Solar Projection Box Construction

The solar projection box is attached to the draw tube of an 80mm refractor to enable the projection of the Sun onto a piece of paper for viewing or drawing of solar features.

Figure 1 shows the projection box attached to the telescope – the size of the box is A: 32cm, B: 23cm, C: 60cm and D: 45cm. The size of the top and bottom of the box is just larger than an A4 sheet of paper. The paper is attached to a piece of thick cardboard by two large paper clips and thus the box top/bottom of the box needs to be large enough to fit the cardboard and clips. The length D depends on the combination of telescope focal length, eyepiece focal length and the required size of the projected solar disk. Thus the size D depends on your telescope, eyepiece and solar disk diameter – see Figure 2 for close up of the bottom of the box. The size C just needs to be equal to or longer than D. I use an 80mm f/11 telescope (focal length = 910mm), a 20mm eyepiece and a 152mm (6”) diameter for the projected solar image. A different combination of telescope, eyepiece and disk diameter will give a different value for D and hence C.

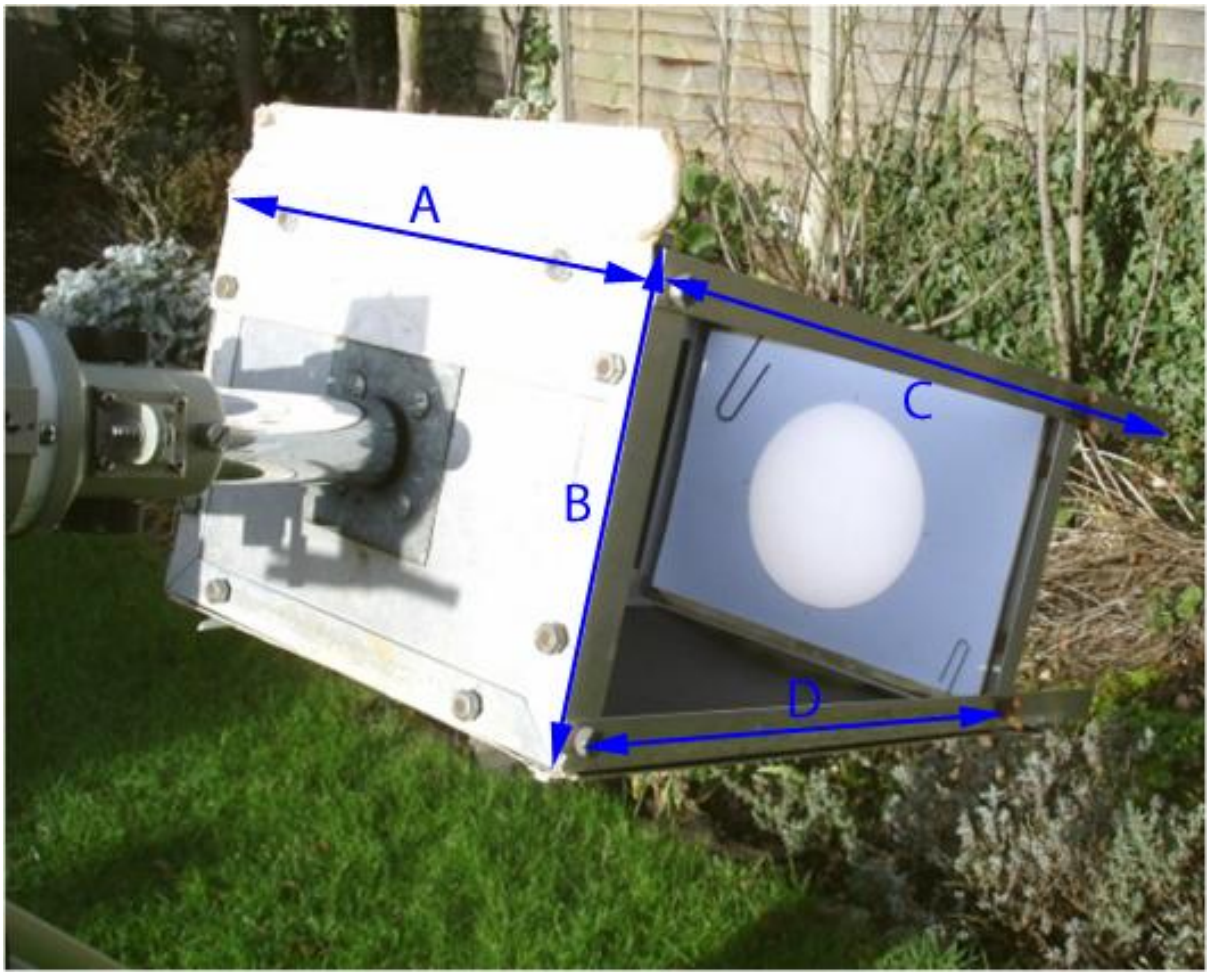

Figure 1. Solar Projection Box

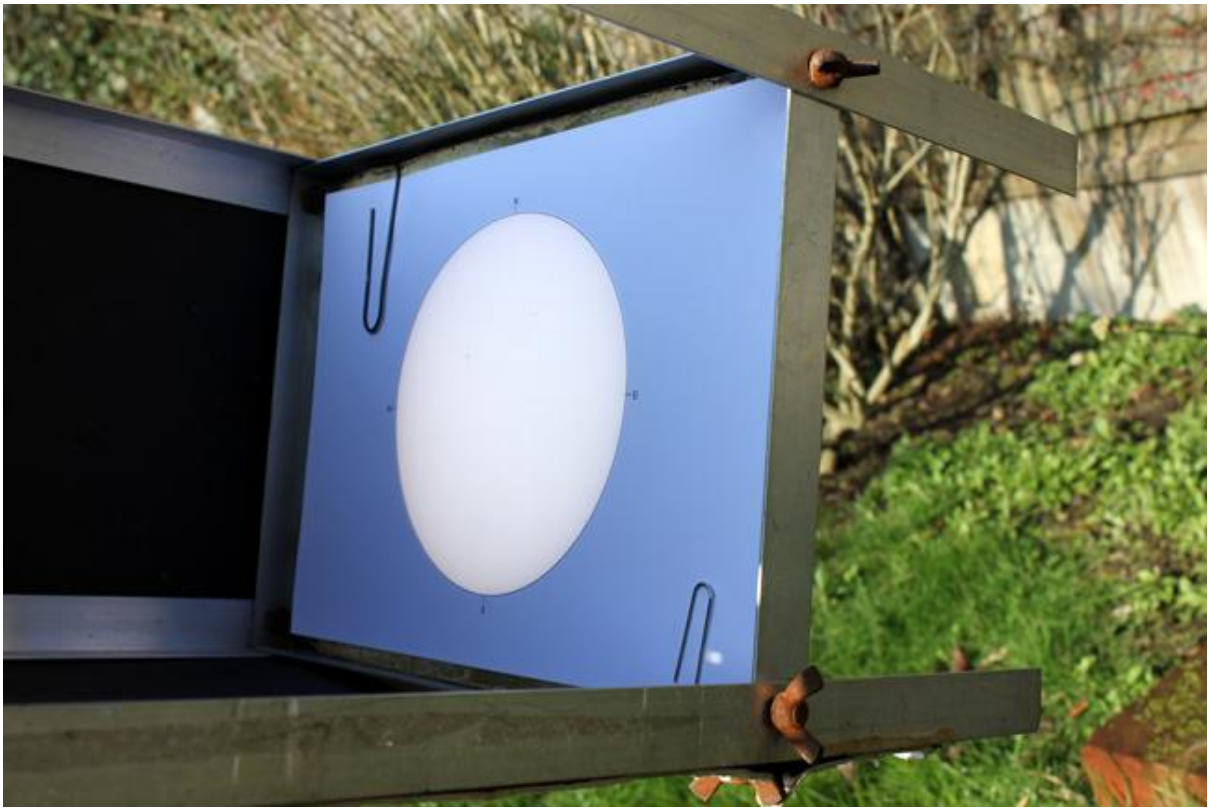

Figure 2. Bottom of Projection Box

Since the box is attached to the telescope draw tube, it needs to be constructed as light as possible. The box sides and the top & bottom frame are made from 25mm by 25mm L shaped aluminium lengths (total length = C*4 + B*4 + A*4 = 460cm or 4.6m). The top and bottom are made from aluminium sheet about 2mm thick. Nuts and bolts are used to fasten the sides and top/bottom together. If possible these should be made of a light metal.

Two of the sides are covered with cardboard, one side of which is black. Cardboard is also fitted to the top of the box to stop sunlight falling on the solar disk (shown in Figure 1). Additional cardboard can be fitted around the box to improve the image contrast.

