

UW Mobile Planetarium Optics Box Construction

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Introduction and Parts List

The UW Mobile Planetarium uses a folding box to house our hemispherical mirror, projector, and flat mirror, and hold them at the correct positions to project an image. We built three separate pieces, the optics box, the projector bench, and the flat-mirror support. The box has rigid sides, back and bottom, with a front and lid that can open on piano hinges. The lid has a lip on every side with the mirror mounted snugly inside.

We've found that this box has worked well for us over the last six months of use, however we do have some ideas for the next build. We used friction lid supports to hold the mirror at different angles, but we always open the box to its full extent. Also, I (Oliver) managed to bend one of supports once. I recommend thinking about a rigid support that has only one open position. With this change you could still adjust the image by moving and angling the flat mirror. In addition the projector bench, and possibly the flat-mirror support, could be built into the optics box.

We used:

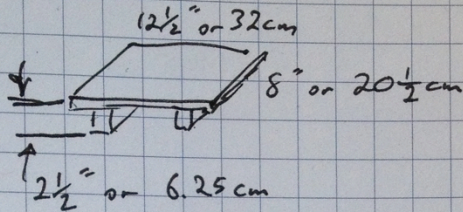
- A large slab of 3/4" plywood
- Wood stock for projector stand feet
- 2 "piano" hinges
- 2 friction lid supports
- 2 hasps
- 2 handles
- Screws
- Wood glue
- Heavy-duty Velcro



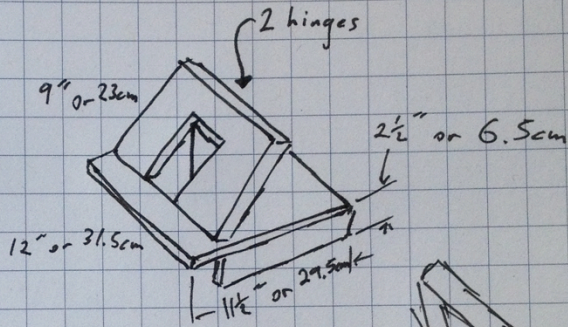
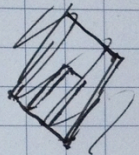
The sketch on the next page shows all the important dimensions of our optics box, projector stand, and flat mirror support.

