Building the ArcadeCab Trackball/Single-Player Controller

Introduction

This help document details the construction of the original ArcadeCab Ultra-Trackball controller. It is based on my construction document that was used exclusively in-house. About fifteen months ago I changed the trackball design to become CNC-based, although the single-player panels continued using these plans to great success. As I have more or less stopped building these for sale, I'm freely offering these plans to those who might wish to build their own. I hope it benefits you. If you build one using these plans, please email me a picture or two at Mike@ArcadeCab.com.

Mike Trello
January 8th, 2007

List of Materials

Below is a list of materials you will need and the major tools required. Certain items, such as the table saw, are handy but not mandatory. A 3/8" spade bit does a great job in lieu of a countersink bit. You may find you need items in addition to those listed.

Materials

- ❑ 24" x 24" ¾" MDF board (or plywood)
- ❑ 13-1/2" x 7-5/8" 3/16" masonite/hardboard
- ❑ 1" x 2" x 16" ledger board
- ❑ 1-5/8" coarse drywall screws (12)
- ❑ 1" coarse drywall screws (4)
- ❑ Package of four (4) ¾"x 5/16" rubber bumpers (http://hardware.hardwarestore.com/28-453-pads-and-bumpers/brainerd-rubber-bumper-234211.aspx)
- ❑ 24" x 24" laminate piece (optional)
- ❑ Laminate glue (optional)
- ❑ Metal file for the laminate edges (optional)

Tools

[ ] Circular Saw	[ ] Table Saw	[ ] Drill
[ ] Jigsaw	[ ] Router	[ ] Slot cutting bit
[ ] Flush trim bit	[ ] Laminate trim bit	[ ] Saw horses
[ ] 1-1/8" spade bit	[ ] Assorted clamps	[ ] Extension cord
[ ] 1/16" bit	[ ] Countersink bit	[ ] Straight edge

Arcade Accessories

To build a complete Ultra-Trackball controller, you will need five feet of ¾" T-molding, a 3" Happ or Betson trackball, a Happ trackball mounting plate, and three Happ Horizontal Pushbuttons.

AutoCad Dimensional File (.DWG)

I have a file that details all the parts' dimensions in an AutoCad file. There are a number of free viewers available if you do not have a CAD program. The file is located at http://www.arcadecab.com/Projects/TB_Plans/ArcadeCab_Ultra-Trackball_Original_Design.dwg. Note that if you cannot open this file you aren't missing anything critical- it is merely another project resource.
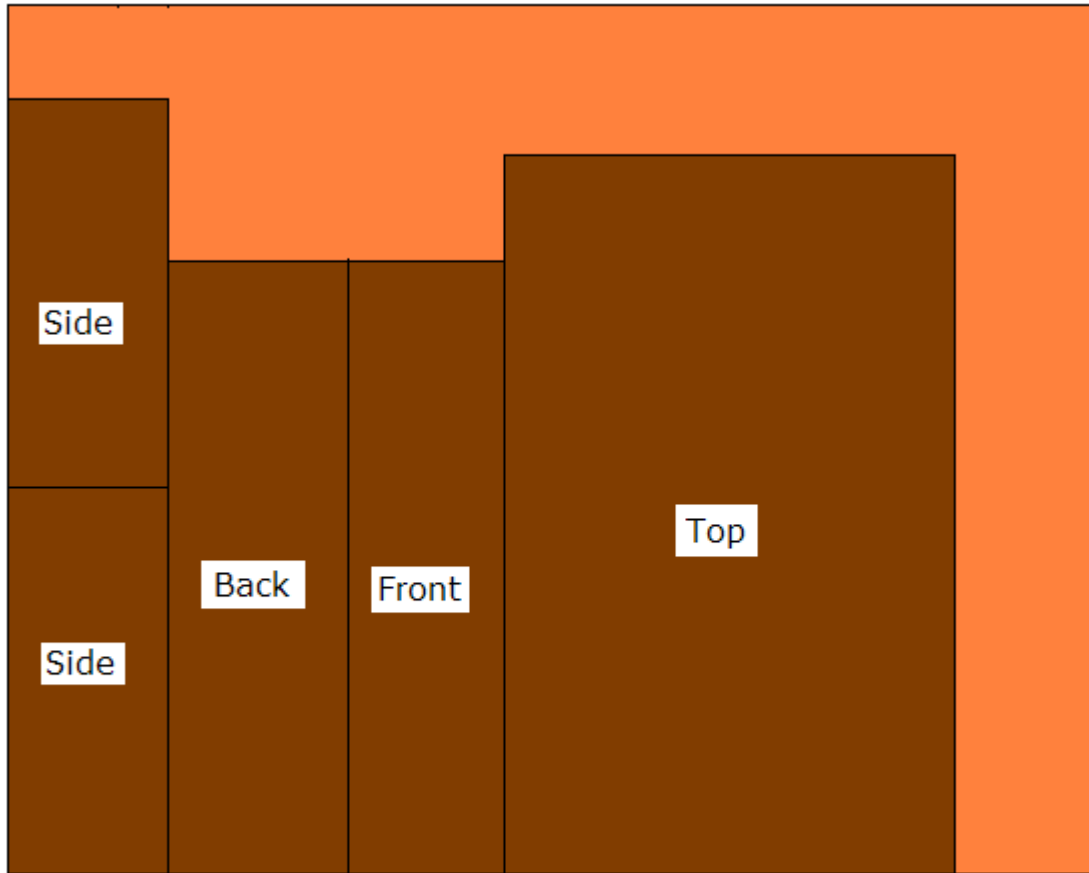
Cutting diagram for the 24" x 24" board

