Here the author demonstrates two important things: it flies and does its flying in small places.

FIELD AND BENCH

DU-BRO WHIRLYBIRD 505

The Whirlybird that started the whole thing makes an excellent subject for the review not only because it is different but because so very many are waiting for it.

Every project should have some glamour and Paula Hail provides setting for the Whirlybird.

BY NATE RAMBO

• I first saw the Du-Bro Whirlybird "505" at the World Championships at Doylestown last September. It was a case of love at first sight. After a short talk with Walt Schroder, things were set into motion for this Field and Bench article.

Before going further, please be assured that this article is a true product report written from first hand experience. It will cover the very basic theory of the "505" design, the quality of the kit, building information, and, finally, the saga of flying. Note the word "saga." You haven't lived until you've tried to fly a model helicopter! But more on that later.

The design of this helicopter is ingenious and reflects favorably on its creator, Dave Gray. Now let's look at the way Dave approached the helicopter problem. As can be seen from the photographs, the .40 size engine and propeller sit on top of the "505" main rotor. This rotor turns from torque reaction in a direction opposite to the propeller. Lift is varied only by changing engine throttle setting, there being no collective pitch mechanism as on full size helicopters. A very large percentage of the lift comes from the propeller. The rotor generates some lift but is used primarily to effect control. By utilizing the spinning engine technique, Dave has been able to avoid an expensive gear box, clutch and blower. This system also avoided torque input into the fuselage thereby easing the pilot's problems.

Let's now take a simplified look at the rotor and its control principles. The rotor is rigid, therefore the blades cannot teeter or flap; they can, however, change pitch, and the helicopter's flight direction is controlled by the cyclic change of blade pitch using what would normally be the elevator and aileron controls. The rotor blade pitch is not controlled directly but via linkages to a flybar which may be seen in the photographs. This acts like a large gyroscope that stabilizes the helicopter.

The tail rotor is super simple to understand. It provides yaw control and operates like the tail rotor on a big helicopter. It is gear and shaft driven from the main rotor shaft. The rudder servo controls the pitch of the tail rotor to achieve "steering" of the helicopter.

Having some idea of the principles of the 505, let's critique the hardware. The kit is really impressive because of the numerous parts; it's an inventor's dream. Most of the fabulous little metal pieces and machined parts are packaged in plastic bags, each one labeled so that the builder knows what subassembly the parts fit. For instance, one package is labeled "Tail Rotor," and in that bag are all the little pieces re-

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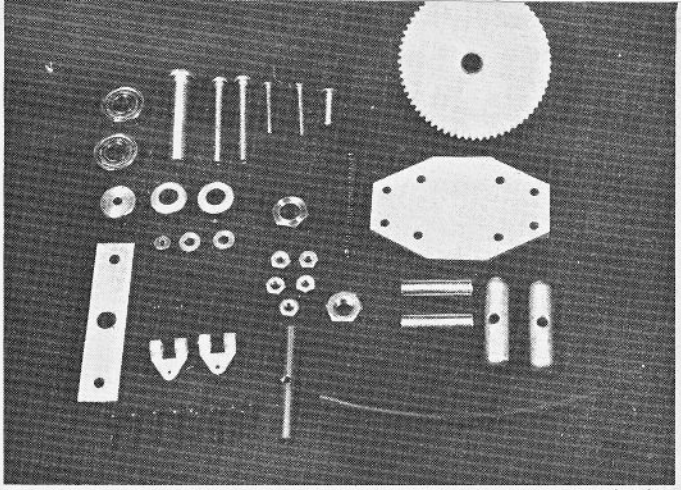
Kit package with the parts spread in orderly fashion—132 different parts.



Kit packages full of many tiny metal and nylon parts, all well machined.

PHOTOS BY TOM ROE

quired to build that assembly. This is pretty important when you consider there are 132 different kinds of parts or pieces in the kit.

The large number of parts in the kit brings up the next thing. With all those pieces it takes one darn fine instruction book to put them all together. Dewey Broberg didn't spare the effort here. He includes with the kit a 34-page instruction book consisting of Heathkit type step-by-step instructions, exploded diagrams, and a parts list. The builder can order spare parts from DuBro using the latter.

