



# ClassicCabinets

**The home of home cabinet construction.**

You are number -  - to build a cabinet.  
Good luck, and have fun.

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Note: This page reads serially, and can be printed as a whole.

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## Why you need a cabinet

In reality, you absolutely, positively do not need an arcade size cabinet in your home; however, if you truly want to have the same experience that you have in an arcade, you do not have a whole lot of choice in the matter. Nothing except standing in front of a really big box will create the same feel as a cabinet.

As far as other reasons to build a cabinet, the list is almost infinite. Perhaps you always wanted to collect the games from your youth, but do not have the money or the space (a collector's arcade machine can cost anywhere from \$50 to \$1200, and takes up a 3'x3' spot per game). Perhaps you are disgusted with the nasty little joysticks and want something which will not only stay in place, but will also take some abuse. Or, maybe, in some warped way you think that this will be so cool that chicks will dig you (don't get your hopes up, they generally flee in terror at the sight of my setup).

The end argument is, of course, you have too much time and too much money on your hands. This page, therefore, explains how to spend most of those things building your own arcade cabinet. If you just have too much money, I will be happy to build and ship one to you for the low, low fee of \$2000.00 (I can dream).

One word of warning before your begin. The original design was created for a Sony Playstation and a 25" TV. Two cabinets were linked, and the layout is a great deal of fun. If you plan to use different hardware, some of the information will not apply directly to you. It is up to you to modify the design slightly.

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## What a cabinet will really cost

The cost of a cabinet is completely up to you. A cabinet is much like a car. You can put together a completely stripped down version for about \$50.00; however, if you are looking for the luxury of a Cadillac you can easily spend up to \$2,500.00. To let you decide what kind of investment you are considering, the following should help. Keep in mind, that two linked playstation cabinets will cost twice as much as shown.

### 1. **Basic cabinet materials:**

The basic cabinet materials cost is roughly \$50-\$75, and includes the fiberboard to build the cabinet, the hardware to assemble the fiberboard with (screws, etc), enough 1x8 pine to build a couple of control panels, and the paint to coat the cabinet with.

### 2. **Additional cabinet materials:**

If you wish to add additional features to your cabinet and arcade area, you should budget roughly \$50 more. This will include hinges for a shelf door, a main power switch, perhaps some additional paint, a couple more 1x8 pine boards for control panels, and a couple of barstools. You might even want a small shelf or end table either next to, or attached to the cabinet. If you wish to go all out,

you can spring for a small amplifier and a couple of speakers, just budget accordingly. I stuck a 6" fan next to mine so I would have a little breeze while playing some of the longer games (it also has a neat feel if you move it on top of the TV to play driving games).

### 3. **Basic console hardware**

You will need a game console. Budget anywhere from \$20 for an old 8-bit Nintendo to \$200 for the latest and greatest system with a mod chip installed. Personally, I went to Buy-Rite and bought 2 playstations and 2 games for about \$300.00.

### 4. **A television**

There isn't much to say about this. You will need a dedicated TV. A 25" TV can range anywhere from \$50 for a used one, well up to \$500 for a brand new TV with all the features. I bought display model Zeniths at Circuit City for ~\$250. The only features I cared about were Stereo Sound, and RCA jacks in back.

### 5. **Arcade buttons, joysticks, etc.**

The number of different control panel options will determine how much money you wish to spend on buttons and the like. I have a control panel with the correct button and joystick positions for almost every classic game. A game like Asteriods uses 7 buttons, while a two player fighter will run you 2 joysticks, and 20 buttons. Defender, being in the middle, takes 1 joystick and about 8 buttons.

I originally ordered \$50 in controls, which I used up almost immediately. The last order I placed was for about \$200 worth of stuff, and I have more than I ever expect to use. My suggestion on controls is to order more than you think you will need, and take advantage of the price discounts for ordering in bulk.

### 6. **Control pads, steering wheels, etc.**

As you build control panels, you will burn through control pads and other devices. Each panel will use at least one control pad. I buy the cheapest thing available at Wal-mart. A basic controller is about \$10. Additionally, you may wish to budget in steering wheels, the Sony twin armed analog controller, a couple of mice, a light gun, and whatever else fits your style of gameplay. For a very basic system, \$50 will cover most of your needs, but as soon as your desires climb, so will the price.

### 7. **Games**

Here again is one of those catagories that cannot be priced easily. When I started my project, I was replacing all of my full-size, arcade machines with the emulators on the Playstation. Asteriods went out the door, and I spent \$50 on the Midway Atari Collection. The Namco collections followed, as did the Williams Collection. The total cost was around \$200, and I had many classic games,

replicated down to the buttons you push. Since then; however, I have spent money on newer games and no longer have any idea what my total cost is.

## 8. Beer

Budget plenty for this. You will want it while you build the cabinet, as you paint the cabinet, while you build the control panels for the cabinet, and as you play games. You can never have too much beer.

A rough estimate of my initial budget follow. My plan may differ from yours, as I intended to build 2 cabinets from the start. Also, keep in mind that I was selling 5 arcade games, so I was expecting to spend about \$300 out of my pocket to change my system over. Since this budget, my cost has grown. The additional expense has always been by choice, and has happened slowly. There is no reasons to buy everything on the same day.

Item	Cost
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Building materials	\$150.00
2 Playstations	\$300.00
2 TV's	\$500.00
Buttons, etc.	\$100.00
Controllers (Mice included)	\$100.00
Steering Wheels (4)	\$250.00
Games	\$200.00
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	\$1,600.00

## What skills are needed for this project

You do not need any special skills or knowledge to build this project. Basic contructions skills, basic wiring, basic soldering, and basic finishing skills are all that is required. If you have never built anything with wood before, you may struggle a little bit. Likewise if you have never soldered or worked with wiring before, you may struggle a little bit. Fortunately; however, you are intelligent enough to have found this Web page, so you should be intelligent enough to surf the web for construction tips and soldering tips. Or, if you are really worried, run by Home Depot and buy a furniture construction book, then run by Radio Shack and buy a book on basic electronic wiring and soldering. You do not need any technical knowledge to build the cabinets, just the ability to follow instructions and a little common sense. This project is really about as hard as those electronic kits that 6 year-olds get for Christmas.

I built my cabinet using only two power tools: a circular saw, and a drill. A couple of other tools would have been nice, including: a power sander, a router, a radial arm saw, and a scroll saw; however, they are not needed. Basic hand tools sufficed for most of the work.

The control panels required a fine-tipped, 30-watt soldering iron, electronic solder with resin, a drill, a multimeter, and a set of handy-hands (clips that hold electronic parts together for soldering). Again, a couple of other items would have made life easier (a nice table being one of them), but are not required.

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## Construction materials required

All of the construction materials should be available at your local building supply center (Lowes, Home Depot, etc). If you are unable to haul the fiberboard, the supply center can deliver your order to your door. The list is broken into two sections, required materials and optional materials. The optional list can be modified according to your desires. Enough materials are listed to build a single cabinet. Materials for buttons and other control panels are listed later.

### Required Materials

- Fiberboard: 1.5 - 8'x4'x.75" sheets
- Screws: box of 50, #10x1.5 inch
- Wood Project Glue
- Pine: 1"x8"x8'(any grade)
- Pine: 1"x2"x8'
- shelf brackets/screws (see below)
- Paint: 1 quart or spray paint
- Paint brushes: several of the foam ones
- A felt-tip pen or marker

### Optional Materials

- Hinges for the door on the front
  - Drawer/door Knob
  - Door clasp (magnetic or friction)
  - Power switch (light switch)
  - Switch cover
  - Extension cord
  - Barstools
  - 6" fan
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# Basic cabinet construction

This cabinet was designed originally using cardboard cutouts. Feel free to do the same, and change your measurements. Height was based on an arcade size, Kung Fu Master game. Width was based on the TV, as was depth. The three changes in design from a cabinet you will find in an arcade are: 1) the cabinet does not include an overhead marquee, 2) the controls sit flat and are a little smaller than the newer cabinets, and 3) it is designed as a corner unit, such that the back is trimmed to make it as space concious as possible.

