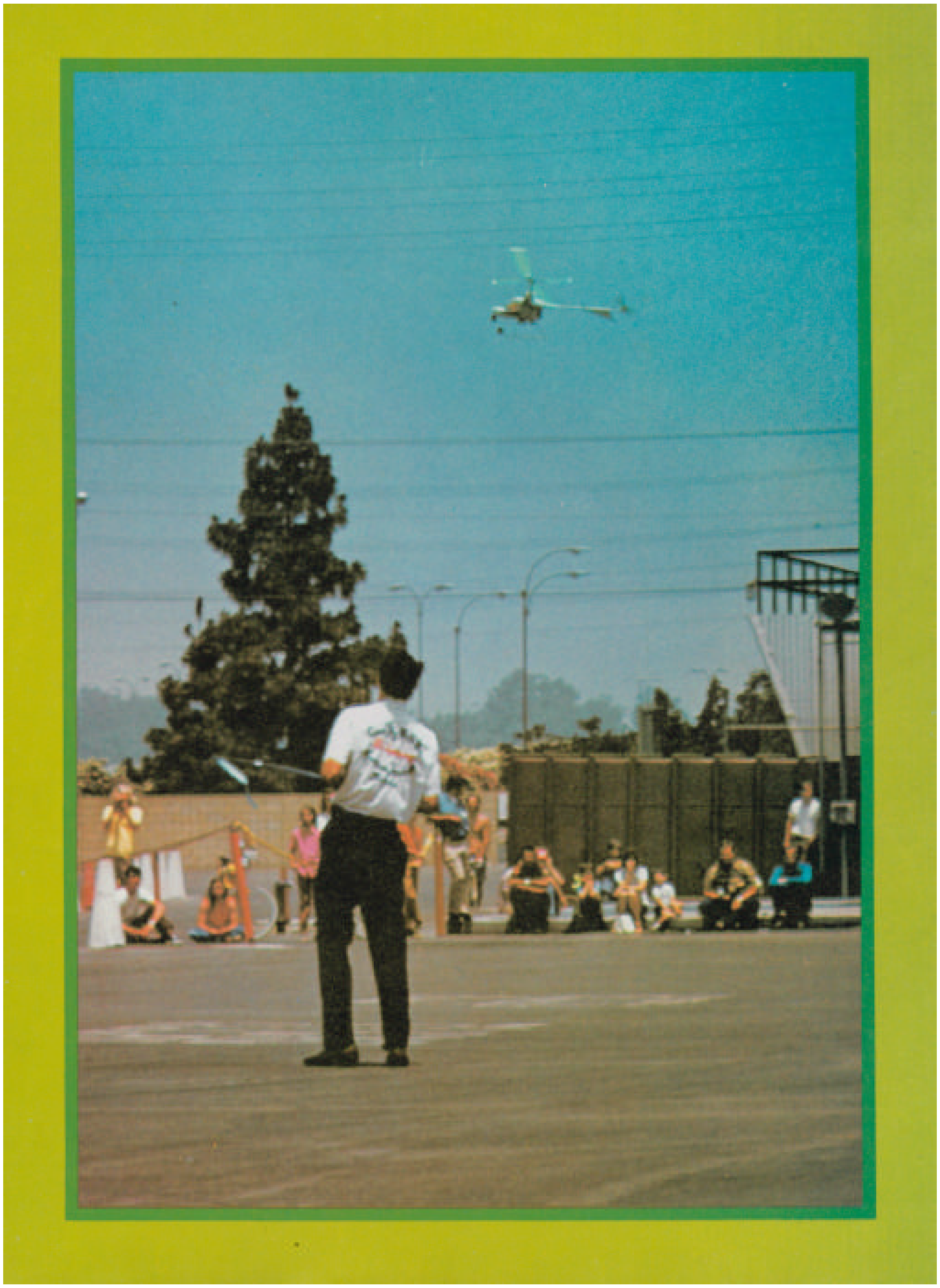
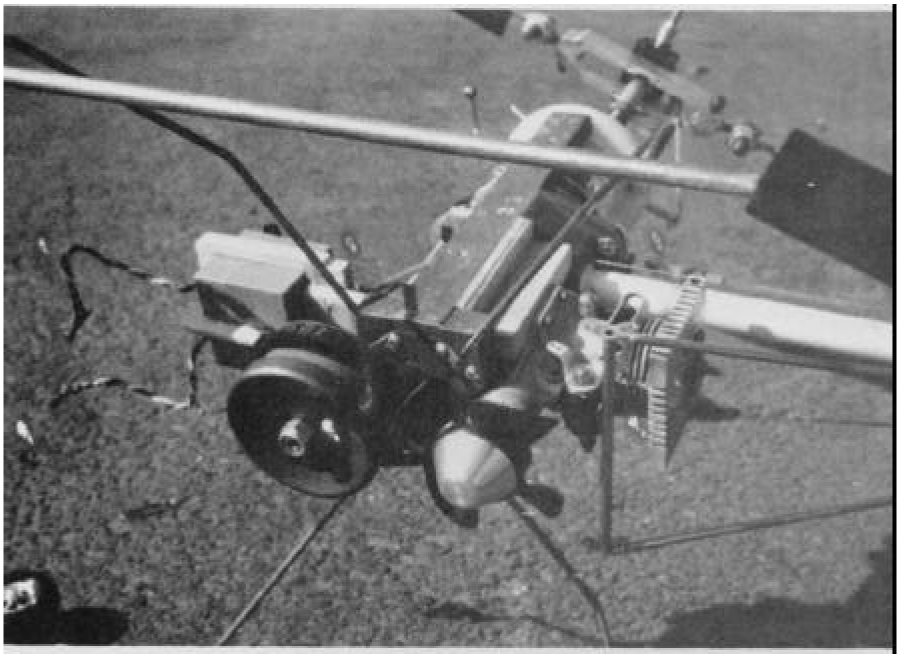
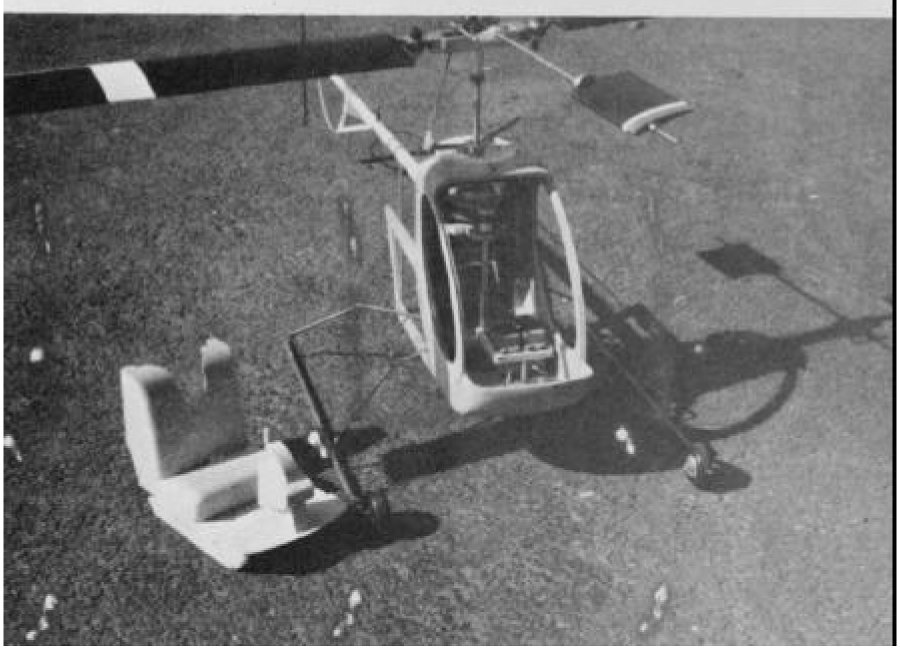
Superbird

Small 19-powered full-performance RC helicopter is simple conversion of the Du-Bro Whirlybird. It is fast, simple, realistic, and inexpensive. / by Ed Sweeney







Superbird

Why not build a small copter? I had a noisy Du-Bro 505 and, without the motor on top, it looked sharp. I had mastered the 505 in calm weather and knew its limitations. I had numerous RC car motors, clutches and shafts in my workshop, so I played around with the 505 frame/body and came up with a shaft-drive system for the model, but would it work?