Mobile Planetarium Construction

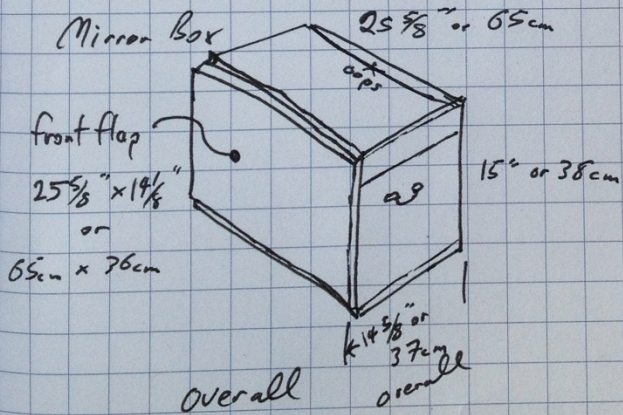
projector stand



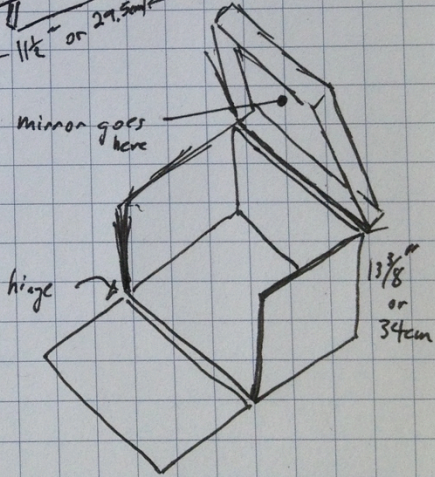
flat
+ mirror support



Mirror box



mirror goes here



The Optics Box

1. We began cutting the lid, and screwing the lip pieces in on all four sides.

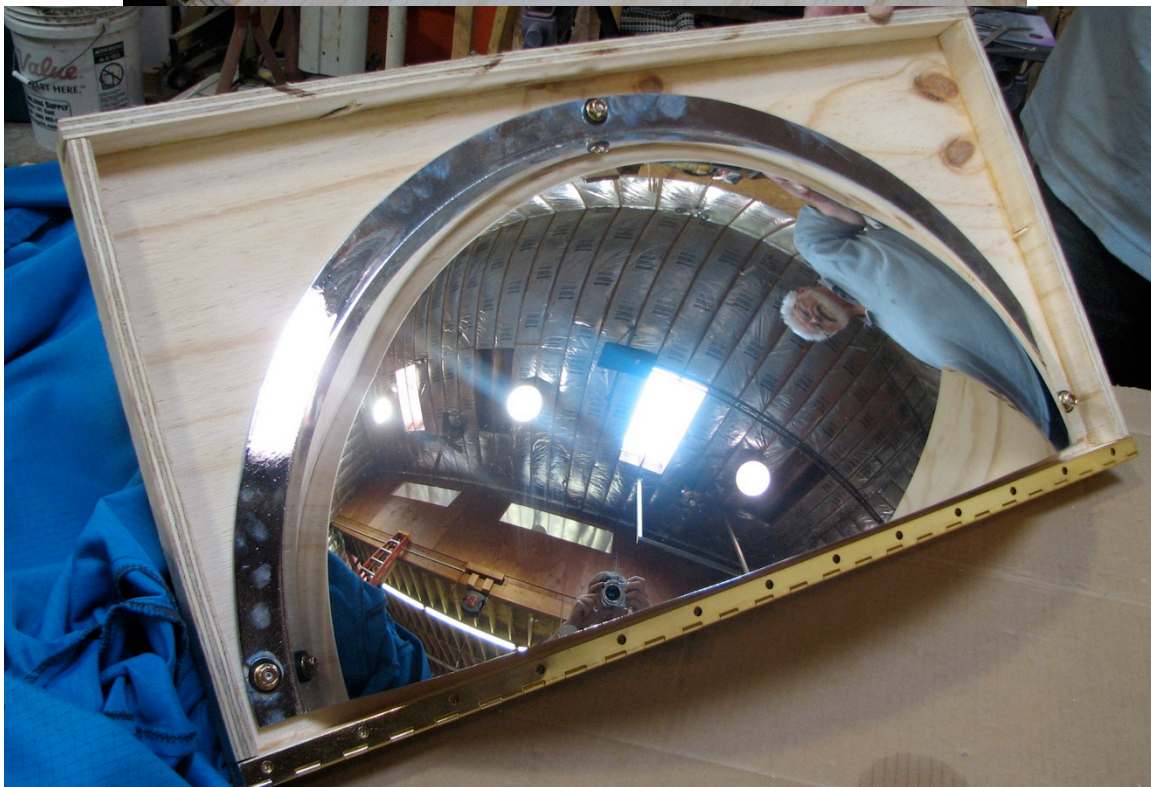


The underside of the lid showing the lip attached.



The top of the lid.

2. Then we cut and attached one of our piano hinges and test fit the mirror. We used the same bolts to hold the mirror that held it during shipment. Note that the "open part" of the mirror borders the hinge.



3. Next we assembled the base, sides, and back of the box. We screwed the back and two sides onto the top of the base, and put the back in-between the two sides. The sides sit flush with the base on the front however, so that the front flap sits firmly shut when the box is closed.

