want to have with our GMP "Hughes 300C" model. Consequently two halves of the GMP "Hughes 300C" will be assembled in a different fashion and those of you who have built "Cricket" should take careful note of this fact.

You will see on the left hand cabin half that the center edge of this half is rebated out before the canopy half turns to the right angle flange. You should cut the canopy, leaving this rebated edge to be 1/4" wide at all points around the canopy. (There is a faint line indicating the cutting point.) The right hand half of the canopy also has a line in the molding and you should cut this half along the line also. Now gluing the two halves together can be quite tedious but this procedure is a prerequisite to preserving a scale appearance. There are many methods which have been developed by individual modelers for making this task easier. Here's one method -

First cut out the back of the canopy to the dimensions shown in the sketch provided. "Tack" the canopy together in about five places using 1/2" paper masking tape. The tacking is performed by 3" or 4" long strips connecting the right and left hand halves of the canopy so as to

hold it temporarily in the right position. Then, using very small amount of a cyanocrylate adhesive, "spot" glue the canopy together in several places, making sure that the contour (especially on the transparent part of the canopy) is evenand pulled tight. Once the "tacking" has been accomplished you can carefully remove the paper tape and continue using the cyanocrylate adhesive, allowing it to run by capilliary action, between the two surfaces of the right and left canopy halves. Be careful that the cyanocrylate adhesive is not used too liberally since it can run onto the clear portion of the canopy and spoil the appearance for you. So use this adhesive very sparingly.

Other builders prefer to use a PVC glue along the seam before it is connected together. This provides an opportunity to move the canopy halves around a little bit before the glue finally sets. We have also used this method ourselves sometimes with good and, sometimes, with disastrous results when the two halves slipped and the PVC glue is deposited in places where we don't want it (ie. on the supposed-to-be transparent parts of the canopy). Whichever method you use, please build this part of your model slowly and carefully since a well-finished canopy reflects very much into the final appearance of your GMP "Hughes 300C".

After the two halves are connected together properly, by masking the transparent areas with paper tape, you can spray the rest of the canopy with a polyurethane paint. Use several coats, rather than one thick one, and you will get a better finish. When the polyurethane is dry you can remove the paper masking tape and then, by using trim tape, outline the desired parts of the cabin

For the "tail numbers" you can use 2" high vinyl lettering and some of the photographs in the literature contained in the kit will show you the position for this lettering. We have not included decals for this purpose since a flexible lettering is required to fit flat on the compound curve of the canopy and decals compound curve of the canopy and decals which we can provide are just not flexible enough.

Finally, you can use a second trim tape to highlight or outline the door and window edges. The decal sheet provided will let you add trim your model to look as realistic as possible.

STAGE 1 - MAIN FRAME AND LANDING GEAR

The assembly photo sheets will help to ensure that you carry out a fast and correct assembly for this stage. Use the following nuts and bolts from the hardware bag:

12 - 3x10mm Pan head screws
4 - 3x12mm Pan head screws
8 - 3x16mm Socket head screws
24 - 3mm Lock nuts
4 - 3mm Washers
4 - #2x3/16" PK screws

Slide two landing gear clamps on each landing gear skid. Position the landing gear clamps so that the rear one is 5/8"' from the end of the landing gear skid and the front ones are approximately 5 3/8" ahead of this. Now take the two landing gear cross struts and place them in the landing gear clamps. Make sure the cross struts are positioned so that the two off-set center holes which take the main frame later are toward the right hand side of the model. There are two ways that you can fit these cross struts. Now, using the 3x12mm socket head screws, connect the clamps to the cross struts with the screw heads on the outside of the model. As you do this, the landing gear tubular struts must also be put onto the screw before the nut is temporarily attached. If you look at the second drawing in the assembly photo sheet #1 you will see that you must now attach all of the landing gear tubular struts at the same time, using four 3x16mm socket head screws and four 3mm lock nuts. Temporarily attach the nuts on to all the screws. Now fit the two side angles using

four #2x3/16" self tap screws. Now finally tighten up all the nuts and screws in sequence. You should finish up with the landing gear assembly as shown in the photo sheets. By the way, while we have suggested that you project the landing gear skids by 5/8" at the rear of the landing gear cross struts, you should note that there will be a tendency for your GMP "Hughes 300C" to tip rearward during take-offs and landings so, if you are not too experienced a flyer and wish to have a more stable model on the ground (at least for the time being), then you should adjust the skids to project rearwards by an additional 1". This will detract from the scale appearance a little but will give you a better ground stability in your early flying attempts.

Now that you have a landing gear strut and skid assembly, you can start to assemble the main frame on to it. First take the two plain channels and fit these as shown on the two center holes of the cross struts (remember these should be to the right hand side of the model). Use four 3x10mm pan head screws, with the heads at the top and the lock nuts underneath. Don't fully tighten these until the rest of the frame is connected. Now you can attach the main frame, using two 3x12mm pan head screws and two 3mm lock nuts and, finally, the two vertical channels, using six 3x10mm pan head screws and 3mm lock nuts. Once this whole assembly has the nuts and bolts fitted you can then firmly tighten them.

The final part to fit in this stage is the tank mounting bracket. This should be fixed onto the right hand side of the main plate with the flanges facing up, using two 3x10mm pan head screws and lock nuts. The heads of the screws should be on the tank mounting bracket, or right hand side, of the model. You have now completed Stage 1 of your GMP "Hughes 300C".

Stage 2 - Rotor Drive Gear Train

Open Bag #2 which contains all of the parts necessary to build the rotor drive gear train. Reference to the assembly drawing and photo sheets will again be helpful for this stage. You will need the following hardware which should be selected before you commence:

8 - 3x30mm Socket head screws
1 - 3x20mm Pan head screw
8 - 3mm Lock nuts
1 - 3mm Hex Nut
1 - 4x4mm Socket head set screw

Take the main shaft, which is already fitted with the 60 tooth gear, and assemble in the following sequence. Above the gear (the opposite side to which the teeth face) fit two 9/32" OD x 0.40" long brass sleeves.

Next, slide on to the shaft the one bearing block, complete with bearing, which has an extra hole machined in one side. This extra hole should face away from the main frame when fitted. The exposed bearing surface should face down toward the brass sleeve and gear. On the end of the shaft, which protrudes from the other side of the gear (the side with the teeth), place one 9/32" OD x 0.40" long brass tubing, followed by another bearing block, complete with bearing. This bearing block should be assembled such that the exposed bearing is facing the 60 tooth gear.

Place this whole assembly up against the left side of the frame and secure the bottom bearing block by means of two of the 3x30mm socket head screws and two 3mm lock nuts. The screw heads should be on the same side as the bearing block, and the lock nuts on the opposite side of the main frame. Before you fit the 3x30mm socket head screws to the top bearing block, take the swashplate locating bracket and fit a 3x20mm pan head screw in the center hole with a plain nut facing outward (L). Tighten the nut to secure the screw firmly to the locating bracket. This screw will form the pivot for the T-lever assembly which will be fitted later.

Now fit the swashplate locating bracket on to the left side of the top bearing block, using the two 3x30mm socket head screws. Push the screws right through the block and the main frame to secure the top bearing block in the same manner as the bottom one. Fit two 3mm lock nuts and tighten.