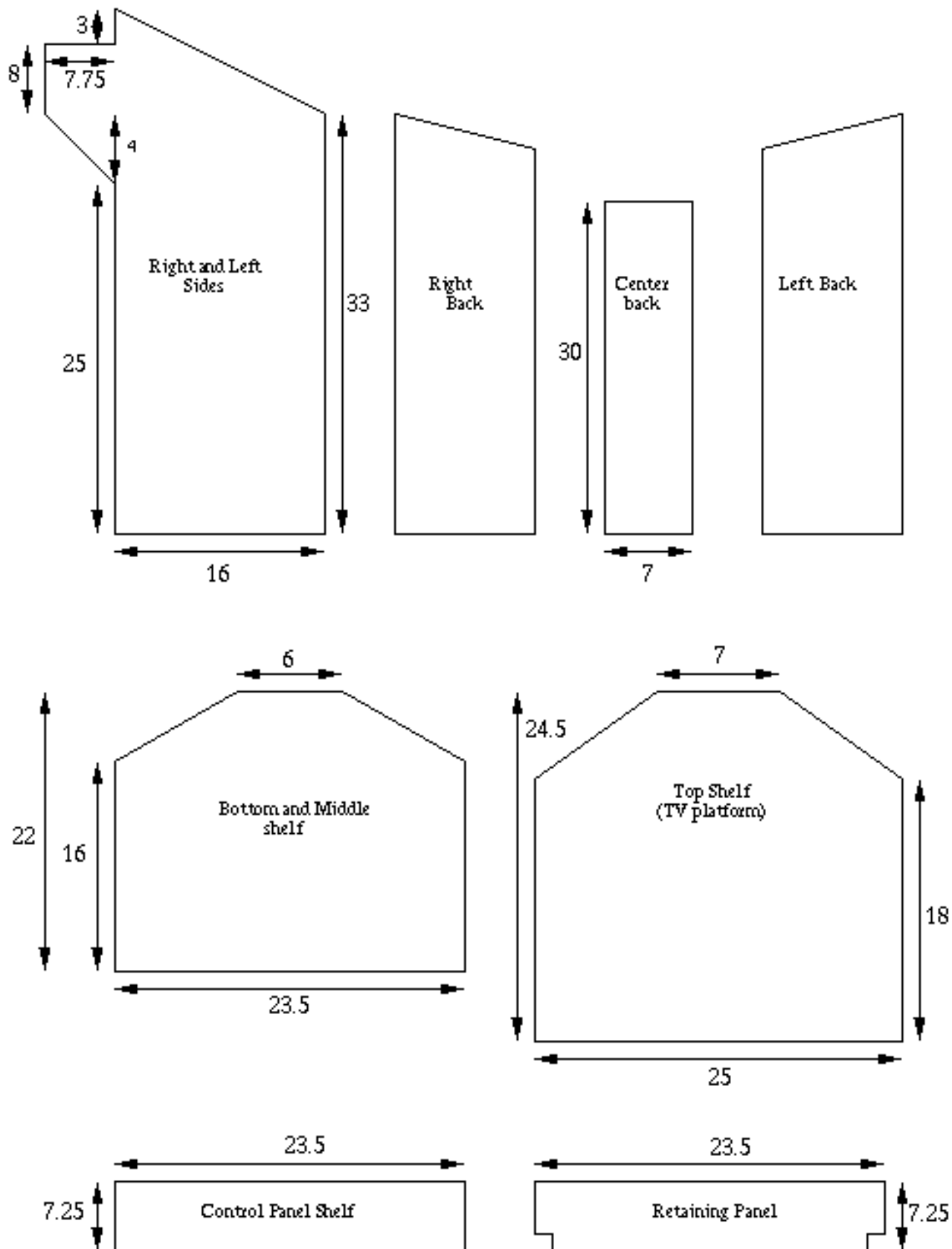
Cabinet construction has been divided into three sections: Basic construction, advanced ideas, and control panel construction. Basic construction includes cutting all of the pieces for the cabinet frame, building the cabinet frame, installing the slides for the control panels, and finishing the cabinet (paint). Advanced ideas include the door for the control panel storage compartment, a power switch to turn your entire system on and off with, the environment the cabinet sits in, a sound system, and other painting ideas. Control panel construction describes how to build the various control panels you might want.

## Cutting your main pieces

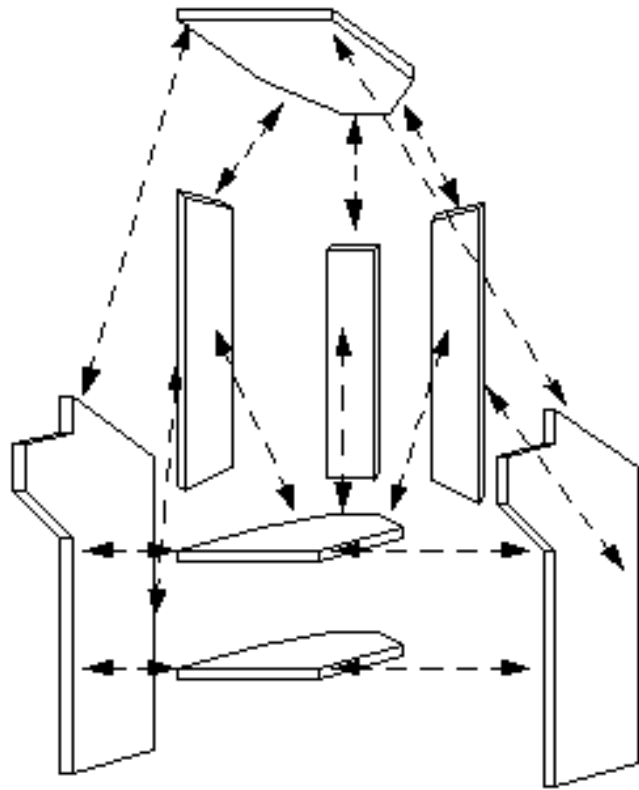
All of the main pieces are cut from fiberboard except for the control panels and the retaining panel. The control panels and retaining panels are made from 1x8 pine. Begin by measuring out the sides and the shelves on the fiberboard. Use the marker to clearly show each piece. DO NOT begin cutting until you have assured you will not run out of fiberboard. The back panel measurements are not given as any changes in your angles, or your decision to bevel the edges will make any measurements useless. Don't worry about the size of your back pieces yet, just rough out the sizes for now.

Cut the pieces you have measured. In the case of the sides, be sure that they are an exact fit by temporarily screwing the sides together and trimming any excess. Repeat the process for the inner shelves. Both the sides and the inner shelves have to be exact matches. Also, the inner shelves not only have to be duplicates of each other, but the depth of the side of the shelf needs to be very close to the depth of the sides. A diagram of each piece and its measurements follow:

## Main Playstation Cabinet Parts (not to scale)



## Building the cabinet frame



The cabinet is built by attaching the the two inner shelves to each of the sides, and then attaching the top. Once this has been done, smaller pieces and the back are attached.

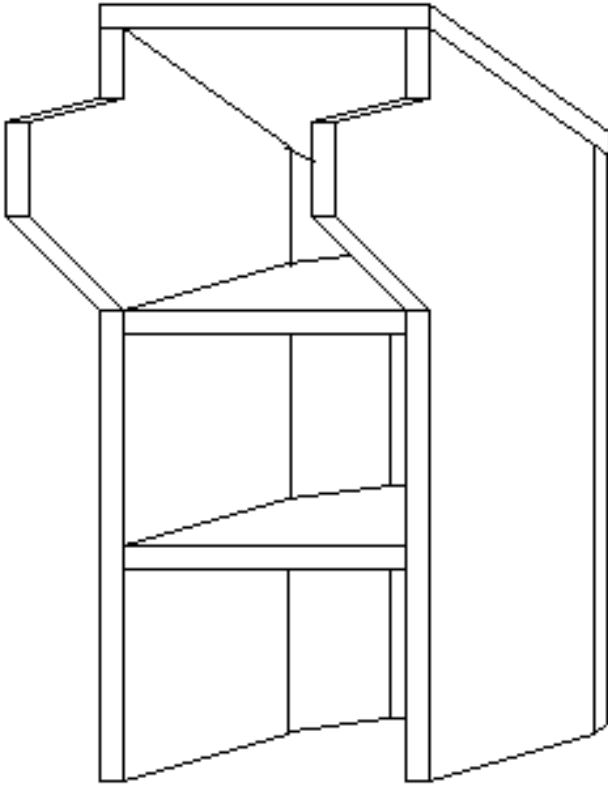
Build your cabinet on a flat spot. The linoleum in your kitchen is ideal. Your first shelf should be at a height that lets you put a gas pedal comfortably underneath. To build mine, I set the first shelf on top of a milk crate. I then attached each of the sides.

To attach each piece, use three screws per side and the glue. To put the screws in place pre-drill a hole slightly smaller than the size of the screw (the box of screws should show a drill bit dimension). You can either use a drill bit, or you can purchase a drill piece specifically designed to both create the pilot hole and to create a small, bevelled hole for the screw to set into. The special piece will cost about \$1.00, and is available at any hardware store. Just ask the salesperson for the right

size for the screws you are using. Once you have drilled the pilot holes, place a small amount of glue on the shelf and attach the shelf.