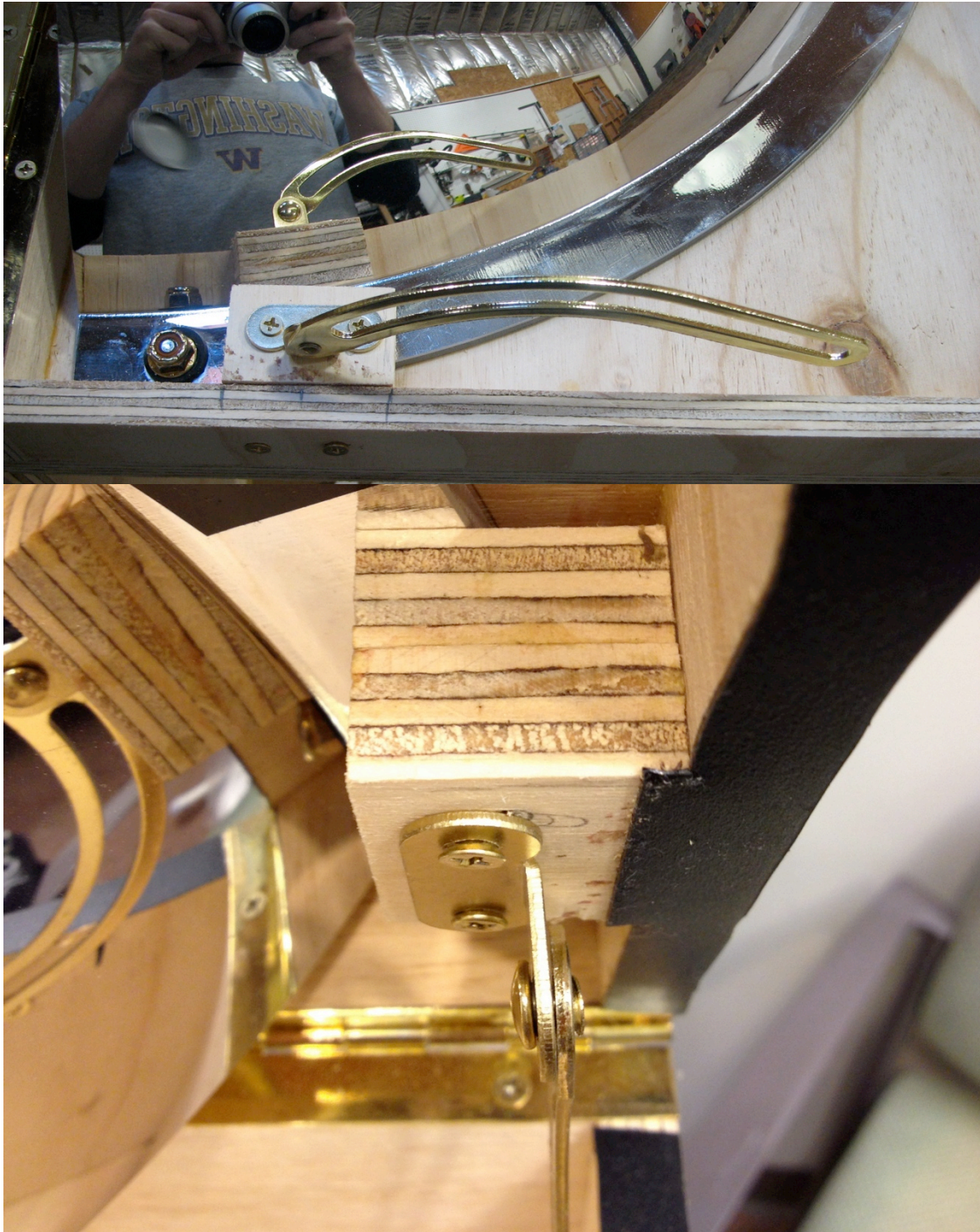


4. The front of the is attached with our other piano hinge, so that the base and front of the box will lay down at the same level.

