American R/C Helicopters MANTIS

CIRCUS HOBBIES JR 5-CHANNEL HELICOPTER SYSTEM H.B. 40

A low-cost helicopter that is ideally suited to beginners and more advanced fliers alike. Mantis is a great way to start in rotor flying.

Principals of this "revolutionary" drama, American R/C Mantis, JR 5-channel helicopter radio system and the HB 40; Mantis can be assembled in as little as 10 hours.

Field & Bench REVIEW

by Jeff Baker

• The New Mantis R/C helicopter kit, manufactured by American R/C Helicopters Inc., 635-11 North Twin Valley Rd., San Marcos, CA 92069, (714) 744-7533, is priced at $169.00. The model is 43" long and 13½" high, requires a 4-channel R/C system, and flies on any standard .40 engine you have around. It boasts a 41½" hardwood main rotor (consisting of two 18⅜" blades) and 9" tail rotor, and has fixed pitch.

The kit includes everything you'll need to get the Mantis into the air except adhesives, paint, fuel tank and fuel tubing, engine, and muffler. We were very pleased with the packaging of the parts. Each package is numbered according to the step-by-step building instructions, which really simplifies finding the parts you need at the time. The instructions also include 75 construction photos that are keyed to the instructions and full-size plans. While we didn't see the need for the full-size plans at first, we found that they helped us to plan ahead for the radio installation, and also helped clarify things that came up in reading the assembly instructions or studying the photos. For example, we had a question about the orientation of the fore/aft swashplate bellcrank as discussed in the instructions and as shown in the photos; the plans show it clearly.

We referred to this as the New Mantis kit because it incorporates several modifications in the original design. These mods are intended to make it a more rugged machine, and to make it easier to build, trim and fly. The modifications include injection-molded sturdy side frames, a new engine mounting block designed to fit all standard .40s, and a new tail rotor belt-drive system with new pulleys that are more reliable and easier to install. (If you have the earlier version of the Mantis with the plywood side frames, an updating kit is now available for $15.95. This is an exceptionally good price, as it includes the plastic side frames, new belt-drive system, belt, engine mounting block, and all necessary hardware.)

In addition to the plastic side frames, the kit includes a 2-part plastic canopy, plywood bulkhead, servo tray, tail feathers, aluminum cross strut and skids, ¾" aluminum tail boom, shielded bear-

ings, nylon gears and tail rotor drive pulley, tail rotor drive belt, starting belt, clutch, fiber-filled plastic paddles, plastic see-saw, linkages, clevises, etc. One of the things that we really liked about the design of the kit is that all American Standard parts are used. That makes it easy to find replacement nuts, bolts and other parts. (If you have ever tried to locate a special metric nut or bolt, you know what a problem that can be.) For example, the tail boom is a straight length of 3/4" standard aluminum tubing, and you can buy replacement tubing at your local hardware store. The ready availability of parts also helps keep repair costs down.

BUILDING. What really impressed us about the New Mantis was that our building time was only 10 hours, considerably less than it had taken us to build the original version. This was due, in part, to the time-saving and sturdier plastic side frames. As a result, there is minimal wood work. Prepare the bulkhead canopy interior pieces and the tail pieces.

There was nothing to assembling the rotor head. The hardest part was sliding the flybar washers and wheel collars in place. We really had to work to get these parts past the threaded end of the flybar. But...that's also good, because it takes any play out of the flybar system. A clever feature of the flybar is the adjustable collars, which allow you to dynamically balance the main rotor/flybar system for relatively vibration-free operation. That saves wear and tear on the servo mechanics, battery pack and receiver.

One concern about all helicopter kits is the main rotor blades. All you need is one heavier than the other, and you've got your work cut out for you to balance them. The hardwood Mantis main rotor blades are factory-weighed, and each blade is marked with its weight in grams. When we set up the blades, we found that they were so closely balanced that it was hard to decide which blade we could add a length of striping tape to in order to check the blade tracking.

The kit includes adhesive-backed vinyl material to cover the blades. The root end of the blades, which is not covered, should be sealed to prevent fuel penetration. We painted that part of the blades the same color as the covering material.

The tail rotor assembly goes together quickly and easily. Just slide on the wheel collar, pulley and bearing, slide the unit into the housing, and add the other sealed bearing. That's it. Not much work with the belt-drive system; no gears to adjust. The tail rotor drive belt runs from the drive pulley down inside the aluminum tail boom to the tail rotor pulley to keep it relatively dirt-free.

We should also mention that the tail rotors are set up so that they are protected from the ground (vertical stab acts as a rotor guard, giving about 1/2" of ground clearance between the bottom of the stab and the blades); thus, it would require some very creative flying to find a way to bang up the tail rotor blades. The whole tail rotor system assembly took us about an hour.