The second shelf should be at a height that allows you control panel storage in between the shelves. Here again I used a milk crate, placed on top of the first shelf. Once the shelf was sitting on the crate, the sides could easily be attached.





After both the inner shelves have been attached to the sides, attach the top. The sides should screw to the inner 23.5" shelves, giving a total width of 25". The top should sit directly on the sides, and can be attached by screwing down into the sides. The top will hold the entire weight of your TV. **DO NOT ATTACH THE TOP BY SCREWING IN FROM THE SIDE.** If you attach the top from the sides, you will be putting your TV at risk.

Prior to building the back, set a piece in the 3 inch gap from the TV to the control panel. This piece will add a large degree of strength as you work on the back.

Carefully tilt the cabinet onto its front, such that you can easily access the back. Measure the each panel carefully and build the back. Start with the right and left panels. Leave the center panel until the end. Multiple measurements and cuts may be necessary for each side.

When I built my cabinets, all I had was a circular saw. If you are not very experienced with woodworking, you do not have much to fear. If your cuts are not perfect, the cabinet will still look OK. The rear panels are all out of sight when you set the cabinet up. Building the rear panels took some time, and I had to make quite a few cuts, as follows:

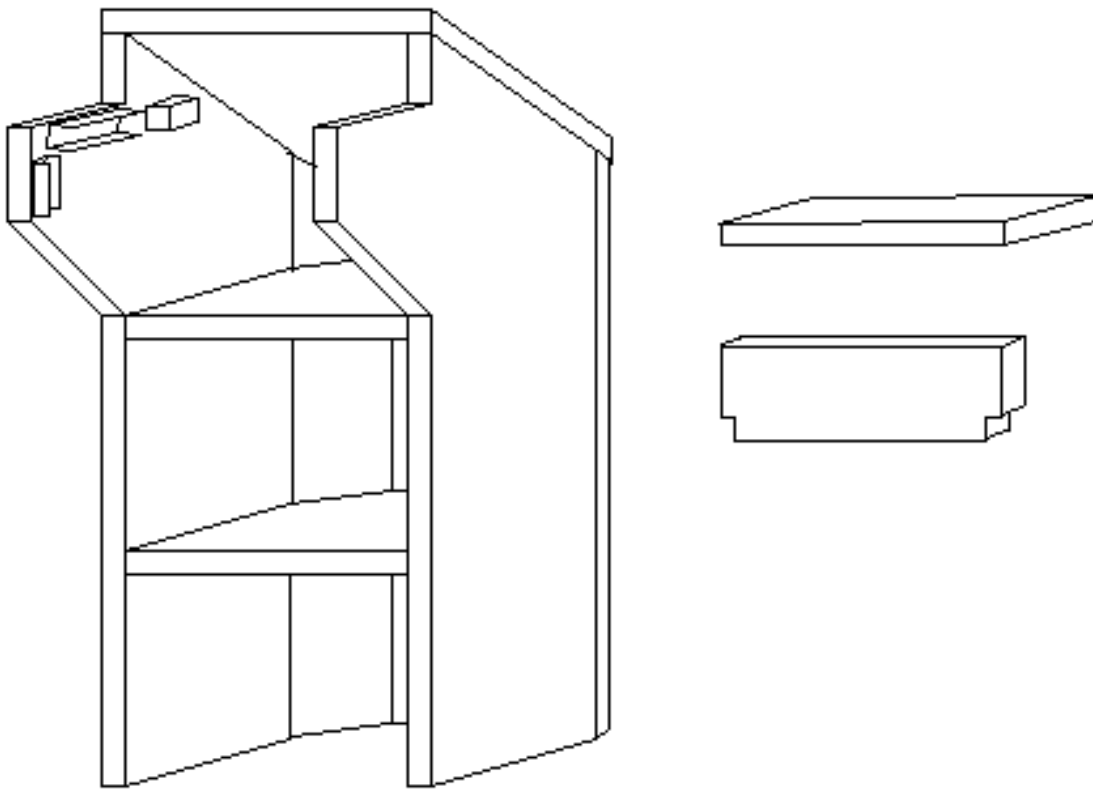
1. I rough cut one of the rear side pieces about two inches large sideways and about 8 inches long.
2. I then took this piece, and set it in place with the best edge against the side of the cabinet. I measured the angle, and trimmed the angle such that it fit neatly up against the side.
3. My next cut was to trim the angle along underneath the top of the cabinet. To do this I set the piece in place, and using a large rectangular shape (a big book works well), I scribed the angle of the top onto the piece I was going to cut. The length was still too long, but by making this cut the piece fit neatly along the side of the cabinet and under the top. I made that cut with a slight angle such that it fit very well.
4. My next cut was along the back side of the cabinet. Here again, I put my piece in place. This time I used a piece of scrap wood to scribe the underside of my piece along the back side. I then figured out my angle and made the cut along the mark. My piece now fit correctly on three sides, but was still too long.
5. Instead of cutting the length, I cut the opposite rear side panel. Then with both of the rear side panels in place (temporarily screwed in place), I tilted the cabinet up onto its top. Once it was upside down, it was easy to scribe the overall length and make the cuts. Then, I permanently

attached the rear side panels.

6. Finally, I was able to measure and cut the back panel. I cut the back panel by cutting the angle on one side, then measuring and cutting the angle on the other side. I cut the length about six inches short. When I attached it to the cabinet, I had the cabinet sitting on it's base as if it were finished. I made sure that the back was flush to the floor and well attached to the rear sides and the inner shelves. A hole roughly six inches long was left between the top, and the rear panel. The hole makes a nice handle to carry the cabinet by, and a nice hole to feed your wiring through.

Your cabinet should now be sturdy, and it should look like a cabinet. The back of the cabinet should stop any sway you noticed earlier. Feel free to use the scrap material you have left over to fill in any gaps. I used scrap to fill out almost every gap. If you still have sway in the cabinet, add an entire fiberboard base.

## Installing the slides for the control panels



The control panel layout is really quite simple. The basis, as shown above, are a couple of the larger size, premanufactured, metal shelf supports. If you have never seen them, they are U-shaped in nature. Originally designed to be screwed to a wall and have additional metal supports placed in them, the cabinet uses them backwards. Many bookshelves use them to allow adjustable shelf.

In the cabinet, they are installed backwards such that horizontal and vertical slides are created. The vertical panel was notched, to allow for several screws to be used as a vertical stop. Stop blocks are attached behind the two horizontal pieces such that a snug fit is created for the panel. Finally, the slides were crimped slightly to create the snugest fit possible.

To build the control panel slides, then, begin by installing the horizontal and vertical shelf supports. Placement is simple. Screw them in place such that the U-shape will allow one of the panels to slide in and out. Place the horizontal support with it's top flange flush against the upper edge of the cabinet side, and in about .75" from the front of the cabinet. When screwed in place, a control panel should slide in to be level at the height of the joystick in an arcade game. The vertical slide should be flush with the front edge of the cabinet side, and down about .75" from the top of the control edge. When all of the slides are in place, you should be able to slide a horizontal panel in, and then slide a vertical panel in.

To install the vertical stops, screw two small screws (not supplied in the list of materials) or pound a couple of small nails in at a height that allows the vertical slide to stop just below the height of the horizontal panel. The horizontal panel should now be stopped from falling out (by the vertical panel), yet the vertical panel should not stop you from comfortably setting your hands where the buttons will go.

To install the horizontal stops, slide the vertical panel up so that you can reach in behind the panel. Snug the horizontal panel up to the vertical panel, and mark where the panel ends. Attach a small piece of spare wood inside the cabinet at that point (glue and a screw). When you have both the horizontal panel and the vertical panel in place, the horizontal panel should not move.

Finally, once all the stops are installed, crimp the horizontal slides slightly to remove any movement up and down.

To change a panel (from Robotron to Defender for example), simply remove the vertical slide and the horizontal panel. Place a panel with the Defender controls back in the horizontal slide and replace the vertical slide.

## Finishing the cabinet

Prior to painting your cabinet, have a friend hold your TV in place while you mark several spots to put 1x2 trim. Screw and glue the trim in place so that your TV is stable and will not slide. Don't worry about your TV flipping over backwards. Once you have the cabinet against a wall, it is not possible. From experience, it takes a really good whack on the cabinet to make the TV shudder at all. Also, if you have a router or power sander, trim the sharpness off the edges. If you do not have any power equipment, just do what you can to remove any dangerous spots.

