Building a Digital View Camera Interface

John Siskin

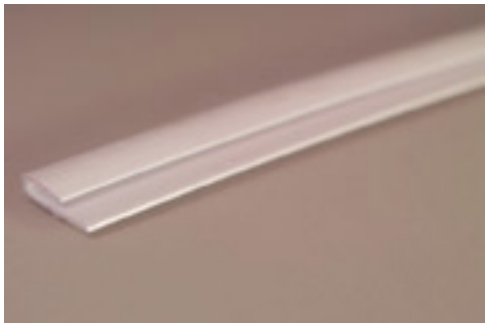
This didn’t start out to be a digital view camera. It started as a way to use a 35mm camera to meter through the lens of a view camera. Something happened, which was that a friend wanted a digital view camera. So what will this camera do well? First we can selectively focus in a table top situation. This will give us better control over the viewers’ eye in the final photo. The camera does this very well. The camera also has possibilities in architectural settings; however I know of no way to focus a lens shorter than 40mm to infinity. This design may have

possibilities for stitching a large image out of several small images. I think you could still use it to meter through the lens of a 4X5 camera.

The movements on the camera are affected by the actual length of the bellows. A longer bellows will give more movements, but the bellows may drop in front of the lens, causing vignetting. A greater distance between the rear nodal point of the lens and the front of the camera will provide more camera flexibility, but will usually mean a longer focal length. With an 80mm f4 Rodenstock Rodagon at infinity, my Kodak 14n has about 12º of swing and about 10º of forward tilt, more of backward tilt. About 1 inch of shift is available in all directions. The camera design offers both tilt and swing in the rear; however, in practice, these movements are very difficult to recenter. The camera will focus an 80mm enlarging lens at infinity. If you have the capability to mount a medium format retro-focus lens onto a recessed lensboard it will probably focus at infinity, mine do. It will not focus a Schneider Super Angulon lens at infinity, the rear element extends too far.

I had several goals when I began this project. I wanted to create a design that would utilize my existing view camera with my 35mm style digital camera. I wanted to use a minimum of precision fabrication; that is I wanted to be able to do it myself. I wanted the finished design to have a professional look. Lastly it needed to be easy to actually use. I think this design fulfills all those goals.

Here's the materials you'll need to build the bellows. First get a t-mount adapter. These are available from many camera stores, or you can get one from B&H Photo, on line. Next you'll need some very thin leather, pig suede works pretty well, although it sometimes needs additional sealing with black silicone sealant. Your leather will need to be at least 2 feet by 10 inches, preferably a little larger; also it should have one smooth side. You'll need a lensboard for your camera. Since you're going to cut it up, the lensboard doesn't need to be new, or all that clean. You will also want some cardboard. You're going to need contact cement, please use fresh (recently unsealed) contact cement. You want black silicone sealant; the only places to get black sealer are auto parts stores. Auto parts places call it black gasket maker. All this gluing will require a lot of cotton swabs (Q-Tips). Another needed product is matt black spray paint. Lastly you'll want a product I get at Home Depot called "plastic end cap moulding" to make holding clips for the bellows.

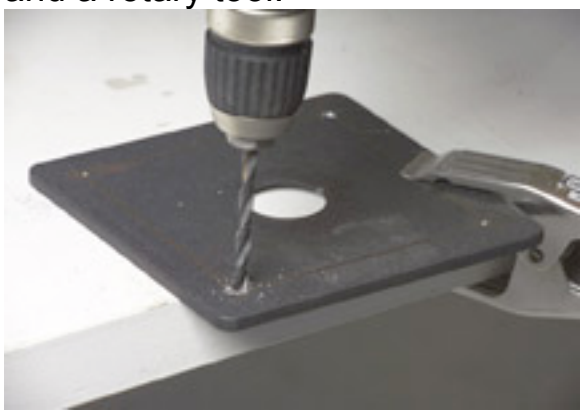


You can do this project with hand tools, but you may hate yourself. I think you'll want a power drill and a rotary tool, like a Dremel Tool™ to do your lensboard. You will also want a good pair of scissors and a craft knife (X-acto knife). A good very small screwdriver will be important. Two sizes of spring clamps will be used: 2 inch (very small) and 6 inch (medium). Please be careful as you use these tools.

