

MONOCOPTER

Simple, single-rotor design that flies...and flies!

By Bill Hannan

BUILDING A Monocopter can offer hours of free flight fun with little investment in time or materials.

This helicopter is simple, with only one rotor blade and no belts, pulleys, or other intricate parts.

Although it is a profile design of the Italian Agusta A-109 Twin, it can be built with another design if the layout is similar.

Before building, make a copy of the plans to preserve the originals, and when selecting materials, remember that weight is a performance enemy in any aircraft, but especially in helicopters.

CONSTRUCTION. Cut the Monocopter's motor stick from a stiff, medium-hard strip of $\frac{3}{16} \times \frac{1}{8}$ inch balsa. Glue a short section of balsa to one end to act as a spacer for the rotor-shaft bearing.

The bearing is a section of $\frac{1}{16}$ -inch diameter aluminum tubing. Cut it to length by rolling it under a single-edge razor blade, then snapping the tube along the scored line. Smooth the end with a fine file and sandpaper.

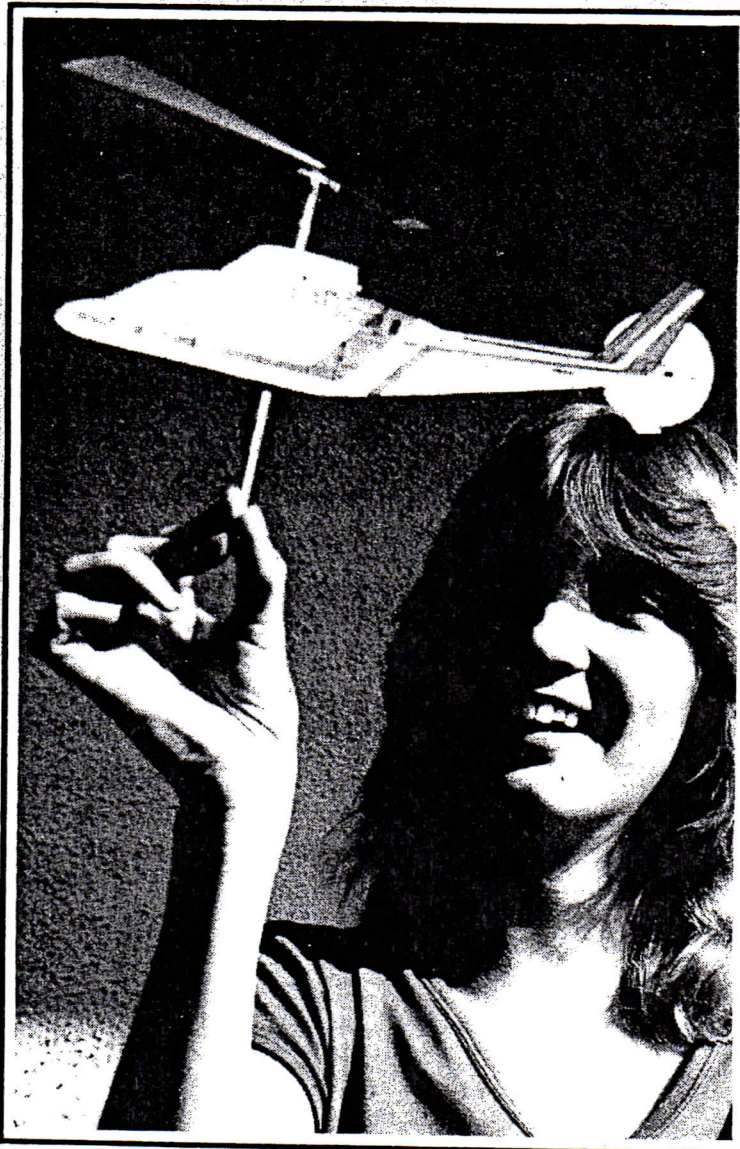
A Peck-Polymers nylon thrust bearing can also be used. For either tube bearing, roughen the outside for better glue adhesion.

Bend the rubber-motor retaining hook from thin music wire, then roughen it and insert it in the lower end of the motor stick. Wrap both the rotor-shaft bearing and retaining hook with strong thread and secure them with glue.