## Section 1- Cutting the Sides
Create the Sides

[   ] Referring to the very simple cutting diagram above, cut a strip off the MDF sheet 3-1/2" wide.

[   ] Cut this strip into two 8-5/8" pieces. Be exact. You'll end up with boards that are 3-1/2"x8-5/8".

[   ] With one of the two sides, make a mark 2-3/4" up on one end. Draw a line from that mark to the upper corner of the opposite end. Take the jigsaw and, carefully, cut along the line. You should end up with a board like the picture at top of next page.

[   ] Repeat with the second side.
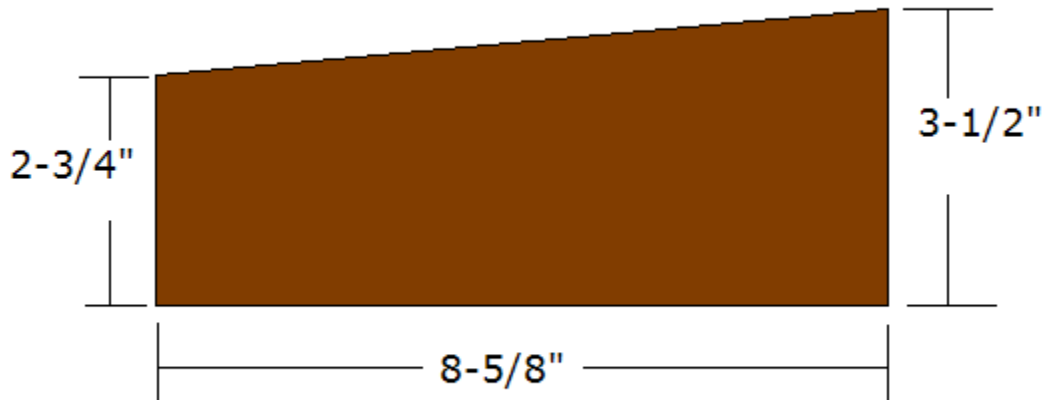
Dimensions of the Side Boards

Creating the Front and Back

[   ] Cut a strip off the MDF sheet that is 4" wide. This will be the back.

[   ] Cut a strip off the MDF sheet that is 3-1/4" wide. This is the front.

[   ] Take the back strip (4"x24") to the table saw. Set the table saw at **exactly** 6 degrees.