It was found that the aluminium sheet that forms the top of the box was not strong enough when attached to the draw tube (the aluminium sheet bent slightly under the weight of the box thus making it difficult to form a image of the Sun in the middle of the solar disk drawn on the paper at the bottom of the box). The solution was to add a 10cm by 10cm by 1mm sheet of galvanised steel sheet around the hole in the top sheet – see Figure 3. Four nuts/bolts secure the steel sheet to the aluminium sheet.

Figure 4 shows the top of the box with the steel sheet together with the eyepiece holder. Note that the hole in the aluminium sheet is smaller than that in the steel sheet. The aluminium size is to ensure that the eyepiece holder fits through the sheet (from within the box itself) – this is approximately 35mm in diameter but this will depend of the eyepiece holder being used. The steel sheet diameter is the same as the end of the draw tube (the

black plastic shown in Figure 3) and this is approximately 45mm in diameter – again this depends on the telescope draw tube being used.

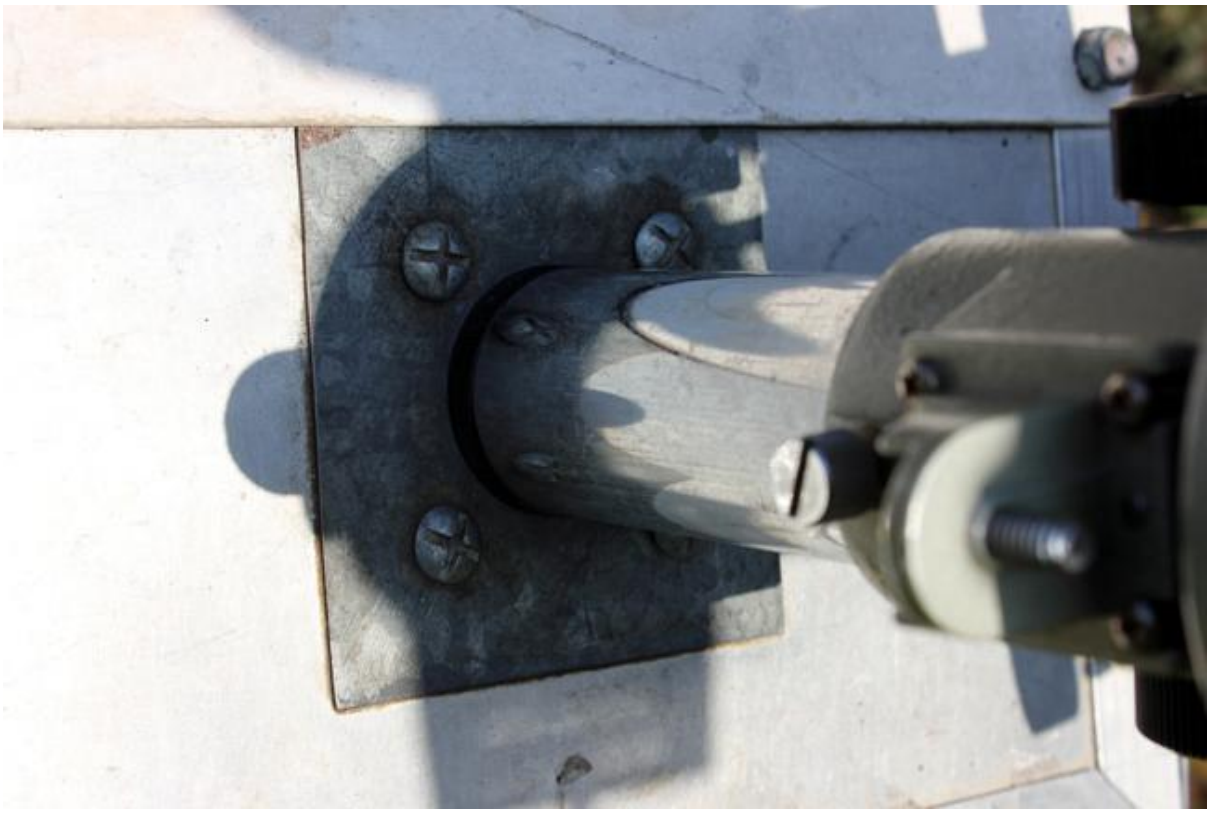

Figure 3. Additional steel sheet around the end of the draw tube.