The basic finish for most arcade cabinets is a black color. Red Devil paints makes a good, single-coat black paint. I did mine in a single, heavy, coat; brushed on with the foam brushes. It dried in a couple of hours, and the setup was complete shortly after that. Prior to painting, include any of the advanced

construction ideas. You will, after all, want to finish the final cabinet a single time. Likewise, you may wish to buy another 1"x8"x8' piece of pine and paint it at the same time, so if you add control panels you will not constantly be painting.

Lastly, prior to painting your cabinet, take a couple of minutes to decide what control options you want. Once you have done this, drill any holes prior to painting the cabinet. For example, if you plan to use basic controllers, drill a notch/hole in the 3 inch piece between the control panel shelf and the top. You will want this to feed your wires through. If you plan steering wheels, you might want to put a little notch at the base of each of the sides, so you can run the wiring from the pedals back up to the wheels.

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## Advanced construction ideas

The section on advanced construction outlines some ideas that you may wish to include. You do not need to include any of them, but each offers a nice additional to the cabinet.

### Including a door

With the cabinet in front of you, it is quite easy to add a door to the control panel storage section. Simply take a piece of the scrap fiberboard and cut a piece that fits from one inner shelf to the next, covering about half of each shelf. Use a router, or trim an angle, to the top and bottom. Then measure it from one side of the cabinet to the other. Again route the side, or trim and angle. Attach the door with a set of hinges. The easiest way to attach it is to put the hinges on the outside of the cabinet and the inside of the door. Other attachment methods are possible (and look a little better), but require a little more work. Look at your kitchen cupboards for more advanced methods. With the door in place, attach a clasp so the door stays closed. Attach a knob so you can open and close it.

While you are working in the storage section, use the 1x2 you bought to create some slides for the control panels. Cut the 1x2 into 15" lengths, and attach them inside the cabinet so that the control panels can slide in and out of the storage section without damaging the electronics that will be underneath each one. I put a slide about 2 inches up, and another about 8 inches up. This lets various different panels fit.

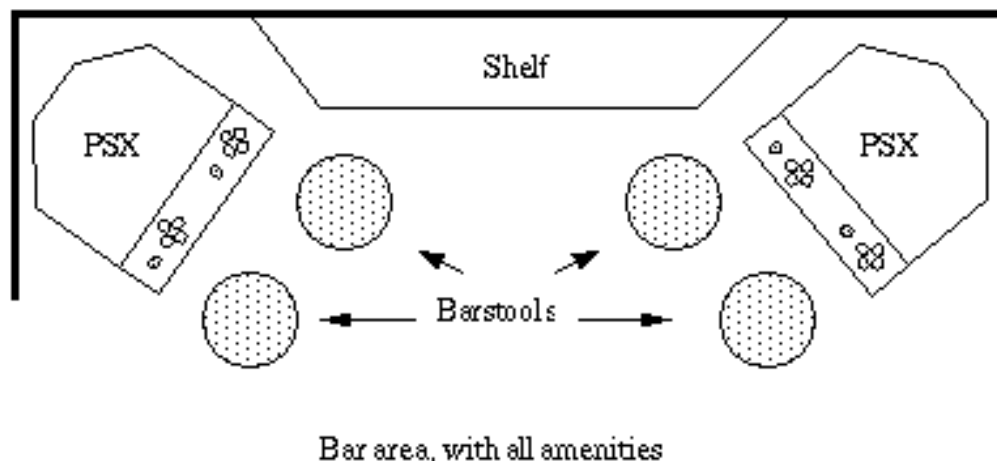
### Wiring in a power switch

A central power switch can be quickly built out of an extension cord and a light switch. Start by cutting a hole in the side of your cabinet slightly larger than the black plastic section of the light switch. Once the switch fits easily into the hole you trimmed, cut one of the strands of the extension cord about 1 foot from where you will plug stuff into it (the female end). Strip the wire back, and attach it to the silver screws on the light switch. There should be a green or black screw, which is the ground. If you bought a basic extension cord, you can ignore that screw. After you have attached the switch to the cord, feed the cord through the hole for the switch and screw the switch down on the cabinet. Put a cover over the switch after

you have painted the cabinet.

You can now plug everything into the extension cord inside the cabinet. You will have one power line to your outlet, and one master switch. Be aware, that there is an assumption that the console you are using has a power supply designed to dampen any spikes. I have not had any problems with my Playstation since I put in a switch. And, I figure that even if I eventually have to replace the console, the wear saved on the TV tube by having a single switch (that people remember to turn off) will be about even in terms of cost.

## Your playing environment



Your overall environment is also worth considering. In my case, I built two cabinets and linked them. They sit about 12 feet apart, in the corners of my bar, and have a shelf along the wall between them. Two little fans create a nice breeze, and the shelf lets players put their beverages down. The shelf is nothing more than a piece of 1x6 pine, painted to match the wall, and mounted using several corner bracket from underneath. The shelf sits at about a four foot height.

Under the shelf, I attached tiny shelves to hold games with their covers visible (like at EB). Players can return games to the cases, and grab other games quickly and easily. Look through the molding section at Lowes for a piece of wood to build these with.

Finally, due to the games being in my bar, players have access to beverages of choice, tunes, a trash can, and many other amenities. From my perspective, the layout is much better than when the Playstations were running on the main house TV's as the mess is contained to an area specifically designed to handle a mess. The floor is not carpeted, trash cans are plentiful, etc. Your layout is up to you, but it is something you should consider.

## A stereo system

If you do not have a stereo TV, you can take advantage of the audio output from your console. Enough space exists to put in a small amp, or as a cheaper alternative, you can put in some computer speakers that

already have some little amps built in. The wiring is straight forward, and where you attach them is up to you.

## Other finishing ideas

Ways to put the finishing touches on your cabinet are only limited by your imagination. Once you have put down a base coat of paint, you might choose to layer polyurethane over the top of game covers, or actual sideart from the originals. You might want racing stripes, or whatever else you think up. As I mentioned, mine are basic black; however, if I were to do it again, I might have the energy to be a little more creative.

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# Control panel construction

Control panels can be considered in two general terms: those that you can buy, and those that you have to build. As an example, if you are a big fan of Battlezone, the cheapest and possibly the best option is to purchase the big, double-joystick beast that Sony sells. On the other hand, if Asteroids is your game, the only way you can recreate the buttons is to build a panel.

## Store bought controllers

The main emphasis of store bought controllers is too make your life easier. They require no maintenance, and can easily be replaced. Sometimes they are cheaper and more reliable than building it yourself, sometime they are not. Generally, I use store bought controllers when I can suffer with the slight problems they have, and the cost outweighs the hassle of building it myself. I have storebought controllers for Battlezone (the Sony Beast), and driving games (MadCatz wheels). If I were a fan of shooting games, I would buy the guns.

The biggest thing to keep in mind when you purchase controllers from the store, is that they may not fit on the control panel. To get around this you have several options. With the Sony Beast, I used velco to hold it down, even though it is slightly bigger than the control panel. When it came to the steering wheels, I wanted them to be a bit wider than the cabinet (2 wheels per cabinet) so players had space to play.

Control panels for oversized devices such as steering wheels can be mounted to a 1x12 instead of the 1x8. The crimping of the slides is enough to hold them in place as there is much less force put upon them.

## Home built controllers

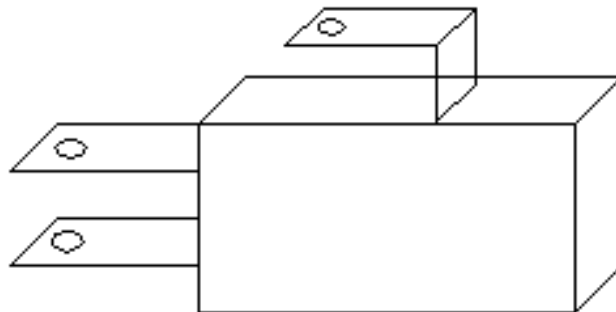
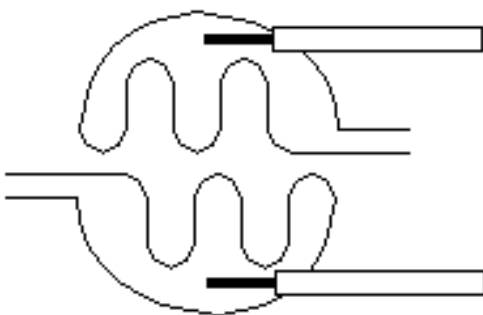
While store bought controllers may be handy and quite useful, the real reason to build a cabinet is to put the proper controls into a panel. There is not any hand-held controller able to simulate the feel of the twin joysticks that Robotron uses, or the five buttons that Asteroids needs. The only way to create the proper

feel, is to build it yourself.

