Some Not-Too-Technical Advice Before You Begin…

This article contains complete information for building a 6 inch dobsonian telescope using a purchased objective mirror. If you are interested in grinding and polishing your own mirror, we suggest you pick up John Dobson's video (listed under "Sources" below) as a start. Also, Victor's Telescope Making Page has step by step instructions for mirror making. **All About Telescopes**, by Sam Brown (found at Orion Telescope and Binocular Center) also has good instructions on this art.

You will need to purchase one objective ("primary") mirror and one diagonal flat, ("secondary) mirror, in order to build the telescope.

REMEMBER! TELESCOPE MIRRORS ARE POWERFUL CONCENTRATORS OF LIGHT.

Sunlight reflected off the face of a telescope mirror can cause BLINDNESS or START A FIRE! Always handle your mirror indoors or in the shade! The telescope described in these plans is for **NIGHT USE ONLY. NEVER** set up your telescope in a location where it may be reached by sunlight, and:

NEVER LOOK AT THE SUN THROUGH YOUR TELESCOPE!

Objective and Diagonal Mirrors

What we describe as a Sidewalk Telescope, or Dobsonian Telescope, is a simple Newtonian reflecting telescope in a sturdy, wooden, alt-azimuth mount or rocker. The telescope consists of a concave (actually *parabolic*) objective (or Primary) mirror, which is mounted in the bottom of the tube. This objective gathers light from the object under observation and brings the light to a focus; forming an image of the object in what is called the *focal plane* or image plane, at the upper end of the tube.

A small, flat, front-surface mirror called the diagonal (or secondary) mirror is mounted inside the telescope tube near the front end. This mirror is mounted at a 45 degree angle to the tube's axis—hence its name. It deflects light from the objective to the side of the tube where the image may be more easily examined with an eyepiece.

The size of the diagonal mirror is dependent on the size and focal ratio of the objective mirror. So, when you order your mirrors, make sure to ask your supplier to tell you the correct size diagonal mirror to order. Specify that you will be using a low-profile focuser. To determine more accurately the size of the diagonal, use the following formula,

d = df +([D-df]/F) x Lde

Where **"d"** is the minor axis of the diagonal,

"df" is the focal length of your primary multiplied by: the result of the amount of fully illuminated field you want divided by 57.3 (radians in a degree). In other words, **F x (x/57.3)** where **"F"** is focal length and **"x"** is the amount of fully illuminated field you desire. *("df," is, in fact, the amount of fully illuminated field).*

"D" is the diameter of your primary,

"F" is the focal length of your primary,

"Lde" is the distance between the diagonal and the field stop of your eyepiece.

A self-serving example: For a 8" f/7.06 mirror. The common rule of thumb is to have a half (.5) degree of "fully illuminated field" for visual use. (But I will also plug in a .25 fully illuminated field, just to see how much smaller my diagonal will be...). The telescope will use a 10.5" outside diameter Sonotube, have a low profile focuser (say 2.125 inches high), and I will add 3/4 of an inch to be sure all my eyepieces will focus with a variety of eyeballs: So my "Lde" will be: 8.125 inches: 5.25 (radius of 10" tube) + 2.125 + .75.

"df" is then,
for a .5 degree fully illuminated field: 56.5 X (.5/57.3) = .493
for a .25degree fully illuminated field: 56.5 X (.25/57.3) = .247

.493 + .133 X 8.125 = 1.57 inches. So, a 1.57" minor axis diagonal will fully illuminate a half a degree at the eyepiece.

.247 + .137 X 8.125 = 1.36 inches. So, if I want only a .25 degree fully illuminated field to produce more contrast on the planets... I would go with a diagonal this size. Diagonal mirrors do not come in the above sizes, of course; but one can round off--in either direction--your preference!

A Word About Focal Length and Focal Ratio

The focal ratio of the mirror you select determines how long your telescope will be. A 10" objective mirror with an f/7 focal ratio will give you a telescope with a 70" focal length. (Multiply the "f-number" by the diameter of the objective mirror to get the focal length.)Your tube will need to be cut to the length of the focal length, so you would have

a 70" long tube. An 8" objective mirror with an f/7 focal ratio would have a 56" focal length, and a 56" long tube.
(John Dobson recommends a focal ratio around f/6 or f/7)
FOCAL RATIO (f-number) x MIRROR DIAMETER = FOCAL LENGTH = LENGTH OF TUBE

TUBE DIAMETER
The telescope tube should be about 2 inches wider in *outside* diameter than your objective. Therefore, a 6 inch mirror would require a 8 inch outside diameter sonotube.