Take the 3" intermediate shaft (which is already assembled to the 22 tooth nylon pulley) and fit the 1/4" ID washer on to the longest end of the 3" shaft up against the nylon pulleys. Fit the other two bearing blocks and fit them on to the 3" shaft on the same long end. The blocks should be fitted so that on the first block the bearing faces the nylon pulley, and on the second block the bearing faces the flat, or outside, end of the shaft. Now take the steel 15 tooth gear and fit the 4x4mm socket head set screw into the gear (L). Slide the gear onto the end of the shaft which has the flat and lightly secure by tightening the 4mm set screw. Fit this sub-assembly onto the main frame using the 3x30mm socket head screws. Secure with four 3mm lock nuts on the right hand side of the frame in a similar way to the main shaft bearing blocks. To set the backlash between the plastic main and steel bevel gear, place a piece of notepaper between them, tighten up all the nuts and, finally, remove the paper. See the main assembly drawing and assembly photo sheets to help you in completing this stage.

Stage 3 - Motor Drive Assembly

Bag #3 contains all of the parts needed for the motor drive assembly. In addition you will need the following items from the hardware bag:

2 - 3x10mm Socket head screws
2 - 3x35mm Socket head set screws

8 - 3mm Washers (Oversized)

4 - 3mm Lock nuts

Fit the flywheel/fan assembly to the engine which you intend to use. Note that there is a 1/4" diameter brass bush in the bag. This is used as a 'filler' in the larger bore of the flywheel when your engine has a 1/4" shaft. If your engine has a section of its shaft which is larger than 1/4" then by not using the "filler" bush your flywheel will still fit. Now you have a spare brass bush if ever you need one! Secure the flywheel/fan by putting the original 'prop' nut into the counterbore of the flywheel and tightening up well. Do not use 'Loctite' on this nut since it will make it difficult to remove the flywheel if you need to later on.

Fit the clutch and starting shaft onto the flywheel with the two 3x10mm socket head screws (L). Place the already assembled clutch bell onto the shaft and then fit the starting cone. Secure the starting cone with the two 3x5mm set screws (L) but make sure that a small gap (the thickness of note paper) is left between the cone and the small pulley. This is so that the pulley can rotate freely when the engine is at idle speeds.

Now place the drive belt over the large and small drive pulleys and fit the engine (using the universal mounting blocks) to the main plate. Four 3x30mm screws are used with double 3mm washers placed on each screw before the 3mm lock nuts are fitted and tightened up. The engine should be adjusted so that the drive shaft is approximately horizontal and the belt tension should be so that when the two sides are squeezed together with finger pressure they have a gap between each side of about 3/4". The belt can and should be run quite slack - much more so than a "Vee" belt which relies upon tension and the resulting friction for its grip. The GMP "Hughes 300C" drive system effectiveness depends upon a relatively slack belt tension so as to minimize friction and, hence, transmission drive losses at this point.

The belt may be removed at any time by removing the starting cone and slipping

the belt off the small pulley and off the 1/4" starting shaft. It may be refitted in the same way. The belt should be removed whenever the system is checked for correct line-up of the drive elements to the rotors, especially the setting-up of the tail drive wire and gearbox. Please refer to the assembly drawing for the correct line-up for the pulleys. Note, also, that the GMP "Hughes 300C" has been especially designed so that you may use a standard airplane muffler with your engine.

Stage 4 - Tail Boom and Tail Rotor Gearbox Assembly

Open Bag #4 to commence the assembly of the tail boom and tail rotor gearbox. From the hardware bag select the following items:

4 - 3mm Lock Nuts
2 - 3x12mm Pan head screws
6 - 2x10mm Pan head screws
6 - 2mm Hex nuts
2 - 2mm Flat washers
2 - 3x6mm Set screws
1 - 3x16mm Socket head screw
4 - 3x10mm Pan head screws

You will also need the following items from the rod bundle to complete this stage:

- Tail boom brace tube (left)
- Tail boom brace tube (right)
- Tail drive wire
- Tail drive wire tube

Gearbox

First we will complete the tail rotor gearbox. The gearbox has been assembled for you with the excception of the blade holders and the control linkages which are used to change the angles of the blades. There are four black plastic blade holders two have a projection for the control ball, the other two do not. Fit one pair of blade holders (that is to say, one with a projection for the control ball and one without) on each side of the tail rotor hub. The cavities in the plastic blade holders will fit over the brass thrust washer cups. Now secure the four blade holders by four 2x10mm pan head screws and four 2mm nuts (L). The 5mm ball for varying the angle of the tail rotor blades is fitted onto the inside of the control arm of each of the blade holders by means of a 2x10mm pan head screw. The ball is trapped between the screw head and the inside plastic of the control arm and a 2mm nut secures it on the other side of the blade arm (L). Fit the rotor blades temporarily, using the 3x12mm pan head screws and 3mm lock nuts. Later on, in Stage 6, we will check the correct positioning of the tail blades and finally tighten the retaining screws.

Take two ball joints and fit them over the balls with the threaded end of the ball joint facing the control plate. Using two 2x10mm pan head screws, fix the ball joints to the control plate. The screws should be tightened sufficiently so that there is no play but should not be over-tightened so as to damage the plastic material of the control plate. Now, if you move the control lever of the gearbox the control rod should move freely in and out of the tail gearbox, and the result of this movement will be to change the angles of the tail rotor blades. To check this part of the construction, temporarily move one or both of the two 1/16" collars already fitted on the control rod so that the control plate has no end play. Retighten the screws. Later we will again adjust these collars to give the proper setting for flight tests. The control plate must at all times be able to spin freely and should be oiled with a light machine oil before each flight. The tail rotor gearbox assembly is now completed.

Now we will commence the assembly of the tail boom and the fitting of this unit to the main frame of the helicopter. You

will need some epoxy glue in this stage to firmly secure the aluminum collars to either end of the tail boom. Since this is a metal to metal joint, a "30 minute" or longer drying epoxy is preferable to the "5 minute" variety which won't have as much mechanical strength. Make sure that you thoroughly remove the grease from the collars and tail tube before commencing to glue these items together.

The first sub-assembly we shall make is the brass tail drive wire guide tube, which is fitted inside the aluminum tail tube. If you will look at the plywood set you will see there are two small discs of plywood with an outside diameter equal to the inside diameter of the tail tube. Press these out from the ply and drill two holes in the center of them so that they will be a snug fit on the brass tube. Push them onto the brass tube and glue with "5 minute" epoxy so that each disc is about 3" from either end of the brass tube. After this glue has dried you can trim the discs a small amount ,if necessary, so that they will slide easily into the aluminum tube. Smear some silicone glue on the leading edge of each disc as it is pushed into the tail tube and slide the whole assembly into the aluminum tail tube so that it is finally fixed in the center of the tail tube. That is to say, both ends of the brass tube will be equal distance from the ends of the aluminum tube.

