Build a Simple Torque Meter

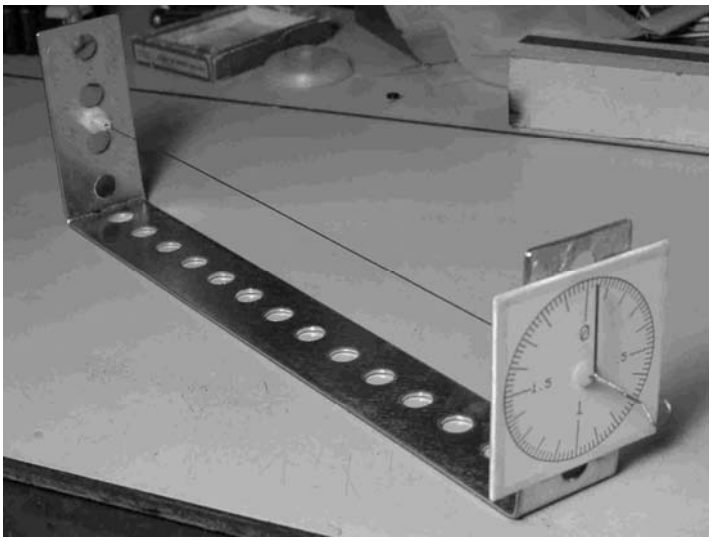
By

Ray Harlan

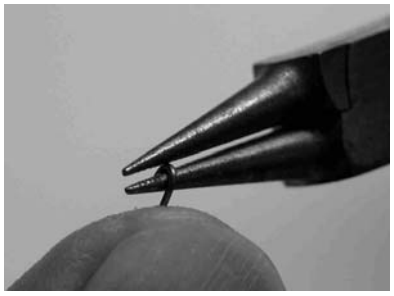
To get the best performance from your Wright Stuff model, it really helps to know the torque that has been wound into the motor and the torque at launch. Many of the details have been presented in the article “How to Make a Flight Log”, also on this website. You will need some materials and tools to make your torque meter. Most of them are:

Perforated steel strapping, 1 3/8” x 1/16”	Home Depot 30699 18070
Machine screw, nylon, 10-24 x 1/2” (part of binding post)	Home Depot 30699 87028
Machine screw nut, nylon, 10-24	Home Depot 30699 86858
Cotter pin, 1/16” x 1”	Home Depot 30699 16288
Nylon thrust bearing, 1/32” hole	Peck Polymers PA001
1/32” music wire	Hobby shop
.020” music wire	Hobby shop

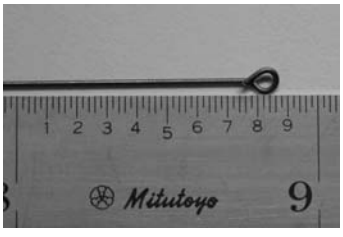
1/16”, 1/8” and 3/16” drill bits
Soldering iron
Solder
Paste-type flux
Thick cardboard – matte board
Epoxy
Xacto knife
Needle-nosed pliers
Round-nosed pliers
Gas pliers
Hacksaw
File
Mallet



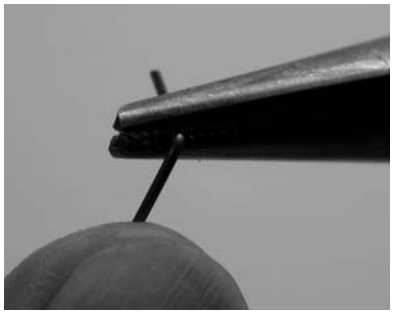
Let’s get started. Begin by bending a loop in the end of the .020 music wire with round-nosed pliers. The loop should be small, only about 1/16” inside diameter. After the loop is formed, bend the shaft back a little so that the loop is in line with the shaft as shown in the picture. Be sure that the loop is flat.



Mark the wire 8.85” from the start of the first loop with a very fine permanent marking pen. Bend a second loop starting at the mark, making it even smaller than the first loop if you can. Cut off the extra wire with diagonal cutters. These should not be fine electronic cutters; rather use some husky pliers because the wire is very tough. When it is complete, the wire should look something like the next photo. As long as the wire has a straight section about 8.85” long, it will measure 2 in-oz in one



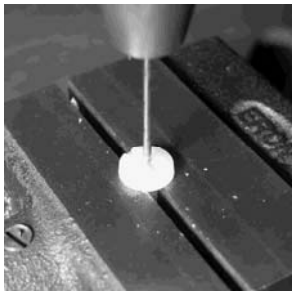
revolution.