Assembly of the parts is relatively easy and a lot of fun. Instead of building just another routine Pattern ship, every part and every step is new. Frankly, the kit puts fun back into modeling because of the novelty. The building time required by the author, however, was more than the advertised eight hours. Someone who has built one before could do it in eight hours, but a more realistic time is 25-30 hours, if it's the builder's first 505.

The 505 is intended for a small, lightweight radio system. I employed a 1969 Kraft Gold Medal Series six channel receiver with KPS-10 servos. With this equipment installed, the 505 weighed four pounds; this is two ounces above the suggested flying weight. Unlike a fixed wing aircraft, flying weight is critical. A radio system weighing more than mine (about 14 oz.) may be too heavy.

My particular 505 was arranged to operate with a two-stick transmitter. A question arises with this type of transmitter concerning set up of the left stick. I elected to rig the yaw control like an aircraft. This is in contrast to Dave's method which is the opposite (i.e. left swings the tail left rather then the nose). Then arises the question about throttle control. I again made mine like an airplane but another local flyer rigged his the opposite and the reasoning there is pretty sound (i.e. pulling stick back makes model rise). My only conclusion from this whole business is that a single stick transmitter would appear to be a much more logical approach. All of the controls would move exactly in consonance with the helicopter's movements.

And now we get down to the heart of this whole article—flying the 505. Perhaps a better description of the following would be "Learning to Fly a Model Helicopter." None the less, here we go. I had no factory help and started with an untested and untrimmed model just like most people will have to do. There were no model helicopter pilots available to inspect, check-fly and trim the

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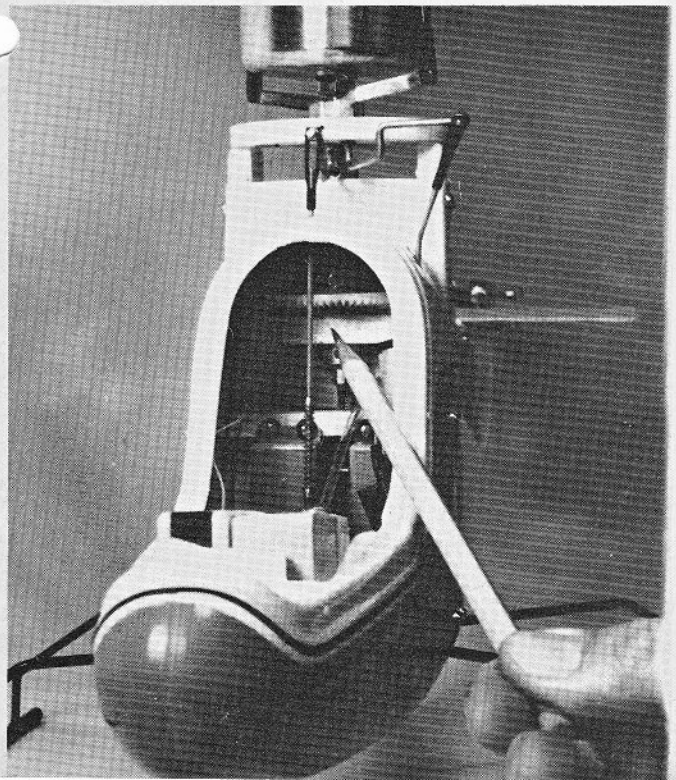
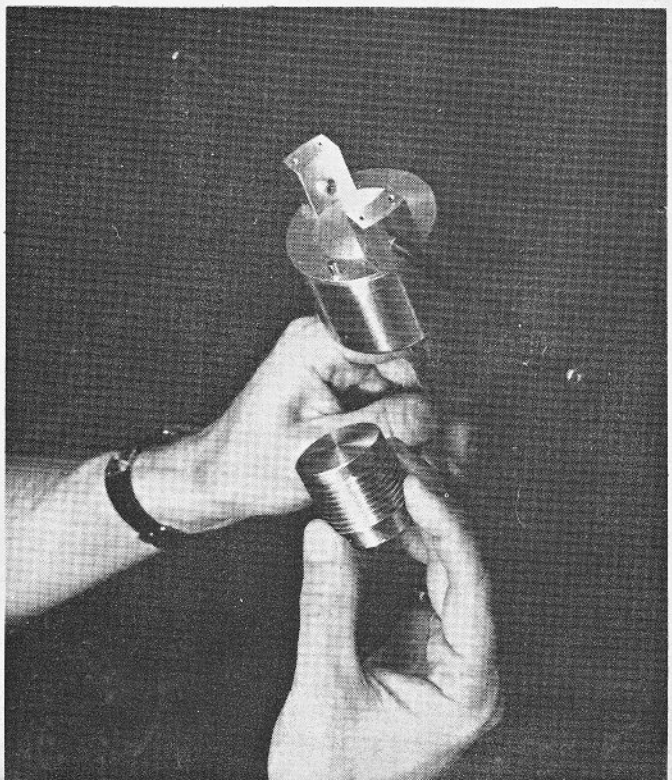
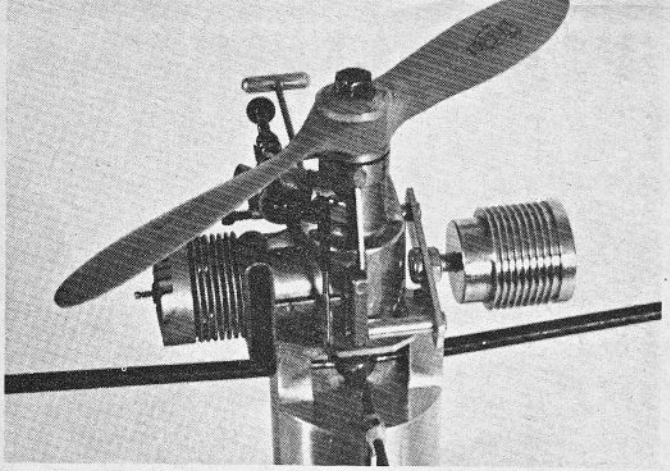
Large crown gear on main shaft drives tail rotor. Receiver and battery pack strapped together to save space. Note springs on control pushrods.