Now take the three aluminum tube struts (which were enclosed in Bag #4) and use the shortest of these struts to attach the forward aluminum tail tube collar to the top of the main frame. If you look at the sketches and sideview drawing it will become clear how this is done. Also fit the two longer struts, noting that there is a left hand and a right hand one, from the two side holes of the aluminum collar to the holes provided in the rear cross-strut of the landing gear. This should position the collar directly rearward of the 3" intermediate drive shaft. Do not fully tighten all of the screws yet.

Now fit the tail brace clamp around the aluminum tail tube approximately 6" from the forward end of the tube. The forward end of the tail tube, by the way, has the three 1/8" dia. holes in it. Attach the two long brace struts (again noting that there is a right hand and a left hand version) to either side of the clamp, using one 3x10mm pan head screw and a 3mm lock nut. Do not tighten yet! Secure the front ends of the struts under the rear landing gear strut, as shown, using the same 3x30mm socket head screws as were used to hold the lower forward struts which you have just fitted. This sounds complicated but you will find that it is easier for you to do than it is for us to try to describe it in words. The photographs will give you a good idea of how to accomplish this.

Now you should have the front end of the tail tube in a position close to the forward aluminum collar. You can now smear some of your epoxy onto the outside of the tail tube for the first 1/4" and slide and twist it into the front collar. All three 3x10mm pan head screws must be withdrawn sufficiently to allow the tube to go fully home so that its front end is flush with the front end of the aluminum collar. Then the tail tube should be twisted so that the three holes in the tube coincide with the three holes in the collar. Now you can re-tighten your screws if you wish but do not forget to give them a twist just before the epoxy starts to "go off" so that the screws themselves will not be permanently held by the glue.

Now you can adjust the tail tube clamp position so that the tail tube is held in the correct position according to the sideview drawings and tighten up the screw. You can also tighten up all the other screws at the front. You will now have a tail tube assembly, correctly positioned onto the main frame and in line with the 3" drive shaft, ready for fitting of the rear collar.

Take two 3x6mm set screws and with (L) fit them into the two 3mm tapped holes in the rear collar. Do not screw them too far in at this stage. Now fit the tail skid into the 5/40" tapped hole in the collar and

screw it home firmly with its final position such that it will curve backward when the collar is fitted onto the helicopter. You now have a rear collar assembly which is ready for glueing onto the tail tube. Smear some of your selected glue onto the inside of the collar, or the outside of the tail tube, and push the collar on so that the rear of the tail tube is flush with the rear of the collar.

At this point you can check that your rotational position is correct by screwing one of the 3x6mm set screws in to locate in the appropriate hole in the tail tube. At the same time you can "sight up" from the rear and make a small rotational adjustments so that the tail skid is vertical and in line with the main frame. Now leave the one 3mm set screw temporarily to hold the position of the collar and allow this to set. When nearly completely dry, make sure that the 3mm screw which was used to locate can be turned. By the way, when doing both these glueing jobs, make sure that the amount of glue that you use is of the minimum quantity to avoid it getting into the holes and fouling them so that the screws won't easily feed through when you need them to.

Install two 4x4mm set screws into the tail gearbox coupler (L) and then fit the tail drive wire fully home into the small hole. Tighten the screws well. Give the tail gearbox a "twizzle" to see if the wire is running true and then, after smearing some light oil on the wire, feed it all the way through the brass tube so that it fits fully home into the 3" drive shaft. If everything else has been set correctly the tail gearbox will then be positioned fully home into the collar and you can use the two 3x6mm set screws to firmly retain it. At the front end, tighten up the 4mm screw which is in the 1/4" collar of the 3" drive shaft to hold the tail drive wire. Make sure that all of the screws holding the tail drive wire are firmly tightened and have (L) on them.

Your GMP "Hughes 300C" should now have all of the mechanical structure completed for the rear end of the helicopter. You can now make your vertical and horizontal tail surfaces, using the 4x4" piece of balsa provided. The sketch provided with the kit shows the section to which these should be sanded and, if you wish to be really scale, you can put the ribbing effect on and paint them, using your favorite method. The vertical and horizontal fins are fitted onto the model by means of the four pieces of wire provided in Bag #4. Simply push these pieces (well coated with "5 minute" epoxy) into the balsa tail surfaces so that they project about 1/4", making sure that their position is appropriate to the holes in the rear tail tube collar and the undersurface of the tail tube. After the glue has set you can then glue them in the correct position on the model, using an epoxy or a silicone glue. Sometimes a silicone glue will be better for this purpose since it does give some flexibility and prevents the surfaces from breaking off due to vibration. You have now fully completed the rear section of your GMP "Hughes 300C" so now we'll move on to the next stage which is the cooling system.

Cooling System Installation

Now that you have basically completed the structure and engine installation of your GMP "Hughes 300C" the next item to fit is the cooling system. As discussed earlier, while the GMP "Hughes 300C" takes full advantage of conduction cooling through the solid aluminum engine mounts, the wide cabin precludes the efficient use of an engine head heat sink. Consequently the GMP "Hughes 300C" is fitted with a cooling fan and cooling shroud. This system facilitates the free flow of cooling air over the cylinder head and, hence, keeps the operating temperature within limits.

The first thing to do to prepare for this cooling system installation is to make all

of the necessary and appropriate cut-outs and shaping to the black plastic cooling shroud. If you will look at the photo sheets you will get a very good idea of how the cooling shroud provided in the kit must be cut in order to be the correct shape for its role in directing the cooling air over the cylinder head. First a hole must be cut in the raised portion at the top of the cooling shroud molding. The hole should be cut so that it still leaves the lip standing up from the top of the shroud but all excess material inside this lip is removed. The hole should then be carfully sanded to be as round as possible. The photo sheet will give you a good idea of how the finished hole will look.

Next you should cut the cooling shroud shape from the molding provided in the kit with a pair of scizzors. The approximate shape is shown in the photos provided in the kit but each engine will require individual tailoring of the cooling shroud to suit the positions of the needle valve, etc., of the particular engine installation. Basically, however, the idea of this type of cooling system is to use the plastic fan already fitted on the crankshaft to draw in air through the rear hole that you have just cut and, by centrifugal force, throw and flow this air out of the cooling shroud and over the cylinder head. It is this flow of cooling air which keeps the cylinder head at a reasonable temperature. For this reason the shroud must be fitted quite accurately so that the crankshaft of the engine is exactly in the center of the hole cut out in the cooling fan shroud. Also the cooling fan must be fitted as far forward as possible so that the cooling fan has a very small clearance between the top of its blades and the underside of the cooling shroud plastic top. Other cut-outs must be made to facilitate adjustment of the needle valve and idle adjustment and, also, to clear the muffler extension. However, keep these cut-outs to a minimum so that there is less chance for cooling air to escape before it has performed its job by flowing over the cylinder head itself.