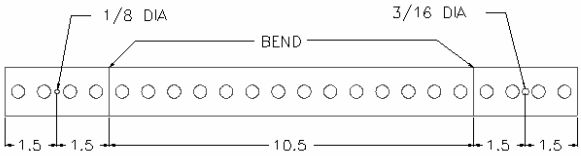
Cut a piece of 1/32” music wire about 6” long and make a sharp-angled bend in one end (more than 90 degrees) with needle-nosed pliers. The short end should be about ¼” long. Then hold it in the toothed jaws of gas pliers and squeeze the bend into a U. The opening should be large enough for the .020” wire. Also bend the shaft back a little so the bottom of the U is in line with the shaft, as shown in the photo.

Assemble the cotter pin to the .020” wire at the larger loop and the 1/32” wire to the smaller loop. Clamp the cotter pin vertically in a vise and let the rest of the assembly hang from it. All wires should be in line. Apply some paste flux to the two joints and solder them while holding the 1/32” wire in tension, vertically. Just a little solder will do, enough to fill the loops. When finished, wash all of the flux off with hot water. The assembly should be straight, with all wires and the pin in line with each other. If not, resolder any misaligned joints.

Drill a 1/16” hole in a nylon screw. While this can be done by hand, it is much better to use a drill press and a vise to ensure a straight hole. Try to drill the hole in the center of the screw.

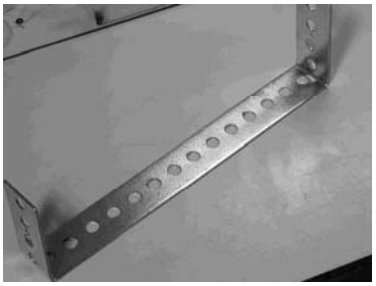


The steel strap has holes every ¾”. You need to mark it so the holes for the nylon bearing and screw are between them. The strap may not be cut halfway between tow holes, so mark it as the drawing shows and cut it with a hacksaw. File off any sharp burrs and round the corners. Drill the 1/8” and 3/16” holes in the center of the strap. If you cannot get the bearing, and you can drill a screw straight, use a second screw and drill two 3/16” holes in the strap. Clean off any burrs with a file.

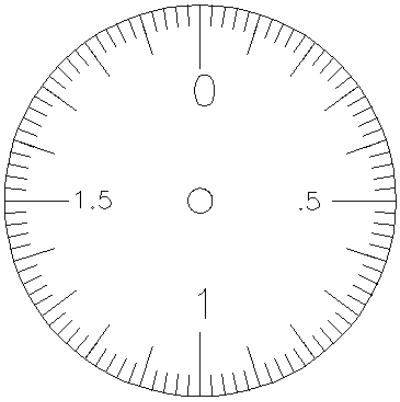


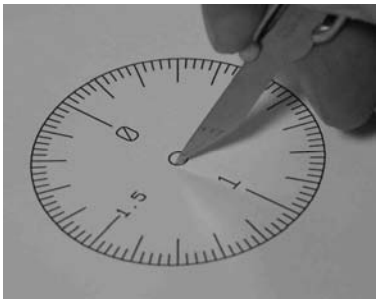
The next step is critical and, perhaps, the most difficult. The bends must be at square to the strap. Be sure the bend marks are square to the sides of the strap and line each one to the jaws of a vise before bending. Use a square to check it, if you have one. Bend the strap by holding a block of wood against it and hitting it with a mallet. Bend it until it is a square angle. Bend the other end. The distance between the legs should be close to 10.5” and the legs should be parallel. Check this by laying it down on a flat surface; it should not rock. If it does, find the leg that is more twisted relative to the base. Clamp the base in the vise with about 1/4 “ to 3/8” of it sticking out above the vise jaws, near the twisted leg. Tap the leg sideways with the block and mallet until it is parallel to the other leg. Also check that the legs are parallel when looking from the top. If not, put the leg in the vise, leaving 1/4” to 3/8” above the jaws and tap the base sideways to twist the leg into

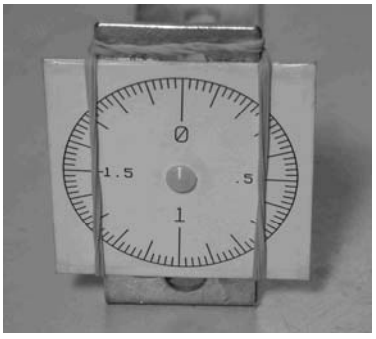
alignment. When finished, you should have a body with base flat and legs square and parallel, with just a few funny little squiggles near the bends. It should look like the photo.