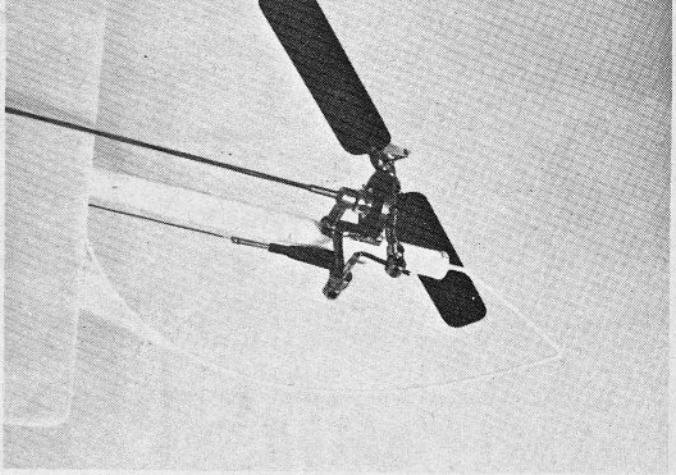


Very clever engineering here with combined fuel tank and counter balance. Engine bearer attached to the two drilled stubs, well machined.





Rotor head completed with engine and counter balance installed. Muffler can be used but requires careful relocation of the balance weight.



Completed tail rotor assembly with pushrod attached to actuating horn. Large gear drives rotor, pinion gear changes pitch angle of rotor blade.

FIELD AND BENCH . . . CONTINUED

machine in the air. Being qualified in glorious fixed-wing competition all over the world was absolutely of no help. I found that I really was a mere mortal after all. Let it be very clear that *flying a model helicopter involves learning a new skill.* To acquire this skill takes time and patience . . . there were many times during my early flights when I questioned my own limitations and capabilities or cursed the 505 for not doing what I wanted. Dale Willoughby put it very aptly when he said, "You don't carry on an idle conversation with friends while flying a model helicopter!"