After many conversations with Dave Grey, John Burkham and Gene Rock, the mechanical parameters for a helicopter using only the power of a typical RC 19 engine were determined. Less than a month later, the prototype was ready to fly. In about a year it has flown over 200 hours and many, many changes have been made. My goal had been to build a 505 conversion as close to the original design as possible. It had to be practical, durable and repairable.

These objectives were finally achieved. The model, as simple and as inexpensive as a shaft-driven helicopter can be, requires only average model building skills. If you have a 505 and know how to fly it, here's a neat way to find out just how well helicopters can fly.

Without question, the Du-Bro 505 helicopter has been made and flown by more modelers than any model chopper to date. It is still the least expensive kit for a workable helicopter. The 505 is a great trainer machine, but it does act somewhat top-heavy. It is not a very realistic looking machine though, and its performance is limited. The model uses a 40 located atop the rotor shaft driving its own 10-6 prop one way and spinning itself and the main rotors the other. This method of powering the helicopter is known as torque reaction. It is ideal for learning to handle a helicopter in calm weather or indoors. Throttle changes give instant altitude control and no sudden swing of the tail. So, if you want to get into helicoptering, use the 505 in stock form. Once you have mastered it, try either the conversion helicopter presented here or buy one of the big expensive and scale kits.

Our little helicopter will perform just as well as most of the big models; being smaller gives it many advantages. The Superbird can cruise at 35 mph in forward flight, and it loves to fly in a wind. It is small and quiet—great for backyards that intimidate the larger model copters. It can be transported in small autos (like VWs) without removing rotors, costs very little additional money (if you have a 505 now), is extremely durable, uses only a 19 for power, and most of its components are readily available as stock items.

The conversion uses the 505's frame body mechanical systems and all fittings, to which a motor mount, clutch, shaft, more durable tail rotor system, and a new rotor head are added. Belts and pulleys are the transmission. A conversion will cost you about $30 and an engine.

Top: Carlin Tobin's conversion is a bit more ambitious. He made all the changes shown in this article and even fabricated his own Hughs 300 body for it. Note his use of a commercial four-bladed cooling fan and his big homemade engine heat sink. Above: Completely assembled Tobin's model will be a charmer. The little helicopter can handle the heavier body and needs lots of nose weight so the Hughs 300 shape is quite ideal. Right: Dave Grey of DuBro Products, creator of the original Whirlybird, admires the conversion. He found the new mod* el quite easy to fly.

This article makes two assumptions: First, that you already have a Du-Bro 505; second, that you have mastered flying the 505. The conversion machine is the smallest actively flying four-channel RC helicopter around today offering full performance and this is written as a conversion project.

The conversion is a shaft-driven, semi-rigid rotor helicopter. The engine drives a clutch via a belt and the clutch drives the main shaft through another belt. Overall gear reduction here is 12.3 to 1. The large white bevel gear from the 505 is attached directly to the aluminum pulley which was belt driven from the clutch shaft. This drives the 505's original small, white bevel gear. At the end of the tailboom, another set of bevel gears gives an additional 1 to 2 gear ratio increase for an overall main shaft-to-tail ratio of 1 to 8. When the main rotor rpm peaks at 1300, the tail rotor spins at 14,000. The loading is light, but at this speed balance is important—almost critical. Normal speeds are 1000 rpm and 8000 rpm.

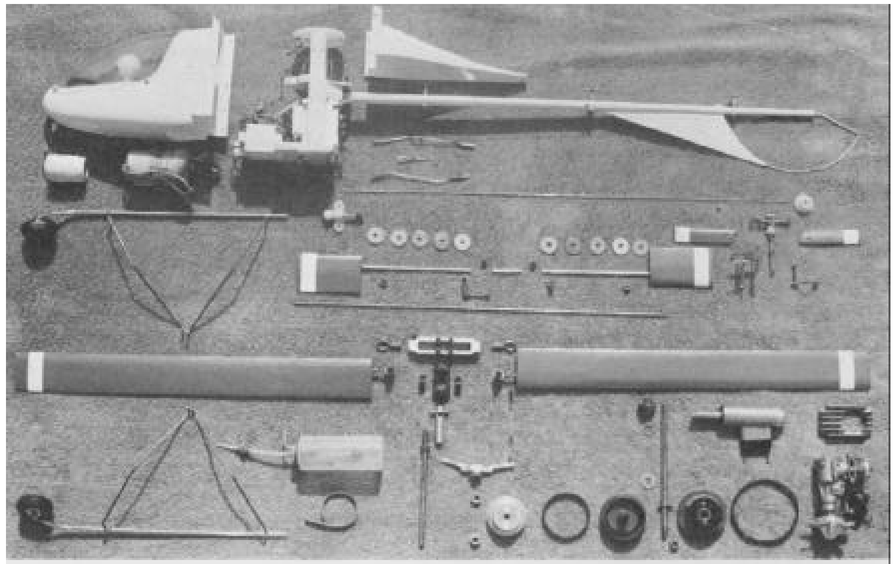
The skill level in building and flying fits three chopper types. From simple to complex, they are torque reaction (like the 505), shaft-drive throttle only for lift control (most kits), shaft-drive and collective pitch (Kavan and Graupner only, at present). If you are new to helicopters, work up the ladder of complex skills; don't try to learn at the top. If you take my advice, converting your 505 to shaft-drive is a perfect second stage. That's exactly what this Superbird is for.

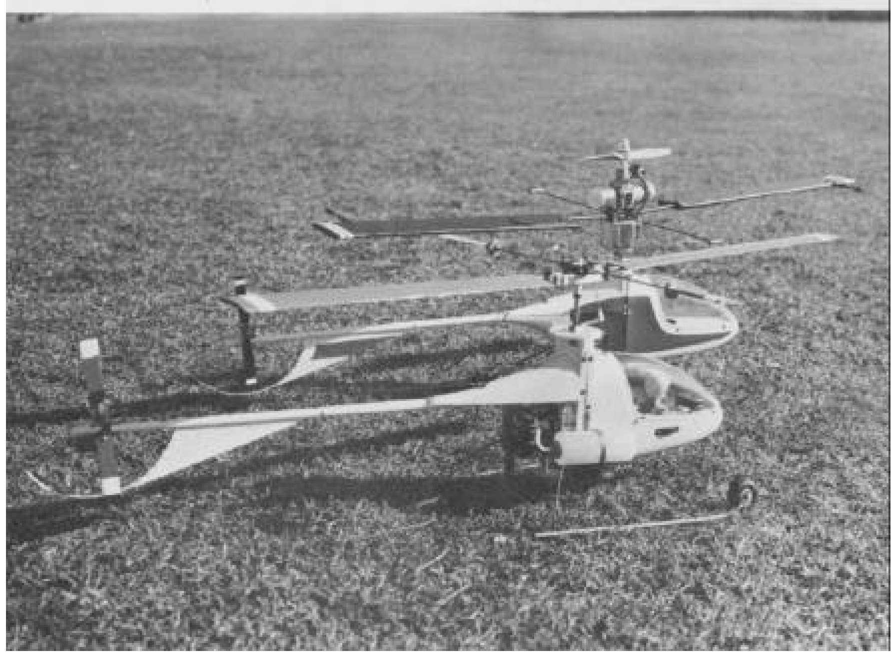
Construction

To begin converting your 505, completely disassemble the model down to the basic frame. You will reuse about half of the parts in the conversion. Obtain a K&B Veco 19BBRC (or similar) and order parts from Stock Drive. List of parts and appropriate addresses are in panel at lower right of this page. Find miscellaneous parts at local hobby shop.