Control panels can be easily built for all games by purchasing an off-brand controller, removing the electronics, and soldering the button connections to the appropriate pads. Buttons and joysticks solder using the standard controller. Knobs and tracballs are based on the mouse. When you hack into the controllers, **DO NOT USE** the Sony controller. The Sony controller is too well built to easily solder to. The cheap controllers work much better. NYKO controllers are the easiest to use as they have small holes drilled at the solder points.

If you have never soldered or worked with electronics before, there are only a couple of things you need to know. First, when you solder, heat the metal until the solder melts; do not melt the solder and hope it sticks to the metal. If you attempt to solder by heating the solder, the joint will be weak and will break. Second, the control pads are designed with a common (ground) loop throughout the board. It will be the little tracing that you can follow from one of the connection points to many others. You can solder to the common ground at any point, and then run your wire from one button to the next without having to constantly solder back to the controller pads. And, third, you will only use two connection points on the microswitch. My suggestion is that you build your first panel one button at a time; soldering the needed connection to the controller and looping it through the switch until you are sure you have the wiring right. It really is not very hard, but if you have never done this before taking your time is always a good move.

The button pads on PSX controllers have two general forms. One is shown below. To solder to the pad, first determine which side is the common ground for all the pads. Solder to the ground only once, and use that wiring to string all of the microswitches together on the ground. The other side of the pad will determine when a connection is made. A sketch of a microswitch is on the right.



To solder to the pad, use your helping-hands to hold a stripped piece of wire against the pad as shown. Press your soldering iron firmly against the pad and the wire. After a moment, touch the solder to the pad and wire (not the iron). The solder should melt. Remove the solder and the iron. The connection is complete.

If your microswitches are not installed in the buttons/joysticks, install the microswitches and put the buttons/joysticks in the board. Once installed, each microswitch will have three flanges. In general, I used

the top flange as my ground, and the center flange as my connection point. Verify that this will work before you solder the connections. The bottom flange went unused.

## The Sony twin-armed analog pad

The Sony twin-armed analog pad works very well for Battlezone, and pretty well for Xevious. Joysticks with fire controls are fairly rare in arcade games today, such that it is easier and cheaper to buy the Sony pad.

To install the pad, I found that the best method was to rip the rubber pads from the bottom, then glue velcro to the bottom of the pad and to one control panel. The suction cups do not hold, so don't bother with them. To use the Sony pad, assemble the control panel and vertical slide, then stick the pad to the velcro. I drilled a hole in the 3" board so the cord would fit directly into the cabinet. When in place, the Sony pad sticks over the edge of the control panel by about an inch.

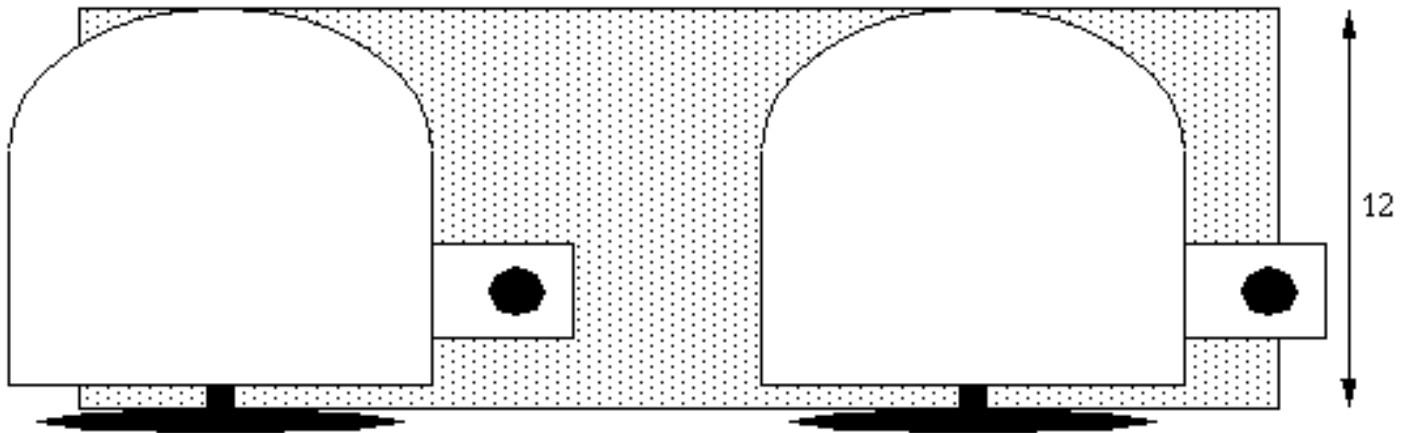
## Steering wheels

Steering wheels are big. That's the biggest obstacle that you face when installing them. To work around the problem, I used 1x12 pine instead of 1x8 pine. On the 1x12, they fit pretty well. And, because you are not yanking on steering wheels like a joystick, the 1x12 stays in place. The other thing I did was to screw them to the pine from the bottom (pre-drill holes in the pine where it will attach to the wheel). I used 4 screws per wheel, and spaced the wheels from the pine using a couple of nuts which were about 1/3 of an inch thick.

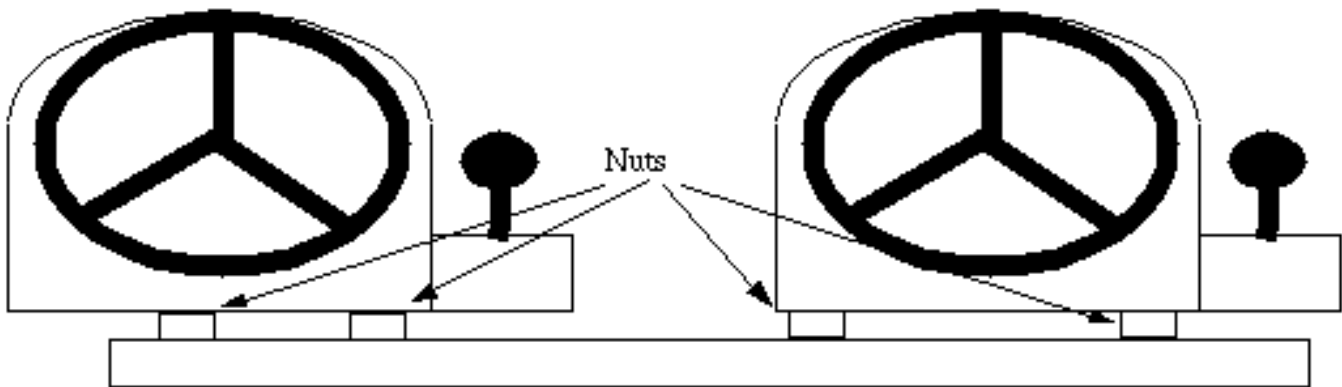
The reason I spaced the wheels off the pine with nuts, was so I could overlap the sides of the cabinet and still slide the panel in and out. By raising the wheels above the height of the horizontal slides, I could shift the wheels. Unfortunately, the steering wheels do not fit in the cabinet storage area, and are stored on a shelf above the cabinet. The look is roughly illustrated below:



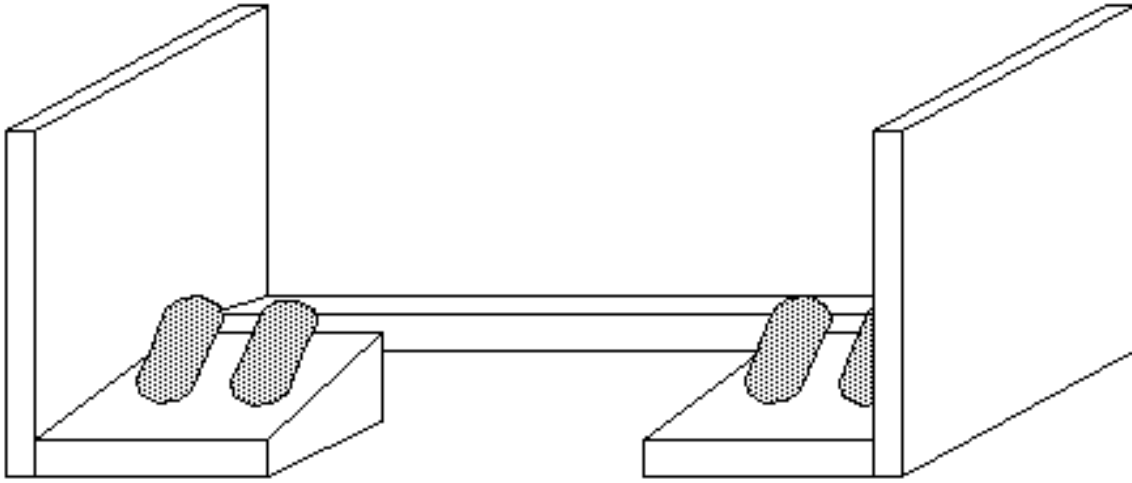
Top View (while playing)



Front view



The pedals for the steering wheels went into the space provided at the bottom of the cabinet. Each cabinet has a set of pedals on the right and left side, inside the cabinet. Each pedal set is permanently attached to a piece of 1x2, screwed in from the back of the pedals. The 1x2 was cut to fit the width of the opening. The 1x2 is then screwed into the sides of the cabinet.