Glue the fuselage, which consists of $\frac{1}{16}$ and $\frac{1}{8} \times \frac{1}{16}$ inch strips. Pin the strips in position while the glue dries.

Cut the fuselage covering directly from the plans. Apply color with fiber-point pens. My Agusta was white with red ornamentation.

ROTOR. Cut the rotor hub from hard



Meredith Lueken puts the rotor in motion, ready to launch the Monocopter.

$\frac{3}{32}$ -inch sheet balsa. Drill a small hole for the rotor shaft. Make sure it is square with the hub so the rotor will run true. Carefully cut away one corner to form the mounting face for the rotor blade. Use $\frac{1}{32}$ -inch diameter music wire for the rotor shaft. Make the bends in proper sequence, forming the hook for the rubber motor first.

Next, slide the shaft through the motor stick bearing, and add brass or teflon thrust washers, then the rotor hub. Make a right-angle bend in the shaft above the hub using the plans as a guide. Make another right-angle bend in the end of the shaft arm to help retain the counterbalancing weight. Bind the shaft arm to

the rotor hub with thread and glue.

Shape the rotor blade from $\frac{3}{32}$ -inch sheet balsa. An exact airfoil is not critical, but a suggested section is shown. The model will perform without washout but twist some in to give the blade tip less incidence than the root.

ASSEMBLY. Make the counterbalance from a length of electrical solder evenly wound onto the end of the rotor shaft arm. Adjust the balance horizontally. A drop of glue will secure the solder in position.

Glue the fuselage framework to the back of the fuselage covering and weigh it down to prevent warping.

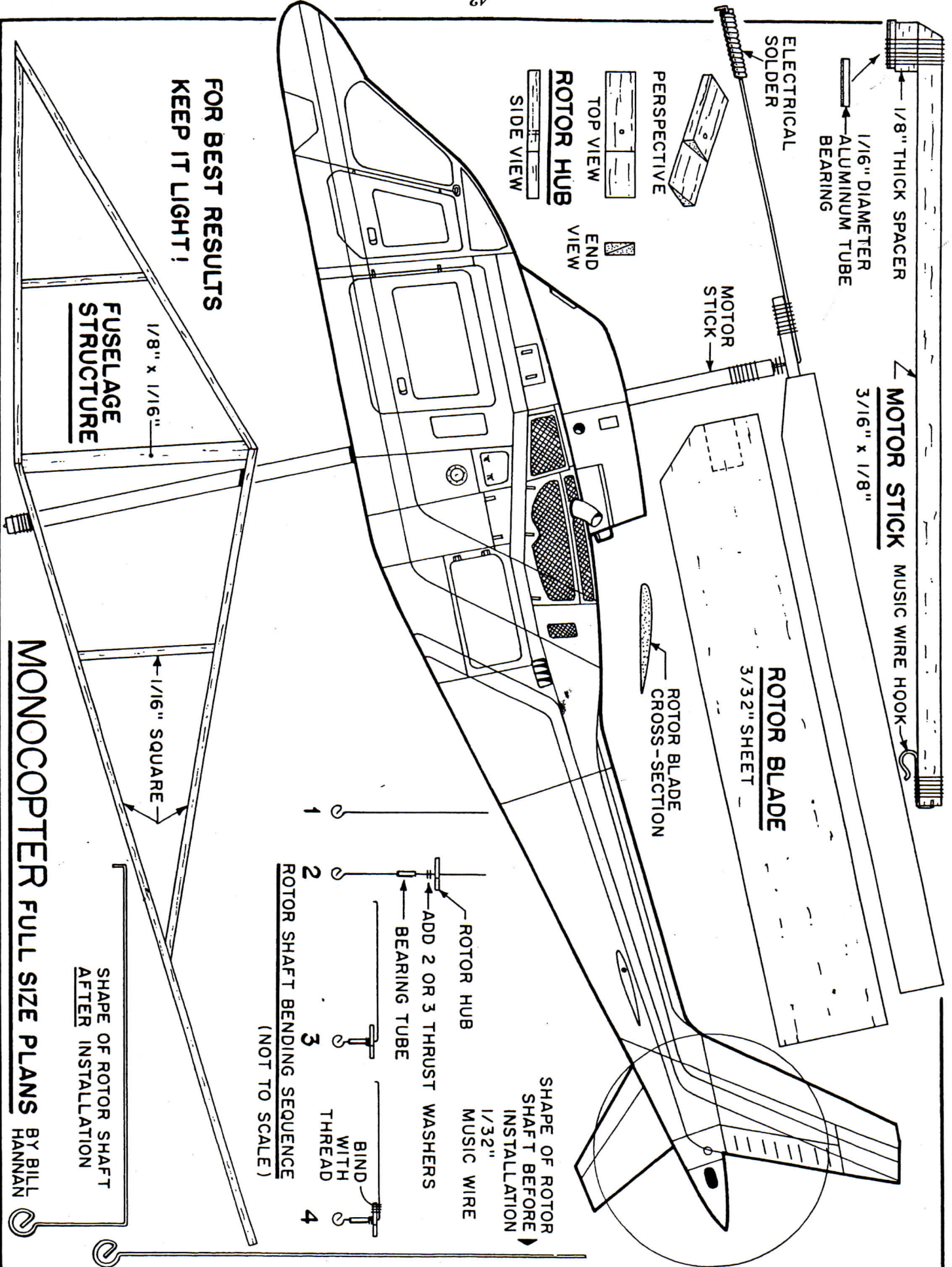
Then glue the motor stick firmly to the $\frac{1}{8} \times \frac{1}{16}$ inch portion of the fuselage framework. Moving the fuselage position up or down relative to the motor stick will alter the model's flight path.