Only two wood parts are shown on the plans. The major rotor head part may be bought at Sears. (The plans with this issue are full-size as printed.) These are the upper adjustable and lower (fixed) clutch shaft bearing blocks. The firewall and engine bearers are cut to fit the original frame which you already have. Firewall is 3/16" (or 1/8") plywood located at the backside of the frame uprights between the tailboom block and gear block. Engine bearers (1/2 x 1/4" cross section) simply glue to the firewall spaced to suit your engine. Seal the completed frame with surfacing resin or epoxy and cover with a very durable paint (K&B epoxy or Hobby-poxy).

Originally, the clutch gripped the shaft it was intended to drive. On our helicopters the clutch is drive-pin engaged. Notice the two slots in the plastic shaft/bearing which enabled the clamp to grip its shaft. After cutting the clamp off, extend the two slots 1/8" inside and below the metal clutch bushing. Also widen the slots to suit your drive pin. Trim the plastic shaft/bearing flush with the steel bushing. Such location prevents the pin from escaping. Natural-





Top: This layout of parts shows general relationship of each part. Note especially body nose section cutout for clutch and radio, receiver, servo and battery positions. Above: Posed together, an original 505 meets the converted model.

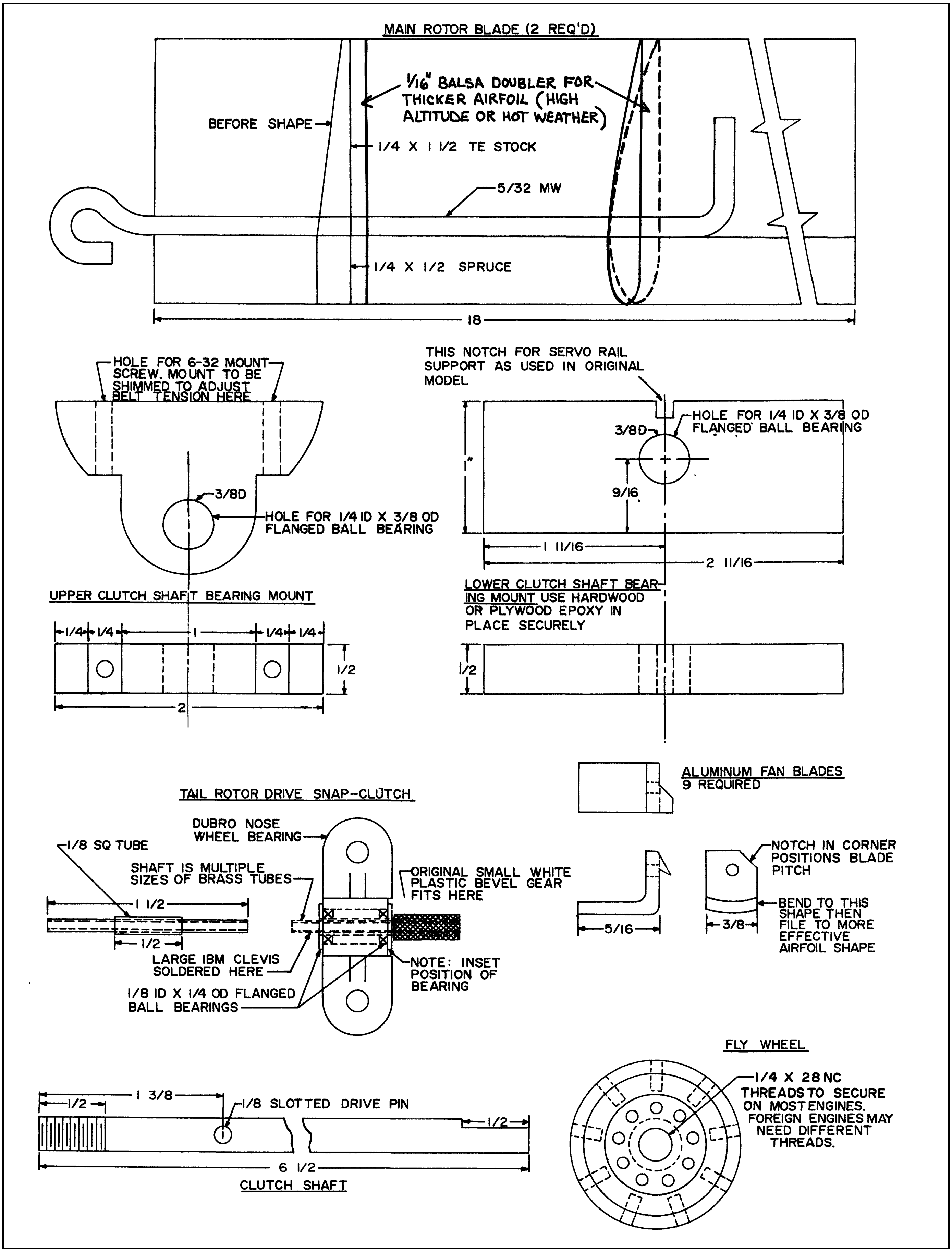
PARTS LIST

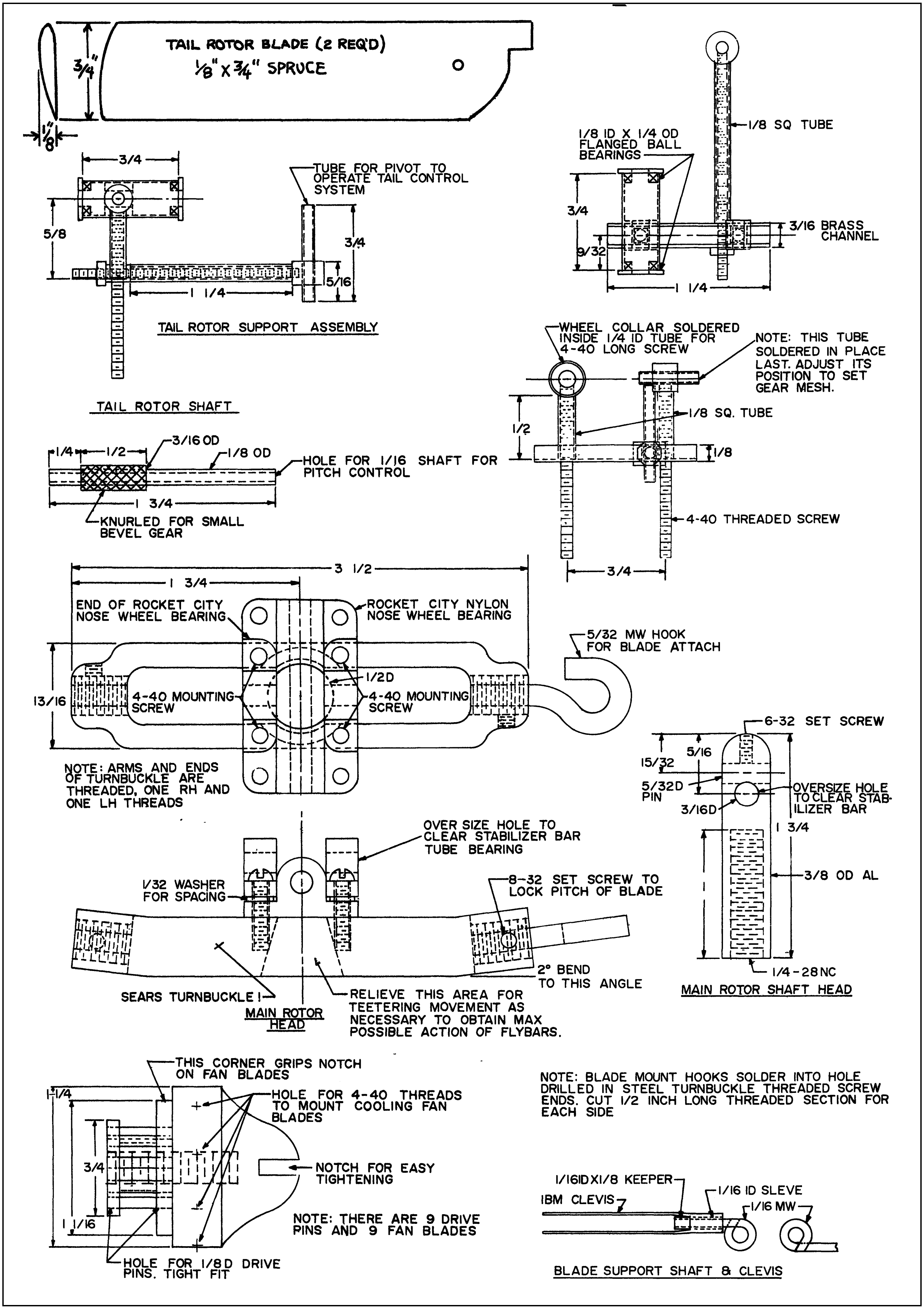
1	30 groove alum. 1/4" pulley 1/5th pitch 1/4" hole	6A3-30DF02508
1	10 groove alum. 1/4" pulley 1/5th pitch 1/4" hole	6A3-10NF03708
1	6 1/2 x 1/4" steel shaft	7X1-08065
1	7 x 1/5" P 1/4" wide belt	6R3-0350025
1	10" 1/5" P 1/4" wide belt	6R3-050025
Set	Plastic Bevel Gears	1M3-Y3216 & 32
2 ea.	1/4 ID 3/8 OD ball bearing flanged	7Y55-F3725
4 ea.	1/8 ID x 1/4 OD ball bearing flanged	7Y55-F2512
	All the above parts are available in one package No. HK105 for $16.39.	
2 ea.	Rocket City nose gear bearing	
3 ea.	I.B.M. large clevises	
1 ea.	Delta heat sink blank (black)	
1 ea.	Curtiss clutch assembly	
1 ea.	3V2" Sears turnbuckle (3V2" alum, part)	
	SDP Handbook of Commercial Drive Components (No. 71) is $1.49 ppd.	

Curtiss-Dyna Products Corp.
Box 297
Westfield, Ind. 46074

Delta Systems P.O. Box 754 Bridgeton, Mo. 63044

Stock Drive Products
55 South Denton Ave.
New Hyde Park, N.Y. 11040


MAIN ROTOR BLADE (2 REQ'D)
1/16" BALSA DOUBLER FOR THICKER AIRFOIL (HIGH ALTITUDE OR HOT WEATHER)
BEFORE SHAPE
1/4 X 1 1/2 TE STOCK
5/32 MW
1/4 X 1/2 SPRUCE
18
HOLE FOR 6-32 MOUNT SCREW. MOUNT TO BE SHIMMED TO ADJUST BELT TENSION HERE