Allow yourself adequate time to do this project. Attention to detail will be rewarded. Cutting the lensboard is rather critical. The interior of the bellows will need to be large enough for a recessed lensboard to fit inside. This enables the camera and lens to get as close together as possible. The outside dimension is defined by the way the lensboard attaches to the camera standard. If your lensboard is 6X6 inches and the camera uses 1/8 of an inch to grab the lens board your bellows and clips assembly can't be more than 5.75 inches across. So the relationships, set up by your lensboard, define the opening of your bellows. The material you use for the bellows affects depth of the bellows and the thickness of the attachment to the lensboard. The bellows should not fold in front of the digital camera when everything is set up.

The lensboard will be used to attach the bellows to the camera. If the camera doesn't have interchangeable bellows, or if the bellows lock is different from the lensboard lock this will not work. To cut the lensboard for a camera, start by measuring the lensboard. The Toyo board is 6.25 inches by 6.25 inches. Next measure the size of the inner projection of the recessed lensboard. On the Toyo Monorail cameras this board is 4.75X4.75 at the back. I know that Toyo has made some changes to its flat lensboard over the years, so please check these measurements on your equipment. This means that the bellows we're building must accommodate a 4.75X4.75 inch object. The slide lock that holds a Toyo lensboard in place requires about 1/8 (0.125) inch for travel; consequently the board must remain clear of bellows, clips and glue in this area. Inside the standard is another area of consideration: the light seal. On the Toyo this is a slot that the lensboard sits in. It extends 1/4 (0.125) inch into the camera interior. If anything, bellows material, clips and glue, gets into this area the bellows will not fit on the standard. I cut my lensboard to 1/2 (0.5) inch from the edge of the lensboard. This means that the bellows must be attached in 3/8 (0.375) inch. It is important to keep in mind that shift movement will depend on the flexibility of the bellows material.

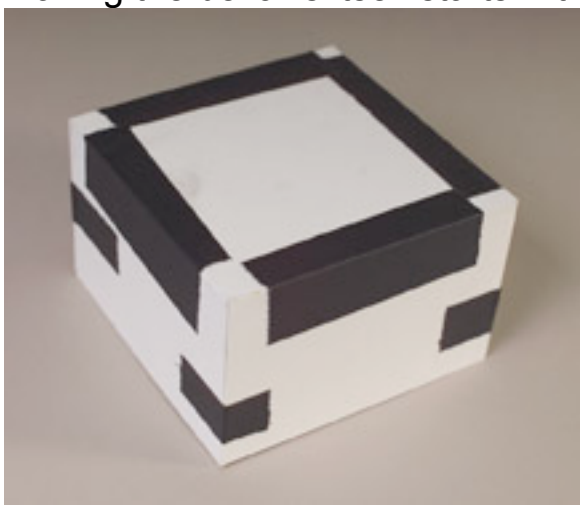
The simplest way I have found to cut the lensboard involves a power drill and a rotary tool.



PUT ON EYE PROTECTION, I want to stress this point! Small cutting tools can break, please be careful. Practice is helpful with power tools. The first step is to drill a hole into each corner of the lensboard. These holes must have their outer edges where the corner will be. I suggest you first mark this on your board. Then use the back end of a 1/4-inch drill bit to find where the center of the hole needs to be. The edge of the hole needs to come out at the measurement you previously determined.

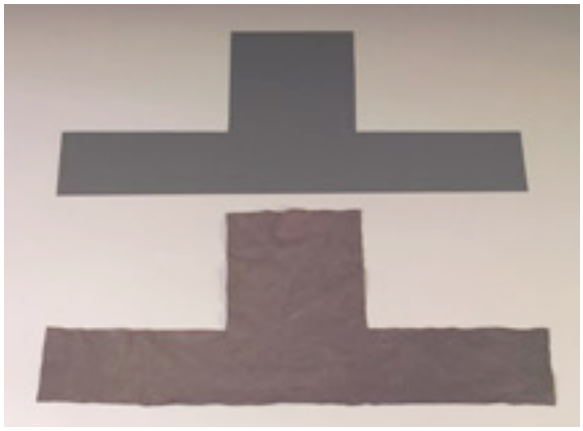
When you have identified this center use a small drill bit (maybe 1/16 inch) to drill a starter hole. Then take the 1/4 inch drill bit and make the final hole (figure 3). Please note, perfection is a goal NOT a necessity, this does have some room for inaccuracies in cutting. Next put one of the cut-off wheels on your rotary tool. The cutting wheels are consumed as you cut; they also break (please wear eye protection). You will probably need several cutting wheels to finish the job. The cut itself is simple; follow a straight line between the precut corner holes (figure 4). When you finish the cut you can use a sanding disc with your rotary tool to smooth the cut.