My approach to learning was to use the Gray approach of using two tether lines held by friends. This helped me out of trouble and gave me some feel of the controls. During the early flights, I learned as much about rigging the 505 as about flying it. For instance, I found how tight to fit the gears, how much slop to leave in the swash plate follower, and so forth. I also learned to start and adjust a vertically mounted engine, which was quite awkward for awhile.

It was between early flights that I made some minor modifications to the 505. First, four small straps were added around the landing gear skids and soldered to the legs to prevent the solder joints from breaking due to my terrible piloting. The second modification consisted of two extra set screws installed in the large crown gear to make it run true on the main shaft. The third modification involved a slight revamp of the tail rotor assembly to lengthen the pitch spring and control arm; this was to reduce friction and achieve better control linkage ratios. While the above changes may not have been essential, I considered them highly desirable for getting the most out of my particular 505.

For wind shelter, most tethered flights were conducted in a large aircraft hangar. This is much better than a small garage because it allows space to move. After about eight or ten flights

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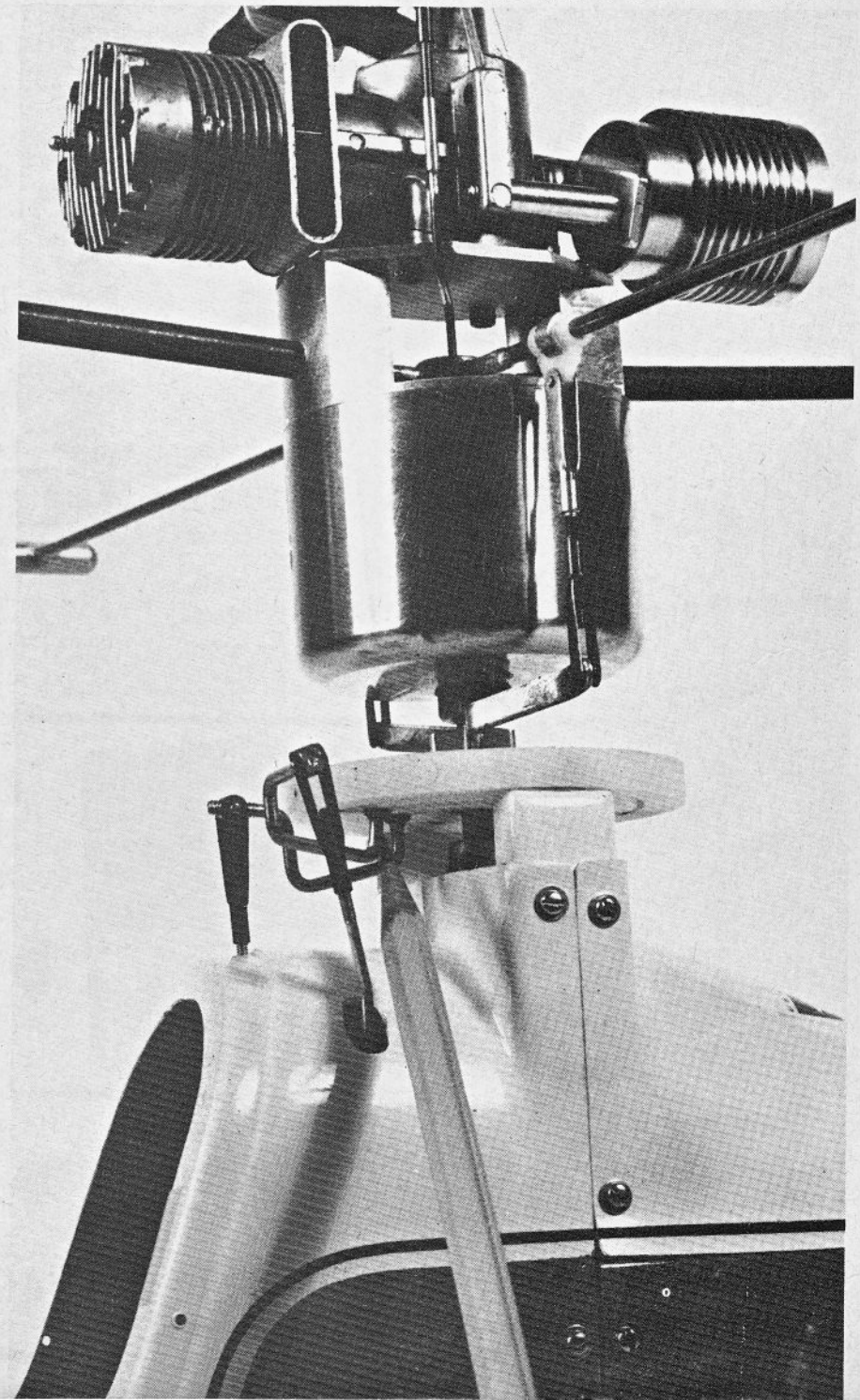
View of swash plate and linkage which transfers control forces to flybar to change pitch.