3/8D
HOLE FOR 1/4 ID X 3/8 OD FLANGED BALL BEARING
UPPER CLUTCH SHAFT BEARING MOUNT
1/4 1/4 1 1/4 1/4
1/2
2
THIS NOTCH FOR SERVO RAIL SUPPORT AS USED IN ORIGINAL MODEL
HOLE FOR 1/4 ID X 3/8 OD FLANGED BALL BEARING
3/8D
1"
9/16
1 11/16
2 11/16
LOWER CLUTCH SHAFT BEARING MOUNT USE HARDWOOD OR PLYWOOD EPOXY IN PLACE SECURELY
1/2
ALUMINUM FAN BLADES 9 REQUIRED
TAIL ROTOR DRIVE SNAP-CLUTCH
DUBRO NOSE WHEEL BEARING
1/8 SQ TUBE
SHAFT IS MULTIPLE SIZES OF BRASS TUBES
ORIGINAL SMALL WHITE PLASTIC BEVEL GEAR FITS HERE
1 1/2
1/2
LARGE IBM CLEVIS SOLDERED HERE
NOTE: INSET POSITION OF BEARING
1/8 ID X 1/4 OD FLANGED BALL BEARINGS
NOTCH IN CORNER POSITIONS BLADE PITCH
BEND TO THIS SHAPE THEN FILE TO MORE EFFECTIVE AIRFOIL SHAPE
5/16
3/8
FLY WHEEL
1/4 X 28 NC THREADS TO SECURE ON MOST ENGINES. FOREIGN ENGINES MAY NEED DIFFERENT THREADS.
1/2
1 3/8
1/8 SLOTTED DRIVE PIN
1/2
6 1/2
CLUTCH SHAFT


TAIL ROTOR BLADE (2 REQ'D)
1/8" X 3/4" SPRUCE
3/4"
1/8"
3/4
5/8
TUBE FOR PIVOT TO OPERATE TAIL CONTROL SYSTEM
3/4
5/16
1 1/4
TAIL ROTOR SUPPORT ASSEMBLY
1/8 ID X 1/4 OD FLANGED BALL BEARINGS
1/8 SQ TUBE
3/4
3/16 BRASS CHANNEL
9/32
1 1/4
TAIL ROTOR SHAFT
1/4
1/2
3/16 OD
1/8 OD
HOLE FOR 1/16 SHAFT FOR PITCH CONTROL
1 3/4
KNURLED FOR SMALL BEVEL GEAR
WHEEL COLLAR SOLDERED INSIDE 1/4 ID TUBE FOR 4-40 LONG SCREW
NOTE: THIS TUBE SOLDERED IN PLACE LAST. ADJUST ITS POSITION TO SET GEAR MESH.
1/8 SQ. TUBE
1/2
1/8
4-40 THREADED SCREW
3/4
3 1/2
1 3/4
END OF ROCKET CITY NOSE WHEEL BEARING
ROCKET CITY NYLON NOSE WHEEL BEARING
5/32 MW HOOK FOR BLADE ATTACH
1/2D
13/16
4-40 MOUNTING SCREW
4-40 MOUNTING SCREW
NOTE: ARMS AND ENDS OF TURNBUCKLE ARE THREADED, ONE RH AND ONE LH THREADS
6-32 SET SCREW
15/32
5/16
5/32D PIN
3/16D
OVERSIZE HOLE TO CLEAR STABILIZER BAR
1 3/4
3/8 OD AL
1/4-28NC
MAIN ROTOR SHAFT HEAD
OVER SIZE HOLE TO CLEAR STABILIZER BAR TUBE BEARING
1/32 WASHER FOR SPACING
8-32 SET SCREW TO LOCK PITCH OF BLADE
2° BEND TO THIS ANGLE
SEARS TURNBUCKLE
MAIN ROTOR HEAD
RELIEVE THIS AREA FOR TEETERING MOVEMENT AS NECESSARY TO OBTAIN MAX POSSIBLE ACTION OF FLYBARS.
THIS CORNER GRIPS NOTCH ON FAN BLADES
1-1/4
HOLE FOR 4-40 THREADS TO MOUNT COOLING FAN BLADES
3/4
NOTCH FOR EASY TIGHTENING
1 1/16
NOTE: THERE ARE 9 DRIVE PINS AND 9 FAN BLADES
HOLE FOR 1/8D DRIVE PINS. TIGHT FIT
NOTE: BLADE MOUNT HOOKS SOLDER INTO HOLE DRILLED IN STEEL TURNBUCKLE THREADED SCREW ENDS. CUT 1/2 INCH LONG THREADED SECTION FOR EACH SIDE
1/16IDX1/8 KEEPER
IBM CLEVIS
1/16 ID SLEVE
1/16 MW
BLADE SUPPORT SHAFT & CLEVIS

ly the pin must not scrape the bushing either.