When the shape and cut-outs are correct in the cooling fan shroud then it can be fitted to the GMP "Hughes 300C" in the manner shown in the photographs and side-view drawing. There are two metal straps provided in Bag #3 and these must be fitted as shown in the photographs to the metal framework of the GMP "Hughes 300C". Then, while holding the cooling fan shroud in the correct position on the model with your hands, the holes should be marked in the shroud where the "PK" screws provided will be fitted, through the holes in the metal straps, to hold the shroud in its correct position. A hole in the plastic can be opened up by a sharp point to a diameter a little less than the smaller diameter of the "PK" screw and then the "PK" screws can be inserted and tightened. It is highly recommended that you use a liberal amount of silicone both under the strap and on the threads of the screws when doing this installation since the cooling fan shroud is subject to quite a lot of vibration from the engine. You can check the operation of the cooling fan by holding the rotor head tightly in one hand and starting the engine. Even at idle revs you should be able to feel the air flowing from the outlet of the cooling fan shroud over the cylinder head of the engine. Be careful not to burn your hand or let go of the rotor blade head. Certainly you should not conduct this test at any speed greater than a fast idle.

Stage 5 - Rotor Head System

Open Bag #5 and select the following hardware from the hardware package:

9 - 3x16mm Socket head screws
2 - 5/40 Lock nuts
2 - 3x30mm Socket head screws
3 - 2x10mm Pan head screws
1 - 3mm Lock nuts
1 - 3x5mm Socket head set screw
1 - 2x20mm Pan head screw
4 - 2mm Nuts

3 - 1/8" dia. Collars
3 - 2mm Washers

The first item to assemble from Bag #5 will be the swashplate. The photograph shows a swashplate connected to all the control linkages and you will see that the lower ring of the swashplate has a larger diameter than the upper ring. Fit three 5mm dia. balls onto this lower ring, using three 2x10mm screws. Place a ball on to each screw, then run a 2mm nut up tight against the ball to trap it between the head of the screw and the nut (L). Fit one 2mm washer on each screw and fit each assembly into the outer ring of the swashplate in three places (L). Fit the swashplate locating wire (a 27mm long piece of 2mm dia. wire with a threaded portion on one end) into the remaining 2mm hole, using a 2mm plain nut to lock the wire into the swashplate (L).

The upper ring of the swashplate (that is the one with the smaller diameter) has two 2mm tapped holes. Only one of them is used. Fit the 2x20mm pan head screw through the ball of the plastic ball joint provided. Then fit the 3/32" O.D. brass tube onto the screw thread which prjects through the ball. Clamp up the tube and ball with a 2mm nut and then screw the whole assembly into one of the 2mm tapped holes of the swashplate upper ring until the nut fits tightly against the swashplate (L). Now in Bag #5 (or on the carpet) you will find a small 1/4" 'O' ring. This should be inserted carefully inside the center hole of the swashplate so that it fits in to the groove made especially for it. The completed swashplate can be slid down the 1/4" shaft, being careful to insure that the 'O' ring does not come out of the groove while doing this. In order to help avoid this problem a small amount of Vaseline or similar grease can be used on the shaft. Move the swashplate down until the locating pin is in the center of the swashplate locating bracket (#135). The 5mm balls will be hooked up to the controls in a later stage.

Now we will assemble the rotor head. Take the aluminum seesaw (with the three large holes) and set it down on the table or bench so that it 'rocks' on the center bend. Now take the two side plates and fix them onto the seesaw by means of two 3x30mm socket head screws and two 3mm lock nuts. Tighten, but not fully, the 3mm lock nuts. Fit the four 3x16mm socket head screws (heads up), temporarily, into the four small outer holes of the seesaw (with 3mm lock nuts). These will be used later to hold the main straps and main rotor blades on to the rotor head.

Take the 1/8" dia. stabilizer rod (flybar) and make a small mark at the center of the rod. Slide the rod through the head side plates with the head aluminum block assembly inserted between them. The block has a 1/8" dia. hole. Place two 1/8" dia. collars on the rod on one side of the head assembly and the flybar control arm, and one 1/8" dia. collar on the other side of the head assembly. Now trap the head assembly between one 1/8" dia. collar and the flybar control arm so the center mark is exactly in the middle of the rotor head. Fit the flybar control arm onto the flybar in such a way that the 5mm ball is located above one of the outer three large holes in the seesaw. Tighten the socket head set screws in the flybar control arm and the 1/8" dia. collar (L) so that there is no significant free play sideways of the stabilizer bar. It should, however, be able to rotate freely.

Check again that the flybar is located so that the center of the bar is exactly in the center of the rotor head. Now take the wooden paddles and push them on each end of the flybar so that about 3/16" of threaded bar is showing. Slide the 1/8" dia. collars (on on each side) out to butt up against the paddles. Secure the collars to the stabilizer rod by means of their set screws (L). Fit the 5/40 lock nuts and tighten them until the paddles are firmly secured between the 1/8" dia. collars and the 5/40 nuts. Make sure, before finally tightening the 5/40 nuts, that both paddles are in line with each other; that is to say their angle relative to the horizontal is equal and their leading (round) edges face the direction or rotation (clockwise, from the top).

Also make sure that the flybar control arm is adjusted so that it is in the same plane as the two flybar paddles. Now flow some cyanacrylate glue (C) into the joints between the paddle and its end retainers to secure the paddles firmly.

Fit the carrier to the main shaft above the swashplate but do not tighten it yet. Set the rotor head aside since the main blades will be fitted later befor the whole assembly is balanced. However, the 3x16mm socket head screw and the 3mm lock nut can be temporarily fitted into the top hole of the 1/4" rotor shaft until the rotor head is finally fitted. This completes Stage 5.

Stage 6 - Tail And Main Blade Assembly

Tail Blades

The main and tail rotor blades for the GMP "Hughes 300C" have been carfully selected from the same stock of wood so that the weights of each pair of blades should be very close and, hence, balancing the rotor blades will present very little problem. First we will prepare the tail rotor blades for mounting on the model. The tail blades may be decorated as you wish but it's usually preferable to not add any extra weight to them by using a foil covering. We prefer to use a clear dope or varnish on the blades to fuel proof them and leave them this way. You may prefer to give a few coats of colored dope and then, perhaps, a white or red strip at the tips so that the blades look like the blades of the real Hughes 300C. Either way is fine, except you should be careful not to change the weights of the blades and not to add too much weight to them. The tail blades must be fitted into the tail rotor blade holders to that when the tail shaft rotates anti-clockwise, viewed from the left hand side of the helicopter, the rounded side of the blades will also be facing you. The ball connection of each plastic blade holder will be on the trailing edge side of the tail rotor blades.

Don't forget that the blades for the GMP "Hughes 300C" are not identical to "Cricket" tail rotor blades. Because the tail gearbox is on the left side of the model ("Cricket's" is on the right) the tail blades have the fixing hole at the opposite end of the blades. Of course you could always re-drill a hole the other end to make GMP "Hughes 300C" blades work on "Cricket" or visa versa but take care, the holes must be drilled accurately or you have a vibration (or even worse) problem.