[   ] Take a side piece and set the table saw's width to exactly the back edge width of the side piece (3-1/2"). See below for an example. Once happy, cut.
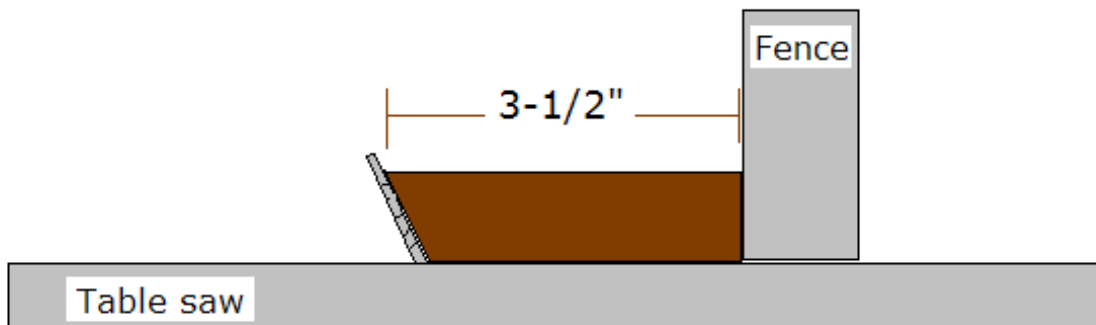
How to cut the top bevel on the back strip (from the 4" stock)- Make sure the blade is set to 6 degrees

[   ] Reset the saw for the front board (3-1/2"x24"), using the front edge of the side piece. Cut a test board, then the final strip when the setting is perfect.

[   ] **Set the table saw back at 0 degrees.**

[   ] Take the two beveled strips and cut each into 13-5/8" pieces. The resultant boards are 13-5/8"x2-3/4 (front) and 13-5/8"x3-1/2" (back).

Section 2- Putting the box together
Put the box together

[   ] Put a side board and back together. Pre-drill, countersink, and screw a 1-1/4"
screw into the side. When drilling the hole, you may want to drill halfway, back the
bit out, then drill the rest of the way. MDF fills the bit rather fast.

Note about pre-drilling MDF- Make sure you pre-drill **all** holes when you work
with MDF. MDF has a nasty habit of splitting when you don't do this, especially
when you screw into an end. Do this religiously and you'll have no problems.

[   ] Put second screw into the side, being sure the pieces are perfectly flush.

[   ] Add the second side. Then add the front. Be sure that everything is flush.

Cut hardboard for the base

[   ] Take a piece of the 3/16" masonite/hardboard. Cut a piece 13-1/2" x 7-1/8".

[   ] It should fit tight inside the box, except for a gap of about 1/8" at one end.
Below shows the base set within the sides/back.

Why the 1/8" gap? Simple, it is there so you can remove this bottom panel as
needed. I discovered that if the bottom was cut to fit the hole exactly, it was nearly
impossible to get back out again. The gap allows you to use your finger or a coin to
get it started.

Section 3- Finishing the Base
Cutting and attaching the 1x2s

[   ] Cut two strips of 1"x2" that are 7-1/8" long. You'll need only two despite what the picture below shows.

[   ] Take the controller box, put the hardboard into the bottom of it, then place the 1x2s inside, tight against the sides (as shown below).

[   ] On the outside of each box side, mark where two screws will go, up 5/8" from the bottom.

[   ] Pre-drill and countersink where you made marks, being sure to keep the 1x2 in place. Then drill 1-5/8" screws into the holes to attach the ledgers permanently.

Pre-drill the holes for the hardboard base

[   ] While you have the hardboard insert in place, flip the controller upside down.

[   ] Pre-drill two holes on either side, into the ledgers within. Countersink each hole slightly.

[   ] Drive in 1" screws and then back them out. We'll replace them at the very end.   Set the hardboard bottom aside for later.

Painting the underside of the top and the bottom (Optional)

[   ] Flip the base upside down, removing the hardboard insert.

[   ] Paint the bottom edges of the box with the black latex paint. Use a sponge brush.

[   ] Let the pieces dry, then apply a second coat. This is just to seal the MDF and to give it a little more polished look.