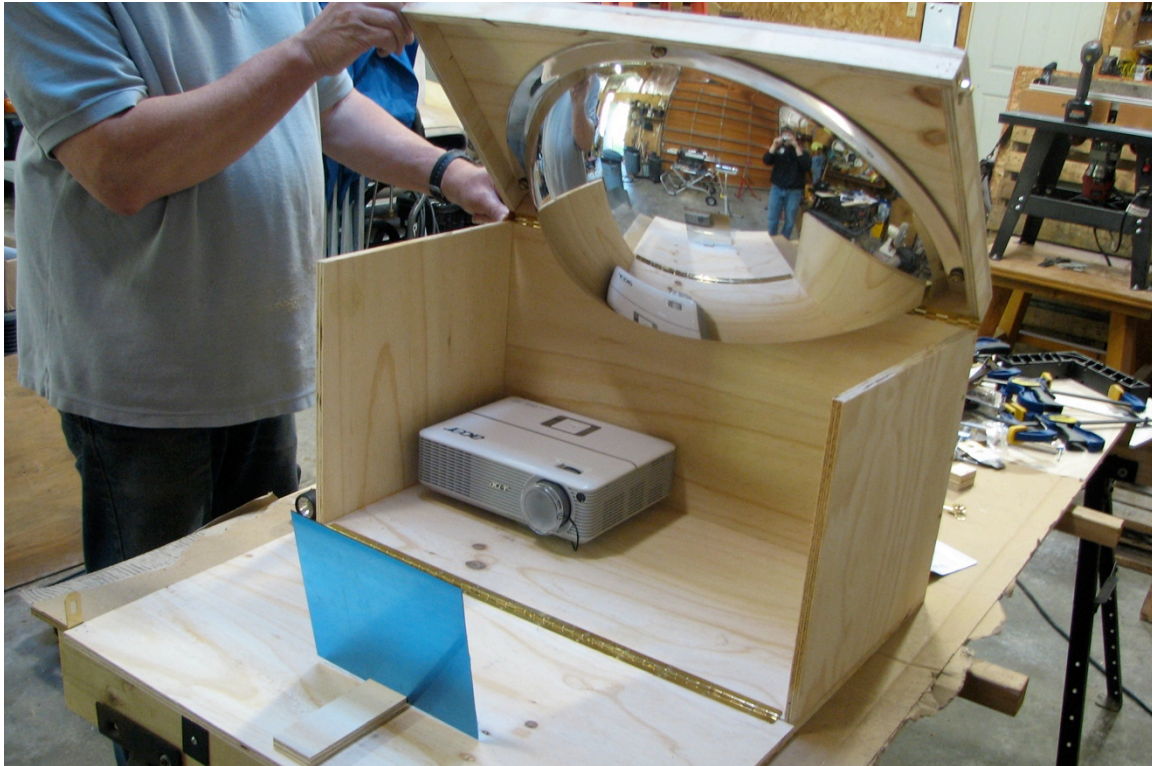


As can be seen in the picture above, the back and two sides sit on top of the base while the front can lay out flat to provide the support for the secondary mirror.

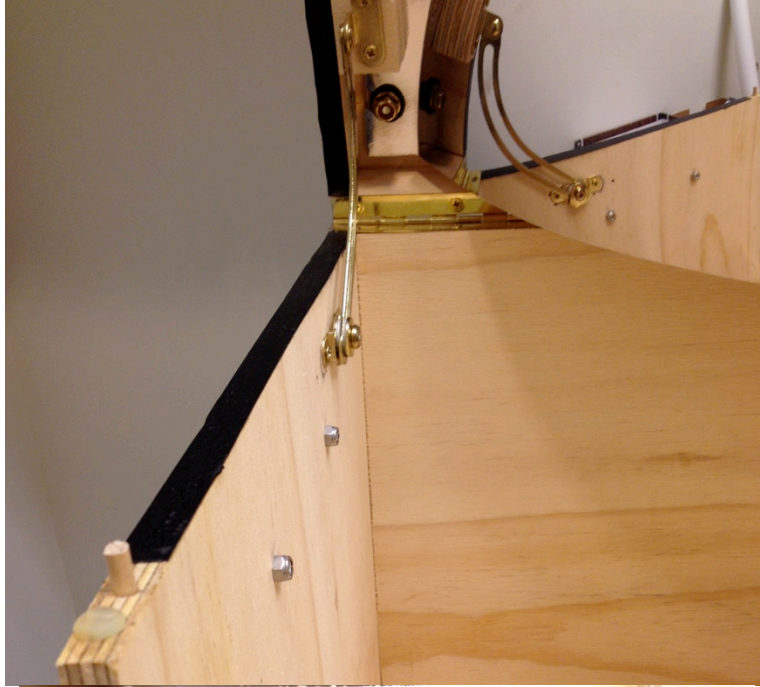
5. Before attaching the lid to the rest of the box, we built blocks for the friction hinge supports out of plywood and screwed them to the lid lip on either side of the primary mirror.



6. The lid is attached by screwing the other side of the piano hinge of the lid to the back piece of the box. We actually blacked out the flat lip of the mirror with electrical tape before bolting it on for the last time.



7. To finish the box, we attached handles and rubber bumpers, and wooden dowels to lock into place in corresponding holes on the lid. We also attached vinyl strips in an effort to seal the box, although they aren't quite thick enough. Let me know if you have a better idea!



To keep the box closed we affixed a hasp on either side of the box, where the front meets the lid. We use two carabineers to ensure that the hasps stay closed