Making the bellows itself starts with making a cardboard box.



The box is the form on which the bellows are assembled. The sides of the box are slightly larger than the whole you cut in the lensboard. In my case the sides are 5 and 3/4 (5.75) inches on each side. This provides flexibility in the finished product. The box is 3 and 1/2 (3.5) inches deep. If we make our bellows too deep they will fold up in front of the camera. This causes difficulty with vignetting and positioning the camera and lens. The bellows do need to be deep enough to enable you to mount

the camera to the bellows while a lens is mounted to the standard and to allow for camera movements. Next we make the pattern for the leather. This is simply a big piece of cardboard the size we will want the piece of leather to be.

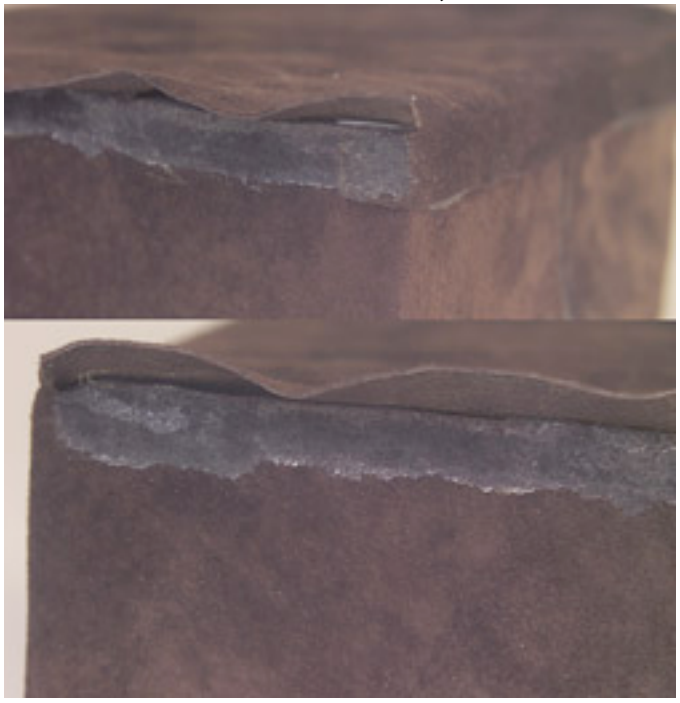


We can figure its size by laying out the sides for our box. Its size is four sides plus 1 inch, in the center of that length the top is attached; actually it's never cut off. Like the sides need an extra inch, the top needs 3/4 (.75) inch extra material on each side and the top to attach it to the rest of the bellows. So that means that the finished piece will be 24 inches long and 3 and 1/2 (3.5) inches tall except in the center 7 and 1/4 (7.25) inches where the material will be 9 and 3/4 (9.75) inches tall. Please see the sample photo. You will use this to trace onto the leather. Carefully cut out your leather and you're ready to assemble your bellows.

Contact cement loses its fluidity when it has been sitting in a resealed container. All the camera repair people I have know are very picky about the condition of their contact cement. It will help to know how to use this stuff: you apply it to each side that will be attached separately; then after it dries, press the two sides together. You will want the cement to be very fluid so that it will soak into the material you're gluing. You may want to experiment with some scraps before gluing your bellows.

When you assemble the bellows keep the smooth side of the leather inside, it will have less dust than the suede side. Start by covering the last inch of the outside arms of your bellows material with contact cement. You'll use the cotton swaps to spread the contact cement. Wait for the cement to dry. Wrap the bellows material around the box and attach the cemented sides. They should stick immediately.