Figure 4. Steel sheet on top of the projection box and eyepiece holder.

Figure 2 shows that the bottom of the projection box is attached to the L shaped frame by wing nuts. This is so that the position of the bottom can be adjusted upwards or downwards to ensure a focused image is seen on the sheet of paper. Figure 5 shows a vertical slot in one of the L shaped lengths.

Figure 5. Slot in the L shaped lengths at the bottom of the box.

A more effective way to achieve focus is to adjust the position of the eyepiece within its holder. Figure 6 shows that the eyepiece is not fully inside the eyepiece holder (but is tight within the holder via the holder screw) – as shown by the sliver ring part of eyepiece being visible. Note that the amount the eyepiece is within the holder is adjusted throughout the year to compensate for the variation in the Earth-Sun distance and hence the variation in the angular size of the Sun.

Since the projection box is additional weight when attached to the telescope, the balance of the telescope on its mount need to be adjusted which is likely to include additional counter weights.

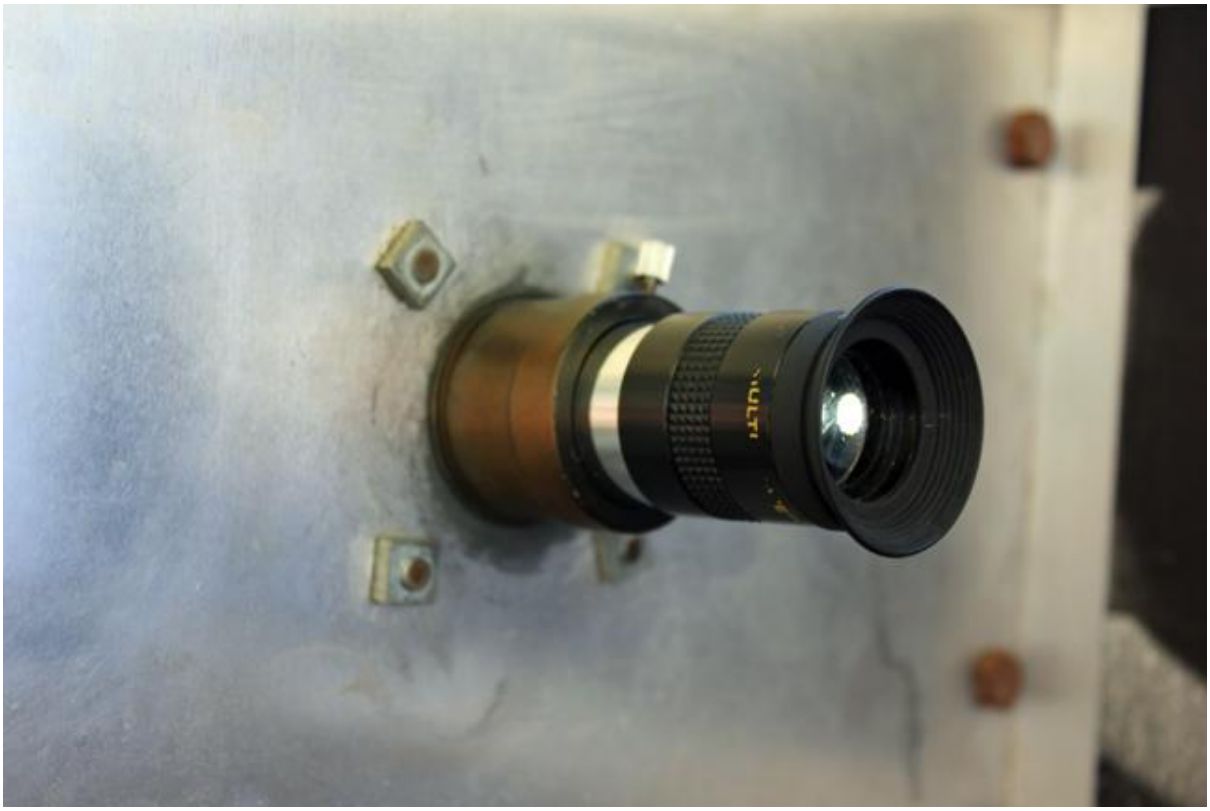

Figure 6. Eyepiece and holder under the top sheet of the box.

Peter Meadows, February 2013.