Main Rotor Blades

The main rotor blades are fully sanded and ready to apply the final finish. Cover the blades with the vinyl film provided or you can buy vinyl film of your own color choice at the local hardware store. Before applying the vinyl it is advisable to lightly spray colored dope on to the first two or three inches of the blades on the inside and also the outer section of the blade at the tip. This will prevent any oil or grease from soaking into the wood. Now to cover the blades, strip the paper backing from the vinyl covering and hold one blade up with your finger and thumb in front of you, with the flat edge of the blade facing you and the trailing (or thin) edge to the right. The mounting portion of the blade (with the three screw holes) will be at the bottom. Now, with the sticky part of the covering facing away from you, overlap the trailing edge of the blade facing you by about 1/2", attaching it at the top or end of the blade first, and then carefully let the blade covering stick to the trailing edge underneath until you have the full length fully covered by 1/2" of vinyl. Smooth down carefully with the fingers and then

you can take the blade horizontally in your hand and fold the covering over the top suface of the blade, making sure there is a sharp crease at the trailing edge. If the material is handled gently and carefully covering a blade with vinyl covering is very easy. It can be made difficult if the covering is pulled hard in some places and not in others. So be very careful to just gently smooth the covering over the blade rather than pull it too tightly. After the top surface is covered, the covering can be wrapped around the leading edge carefully and pulled underneath the blade again until it overlaps the first 1/2" joint that we made at the very beginning. The blade will now be covered with the vinyl and the same can be done for the second blade. Balancing the blades will be done on the rotor head itself.

Now take the four blade straps from the hardware bag, together with six 3x16mm socket head screws and six 3mm lock nuts. Fit the blade straps, as shown in the photographs, with the heads of the screws on the top surface of the blades and the 3mm lock nuts underneath. The two straps with the two hole center portion go on top and the straps with the single hole at the center go underneath. Tighten up the nuts but, before you do, use a steel straight edge to make sure that the blade straps are fitted so that they are exactly parallel to the leading or trailing edge of the blade. After this is accomplished, carefully tighten all three nuts on both blades. (Don't squash the wood!)

Now the blades can be fitted to the rotor head. Take the temporarily fitted 3x16mm socket head screws out of the seesaw and, using them, fit the blades onto each end of the seesaw by the end holes of the blade straps. On one blade fit the small metal bracket which has a 3mm clearance hole on one side and the 0.70" hole on the vertical side. The photograph will show you the way in which the bracket is mounted. Do not fit the teeter wire yet. Now fit all four 3x16mm screws and 3mm lock nuts and tighten lightly. Line up both main blades so that they are at 180 degrees to the flybar and then fully tighten up the 3mm nuts.

Now rest the flybar on to two parallel sharp edges so that the whole blade system can 'teeter' on the flybar. One blade will prbably fall and this is the heavy blade. Now cut a strip of colored 'Monocote' tape, about 3/4" wide and 2 1/2" long. Fold this over the lightest blade near the tip and secure down firmly. This will provide some extra weight for the light blade and also provide us with recognition of which blade is high or low when we come to "track" the blades.

If the "light" blade still needs more weight, then a small strip of vinyl, say 1/2" to 1" by 8" long, may be fixed underneath the flat surface of the blade, along its length, until the necessary balance is achieved. This particular part of blade finishing is very important and, if done carefully, will help to avoid vibration and shaking of the helicopter later on.

Before we can flight test our helicopter there is an initial static setting which must be made to the rotor blade system. This is the incidence of the main blades. So let's do it now.

The GMP "Hughes 300C's" main rotor blades operate best at an angle of about 4 1/2 degrees, measured from the flat underside of the blades. This may be readjusted slightly during flight testing. It is normal to use some form of gauge to line up the angle of the blades, looking end on, with the plane of the flybar. We have developed an idea for "Cricket" which works well and we suggest you try this method for setting the blade angles of your GMP "Hughes 300C".

The incidence gauge is made of a piece of 1/16" steel wire, about 14" long. Each end is bent into a half circle, or small hook, which fits snugly over the flybar. The wire is then formed into an open sided rectangle with two 4" long sides and one long end. The angle between the two side legs is set to 4 degrees. To do this, place the gauge on a flat surface with the hook ends facing up and away from you.

Twist the right hand leg up until it is about 5/16" higher than the other leg. This will form an angle between the two legs of approximately 4 1/2 degrees. Now take this piece of wire, hook it onto the flybar. under the blade and rotate upwards to just touch the bottom surface of the blade. This will give an instant indication of whether the blade angle needs to be increased or decreased. Note that the wire should only just lightly touch the under surface of the blade, otherwise the angle measured may be incorrect.

In order to set the required incidence angle of 4 1/2 degrees, the blade straps must be twisted between the end of the blade and the seesaw. This can be done by using two "Crescent" wrenches, holding one across the seesaw and the other one just inside the third screw holding the blade straps to the blade. Using the Crescent wrenches as levers, twist the blade until it is set to the right positive incidence angle of 4 degrees to 4 1/2 degrees. Check this setting by using the wire incidence gauge.

The main rotor blades should also be checked that they have the correct coning angle. This angle has been set into the seesaw, and, provided that the blades project out straight from their respective sides of the seesaw, the coning angle will be correct. To check on this, hold a ruler or other straight edge under the seesaw. The blade undersurface should be parallel and just touch this edge.

The setting-up procedures and flying instructions are given in a separate brochure with this kit.

The fully assembled rotor head is now fitted onto the main shaft, using the 3x12mm screw and 3mm nut which were temporarily fitted into the top hole of the main shaft. Make sure that this nut is tightened securely. Also fit the .055" dia. teter wire and tighten the 3x5mm screw which retains it (L). (See photographs and assembly photo for guidance.)

STAGE 7 - CABIN ASSEMBLY

Open Bag #7, which contains two 4" pieces of 1/8x1/4" spruce, five basswood blocks, as well as the balsa which we used for our stabilizer fins.

Take the plywood sheet from the main carton and very carefully press out all of the necessary plywood parts to make up the front cabin of your GMP "Hughes 300C".

You will have already taken the two round discs to fit in the tail tube in a earlier stage - remember?

We have provided an instruction sheet in the kit which shows sketches of the construction of the tail surfaces, plywood cabin and cabin assembly. If you look at the assembly of the main plywood cabin you should be able to see quite clearly how to assemble the parts that you have just pressed out from the main sheet. Where a dimension is needed it is shown on the sketch. Carefully sand all the edges of your ply to the finish you desire and then glue the whole assembly together, using "5 minute" epoxy glue. Before you add the wooden blocks you should bevel or shape them as shown. In the case of the two top blocks they must be curved to fit the back side of the cabin. The block which holds the console on in the front of the cabin floor must be curved and sloped slightly on its top surface and you can see how to do this in the sideview drawing of the helicopter. This will use up the 3/4x3/4x3/4 block and the two 3/4x1/2x1" blocks. The final two blocks, which are 1/2x3/4x1", will be used to mount the plastic dummy fuel tanks of your GMP "Hughes 300C". Once you have assembled the plywood cabin, together with the wooden blocks, you should paint it in the color you desire. We normally use a "Pactra" spray dope for this purpose and paint the cabin parts black.

Also you may wish to cut the hole for your

radio switch, if you have decided on its location at this point. If you look at the sketch of the main plywood cabin, you will see a suggested postion for this radio switch.

The plywood cabin assembly can now be fitted to the front of the metal frame by the four 3x10mm pan head screws, putting a washer under the head of each screw so that it prevents the head from pulling through the plywood. Four 3mm lock nuts are used on the back of the vertical frame to which the cabin is attached.