Print this page and cut out the center hole of the scale with an Xacto knife. Cut a piece of matte board 2 1/4” square and mark the center by drawing diagonals from the corners. Drill a 1/8” hole in the board (or 3/16” if using a screw) and remove burrs with fine sandpaper. Coat the back of the scale with a glue stick and put the nylon bearing through both the scale and the matte board. Rotate the scale until the zero mark is centered on one edge of the board and then press the paper to the board. Remove the bearing, turn the board over and cut the paper along the edges of the board. Add some Scotch tape around the edges to give extra protection to the scale.

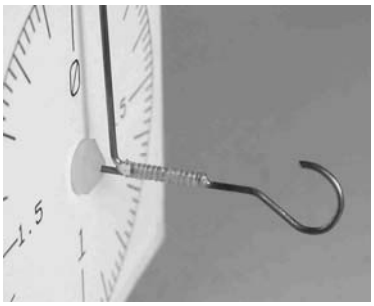






Put the bearing through the scale and insert it into the 1/8” hole in the base. Align the board square with the base and mark the base along the top and bottom of the board. Remove the scale and apply some epoxy between the lines on the base, keeping it away from the bearing hole. Reattach the scale, with the bearing in it and the base. Align the scale to the base and hold in place with some rubber bands as in the photo.

After the epoxy has set, remove the bearing once more. Insert the 1/32” wire of the wire assembly into the bearing. Attach the screw to the base from the rear and thread the nut onto it. Do not tighten. Feed the cotter pin end of the wire assembly into the scale hole. Move it back and feed the pin into the screw. Move it back as far as it will go. Mark the 1/32” wire about 1/16” in front of the bearing. Then pull the shaft forward as far as it will go.



Make a pointer from 1/32” music wire by bending one end 90 degrees. The short end should be 1/2” long. The long end should be 1”. Attach the short end to the meter shaft by wrapping it with one strand of wire from a piece of electrical wire, about 6” long. The bend in the pointer should be even with the mark on the shaft. Solder the joint, using paste flux. Wash all flux residue off with hot water, being careful not to get water on the scale. Bend a hook, as shown in the photo and cut off excess wire.

Push the cotter pin back as far as possible. Rotate the pin until the fingers are aligned with the screw slot. Bend the fingers over into the slot on both sides. You can cut off the ends, but leave some extending from the screw head.

The meter is nearly finished. The pointer needs to be lined up with zero. Do this by turning the screw. Use an adjustable wrench against the cotter pin ends. Hold it in place and tighten the nut with another wrench. Test it by turning the hook one revolution and then letting go. If the pointer returns to zero, the nut is tight enough. If not, realign with zero and tighten the nut some more. Be careful not to strip threads by over tightening.

Now that your torque meter is finished, what do you do with it? The first thing is to build a winding setup. Many indoor modelers put their meters on model boxes and add a holder for their winder. You may not have a large model box, so making a winding stick is the best way to go. Get a piece of solid wood (pine, spruce, etc.) about 1" x 2" x 31" and mount the torque meter on it with two screws. Use washers under the screw heads to cover the holes in the base. Mount it so that 5 ½" of the stick extends behind the rear of the meter to act as a handle when winding. Build a box from 3/16" or 1/4" hard balsa wood (from a craft store or hobby shop) that fits around your winder and allows it to be dropped into the top. For example, if you have the popular yellow-plastic 15:1 winder, a box 2" long, 5/8" wide and 1 ½" high (inside dimensions) with the top open would hold it. Glue the box together and attach it near the front of the stick with carpenter's glue. If about 1 ½" of stick extends in front of the box, there is room to glue a piece of balsa to act as a stop for the handle when the winder is in the box. You may want to add a couple of triangular gussets to strengthen the joint with the stick.

Once complete, you now can wind the motor with the model in a safe place away from the rubber. If the rubber breaks, the model won't be damaged. Since you will stretch the motor, having a handle behind the torque meter makes it easy for your partner to hold the stick. When the motor is fully wound, put the winder in the box and record max torque and turns in your flight log. Then remove the winder, back off the winder to the launch torque that you choose and put the winder back in the box. Get the model and transfer the rubber to the rear hook. Finally, transfer the motor to the prop hook. Using O rings on the motor makes the transfers easy. That's all there is to using a torque meter-winder setup.

Nose button vendor: Peck Polymers
www.peck-polymers.com