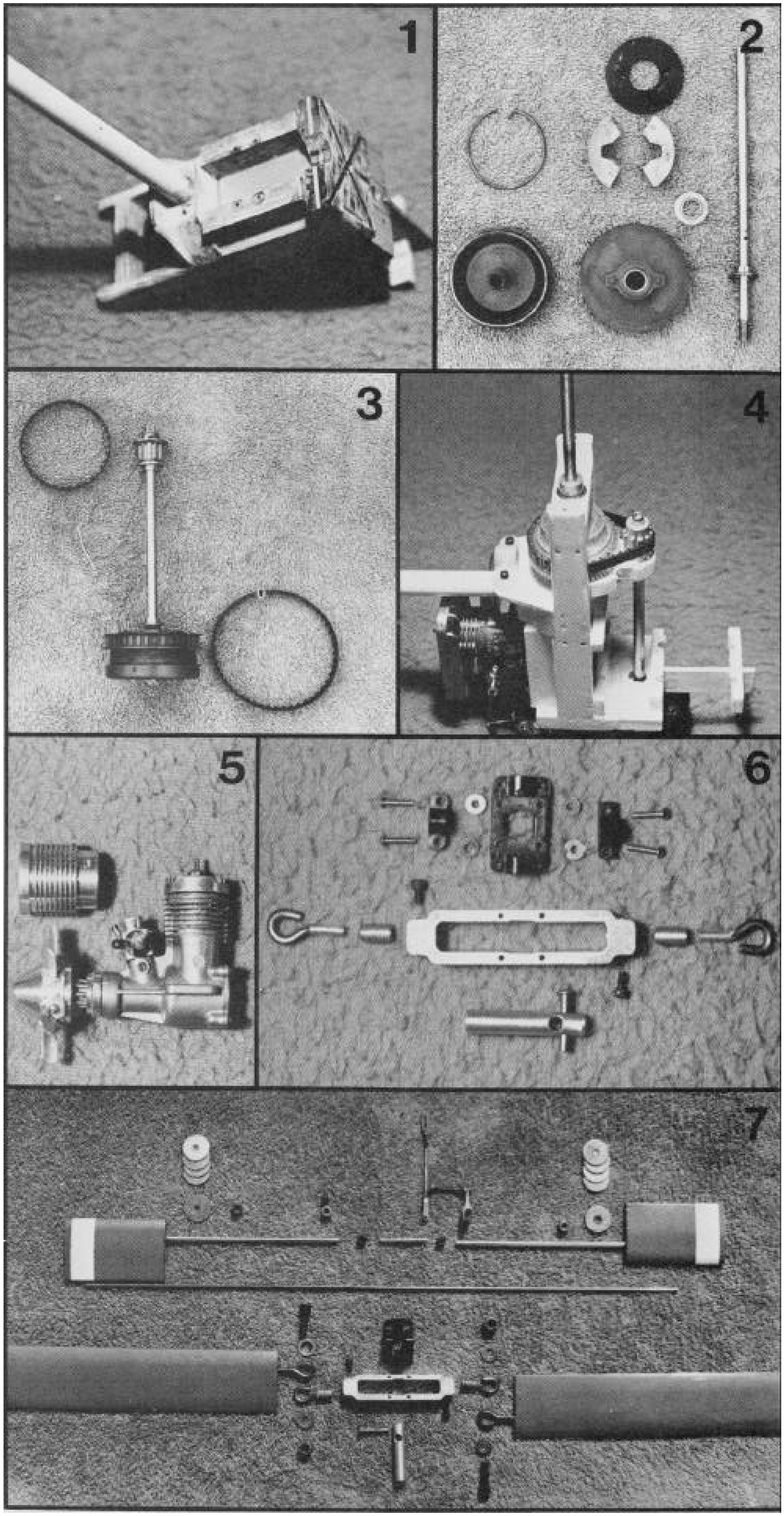
Prepare the clutch by surfacing the bell (instead of the shoes) with leather or cork lining. Recess the spring by grooving the shoes with your Dremel tool, then tighten the spring by removing about 3/4" of spring coils. This is a starting point; the spring must be adjusted later to suit your engine's idle speed.

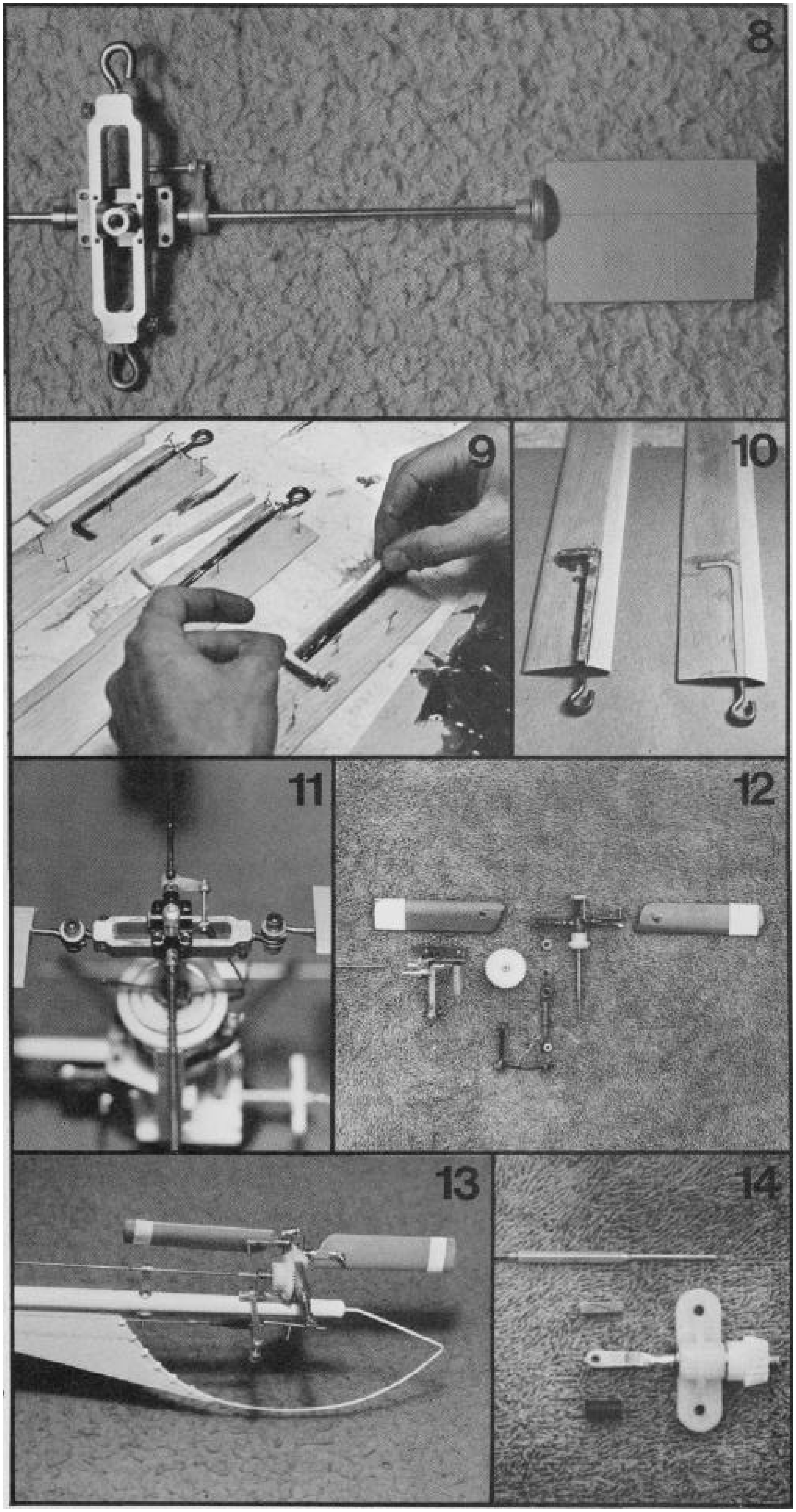
The 505's aluminum engine counterweight can be machined to make the new flywheel/fan assembly. Any machine shop will do this for a nominal fee. Also have them shape and drill the aluminum main shaft head piece. Do all the thread tapping yourself. You will use 4-40 and 1/4-28 NC taps. Also make and attach the fan blades and the nine steel pulley drive pins.