Now the front instrument console can be cut to shape and the instrument panel detailed and glued on to the piece of plywood provided. We have shown you a typical instrument panel in one of the photo sheets. The finished console is then mounted on the wooden block provided with "5 minute" epoxy, making sure that the front of it will just clear the canopy when it is fitted.

The seat should then be cut to shape and you can see from the photo sheets where the cut lines will be. You should also note that two cut-outs have to be made on the sides at the top to clear the wooden blocks on which the transparent canopy is to be mounted.

The transparent canopy is mounted by sliding it over the bottom front section of the completed cabin and then pulled over the top, around the wooden blocks. Two #2x1/4" PK screws are used to hold the cabin in place. You can see these screws clearly in the side elevation drawing and also in some of the photographs. Naturally you can complete the cabin detail as much as you wish, adding a "joy stick", for instance, and a collective pitch lever, etc.

Now, to make the dummy fuel tanks, form each of the thin pieces of plastic around your finger or some round object until they follow the contours of the side pieces of the tanks. The whole tank can then be glued together, using "5 minute" epoxy glue. After the tank is finished it can be painted and then, by using "5 minute" epoxy and suitably shaping the two wooden blocks provided, the tank can be fitted into the position shown in the various diagrams and sketches. The two projections which you see in the photographs of our model are intended to reproduce the projections of the filler cap and the tank contents gauge.

So far as pilots are concerned for your GMP "Hughes 300C" you will find that the 8" high toy figures which you can buy at the various local toy shops are almost a perfect scale size for the helicopter. Since the helicopter is 1/8 scale then a 8" to 9" figure will give you a good proportioned pilot for your GMP "Hughes 300C".

You will have noticed that we have not yet mentioned the use of the 1/8x1/4" spruce strips. These are to be used later on in adjusting the height of your two lower servos. You will find, when fitting these, that there is a certain position vertically which they must sit and you can use these strips to raise or lower the servo accordingly. Thought you caught us out there, didn't you?

CONTROLS INSTALLATION

Controls

First open Bag #8, which contains the items needed for the controls installation of your GMP "Hughes 300C". You will also need the following hardware items from the hardware bag:

1 - 3x25mm Socket head screw
2 - 3mm Lock nuts
1 - 5x32" x .28" Brass spacer
1 - 5x32" x .40" Brass spacer
2 - 3mm Washers
3 - 2x10mm Pan head screws
6 - 2mm Nuts

Before we can proceed on the installation

of the controls, there are two control levers which must be fitted. The first is the plastic L-lever, used for roll control. This is installed as follows:

Roll Control Lever

Fit a 5mm ball to each of the arms of the 'L' lever arm by means of a 2x10mm pan head screw and two 2mm nuts. This must be done exactly as shown in the photos and note that each ball is fitted into the center hole of the three holes on each leg and the balls face in opposite directions on the lever. The top ball, which connects to the swashplate, will face inwards and the lower ball, which connects to the roll servo, will face outwards.

Now take a 3x25mm socket head screw and fit the short (.28" long) brass sleeve up to the head of the screw. Slide the L-lever onto the sleeve so that the side of the L-lever with the 5mm ball faces away from the screw head. Fit a 3mm washer and the longer (.40" long) brass sleeve onto the screw, and then fit the whole assembly onto the right hand top side of the main plate. The hole to be used is located just ahead of the main shaft top bearing block. See photographs.

Pitch Control Lever

The second control lever to be fitted is the T-lever, which is used for pitch control of the swashplate. This lever is complete except for the fitting of three 5mm balls. Two of these balls are each placed on a 2x10mm pan head screw and locked in place with a 2mm nut (L). The screw is then fitted into the small holes on the sides of the lever with the screw head and ball facing outwards. A 2mm nut is then fitted to the screw projecting through to the inside of the T-lever and locked up tightly (L). Make sure that these two balls are very firmly fitted to the T-lever since a failure at this point can result in a control failure to the helicopter. The third 5mm ball is fitted in a similar manner to the lowest hole of the vertical arm of the 'T' lever - facing outwards.

Now slide the completed lever onto the 3mm screw which was previously fitted to the center hole of the swashplate locating bracket. Fit a 3mm lock nut onto the screw to retain the T-lever and tighten so that the lever can move freely but the 'free play' is kept to a minimum.

Swashplate Connections

The swashplate is now connected to the three balls on the T-lever and L-lever, using the three double ended ball links. This arrangement is much like a three legged stool and provides a very tight control for the helicopter which greatly improves its flight performance. These three double ball joints 'support' the swashplate from the T-lever and L-lever. Any movement now of either lever will result in a direct response of the swashplate. Check, at this stage, that the 'O' ring is still in the correct location in the groove inside the swashplate inner ring.

A 2x90mm control rod (threaded both ends) should be fitted with a ball joint with ball on one end. The other end threads into the ball joint which is already fitted on to the flybar control arm. This link fits between the flybar control arm and the end of the upper swashplate output arm. The length should be adjusted so that the paddles are exactly parallel to the top surface of the swashplate. The carrier should be adjusted so that it is vertical when the main shaft is 'driven'. The vertical position ofthe carrier can be determined from the one-half scale side view of the GMP "Hughes 300C".

In the kit literature you will find a diagram showing the general arrangement of the servos and the control surfaces related to the control stick movements on the transmitter. The two lower servos are mounted inverted so that the contol linkages can be as short as possible. You

may need to adjust the height of these servos, as we mentioned earlier, by using the 1/8x1/4" spruce strips. In the case of the rudder servo, which is on the right hand side of the model, the connection between it and the pitch lever on the tail gearbox is carried out by means of the flexible cable running through a plastic tube. Each end of the cable must be fitted with one of the servo rod ends provided and this is connected to the cable by means of a soldered joint. At least a good "soft solder" should be used and preferably a "silver" solder. There are many good low temperature silver solders on the market today. Do make sure that these connections are well made so that they will not fail on you in flight. The length of the cable, then, must be adjusted so that when the routing is properly made down the fuselage and up the right hand tail boom strut, the tail control lever is centered when the rudder servo is centered. You can see the general routing of this control in the various diagrams and photographs. The rudder control cable can be secured in several places using nylon cable tie wraps. The pitch and roll servo arms are connected to the 'T' lever and 'L' levers by means of a 2x45mm rod and a 2x30mm rod, each fitted with a ball link on each end. The throttle linkage uses a 2x90mm rod fitted with a clevis on each end.

RADIO INSTALLATION

There are no special requirements for the radio installation of the GMP "Hughes 300C". Naturally, being a scale helicopter there is very little space avaialable for the radio installation if you wish to keep the cabin clear and scale-like. Therefore a bit more ingenuity than usual must be exercised in fitting your radio. If you take a bit more time in this particular task you will be rewareded by a very scale-like appearance of the cabin and lots of modelers scratching their heads wondering where the heck you put all the radio equipment.

Receiver and Battery

Your receiver may be packed loosely in foam and inserted in the cabin under the seat. The battery pack should be fitted as far forward as possible. If you wish to preserve the scale effect of an "open" cabin then some ingenuity will be needed to get your batteries under the cabin floor. Some builders have 'split' a 450 mA flat pack into two sections of two cells each and fitted a section on each side under the cabin floor. Of course you must be careful that the electical connections remain intact and sound so that battery failures are not caused by your custom installation.

