

# How to Redeem a Department-Store Telescope

You don't need to be a workshop wizard to save the wobbly, little refractor that doesn't satisfy. Turn it into a user-friendly telescope that offers many hours of pleasure.

by David Trott

Are you the disenchanted owner of a "department-store" telescope? The scope's traits are easy to recognize. It advertises high power (400x or more) and stands on wobbly wooden legs. This ubiquitous telescope sells under many brand names for \$80 to \$150 in department stores, camera shops, and even "educational" toy stores.

Unfortunately, this type of telescope has notorious deficiencies. The scope usually comes with low quality eyepieces and an inferior finder scope. But fixing the most serious problem — the mount — will go a long way toward improving it.



Carefully read the article, then assemble all materials needed for the project.

## Solutions

You can build an improved, stable mount for a department-store telescope for under \$50. The legs on this mount uses one-piece construction, and they are sturdier than the originals. Also, the bearing surfaces are larger to improve stability. Instead of fumbling in the dark to set up the flimsy mount, simply spread the legs and twist the tension triangle into position. The triangle operates smoothly

Sturdier, more efficient and stable, the new mount will help provide more observing enjoyment. The inset shows the department-store scope before changes.



David Trott (all photos)

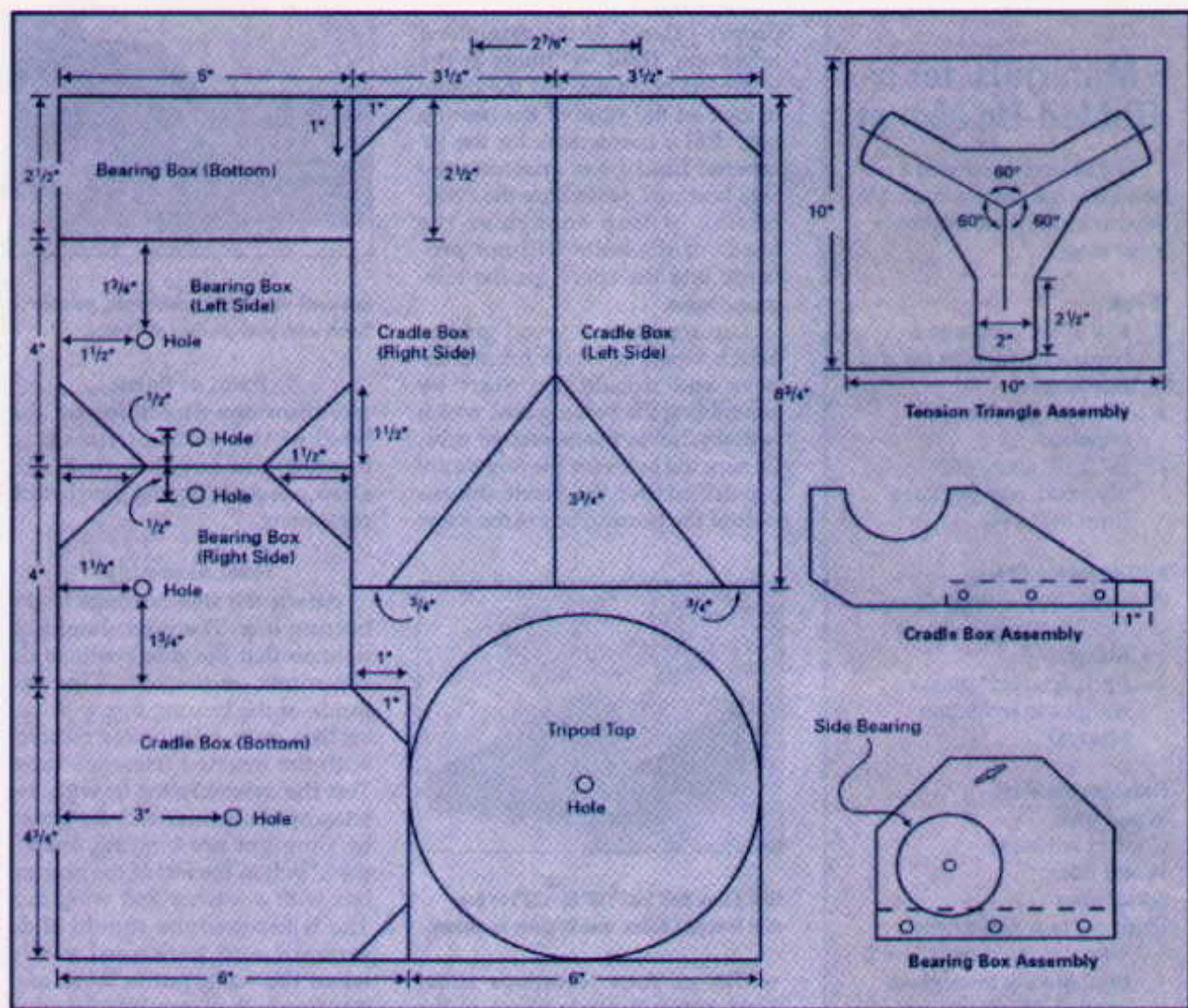


Illustration: Phil Kuchmeister

and holds the scope in position when released. You track astronomical targets with a simple push of a finger — no knobs to release, no quivers.

The plans above show dimensions for a 2½" telescope. If your telescope has a larger tube, scale up the dimensions; if the tube is smaller, shim the bearing box to make it fit.

### Construction Steps

Obtain all materials and prepare to cut the wood.

Carefully lay out the plans directly on the ¾" plywood. If your side-bearings (PVC plumbing fittings) are not quite 2⅜" diameter, carefully measure their diameter and add the thickness of the foot pad bearings to calculate the radius of the semicircular cut in the cradle sides. Before you make any cuts, be sure the bottom

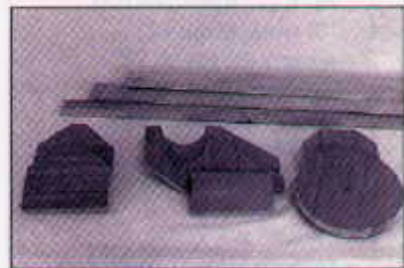
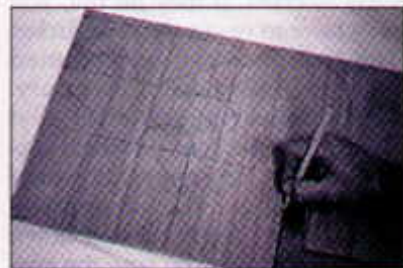