To prepare the 505's large white bevel gear, cut it flush on its backside, center it on the bare bottom of the 30 groove pulley, then attach it with two or three screws to lock the parts together. Prepare the clutch shaft with its flats, hole and threads. Now assemble entire power train as shown in the photos. The clutch must be just low enough to clear the landing gear mounting screws; locate the engine height on the frame accordingly. Engine is secured with long 4-40 bolts into blind nuts at the firewall. Upper pulleys are located according to the tail drive bevel gear mesh. Your original 505 bevel gear system can be used temporarily to adjust gear mesh properly. Upper pulley tension should permit only 1/32" movement on one side of the belt. Lower pulley can have 1/4" movement on one side. Shim the clutch shaft or engine to achieve these tensions. Mount the servos. They are positioned almost exactly where they were on the 505 but moved forward by the width of the lower clutch shaft bearing block. The cyclic controls are not spring loaded as on the 505; make them solid. Install all pushrod systems for throttle, cyclic and tail rotor controls.

Using your old 505 body parts, reassemble the forward section containing the battery and receiver. Provide cutouts as necessary for the clutch. Only small sections of the lower rear body cover are used.

Now reinstall the landing gear and swashplate. Prepare the aluminum rotor head main piece—mine was an aluminum Sears and Roebuck turnbuckle. Bend the coning angle into the turnbuckle ends as diagramed, then tap holes for the modified Rocket City nose-wheel bearing parts. The drawings show how the Rocket City bearings are cut, drilled and modified. With the Dremel Moto-Tool, cut away the inside lower edge on the turnbuckle to allow adequate teetering of the assembly. But do it after preassembling the head. You want to maximize the teetering movement, but cut away as little of the turnbuckle as possible.





1 The modified frame showing firewall, engine bearers,lower clutch bearing mount with servo rails moved forward.

2 Preparation of the clutch including a heavy-duty return spring. Note drive pin groove in center of clutch ball bearing.

3 Clutch shaft assembled with bearings, pulley and belts.

4. Entire power train installed on a finished and epoxy-painted frame. Upper clutch shaft bearing mount is secured by bolts and can be shimmed for optimum belt tension adjustment.

5 The Veco engine fitted with the flywheel/pulley/fan which can be made from the original model's engine counterweight.

6 Rotor head parts in "exploded" view. Sears turnbuckle is main piece. Rocket City bearings are the black plastic parts.

7 Complete rotor head system shown here. Number of washers on the flybar determines the control stability/sensitivity.

8 Underside view of assembled rotor head shows how the turnbuckle is cut away to maximize flybar tetering movement.

9 Building the rotor blades is easy. First, splice the spruce leading edge to the balsa trailing edge stock. Then plane and sand to airfoil shape. (Note two airfoils shows on plans to suit conditions. Take the shaped 5/32 mw arm and insert it into a cutout in the blade. Epoxy the wire in place and then epoxy the "L" shaped cutout over it.

10 After resanding, the blade is ready for Mono-Koting and matched set balancing. These are very durable blades.

11 Top view of rotor head with swash plate follower properly aligned and linked to the flybar. "Servo paddles" are pitched by the control. They aerodynamically move themselves up and down for cyclic control.

12 Tail rotor system is similar to original model's unit, but much stronger and ball-bearinged. Note brass center piece in the large gear.

13 Complete tail rotor installed on helicopter uses same spring-loaded control system as on original model. It works surprisingly well, but keep it lubricated. Gears handle quite a load. Keep checking the gear mesh and solder joints for safety's sake.

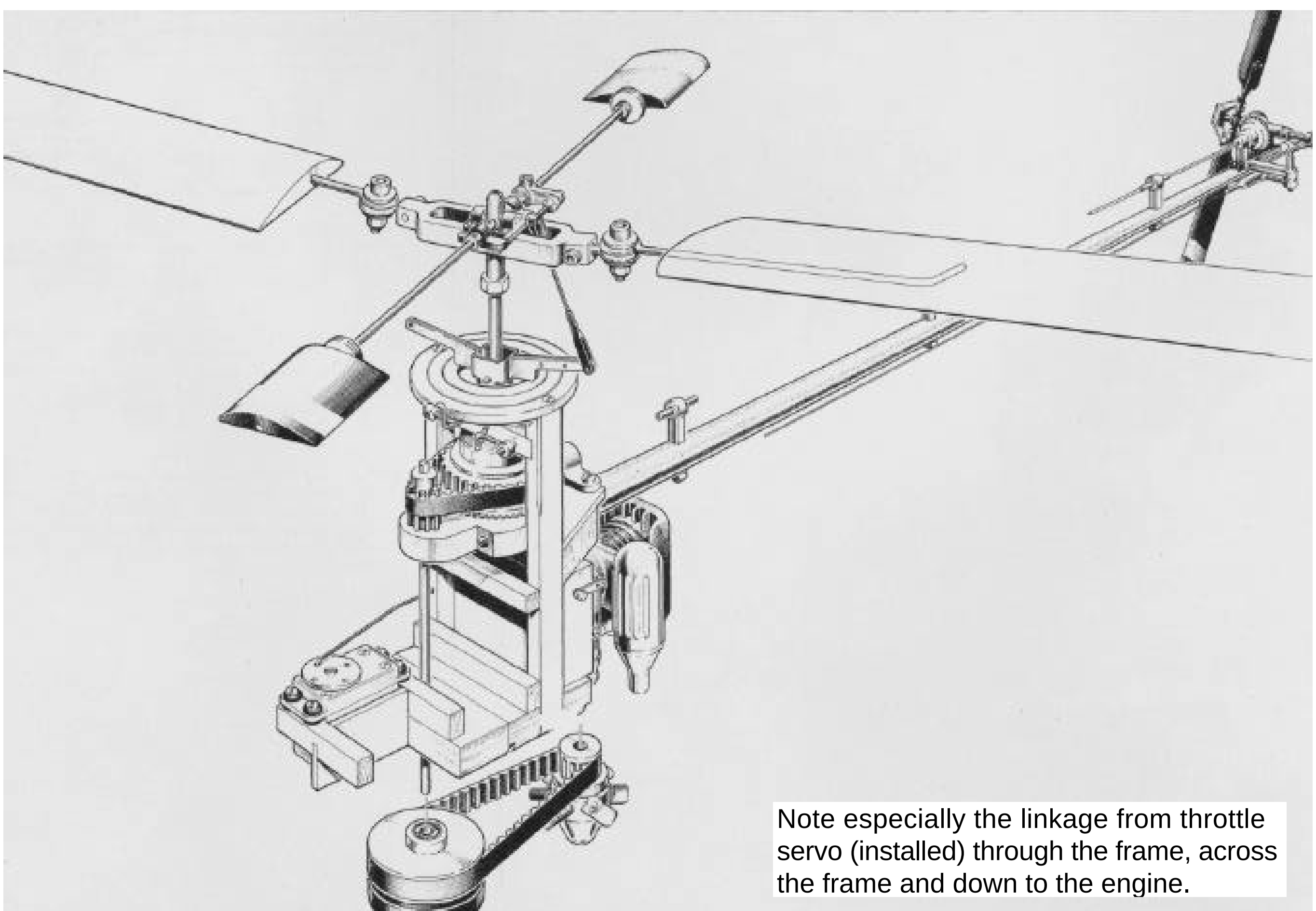
14 The snap clutch provides overload protection for the bevel gears and tail rotor blades. It also permits splining action of the tail drive shaft. Heavy wall Pylon Brand surgical tubing tensions the clevis against the larger square tube.