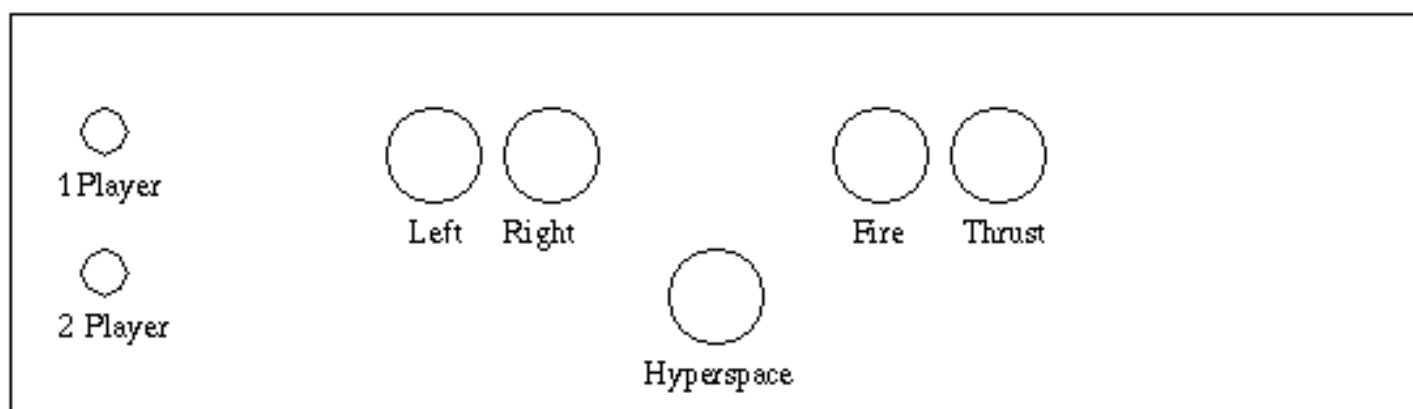
I used Mad Catz wheels and pedals as they are only \$50 each. Most other pedals are \$75 each.

## Asteriods

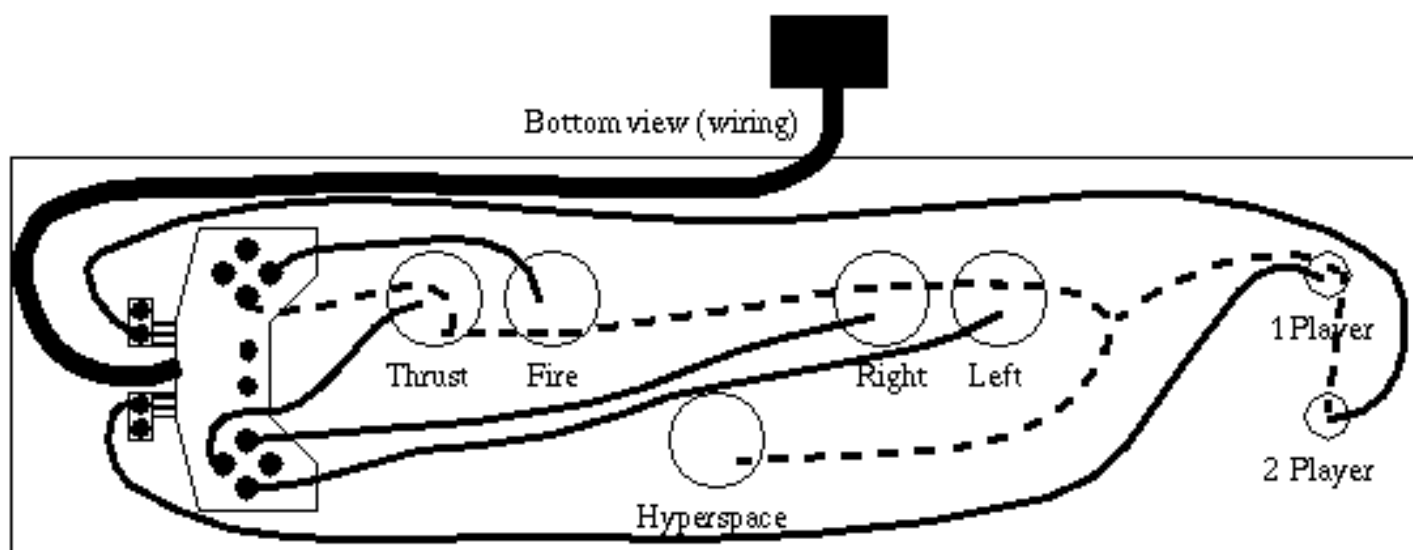
Next to space invaders, Asteriods is the easiest control panel to build. It is only 7 buttons, if it does not matter that you cannot pause the game. It is 9 buttons if you include the SELECT and START buttons.

The Midway Atari Collection uses L1 and R1 as the player selects, X for fire, and the movement pad for movement. I believe that HYPERSPACE is the triangle, but you should double-check. A rough sketch of the control panel, and its wiring follows:

Top View (while playing)



Bottom view (wiring)

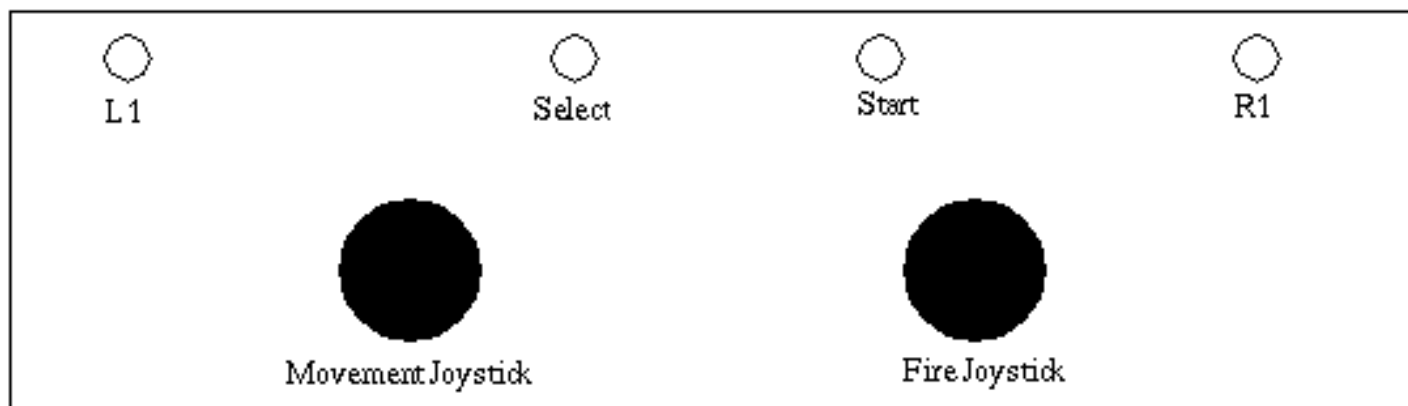


From the illustration you can see that the ground (dashed lines) runs from one button to the next. It only solders to the pad at one point. Each button then solders to the non-common half of the pad. The controller is attached to the panel with several small wood screws. I used sink washers to raise the controller off of the wood a little bit (to protect the raised components). Do not use metal washers to raise the controller, as you run the risk of a short. Sink washers are rubber and do not conduct electricity. Placement of the controller on the control panel is up to you. I always stick is in a place convenient for wiring, but away from the buttons. My solution to protect the wiring on the controller is to Duct tape over it, after I have tested the panel. A better method is probably around, but mine seems to work.