Cutting the grommet hole (Original method)

[   ] On the back, measure in 7-1/2" from the side and up 1-1/2" from the base. Using that as a center mark, drill through with a ¾" spade bit. You'll end up with a hole like in the below picture.

Cutting the grommet hole (Alternative method- Console hole):

I began building the single-player panels with this console hole after numerous requests. To do this, I first measure over 7-1/2" from the side, up about ¾" and draw a line. Take a ½" straight router bit and route up to the line. The result is shown below.

Note about the optional laminate- I laminated all the Ultra-Trackball and Single-Player panels for sale. I did try painting one just for curiosities' sake but it did not turn out well at all. It certainly was not suitable for sale. You, of course, are free to finish the panel any way you choose and painting certainly is the simplest (and cheapest). But if you have access to some laminate, I would seriously consider it as the control panel comes out looking **so** nice with it. Lowes and Menards both sell sheets, although they tend to be pricey. CabinetParts (http://www.cabinetparts.com/) is an excellent alternative if you need to order multiple sheets.

Attaching the laminate to the base (Optional)

[ ] Lay two 2x4s next to each other across the sawhorses. Push them together and this is where you'll hang the box while you are working with it.

[ ] Cut a strip of laminate 4-1/2" wide. Cut two pieces 16" long off this strip (for the front and back). Cut two pieces 11" long (for the sides).

[ ] Glue up both sides and the two side pieces of laminate.

[ ] Wait 45 minutes then attach the laminate pieces securely.

[ ] Trim cut the two sides.

[ ] Glue up the front and back as you did the sides.

[ ] Wait 45 minutes then attach the laminate securely.

[ ] Trim cut the front and back.

[ ] You will need to file the top edge of the front piece due to the bevel.

[ ] File all corners and edges at 45 degrees to smooth them off. ***Raw laminate edges are razor sharp!***

[ ] Clean up any bad spots as necessary.

[ ] From the inside, drill through the center of the grommet with the smallest bit you have. Then flip around and drill through the laminate side with a 5/8" spade bit. Be careful. Trim it up.

Section 4- The Top
Rough cut the top.

[   ] Cut a strip off the MDF that is 10" wide with the circular saw. *Refer to page 3 for the cutting diagram if you need to.* You'll now have a strip 10"x 24".

[   ] Cut this board to 16", giving you a finished dimension of 10"x16".

> **Note**- I have a template that is used to flush-trim all the tops, so I do not have any photos of what I describe in the next section(s). The template is also used for the TB and button hole placement so the description will be very vague. Hopefully the process will be self-explanatory enough.

Shaping the top

[   ] Using the measurements from the picture below, draw out the shape of the controller on your 10" x 16" blank. Cut it out with the jigsaw, and smooth any rough spots with sandpaper.