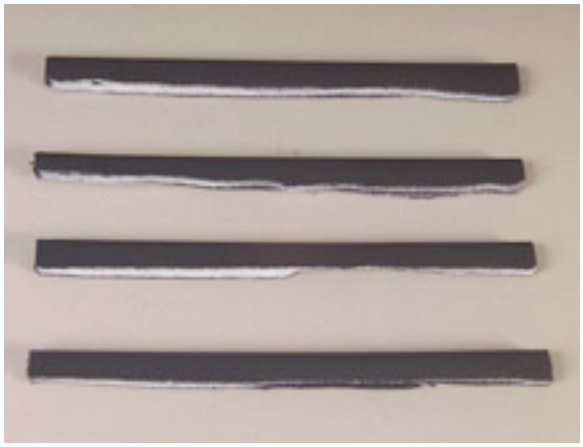
Next spread contact cement on the side of the bellows where the seam is, about 3/4 (.75) inches down. Spread cement on the inside of the top piece, remember these two pieces will meet, so make sure the cement will cover to the meeting place. A similar procedure will work for the sides. The key difference with gluing the sides is that cuts will need to be made to make the corners, and we'll need to do a little more gluing.



First cut the top right at the corner, not all the way to the edge of the box. Now, on the side where the seam is, wrap the tab onto the side you're working on and glue. Please note if you haven't coated these parts and waited for them to dry, you need to do that. You will also need to glue over the top of the tab. On the other side of the bellows, all that is

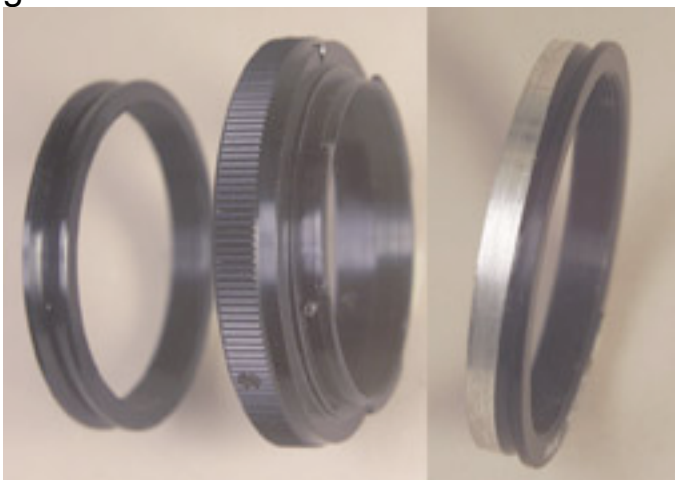
needed is a small cut; the left over bit (from the back side) can be glued down last. This all sound very complex, but it isn't that bad. When you put it together, it comes together, it will help to look at the last picture again.

The clips are used to help hold the bellows to the lensboard. You will need four of them. The product I've used to make them is from Home Depot, called "plastic end cap moulding." This material is too wide, so first we trim it with strong scissors; the goal is to make the material 1/4 (.25) inch wide. Next trim it to size: the length of the inside cut on the lensboard minus 1/2 (.5) inch, about 4 and 5/8 (4.625) inches on my Toyo. Then spray paint the material flat black, as it will be inside the camera.



The next part of this gets very messy. It's best to have some paper towels around when you start. The object is to spread black silicone sealer on the inside edge of the lensboard and onto the inside of the bellows clip. Then attach the bellows leather to the lensboard with the clip. The glue remains fluid for a long time so you get several tries. The leather should not extend beyond the clip on the inside. You should clean off all excess glue (cotton swabs). When you have attached all four sides, put some glue on the corners and press the leather onto the corners. Secure the corners with very small spring clamps. Leave everything to dry for at least 12 hours, this is important.

The last step in making the bellows is to attach the T-Mount adapter. This item is a simple lens mount, without motor attachments or electrical contacts. It is made up of two pieces, an inner threaded piece and an outer lens mount piece. These are held together by several very small setscrews. Release these screws and disassemble the two parts. The inner part has a lip built into it where the setscrews fit. We will need to grind this off.



This can be done using the grinding or sanding attachments for the rotary tool. Whenever you use this tool please exercise caution and wear eye protection. After this part has cooled, position it in the center of the top of the bellows, where the camera will go. Mark the area to cut using the T-Mount part as a pattern. Cut this area out with scissors. Next put silicon sealer on the inside of the lens mount part of the T-Mount and

on the outside of the threaded piece, where you ground off the metal. Position the mounting mark, usually a red dot, on the T-Mount so that the bellows will mount at an appropriate angle onto the camera. On a Nikon mount this is straight up, on a Canon this is about 30º from center.