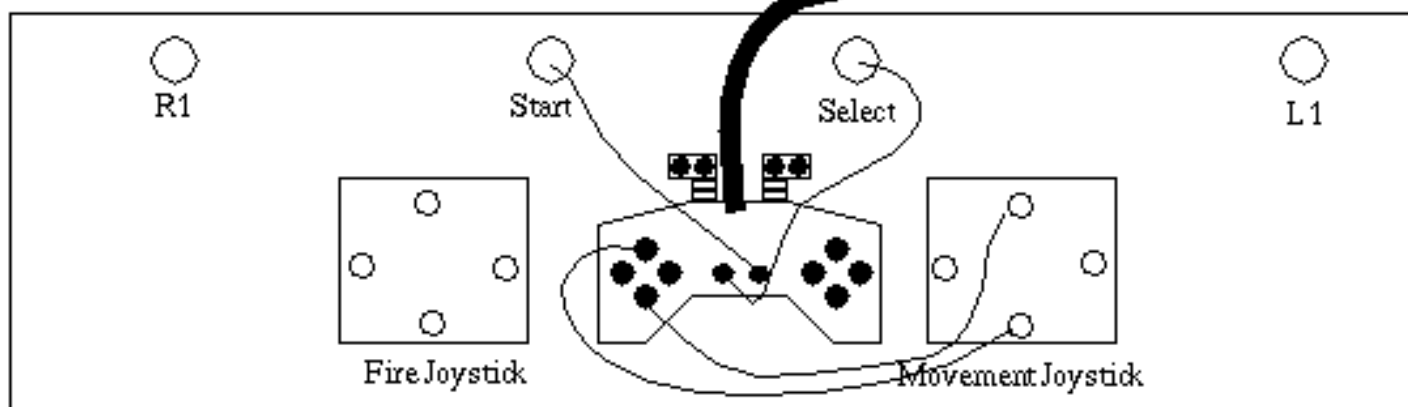
## Robotron/Sinistar

Robtron controls change based on whether you are playing ROBOTRON X, or ROBOTRON 2084. You need the L1,R1 combination for 1-2 players with the original; and the START,SELECT combination for the later. Other than that, it isn't much harder than the Asteriods panel. A rough illustration follows:

Top View (while playing)



Bottom view (wiring)



The ground line is not included in the diagram. On the joystick bases, you can loop it from one microswitch to the next without any trouble. The active connection points are a little confusing as UP is really DOWN on the joystick. A couple of wires are shown.

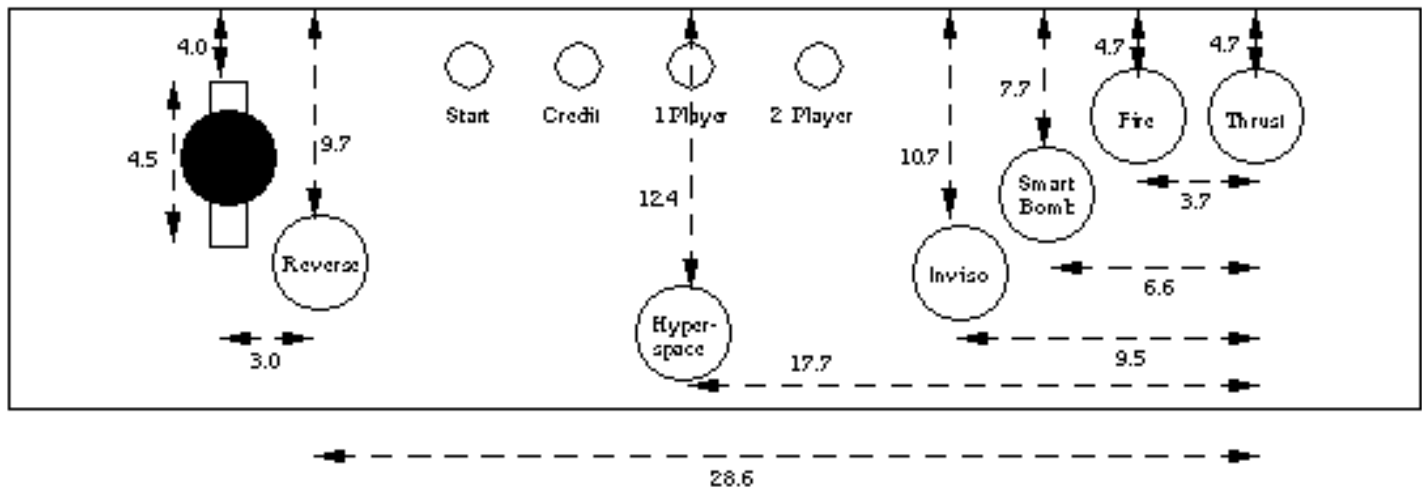
## Joysticks and buttons

Building other joystick and button layouts follows the guidelines listed in the above panels. A diagram is not shown, as it is up to you to determine how many buttons to include, where you want them, etc. With this control panel, you will probably want to build two controllers onto the panel. It follows the exact same concepts as one controller, simply mentally break the control panel into two halves.

## Defender/Stargate

The top of the Defender/Stargate panel is shown below. Defender does not use the INVISIO button, Stargate does. All measurements run to the center of the button, except for the joystick channel. The joystick channel measurements are to the start of the channel, and then the length of the channel. All measurements are in centimeters. When the panel is complete, you will need to re-assign several buttons from the standard layout for the panel to work correctly.

Top View (while playing)

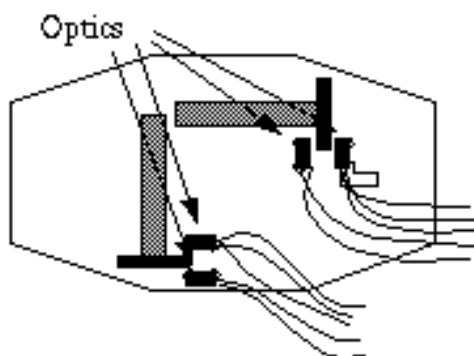
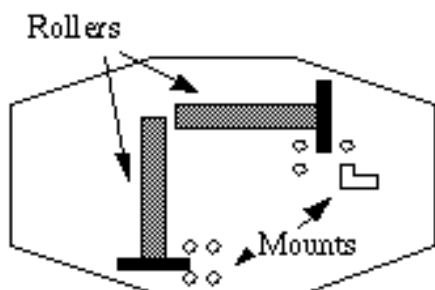
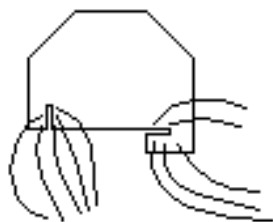
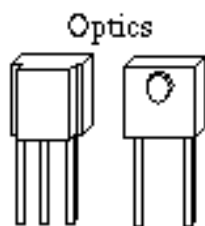
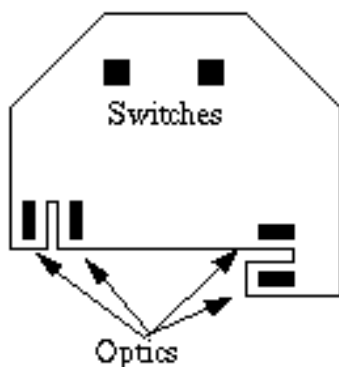


The smaller buttons (start, player select, etc) do not have measurements associated with them. I centered mine on the board. When wired, they attach to the L1, R1, R2, and Start pads. I used L2 for REVERSE. LEFT became THRUST. Each button was labelled on my panel for the function of the button as well as where it was connected to the game pad. This label makes it much faster to set up.

## The Tracball

OK, this is it. Do not rush into this without some time and patience on your hands. If you are careful and take your time, it really isn't too difficult.