[   ] Slot the top panel with the slotter to accept the T-molding. A better explanation of the process is found within my cabinet plans on http://www.arcadecab.com/CabinetPlans2/CabinetPlans2_Cutting_Side_Two.html.
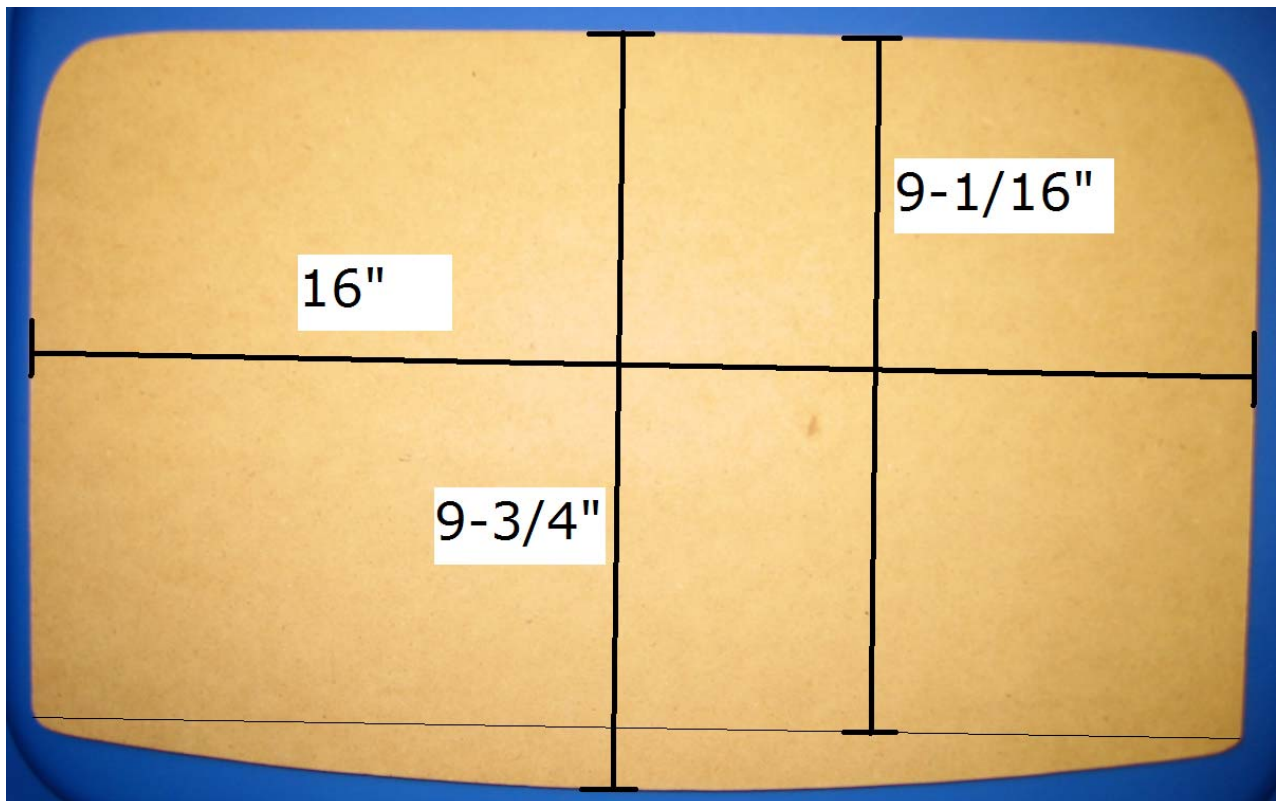
Drilling the top for the trackball controller

[   ] Print out and take your trackball plate template, and three-button template (see Appendix B for the templates) and tape them to the control panel top in the correct location. *The left edge of the trackball plate is 8" from the left side of the panel. The center of the leftmost button is 2-1/2" from the left side, which makes the rightmost button's center 2-1/2" from the left edge of the trackball plate.*

[   ] Drill through halfway for the four (4) trackball bolts. Use a 13/64" bit.

[   ] Start each of the button holes with the 1-1/8" spade bit.

[   ] Remove the paper templates (or what is left of them).

[   ] Finish drilling through the button holes and the trackball holes. You might want to get most of the way through, then flip the panel over and finish from the backside. See below.
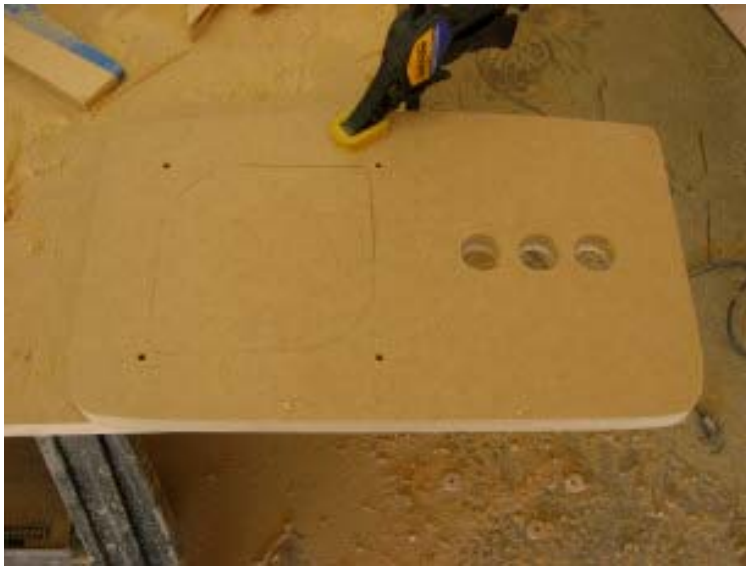

Jigsaw rough cutting the TB cutout

[   ] Trace the trackball hole's outline with pencil.