piece of the bearing box is the same width (2½") as your telescope tube. If not, you will have to adjust some of the measurements appropriately. When everything is correct, make your cuts. Use a special fine-toothed blade. Cut the 10" by 10" piece of plywood to make the tension triangle.

Use a wood filler to fill any gaps in the plywood and give all

pieces a preliminary sanding. Be sure to sand the "points" of the tension triangle and round them off a bit. Later, some touch-up sanding might be necessary to finish construction.

### Assemble

The offset position of the side bearings is necessary to provide clearance for full motion and



Transfer the plans from the blueprint to the plywood, then make cuts using a fine-toothed blade. The photo at right shows cut pieces for the new mount minus the tension triangle.

## Materials for a Beefed-Up Mount

The materials needed to build this mount are available at your local home improvement store.

### Wood:

- 3 1" x 3" x 4" pieces of a hardwood for legs (as stiff as possible)
- 1 12" x 16" piece of 3/4" plywood
- 1 10" x 10" scrap of plywood, any thickness from 1/4" to 3/4"

### PVC plumbing fittings

- 2 Reduction fittings (2 to 1 1/2" PVC pipe reducer fitting)
- 2 End caps (1 1/2" plastic, snug fit to reduction fittings)

### Finishing material

- Wood glue
- Contact adhesive
- Wood filler
- Sandpaper
- Paint or stain and varnish

To paint the mount, use a high quality latex gloss enamel, otherwise, use water base stains with a compatible water-based polyurethane varnish.

### Hardware

- 3 2 1/2" hinges with screws
  - 1 1/4" by 4" carriage bolt
  - 2 1/4" tapered head bolts 2" long
  - 7 plastic foot pads (sometimes called "glides", designed to go on the legs of furniture)
  - 1 1/4" x 12" threaded rod
  - 4 1/4" nuts, three 1/4" wingnuts, seven 1/4" washers, twelve 1 5/8" gold/zink screws (or wood screws).
- Felt 5" x 7" (self adhesive if possible)
- Formica 8" x 8" scrap, smooth texture (linoleum floor tile will do)

proper balance of the assembled telescope. Drill 1/4" holes at the indicated positions. On the inside of each of the sides of the bearing box, drill a countersink for the 1/4" tapered head bolts attaching the side bearings. Make sure the countersink is deep enough so the heads of the bolts will not protrude into the space for the telescope tube.