The only problem we ran into during assembly—and a minor one, at that—was in installing the plywood bulkhead and landing gear. The instructions call for socket-head machine screws, but a 1/64" pilot hole was drilled in the plastic. There is no way a 4-40 machine screw is going to fit into that hole, and we could find no self-tapping screws in the kit. So we just drilled out the 1/64" holes and tapped them for 4-40 screws. No big deal, but it took a bit of extra thinking time to figure out what we were supposed to do.

While the Mantis flies very well with any standard .40, we chose to install an HB .40 with Perry Directional Porting in our machine. We found that the extra power of the HB .40PDP made the Mantis a very lively performer. The smooth transition and steady mid-range of the HB .40 made hovering much easier. Throughout our flight tests the HB .40 was consistently easy-starting and extremely smooth-running. It has been our experience that, sooner or later, a time will come when the pilot powers up a bit too late for the touchdown; having the reserve power can be a life-saver.

Since our HB .40 is somewhat larger than a standard .40, we had to elongate the holes provided in the engine mounting block to accept the engine. The only problem this larger engine creates is that the head of the engine almost touches the back of the main frame, making the glow plug hard to get to. If you use this engine, it will make starting a lot easier if you wire an ex-

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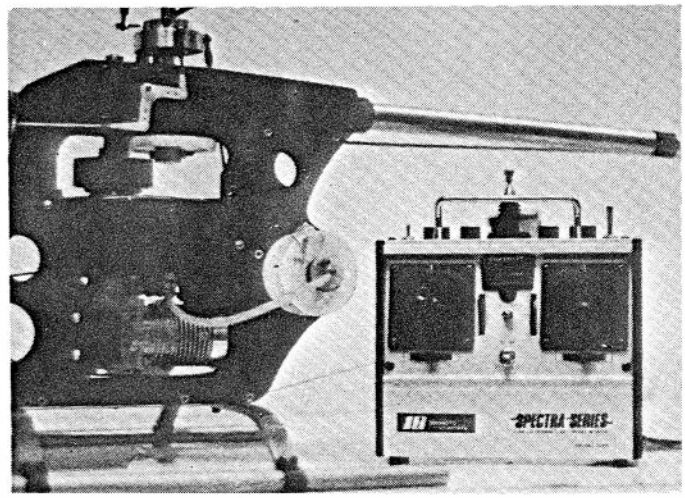
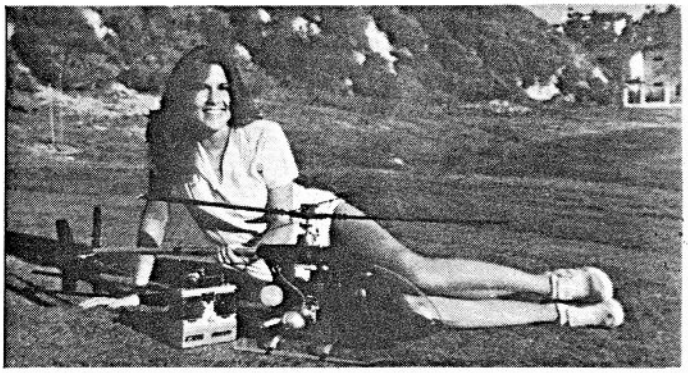


Top left: From any angle the Mantis is a neat and functional helicopter; a collective pitch option should be available in the summer for under $70.



Above: New version includes injection-molded side frames and a new universal mounting block for all forties. Circus Hobbies JR has mixing of throttle and tail rotor.

Left: Melinda Tangora poses Mantis at the Porter Ranch Country Club in California. All photos are by Ben Strasser.

ternal plug to the glow plug. Otherwise you'll have to push the swashplate bellcrank out of the way each time you start the engine. With most .40s, alligator clips can be used to fire up the glow plug.

Most standard mufflers do not fit properly on a helicopter and fail to provide the noise reduction often needed for helicopter use. We have used the Mac's muffler in the past, and due to its excellent noise reduction, with very little engine performance loss, we chose to use one on this helicopter. The high quality of the Mac's Products muffler has consistently lived up to our expectations. Some pilots use a tuned pipe, but it has been our experience that this can lead to problems—especially if the pipe starts coming on tune at or near the hovering point. This can make holding a hover extremely difficult.

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mend, therefore, that beginners add arrow shafts or wood dowels to the skids and put "wiffle" balls on the ends as training gear for a wider stance. While this is certainly not an original idea on our part, it works great to prevent damaged rotor blades. We also recommend that the beginner set the Mantis up with minimal throws for the first flights. Then the throws can be increased after the hover comes easy, and you're ready to go at it.

In our opinion, fixed pitch helicopters are much easier to assemble, set up and repair than the collective pitch versions are, although collective pitch does have many advantages for the more advanced flier. American R/C has provided the best of both worlds with the Mantis. They announced that they planned to have a collective pitch modification for the Mantis available in July 1981 for under $70.00. When the beginner has learned to fly with the fixed pitch head and is ready for a higher performance machine, he can convert it to collective pitch. We saw the Mantis fly with the collective pitch at the MACS trade show in California, and it really becomes a competitive, high-performance machine.