Materials List

- **Cardboard tube ("Sonotube") (1):**Construction, specifically concrete construction supply houses usually carry these tubes, which are used for forming concrete columns. Get the supply house to cut your tube rough, that is, longer than you need by, let's say, six inches or so.
- **Exterior--or interior (smoother) grade plywood:** 4' x 8' x 3/4" thick For an 6 inch dobs, half sheet would be enough. An alternative to "exterior grade plywood" would be "shop grade"; not much more expensive, a MUCH smoother finish is possible. Pre-finished plywood is fine, too.
- (Optional) **Six-Eight feet of Douglas Fir 2"X 2"**: Cut these into small lengths and glue to inside of Rocker Box and Tube Box corners--this will strengthen these joints considerably.
- **Paint and painting supplies:** Flat black for inside the tube; any dark color is fine for the outside of the tube. White is not recommended--it takes longer for a white tube to cool down to ambient (outside temperature).
- **Sheet Metal Screws:** Panhead, size #8, 3/4" long. Get at least a dozen.
- **Nails or Screws**: Assorted sizes. Hot-dipped galvanized box nails work well. Though the plans consistently refer to nailing the various parts of our scope together, using screws instead is highly recommended. 1-1/2" flat head wood screws work great. Be sure to pre-drill and countersink before driving the screws.
- **Machine Bolts (3):** Three bolts, 1" long; 3/8" in diameter.
- **Lag Screw with matching washer (1):** One lag screw, 3" long; 1/2" in diameter. (2" long if making a 4.5" scope).
- **Record (1):** One phonograph record—33-1/3 LP rpm size (A "used" record is fine.) Or visit your local cabinetmaker for some free "scrap" Plastic Laminate ("Formica" is a brand of Plastic Laminate)--you won't need much--just enough to cover the bottom of your Rocker Box and line the outside edges of your Altitude Bearings. Do not use "gloss" Plastic Laminate, however--just the rougher textured stuff. You may also want to search the internet ("google") for "kits" of

Plastic Laminate and Teflon from enterprising--though often elusive--amateur telescope makers.

- **Chrome-plated Brass Tubing:** Washbasin drainline trap—1-1/2" outside diameter: We 'll need two pieces: one about 1-1/2" long, for the eyepiece holder, and one about 6" long, for the aligning tube. (Available from a plumber's scrap bin.)
- **Cedar Shim Shingles:** Three pieces, about 1-1/2" to 2" wide. Shingles break easily, so it's a good idea to keep a few extra shingles on hand. They are most often sold in packages.
- **Wooden Dowel:** One piece, about 3" long. Usually sold as "closet pole" or "hand rail stock"— Approximately 1-3/4" in diameter.
- **Cardboard "Mailing" Tube:** One piece, 1-1/2" inside diameter, about 2" long (Grocery stores have this tube in the produce department—used for dispensing plastic bags.)
- **Thumbtacks (3)**
- **Leather Scrap:** Three small pieces—about 1/2" square. Old belt leather works fine.
- **Sticker or Decal (1):** About 1/2" in diameter. I like to use "hole reinforcements" stickers, for three-ring notebook paper. A "gold star" also works well. Visit your stationary store, your teacher, or raid your "junk drawer."
- **Masonite:** One rectangle of 1/8" thick Masonite board about 3" x 4" (1/4" thick is also O.K.) with a 1-1/2" hole drilled in the center; **and** three pieces about 1" square.
- **Teflon:** 7 pieces, approximately 1" x 1" square, and 1/4" thick. Three pieces will be used for the lower Rocker Box bearings and four for the Cradle Board bearings. Try a local electronics surplus house; otherwise "google" for it. Teflon is sometimes hard to find (and more expensive than you may think)--do not accept anything else! Teflon is the key ingredient for SMOOTH movements!
- **Furring nails (4)** If you can't find furring nails, don't fret; I like to use rubber furniture glides (the kind you just nail in--this serves the same purpose as the furring nails: namely preventing our primary mirror from falling forward.
- **Glue:** White glue works fine. In addition, I like to use 100% black silicone glue on selected parts (like focuser construction and diagonal mirror to diagonal holder adhesion.
- **Telescope Objective Mirror (1):** See above "A word concerning focal ratio.." .
- **Cardboard:** The back of a cardboard breakfast cereal box works nicely.
- **Telescope Diagonal Mirror (1):** Order when primary f/ratio is decided upon.
- **Eyepiece (1):** Eyepieces may be purchased from telescope supply houses (see "Sources"), or you can salvage one out of an old pair of 7 x 35 binoculars (binoculars should be labeled "fully coated optics").

- **Optional Modifications:** Commercial focusers, primary mirror cells, diagonal holders and spiders, one-power finders, additional eyepieces. . . should be factored into your plans, or can be later added as "upgrades" as you see fit.

Tools Needed

- Hammer
- Saw (Table Saw, and/or Jigsaw is/are helpful but not essential).
- Electric Drill and 1/4", 7/16",1/2",and 3/32" Drill Bits, in particular.
- Tape Measure
- Compass
- Screwdrivers
- Nail Set
- Crescent (adjustable end) Wrench
- Awl
- Hole Cutter or 1-1/2" diameter doorhandle drill bit.
- Carpenter's Framing Square (helpful but not essential); Combination Square
- Pencil!