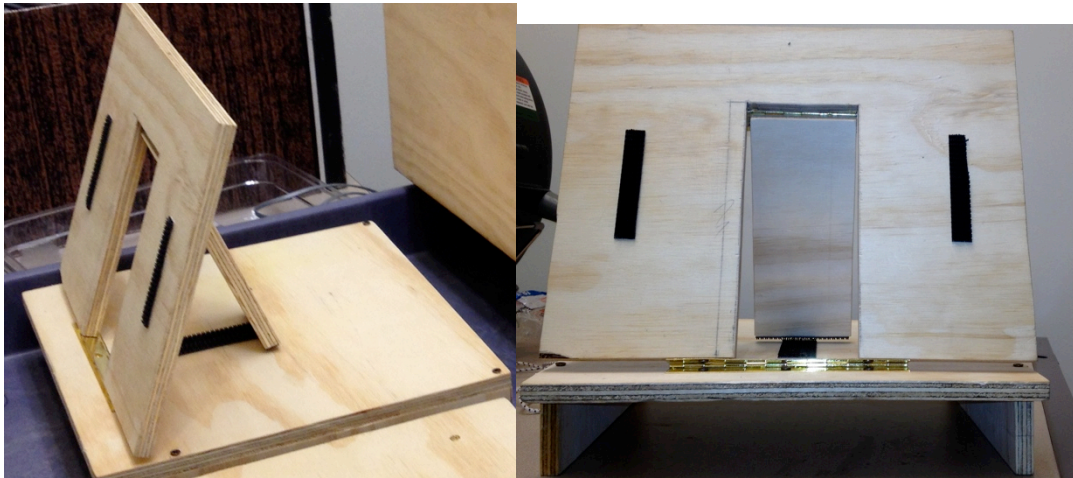
The Projector Bench

We measured the ideal projector height to be a couple inches off the ground. To compensate for this, we build a small independent bench about the size of the projector itself. By not fixing the bench in any way to the optics box, we aren't limited to any certain type of projector. The bench is just a simple piece of plywood with legs to put it at the desired height



The Flat-Mirror Support

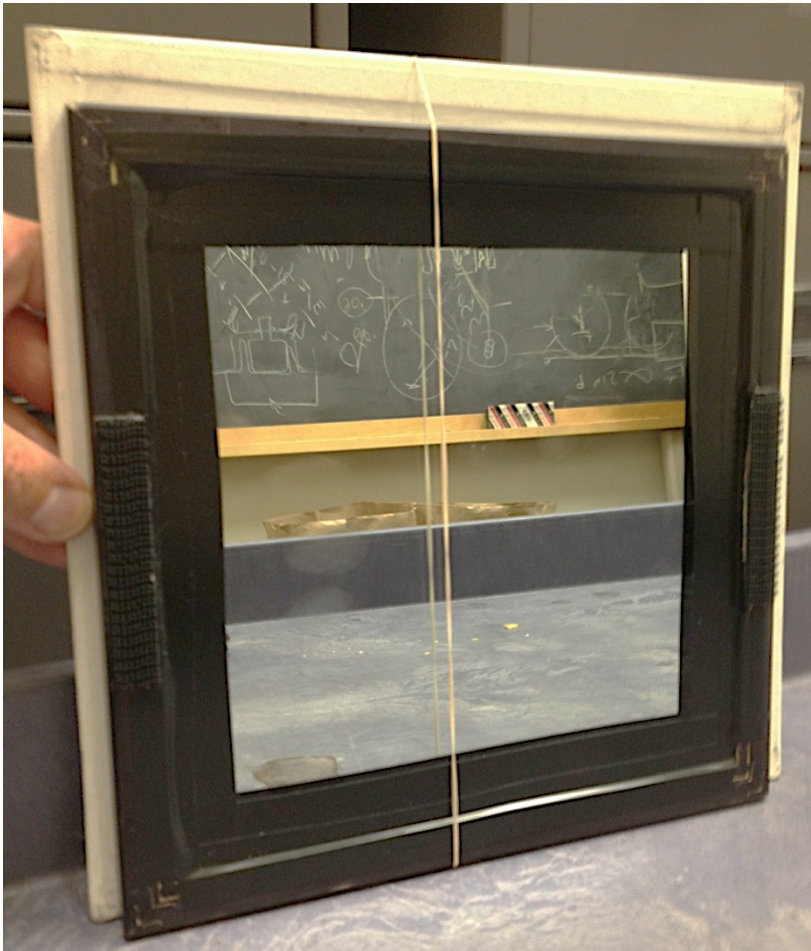
The idea for the secondary mirror support was to have a surface that sat at the same height as our projector, but could also tilt back to various angles. We built a simple bench much like the projector bench, but included a second piece of plywood and attached it to the bench with some of our leftover piano hinge. We then cut a chunk out of that plywood piece and attached it with yet another piano hinge piece so it could function as a leg.



To keep the mirror support fixed at different angles, we used a track of heavy duty Velcro that the support leg could stick to. We chose to leave the secondary mirror stand unattached from the mirror box for the same reasons as the projector bench.

The Flat-Mirror Frame

Our flat mirror didn't come in a frame (it was just an aluminized piece of glass) so Justin took it to a framing store and asked them to make a frame without any backing. The mirror is held place by a border of electrical tape, and easily pops in and out for cleaning or replacement. Two strips of Velcro on the frame correspond to those on the flat-mirror support, and have worked very well for a mount.



This photo actually shows the back of the mirror. Since the frame has no backing, we see the rear of the front-surface mirror (which is effectively a rear surface mirror). Visible also are Velcro, and the tape that holds the mirror in place. The rubber band is holding a piece of canvas board (convex side out) that protects the delicate front-surface of the mirror when it's not in use.