American R/C has opened up the challenging and exciting world of R/C helicopters to the average modeler who has held back because of the high cost of getting started. We really can't stress enough how much we enjoy flying the New Mantis...and it looks great, too! After having seen the collective pitch version fly, we can't wait to try that option. Perhaps we'll do a follow-up on this article to let you know how it works out for us.

When you write to American R/C Helicopters about the New Mantis kit, please be sure to tell them that you read about it in Model Airplane News. ■

We used the new Circus Hobbies JR 5-channel helicopter R/C system in our Mantis. The helicopter version of the R/C system is really great because it includes mixing of the throttle and tail rotor to compensate for torque changes as the throttle is changed. This makes holding the nose position of the helicopter much easier, and will aid the beginner through the most difficult part of his training. With this setup, changes in the throttle setting are automatically compensated for by slight changes in the tail rotor. Since one of the biggest problems beginners experience is "losing the tail," with just minimum practice this R/C system makes the beginner fly like a more experienced R/C pilot. The dual rates on this system are extremely helpful to the beginner and will smooth out even the more advanced pilot. Throughout our testing, and many flights since, this radio system has performed flawlessly. The receiver and battery pack are mounted against the frame of the helicopter with elastic bands and are separated from the frame with foam padding. When you set up your equipment in the Mantis, keep in mind that the tendency is for the helicopter to come out nose-heavy. Unlike on airplanes, the CG should be checked with the fuel tank half full because it is behind the CG. With half a tank, our Mantis came out just a tad nose-heavy and it flies great. So, you want to keep the weight in the nose as far back as possible when you build and set up your model.

While they're not included in the kit, we also added nylon skid guards to the skids to prevent wearing them out. (Nylon skid guards are simply sections of nylon tubing that slide over the skids.) These money-saving devices are available from Hangar Products (20829½ Roscoe, Canoga Park, CA 91306) for under $2.00.

To finish the model, we sanded and coated all the radio compartment and tail wood parts with resin so that the wood grain wouldn't show. Then, after some sanding, these parts were primed and painted with metallic green Formula U paint. The canopy and shroud were cleaned with alcohol, sanded with 400 wet-or-dry sandpaper, primed and painted.

FIRST FLIGHTS. The assembly instructions include some very helpful information about trimming the Mantis for a hover, adjusting the main and tail rotor blades, forward flight and flying maneuvers. Our technique to get the aircraft ready to hover was first to adjust the engine. Then we adjusted the coning. Next we adjusted the pitch, and the final tracking adjustments were made.

We adjusted the engine by having a friend hold the helicopter up over his head with the engine running. (Find a short, brave friend so you can reach the main needle valve easily.) When we tried to peak out the engine, we had trouble. On checking out the machine, we found that the tail rotor drive belt was working down on the drive pulley and binding between the pulley and the frame. After adjusting the tail boom up and down to no avail, we realized that the main rotor shaft (and tail rotor drive pulley) could also be adjusted. Adjusting the angle of the main shaft solved the problem. The cooling fan and shroud work great. We have absolutely no overheating problems with our engine—or with the original version of the kit, for that matter.

The coning angle was aligned by laying a straightedge along the plastic teeter bar—called the "see-saw" on the plans—so the blade was in line with it. With the coning angle set, we next adjusted the pitch. A pitch guide is provided with the building instructions. Eyeball the gauge in relation to the flybar; for the experienced helicopter pilot, it's almost as easy just to eyeball the main rotor blades without using the gauge. The real adjustment must be done with the engine running—depending on the performance of your engine. We started out with 1° positive pitch in the main rotor blades. Then we ran up the helicopter to about half throttle. We slowly increased the pitch in ½° increments until the helicopter would break ground at half throttle. (That's the way it should be. You can't say that a certain pitch is best, because it will be different with every engine. The pitch gauge provided in the kit does, however, give you a good starting point.) Finally, we adjusted the tracking by checking the rotor blades with the engine running a few rpm short of lift-off speed. (Normally you will find that one blade will be a bit higher than the other. Decide whether the high blade should have its pitch decreased or the lower blade pitch increased. Run it up again and check your work.)

After all the adjustments were made, we throttled up for the first lift-off. The helicopter vibrated somewhat. To smooth out the vibrations, the wheel collar weights on the flybar were adjusted to make the operation relatively vibration-free. We then lifted off a few times to adjust the tail rotor for a smooth lift-off. And a smooth lift-off and touchdown it was.

We really enjoyed building and flying the original Mantis. The modifications in the New Mantis kit have really paid off in a model that builds considerably more quickly, is sturdier, and flies even better.

The New Mantis has plenty of power with a standard .40—which is what we used to fly the original version. While it flies very smoothly, it is also very responsive to the controls. Just tuck the nose down while in the hover and off it goes. The large rotor blades make the Mantis less subject to the winds than smaller-blade helicopters are; much like planes with larger wingspans versus smaller wingspans. As with most helicopters, the beginner will find that it is easy to tip the helicopter over and bang the main rotor blades when learning to fly. We recom-