the tethers were removed and free flight attempted. The result was a series of minor crashes. The next 20 flights were spent on and off the tether lines which at times seemed to hamper me more than help. An important thing to suggest here is addition of a training landing gear, if the weight can be tolerated. Two 1/4" dowels with rounded ends (or wooden balls glued on the ends) can be lashed to the 505 undercarriage in the form of an "X." In my case, they contributed immensely to finally winning the battle of learning to fly a model helicopter. This attachment permits the model to be flown free with far less chance of a minor accident. Like most helicopters, the 505 landing gear is small, and the machine can be easily upset unless it is equipped with such a training gear.

At the time of completing this article, I am able to hover the 505 under calm air conditions; I am able to control it with reasonable success and move it back and forth at low speeds. I have really just begun a long learning process and I feel that any model helicopter will require the same level of piloting ability.

As any other model helicopter, the 505 is easily damaged. However, it is very easy to repair. I "bent" my 505 numerous times and expect to "bend" it more before achieving the demigod status of a fully qualified model helicopter driver. Damage on most occasions has been a broken rotor blade and some bent music wire, but this is very easy to repair and I would suspect that no other model helicopter on the market today can be put back in the air so easily. I found that a simple field repair kit can be carried including epoxy glue for rotor blade repair, a Bernzematic torch kit for soldering, and a spare large gear for the tail rotor mechanism. With these items, I have always been able to facilitate repair of the 505 on the field no matter how hard I flew it into the ground.

As the reader can readily grasp, the 505, like any other model helicopter, opens up great new flying fields like the front street, the driveway, and so forth. The ship likes these hard top surfaces which permit it to slide when landing rather than turning over. Most of my free flying has been on a little-used side street behind my house. I found, however, that the 505 should not be flown over dirt. The dirt situation is bad enough on any surface because the oily engine exhaust on the fuselage picks up dirt which re-circulates with rotor wash. There are several areas of concern here besides covering the whole ship with a greasy dirty mess. First, engines don't thrive on dirt, so a Perry air filter or similar device is mandatory on the carburetor regardless of how clean the flying conditions are. Secondly, dirt causes excessive wear to the tail rotor components which, on the 505, have a limited life. My only answer to the latter problem is to buy extra crown and pinion gears for the tail rotor from Du-Bro prior to needing them. Changing gears is a simple matter and their cost is reasonable.

There is one very important item concerning flying the 505 which I have not covered—the ship seemed to be sensitive to wind. With my limited piloting ability, I was only able to fly in morning and evening calm conditions because of lift-off and touch down difficulties. With self-imposed time constraints for submitting this article, it was impossible for me to really assess the limitations of the machine in wind and find how many of my problems were solely pilot-induced.

In conclusion, the modeler today who is shopping for a model helicopter kit should seriously consider the 505. It is an intriguing and challenging helicopter to build and fly. The price tag and ease of repair