FLYING. Add a drop of oil to the rotor bearings. Power requirements will depend on your model's weight and testing site. With low power the model can be flown in a fairly small room. Too much power can cause the Monocopter to hit the ceiling. Start with a single loop of 2 mm rubber.

A long loop of lubed rubber winder-wound can yield impressive results in a large indoor site. During the recent West Baden indoor championships, Charles Sotich proxy-flew a Monocopter 80-feet high for over 40 seconds. Outdoors, with more power, the model can fly much higher.

EXPERIMENTS. The Monocopter invites modifications! Improve the balance. Add or subtract from the counterbalance weight to affect vibration. Bend the rotor counterbalance arm slightly forward and down for better dynamic balance.

There you have it, the world's simplest helicopter. Why not give it a whirl? ■



1/8" THICK SPACER
 1/16" DIAMETER ALUMINUM TUBE BEARING
 ELECTRICAL SOLDER

MOTOR STICK 3/16" x 1/8"

MUSIC WIRE HOOK

ROTOR BLADE 3/32" SHEET

ROTOR BLADE CROSS-SECTION

PERSPECTIVE
 TOP VIEW
 SIDE VIEW

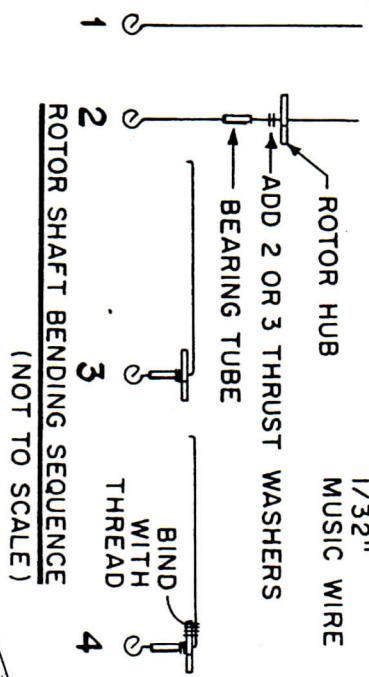
END VIEW

ROTOR HUB

FOR BEST RESULTS
 KEEP IT LIGHT!

1/8" x 1/16"
 FUSELAGE STRUCTURE

1/16" SQUARE



SHAPE OF ROTOR SHAFT BEFORE INSTALLATION

SHAPE OF ROTOR SHAFT AFTER INSTALLATION

MONOCOPTER FULL SIZE PLANS BY BILL HANNAN