Switch

The final item of the radio installation is the radio switch. This can be fitted in the rear plywood wall of the cabin on either side to suit your own ideas.

Don't forget to run the antenna out of the cab and either let it dangle down or it can run back and be connected to the vertical fin by means of a rubber band.

FINAL ADJUSTMENTS

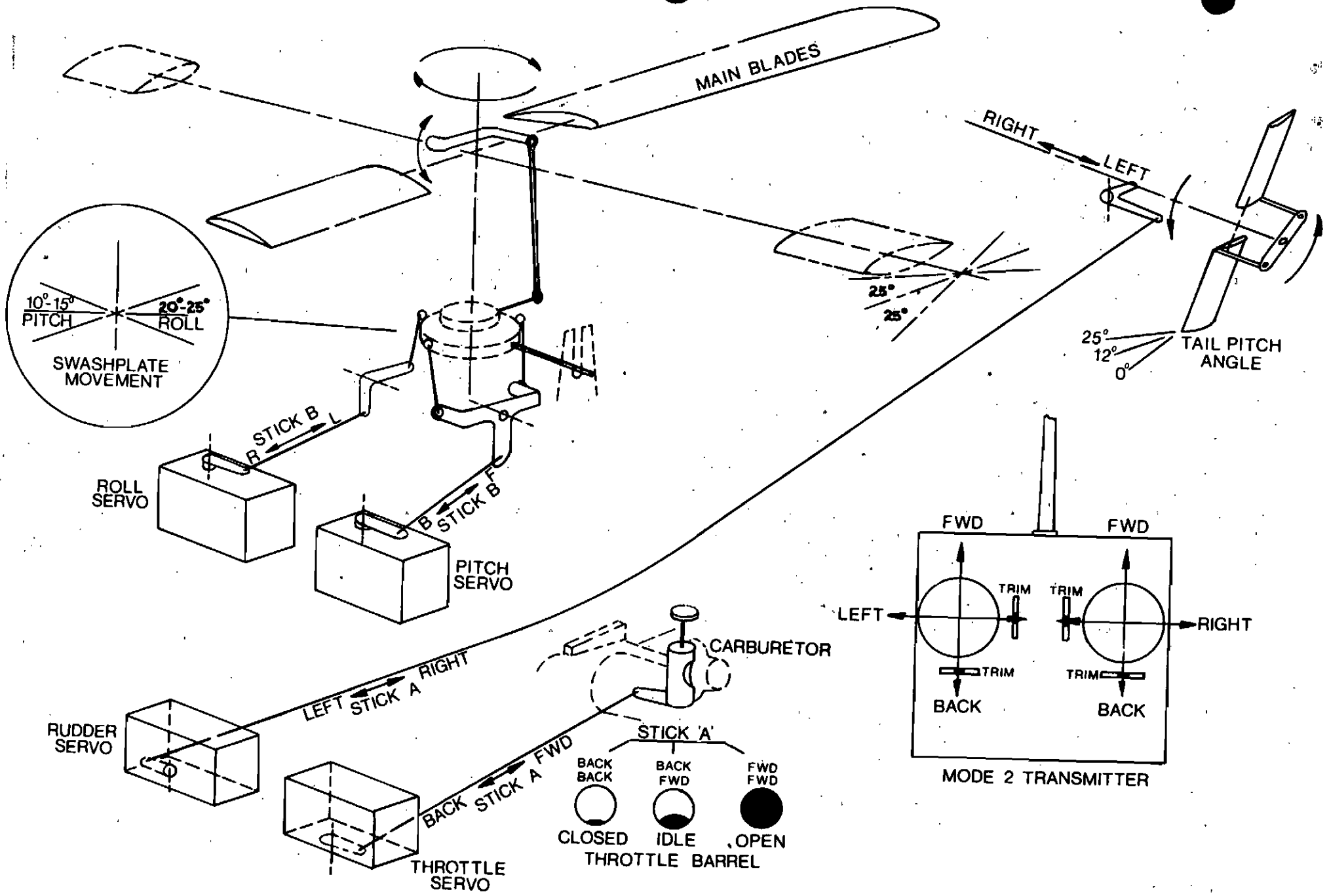
Again, we emphasize the need to be sure that all the controls move freely and easily and to check this by moving them with your fingers at the servo end before the final connection to the servos. Also check thoroughly that the directions of movement are correct by again referring to

the schematic diagram for this information. The full range of movements are shown in the servo schematic diagram. For the beginner, the swashplate should be set up to move approximately plus or minus 15 - 20 degrees in roll, and plus or minus 10 - 15 degrees in pitch. The tail rotor control should be initially set to move through just a little less than the full range permitted by the slot in the tail rotor gearbox. This movement can be reduced if the beginner finds the tail too sensitive. For the expert, obviously greater movement of swashplate can be used. However, make sure that the swashplate locating pin cannot come out of the slot in the swashplate bracket when used with these large movements.

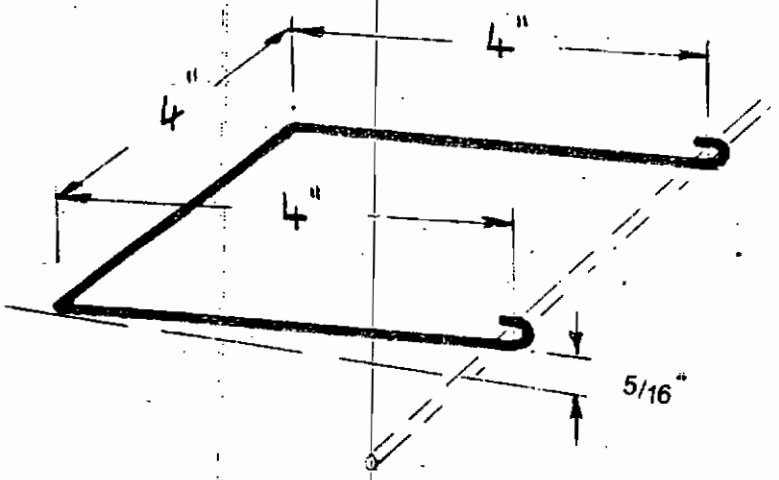
When installing the throttle servo don't forget that moving the throttle stick up the box (or forward) must result in the engine carburettor barrel opening. You will see in the schematic that the throttle barrel should be completely closed when the throttle lever is zero and the throttle trim is zero. Moving the throttle trim to full position should produce a small opening which should result in a fast idle of the engine. This part of the control system is particularly important since it is very necessary that the engine power be thoroughly under control of the pilot at at times and that the engine may be stopped remotely, if necessary, by closing both the throttle lever and throttle trim. Make sure the linkage between the servo and the carburettor is completly free and easy to move. Any excessive friction will result in a drain on the flight batteries which could cause a premature failure of the radio in flight. This point, of course, relates to all the servo channels.

Carry out a final check of the radio when the helicopter is complete and all parts, such as the cabin, fuel tubing, etc, are fitted.