Superbird

The turnbuckle bolts are RH and LH threaded respectively. Cut 1/2 in. from each and center drill each piece for 5/32 hole. This hole takes the 5/32 music wire blade mounting loop—make one for each side. Solder these wire loop parts securely in the threaded sections and cut to equal lengths. Now just screw these assemblies into the turnbuckle. The set screws will later lock the threads to hold the proper collective pitch setting.

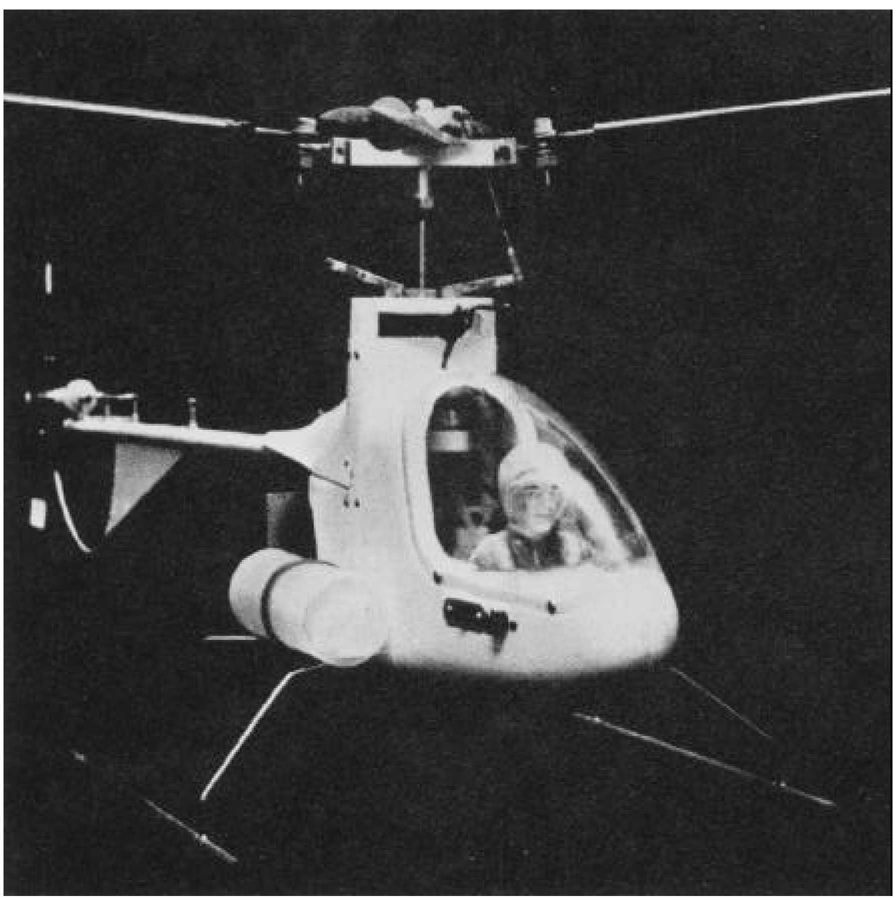
Build your main and tail rotor blades as drawn and shown in the photos. Incidentally, I suggest that you cover the blades (including tail rotors) with trim MonoKote. The servo paddles (as Hiller calls them) in this model use the same lifting section airfoil and chord as the main blades but are only three in. long each. When the paddles are made, epoxy a five-in. length of 1/8" ID brass tubing in them. The flybar is to be 22 in. long of 1/8 mw. It is bearinged in a short length of brass tube inside the longer nose-wheel bearing. Wheel collars pinching the 5/32 OD brass tubes lock the paddle assemblies to the flybar. The flybar is weighted with brass or steel one in. dia. washers with 5/32 hole. The number of washers is varied to suit flying conditions and control reactions desired.

Above: Cutaway was seen in Fred Wolff's fantastic article in *Popular Mechanics* last year. We thank them for letting us reprint it here. Below: This cutaway is his adaptation of the original artwork showing conversion's mechanics.



Note especially the linkage from throttle servo (installed) through the frame, across the frame and down to the engine.

Above: The Superbird in flight with Dave Grey at the transmitter. He likes to fly so close in hovering that you can reach out and touch the helicopter. Below: Stylish body houses four-channel radio entirely inside. External fuel tank shows when to land without disaster.



A short Du-Bro nose-wheel steering arm links the flybar, via a pushrod, to the swashplate. The swashplate follower must be straightened and will be positioned parallel with the rotor blades, not parallel with the flybars as on the 505. A length of 4-40 bolt added to the arm, with one of those neat Du-Bro swivel links and its clevis, completes this assembly. Add two new holes in the swashplate follower to give 1/2 and 2/3 of original control. Link the pushrod to the inner hole. When all parts are assembled, you now have the model complete with body, frame, power system, radio system and rotor head. The threaded joint of the aluminum rotor head piece and the shaft must be extra strong—use a lock nut and "Loctite" compound. Be sure the piece is properly aligned on the shaft in relation to the swashplate follower. Next is the tail rotor drive shaft and system.

You will find the tail rotor system easy to make if you realize it is very similar to the 505 system, but much more durable. The square tubing locks things together with less dependence on solder joints. Some of the work is quite intricate, so be slow and plan your work.

Not shown in the drawings is a 1/16" wheel collar set into the large tail rotor drive bevel gear. Drill out the gear to snug-fit the collar. Drill all the way through the gear's hub into the collar's set screw area. One long set screw through both parts will lock them together. Also, drill and tap for another set screw in from the other side. The small bevel gear is secured on the knurled section of the tail rotor shaft.

The tail rotor blades are mounted via bolts in the large IBM clevises. Under impact the blades pivot in the clevis. This clevis has a short brass tube soldered inside it as-its pivot bearing. The clevis is controlled exactly as on the 505, but a new wire control arm is made to suit the clevis's larger diameter.