[   ] Drill two ½" starter hole within the trackball tracing.

[   ] Take the jigsaw and cut out the area, being careful. Test fit a cover and TB in the hole to ensure it fits correctly before moving on. If the trackball doesn't fit, use the jigsaw to remove any extra material to ensure it does.

Section 5- Finishing the top
Attaching the top

[   ] Position the top exactly where it needs to be and attach two clamps to hold it securely to the base. I place the clamps in the middle of each side.

[   ] You will need to find spots in the four corners of the top panel to drill for the screws. Be sure each location is centered over the base side. See picture below.
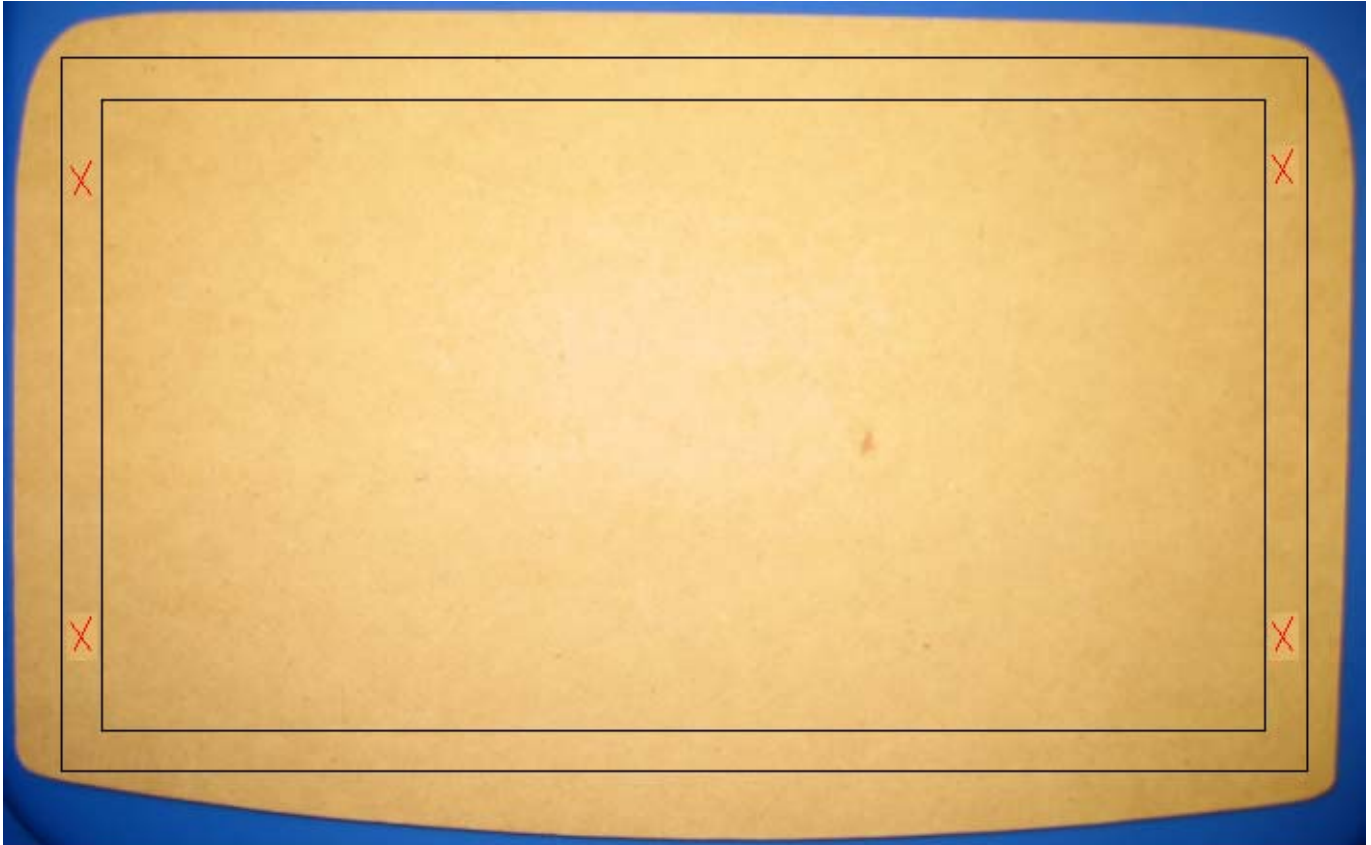
Approximate locations for the four top screws