Finally, don't forget to recharge your batteries before attempting to fly. You have probably used up more capacity than you think in going through the setting-up procedures.



-CONTROLS SETUP-

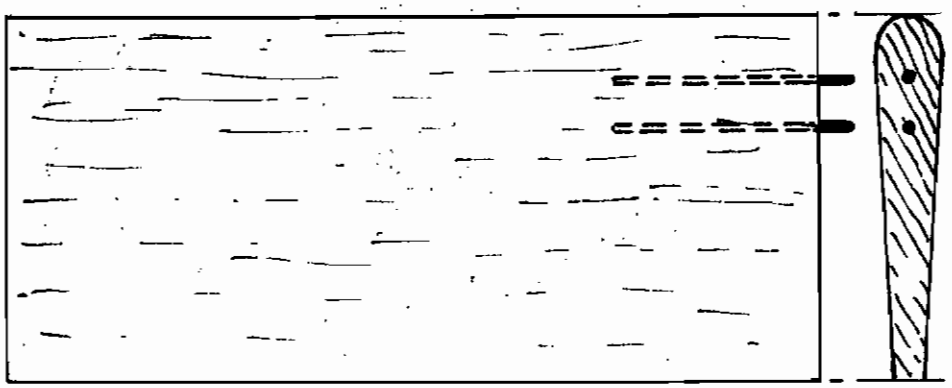


MAIN ROTOR BLADE INCIDENCE GAUGE

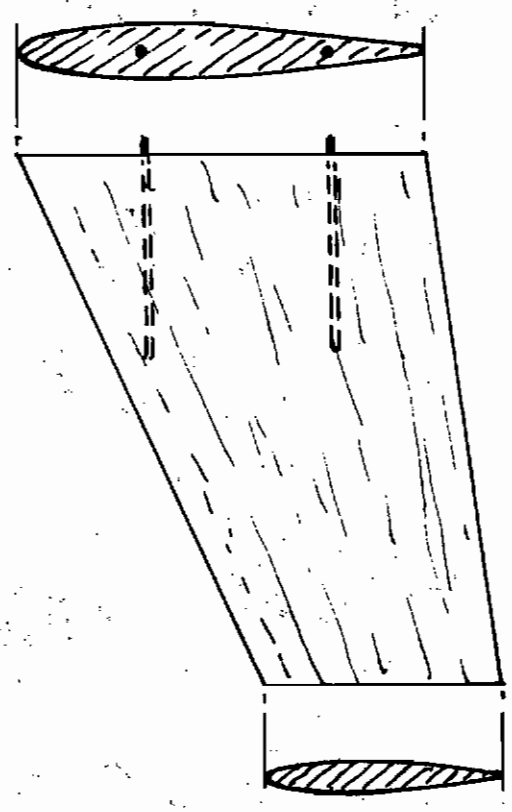
Lubrication

The ball bearings used in the GMP "Hughes 300C" are already lubricated and so is the tail gearbox. A light machine oil can be used on the ball joints and linkages and, especially, on all rotating or sliding metal parts such as in the rotor head and the pitch control links and plate on the tail gearbox. These items must be kept very free at all times and many flyers librucate these parts before each flight. The nylon and steel gears must not be lubricated.

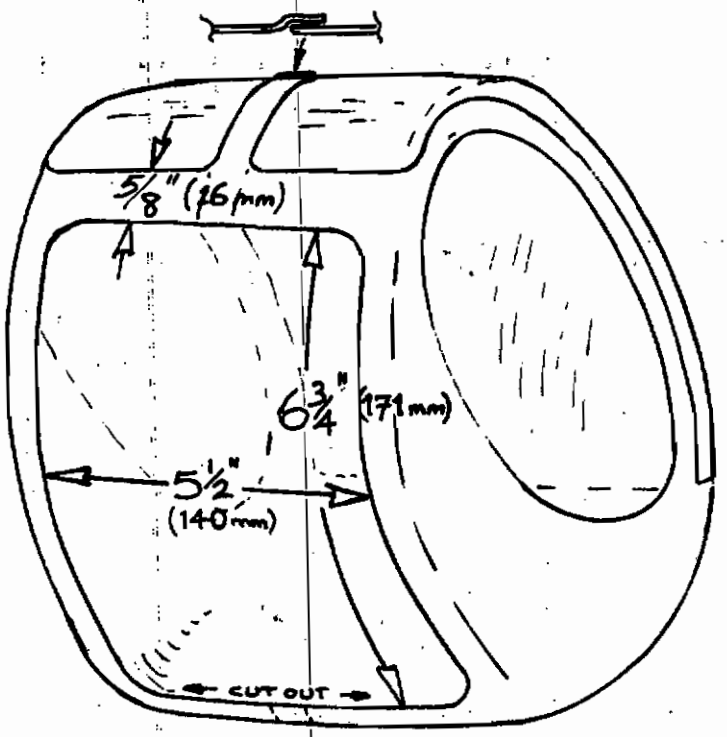
TAIL SURFACE TEMPLATES



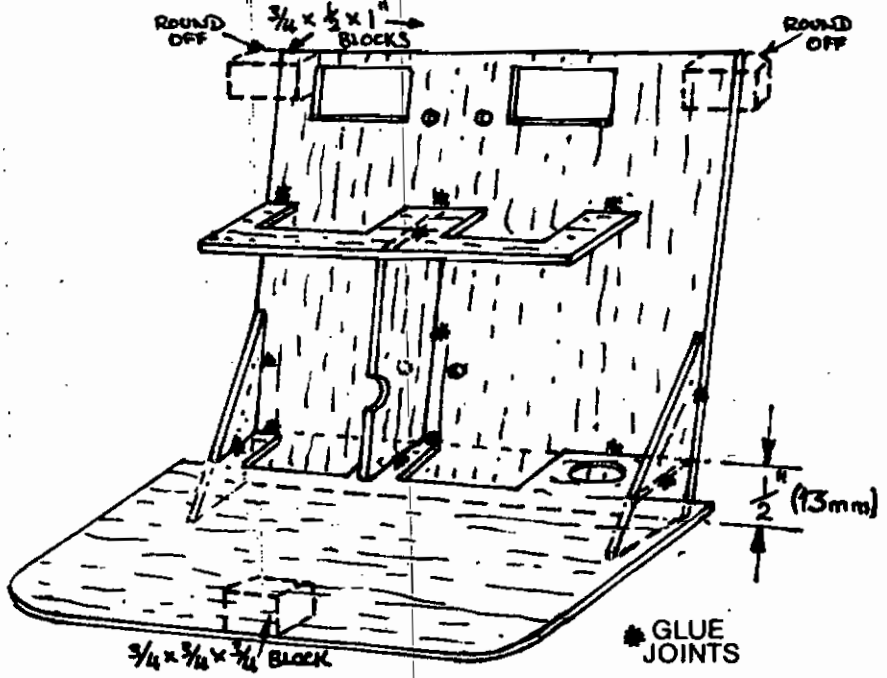
HORIZONTAL STABILISER



VERTICAL FIN



CANOPY ASSEMBLY



ASSEMBLY OF MAIN PLYWOOD CABIN