Check this on your camera. Position the hole in the bellows material between these pieces of the T-Mount and press them together. Secure them with the medium spring clamps from the outside of the lensboard.

Reset the setscrews and allow drying for 12 hours. Your bellows is ready to go!

Well actually you should check the bellows for light leaks. This is especially true since the pig suede is not always entirely light tight. In order to do this attach the bellows to a camera standard and take it into a darkroom (you don't need trays or chemicals). Put a light source inside the bellows; examine the outside of the bellows. You can use the black silicone sealer to plug any leaks. Apply it inside the bellows with a cotton swab.

The camera standard is almost entirely composed of parts from

Manfrotto. This is what you will need: a Super Clamp (part #2915), a 3-D Junior Head (part #3025), a Hexagonal Plate Adapter, (part #625L) and an Elbow Bracket (part #3288). You will also need a 3/8 European to 1/4 American tripod bushing. Finally a 1/2 (0.5) inch piece of 1/4X20 (American tripod size) threaded rod. You can cut this from a bolt with your rotary tool.

These parts are simple to assemble. First put the tripod bushing into the base of the 3-D Junior Head. Next thread the 1/4X20 threaded rod into the bushing. You will now be able to screw this assembly into the threaded hole in the center of the flat side of Super Clamp,

choosing the right hole is important for centering the camera. Next you will attach the Hexagonal Plate Adapter to the top of the 3-D Junior head. Please try to center this over the threaded bolt; it will help to keep things centered. If you don't intend to use these parts for any other functions, use the setscrews in the center of the adapter plate to lock the plate to the tripod head. This is actually a pretty good idea, as it will make camera set-up easier. The Elbow Bracket is attached to the camera tripod socket. Keep the flat side of the elbow adapter parallel to the camera back. The other hex mount should be on the shutter button side of the camera.

Now to put it all together! Put one camera standard on a short monorail. Put the tripod mounting block in front of the standard, this will help to mount the camera and lens closer together. Attach the bellows unit to the camera standard. Next mount the superclamp/3-D head assembly behind the camera standard. Now put the camera onto the hexagonal adapter plate, note that this can be done horizontally or vertically. Attach the bellows to the camera, and we have a digital view camera!

These steps will enable you to set the camera back parallel to the standard. Make sure the lens direction mark on the elbow bracket is set in the direction of the lens. If you do this carefully every time the camera will be easier to set up. Next point entire camera assembly at the ground. Then use a level to set the front standard at level.

Do not use the adjustments on the front standard; keep those set at the zero points. Use the camera tripod adjustments. This is similar to aligning an enlarger. Finally level digital camera back using the Manfrotto tripod head on the monorail. Adjust each direction independently with the releases on the tripod head. Return the camera to the upright position and adjust the angle perpendicular to the camera monorail using the level. This adjustment is less critical. If you center the elbow bracket on the camera body the same way next time, your camera will require very little additional tweaking.

Finally about lenses for your digital view camera. Enlarger lenses make good digital capture lenses. An 80mm lens will focus at infinity with this set-up if a recessed lensboard is used. Most modern wide-angle lenses for view cameras will not work. The rear element on a Super-Angulon or similar lens extends too far from the rear nodal-point to clear the camera body. Wide-angle lenses from medium format cameras can be used with custom lens boards. Such lens boards will need to be recessed also. So a custom board for a Hasselblad or Pentax 6X7 might be very useful since you'll be able to focus a 40mm lens at infinity.

There certain aspects of using this camera I would like to point out. Although the 3-D Junior Tripod Head will provide tilt and swing movements it's best not to use them. Since there are no detents or reference points on the 3-D head it is time consuming to have to realign the camera after using these movements. Since this design

utilizes the Elbow Bracket it is easy to release the bellows and the bracket and reorient the camera to vertical. This makes the camera more functional. It is also possible to use the shift movements to expand the capture area of your camera. Several overlapping images are taken moving only the front standard. It is then possible to mesh these images together in Photoshop giving you a very large image. This can also create a more wide-angle perspective.

This project will require time and patience. It is a good value for your effort. You achieve a new level of control with the other advantages of digital photography. I would like to hear about any experiences in using this rig.