[   ] Pre-drill and countersink a hole at each mark. Drive in a 1-5/8" screw into each hole. This should lock the top to the base very solidly. Make **very** sure that the screw heads are below the surface!

Laminating the top (Optional)

[   ] Rough cut a piece of laminate that is 12" x 18".

[   ] Flip the laminate upside down and apply glue to it. Apply glue to the top (clean) surface of the top panel.

[   ] Wait 45 minutes (or until the glue is clear) then apply the laminate to the top panel.

[   ] Flush cut the top panel's edges.

[   ] Flip the panel upside down. With a 13/64" bit, drill through the two trackball holes that you can reach. Take your time.

[   ] Take a 5/8" spade bit and drive holes through the center of the button holes and trackball area. Pop thru from the back just slightly and finish from the topside.

[   ] Flip the panel right side up again.

[   ] Trim each hole out with the laminate router bit. If you could not reach the 3rd button hole, drill through it from this side with the 5/8" bit and then clean the hole up.

[   ] Take the trackball template and figure out where the remaining two trackball holes need to be drilled out. Use the 13/64" bit and drill them out.

Cleaning it up

[   ] Remove any traces of the laminate's paper backing.

[   ] The four corners will need touched up with a Sharpie. Use the pen and mark the edge, making sure to hit it all. Then, immediately rub the ink off the corner with your finger. The ink should stay where it was needed and be wiped off the laminate.

[   ] Repeat for the other three corners and any other imperfection.

Attach the feet (Brainerd ¾" x 5/16" Rubber Bumpers)

[   ] With the controller upside down, place a foot in a corner and pre-drill. Then screw the foot into place. Repeat for the other three corners.

Putting it all together

[   ] Blow any dust and debris from inside the controller. Wipe it out.

[   ] Install each button and the trackball proper and its cover. Apply the nuts where applicable. You'll need to crimp the connectors tighter. Wiring for the trackball buttons is:
- Green = Left
- Red = Middle
- Yellow = Right