There is one critical step. A tiny length of 1/16 ID brass tube retains each blade mount clevis on its axle. If you overheat the joint, you might solder everything together; not enough heat and the joint might fail causing a blade to fly off!

The snap clutch on the tail rotor drive shaft is a unique feature. Because the new model's shaft is turning faster and at a higher load, the brass-in-nylon bearings won't last and the gear mesh must be kept accurate, hence the ball bearings. The clutch has two purposes: First, it allows splining action when the tailboom flexes up and down. Second, it releases overloads which result from striking the tail rotors into the ground by accident. Adjust the clutch later using thick surgical tubing to clamp the clevis on the outer brass square tube. This adjustment must safely handle the maximum flight loads on the tail rotor. With this feature, I have never lost a bevel gear; without it, gears were constantly failing as a result of ground impact.

When final assembling the tail rotor system, make sure the drive shaft is

(Continued on page 79)

SUPERBIRD

(Continued from page 52)

straight all the way. Shim up or shorten any of the three supports to achieve this if necessary. Bevel gear mesh in front and in back are critical. Be sure that the teeth fully engage, that the shafts are at right angles to each other, and that there is no possible slop when under load. Note that a 1/16" collar is used on the tail drive shaft to locate the shaft at the rearmost bearing.

Now comes the balancing act. Balance your blades and paddles as individual sets removed from the model. Balance the blades by bolting them together at the loop in the music wire. Set this on a flat surface with the blades at 180 degrees. Lighten the heavy blade and/or heavy-up the light blade. While the blades are removed, balance the flybar system. When reassembled you will have a balanced system. Set main rotor pitch using the original 505 pitch gauge—the conversion's pitch is the same. You will have to remove the middle brace from the gauge to use it. The rotor blades must turn in the *exact* same disc of rotation. Being a rigid-headed helicopter, an out of track blade can render the head system useless. Bend or shim the parts to achieve correct tracking.

Balance the tail rotor by removing the control input arm, but leave the spring and collar in place. Remove large rear bevel gear. If the tail rotor is out of balance, the assembly will turn on the ball bearings showing which side is heavy. With plastic tape, heavy up the light side. Reassemble.

Fore and aft balance of the helicopter is very important. It must balance 1/8" ahead of the main rotor shaft. I used over seven oz. of lead in the nose of my bird to balance it. Incidentally, to locate CG, turn the model on its side; don't guess the CG by hanging the model by the rotor head.

The controls should do the following: Forward stick tilts the swashplate down in front. Right stick lowers the right side of the swashplate.

Flying

Now it is time to fly. If you know the 505, you'll have no trouble. Don't bother with trainer gears. They are nice, but heavy. Absolutely don't use a tether.

Needless to say, your engine must be broken in before helicopter use. Set the idle as low as possible with drive belt removed. Use a needle setting at high speed that is a bit rich. Attach the belt. Always start at low throttle-high trim. Set the clutch spring tension so the rotors will fully disengage at engine high idle speed. Shorten the spring as necessary. Advancing the throttle must engage the clutch smoothly and positively. Usually about 1/2 hr. of running is needed to smooth the clutch.

The only screws that loosen with use are the main rotor drive pin retaining screw (the one in the top of the shaft) and the tail rotor assembly where it secures to the tailboom. Keep checking these frequently.

Now start the motor and hold the helicopter overhead, holding it under the back side of the swashplate. Run the engine up to 1/2 throttle to check for vibration. If there is any, inspect blade pitch, tracking and balance. If not, go to full throttle to set the needle for a two-cycle run. Hold it for a minute to be sure the engine won't sag as it heats up. The model should have a strong upward pull.

Check to see if the helicopter wants to swing R or L at the nose. Adjust tail rotor trims or stop and reset linkages. I can't tell you what pitch your tail rotors need; this test will guide you.

When making your first takeoff, concentrate on the tail. Get it trimmed when it is about one ft. up; don't try to trim it during takeoff. Also, being a rigid-rotor helicopter, the cyclic controls are useless until the model is airborne.

If the wind is calm, your 505 training will help you keep the new model in one spot. Hover at about two ft. for most early practice. Don't make sudden throttle changes. If there is a wind, learn to hold forward trim to stay in one spot. Note that the power setting is less when hovering in a wind and the tail stays aft more steadily. (It acts like a rudder in forward flight.)

During this training period, use at least four washers on each end of the flybar. Set the control response for the maximum control. This combination gives you the most stability and good control. Later, reduce control sensitivity to gain smoothness in hovering and at the same time reduce flybar weight as your skill increases. In calm weather this model can respond very fast without flybar washers, but in a gusty wind use all four on each side.

Still you are only hovering. Forward flight is easy and a real thrill. It is extremely easy to begin forward flight-just push forward stick and the model will accelerate and climb. But slowing to land-that is, coming out of forward flight into a hover—is quite difficult at first.

In forward flight the model behaves like a plane—aileron and elevator do the flying (cyclic controls). You can almost ignore the tail rotor control. *Warning:* Never go into forward flight if it takes more than 2/3 throttle to hover the model. You can cruise around in forward flight at your hovering throttle setting or higher. But if power is marginal, landings are abrupt.

As mentioned earlier, getting back to hovering is hard and can be disastrous unless it is done gradually. Here's the only safe way down that I know. Keep in steady forward flight until about six ft. altitude while reducing throttle enough to establish a slow rate of descent. The model must be moving forward, never stopping. With a helicopter, you need less power in forward flight— or to put it another way, you need lots more power in hovering. In this descent at a steady, slow forward flight the model will be nearly level. Keep the rate of descent steady with throttle—just like a plane. When you get to six ft. altitude and about 20 ft. from the intended landing spot, level off with a touch of aft stick. You should have slowed to under five mph.

Now things get tricky. You must add power as the model nears a hover, but not enough to completely arrest the slow rate of descent. As far as I am concerned, hovering is mostly done looking down on my model; forward flight is done higher up. So now the helicopter is descending below six ft.; forward motion (in a calm wind) stops and the chopper is hovering again.

Practice the above sequence only with plenty of fuel. Become very proficient in descending to a hover for landing. Why all the fuel? Well, if you feel unsure of the descent at any time, add power, push forward stick, and go back into forward flight like an airplane. It takes practice.

Once you have mastered takeoff, hovering, forward flight and landing, practice some aerobatics. Wingovers are especially fun and easy—do them as with a plane, but at a steady throtte setting. Try a wingover with a full turn and a half for added spice. Two-bladed helicopters can't loop or roll—my attempts have ended in crashes.

I have also flown this little copter with a collective pitch rotor head, with which some modes of flight are easier, others more difficult. It has been flown with full gimbaled rotor head, but again there are advantages and disadvantages.

If you are trying to fly your model at a high altitude location or on very hot days when the density altitude gets above 4000 ft., or if your engine just won't put out enough power, make a change in the rotor and paddle airfoils. Thicken both of them by 1/16". Either make new blades and paddles or splice a sheet of balsa to the bottom side and reshape them. In any case, be sure to keep the rotor rpm up to 1000 at hover.

If there is enough interest in these little Superbirds, we will publish other rotor heads for you to try. At the time of this writing, about seven Superbirds are being built and flown by modelers. It is a well-developed and proven model. But, as improvements are developed by all of us, they also will be published. Should there be a problem, write me at AAM. I'm the editor. I'll try to answer questions as best I can.

If you need more information to build your model, note that a limited supply of expensive photo material on this model is available through our Plans Service. The photo set is $5.00 including first class postage—write to me directly for it.