Use screws and wood glue to attach wood to wood for sturdiness and durability. Start by assembling the bearing box, which actually holds the telescope tube. Be sure the holes for the screws are pre-drilled and the inside dimension of the bearing box is the same



Use a fine drill bit (1/16" to 5/32") to pre-drill foot pad holes, and fit them as shown.

width as your telescope tube. Next, attach the side pieces to the base of the bearing box. Drill the two 1/4" holes at the top of the bearing box. These holes are for the tension bolt which squeezes the telescope tube to hold it securely in the bearing box.

After assembling the bearing box, begin the cradle. Before you actually put the cradle together, check to make sure the sidebearings (the two pieces of round PVC plumbing fittings) fit well in the semicircular cuts with the foot pads inserted. If they do not, you may have to re-cut the semicircles. The foot pads can be shimmed with small washers, if necessary. The sidebearings should rest cleanly on the foot pad bearings without touching any other part of the cradle box. The bearing box should move freely up and down within the cradle. Be sure the telescope tube can swing to a full vertical position, then attach the sides of the cradle box.



In a well-ventilated workspace, paint or finish with your product of choice.

### Paint or finish

Follow the directions on the label of the paint or finishing product you have selected, and allow adequate drying time before continuing.

### Final Assembly

Attach the side bearings to the bearing box. The nuts should be tight so that the side bearings do not rotate on the bolt. Line the inside of the bearing box with felt so that only felt makes contact with the inserted telescope tube. Test the assembly for fit with the telescope tube inserted. It should be snug but not binding. Install the 4" bolt in the top of the bearing box with a washer and wing nut. The telescope tube should slide forward and backward easily when the wing nut is loose and stay firmly in place when the wing nut is tightened. Tighten the wing nut enough so that the tube is firmly in place. Verify that the outside walls of the side-bearing box are parallel.

Trace the bottom bearing circle onto the Formica, cut it about 1/8" inside the circle, then attach it with contact adhesive. Drill a 1/4" hole in the center. Lay out the three hinges, which will attach the legs



Use the bottom bearing plate as a template to mark and cut the linoleum or Formica.™



The bottom board with a 1/4"-20 bolt protruding to fit into the cradle box

to the base in an equilateral triangle on the underside of the base. Mark the positions for pilot holes.

Next, hold one of the legs with one hand while the other hand holds the hinge at the end of the leg. Estimate the placement of the hinge so it will make about a 60° angle to the base when the leg is extended. It's best to attach the hinges so the angle is more nearly perpendicular to the base — you can always sand off a bit of material from the outer edge of the leg to increase the angle. After pre-drilling small holes for the screws, attach the hinges to the legs. Invert the base, put it on a flat and level surface and insert the screws in the pre-drilled holes in the base.

Use two nuts and washers to attach the 1/2" threaded rod which holds the cradle box in place and pulls up the tension triangle, holding the legs in position. Allow the rod to protrude about an inch at the top to engage the cradle box. You might have to countersink the top nut to prevent it from contacting the underside of the cradle



Pre-drilling the screw-holes for the hinges will make attaching the legs much easier.



The finished mount with telescope loaded and ready to use. Add a small counterweight to the front of the cradle box if needed for better balance.

box. Tighten the two nuts so the threaded rod does not rotate. Attach the tension triangle loosely to the lower end of the threaded rod with a washer and wing nut. Install the cradle box and bearing box with the telescope tube.

#### Try It Out

Make sure the mount has complete range of motion. Install the telescope tube and adjust the balance by sliding it backward or forward in the bearing box, adjusting the "squeeze" as necessary. It is designed to be easy to change. To operate the tension triangle, rotate it so the legs are pushed outward

and tighten the wing nut. For storage, loosen the wing nut and rotate the triangle again, then collapse the legs.

If needed, add a counterweight to the front of the cradle box to compensate for the telescope weight.

Your finished product is now far superior to the "old" department-store telescope. It's sturdier and easier to use, and is a good starter for observing the Moon, planets, and double stars, while providing many hours of uncomplicated observing pleasure. □

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Cradle box attached. Note the tension triangle wedge placed to keep legs spread.



The scope held securely in the side-bearing box fits neatly inside the cradle box.