[   ] Ensure all connections are tight. Use a plastic tie to fasten the wires together for a nice, tidy unit. See top of next page.
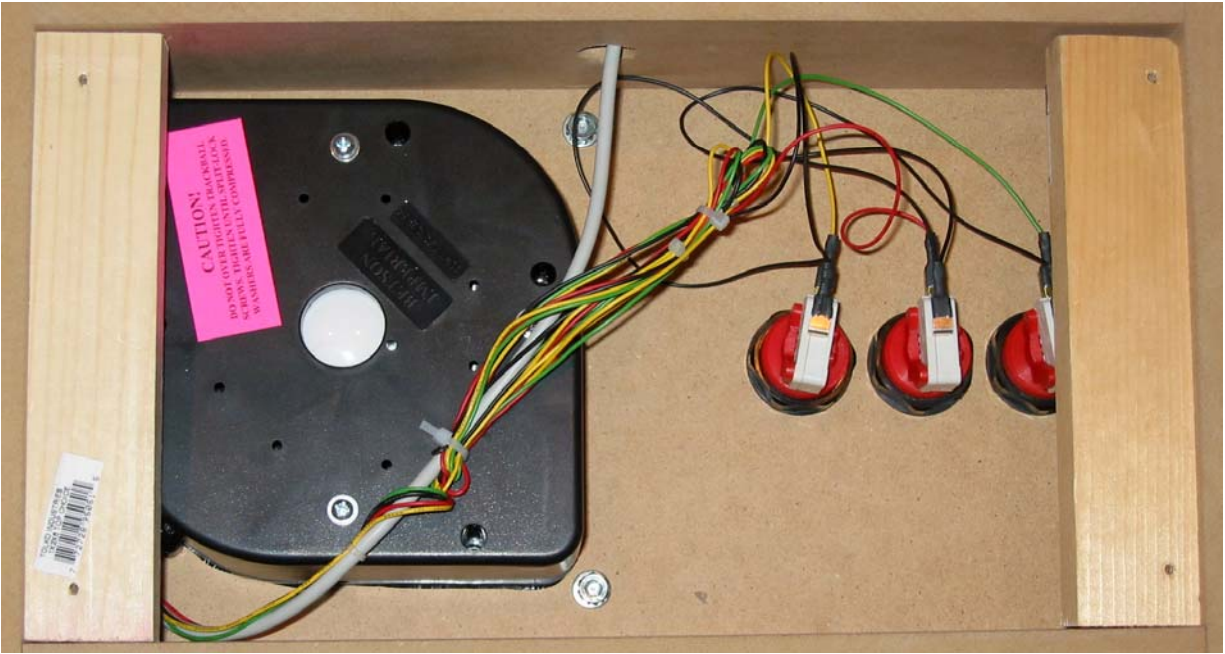
[   ] Add the T-molding. Use a damp cloth to protect the molding when using the rubber mallet.

[   ] Screw the hardboard back into place using the pre-drilled holes.

Section 6- Finishing up
Testing and Cleanup

[   ] Plug the controller into a PC and test it out. Make sure everything works as it should and nothing rattles. Rattles=bad!

[   ] Wipe the controller down with a damp cloth to remove most of the fingerprints.

[   ] Now the controller is ready to go!!

I hope this document has helped. If you are interested in building a single-player controller, read on into Appendix A. Appendix B includes the trackball and button templates.

Mike Trello

Appendix A- Alternatives for the top

The beauty of the Ultra-Trackball design is that all manner of controllers can be designed from its basic shell by altering just the top cutouts. All of the ArcadeCab Single-Player panels used it successfully. There is room within for ten buttons placed comfortably, plus a joystick. In addition, it is possible to add pinball buttons to the sides. You are limited by only your imagination. Below are several PDF layouts that might help with your design. The PDF links print to-scale.   Pages 21 and 22 show the construction progression for a typical single-player panel.

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	http://www.arcadecab.com/images/Store_pics/6-straight.pdf
	http://www.arcadecab.com/images/Store_pics/7-standard.pdf
	http://www.arcadecab.com/images/Store_pics/8-standard.pdf
	http://www.arcadecab.com/images/Store_pics/8-straight.pdf
	http://www.arcadecab.com/images/Store_pics/6-curved.pdf
	http://www.arcadecab.com/images/Store_pics/8-curved.pdf

Appendix B- More Templates
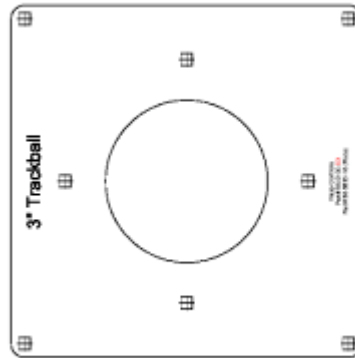
http://www.arcadecab.com/Projects/TB_Plans/Happ_TB_mounting_plate_Template.pdf
or
http://www.arcadecab.com/Projects/TB_Plans/Happ_TB_mounting_plate_Template.doc

This is the Happ trackball mounting plate template. It will print to scale. You drill in the four extreme corners.
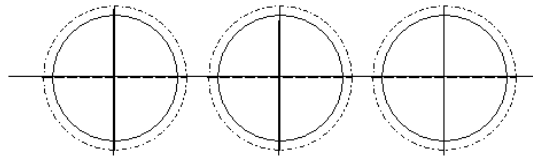
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or
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