The Tracball is created by taking the electronics out of the PSX mouse, and using the electronics in tracball. The example shown uses an Atari 2600 Tracball for the mechanical pieces. Essentially, all you do is unsolder the optics from the mouse PCB, attach some long lead wires to the optics and the solder points on the mouse PCB, and then set the optics into the Atari tracball. Detailed instructions follow:



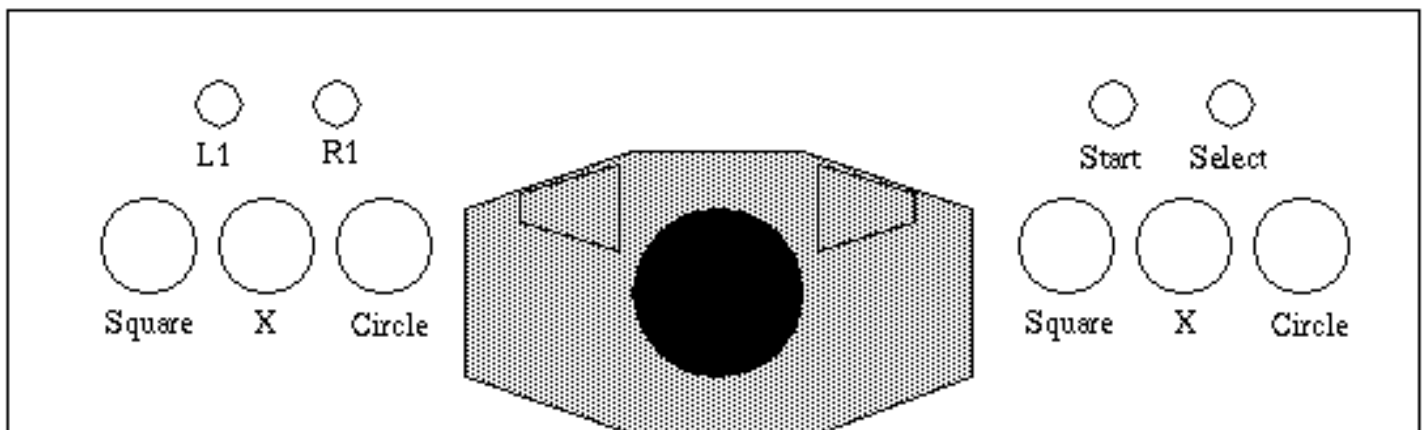
1. Begin by taking apart the mouse. To do so, remove the small screws from the bottom. The screws are under the label. Then lift the cover from the mouse. Take a moment to notice how the mouse operates. As the ball spins, the rollers on each side of the ball rotate. The rotation of the rod is then seen by the optics on both sides of the small discs. In the future, the black and clear pieces will be referred to as the optics.
2. Remove the printed circuit board (PCB) from the mouse. Discard the mechanical pieces, you will only use the PCB.
3. Carefully do-solder the optics from the PCB. Take note that the placement of each optic on the PCB is inscribed on the PCB.
4. Solder a lead wire to each solder point on the PCB. The lead wire can be any length, but I suggest about 18 inches. Wire is cheap, and you can trim them later.
5. Solder a lead wire to each connection point on the optics. Again, I suggest about 18 inches. Helping Hands are a blessing for this stage. If you break any piece, do not throw the PCB or optics away. You can use them as spare parts in your next attempt, or you can use them to build a knob.
6. Using a breadboard, connect the lead wires so that the optics are connected to the PCB exactly the way they were originally. This is important as one of the three leads on the black optics is a 3 volt supply.
7. Take apart the Tracball you plan on using. Instructions are noted only for the Atari 2600 ball. The screws are under the rubber foot pads. Remove the outer covers.
8. Remove the PCB from the tracball. Do not be concerned with any damage done to the PCB, or its wires. You are only concerned with the mechanical pieces of the tracball.
9. Double check to make sure your mouse PCB is correctly wired, then turn on the playstation and plug in the controller. Select a game that uses the mouse. For my testing I used missile command, the sound was off and I used a piece of tape on a second controller's L1 button to make sure a game was always in progress.
10. Position the tracball for playing. Set the horizontal optics in place around the metal disc. Spin the rod and move the optics until you find the exact location. Glue, or otherwise attach, the optics. Set the tracball on the rollers and verify that it works correctly.
11. After the horizontal optics are in place, set the vertical optics in place. The vertical optics will have a backwards effect at this point (ie. UP will be DOWN). Glue, or otherwise attach the optics in place. Set the tracball in place to verify that you have a full range of motion

12. Using a multimeter, determine which lead on the black, vertical optic is the 3 volt lead. **DO NOT TOUCH THAT LEAD.** Swap the other two leads.
13. Play with the tracball a moment to verify that all the directions now work correctly. If they do not, play with the non-powered leads until they do. You probably swapped the horizontal optic lead instead of the vertical optic lead.
14. Carefully remove each lead from the breadboard, and attach it to the corresponding lead.
15. Carefully attach the PCB and all of the wiring inside the Atari housing. Feed the Sony Plug out of the housing, and close the housing. Verify that the system still works.

To install fire buttons, you have two choices. You can take advantage of the Midway design which allows both controllers to operate at the same time; or, you can wire buttons to the microswitches on the mouse PCB. I chose to take advantage of the Williams layout.

To take advantage of the Williams layout, simply hack another controller and wire it up like you did with the Asteriods panel. My button layout is shown below. Your resulting control panel will use both ports on the PSX. I would also suggest that you mount the Tracball using a second (non-converted) tracball as a guide. I mounted the tracball into the control panel so that the top edge of the tracball housing was flush with the pine. When the cutout was complete, and all of the other holes were drilled. I took the converted tracball housing apart, and screwed it in from the inside. With the housing back together, I used a couple of flat L brackets one the bottom to add strength, and filled any gaps between the housing and the wood with sealant. I painted it last.

Top View (while playing)



If you wish to use the microswitches on the tracball, you need to de-solder each of the microswitches. Attach several leads to the locations that the microswitches were at. Then attach the leads to buttons. It is not difficult, but you do not have access to many buttons. If a tracball game ever comes out which requires 2 tracballs at once, or a limited number of buttons, I will consider this option. Fortunately, a rumor that

Sony is considering building a tracball exists, so I might be able to simply buy one at that time. I really see no advantage to using the switches in the tracball, instead of wiring up a second controller.

## Knobs

Building a knob is simply the act of building half of a tracball. When you build a knob, all you care about is the horizontal component of the tracball. The trickiest part of a knob is finding a nice knob to use, and then attaching the optics in place.

To build a knob, make a very basic decision up front. Do you want two knobs on the board, or just one knob. Your initial answer might be two; however, consider that you cannot play Tempest X correctly with two knobs. There are not enough button combinations for you to have a fire, jump, and super-zap using just the mouse PCB. I am still screwing around trying to figure out a way to pull this off, but as of yet I do not have a solution.

The next apparent answer would be to put only one knob, on the board - but then you can't play Pong against your buddy. Oh, what a crisis we face.

My solution was to build a single knob panel so Tempest played correctly. If I eventually get the double knob panel right, I will build one of those.

To actually build the knob, start by finding a nice knob. Then rip apart a tracball for the rod and the disc. Attach the rod to the bottom of a control panel, and mount the knob on top of the rod. Attach the optics around the disc the same way it was done for the tracball (using only the horizontal optics). Mounting the optics is the hardest step as you no longer have convenient points to glue them to. Wire up your buttons to a second controller.

## Other control panels

You can build panels for almost anything you can think up. I am in the process of building a 4 person, joystick with buttons control panel. I will use a 1x12 instead of a 1x8 piece of pine, and wrap around the cabinet like Gauntlet. Other things to keep in mind: Your original controller still works. You do not need to have a panel; however, if you want to build a panel that sends signals to multiple buttons - go ahead. If Sony, or a 3rd party, develops a controller for some purpose - you can hack it into something completely different. The big companies develop products to make money. We develop control panels to play games.

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## The link cable

There is not a whole lot to say about a link cable, except that you can cut one. There do not seem to be any timing issues in the design of the cable. I stretched mine out to a reasonable length (20 feet) by using



phone wire. It was available at Radio Shack for about \$12. The link cable is a nine wire system, so buy a cable with at least nine separately colored wires in it. I believe the stuff I bought had 10 separately colored wires. To assemble the cable, simply cut the link cable near the middle, trim each of the wires back, and attach each wire to a color coded wire in the roll you bought. It takes about 30 minutes. Tape each wire so that they cannot possibly touch. Electrical tape is ideal, but Duct tape works pretty well. You can wrap the wires, solder is not needed.

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## Suppliers

Arcade parts can be found in many different places. Locally, for example, I can run across town and pick up a single button or control. Unfortunately, to buy locally from *The Arcade Guy* is expensive and not a reliable way to get a large number of parts. In my case, I can also rip an occasional part out of an old cabinet or control panel that happens to be lying around the house. Again, this is not the best way - but if all you need is a single, lighted button it will work.

Several large suppliers are found throughout the country. MAS systems contains everything you need, but the prices are very high. Specialty controls might be found by posting on: [rec.games.video.arcade.collecting](http://rec.games.video.arcade.collecting). Several suppliers hang-out on that newsgroup, and can get various parts. Here again, however, prices are higher, parts are less available, and delivery time is longer.

I buy all of my basic components from **Competitive Products Corp.** The prices are significantly better, selection is pretty good, and the delivery time is very good. I have never had a misorder. The only disadvantage is that the buttons are not concave. They have a flat top instead of a ridged top. Gameplay is not affected, so I have accepted the drawback. A 55 page catalog is available from the company. The minimum order is \$25. A short list of products follows.

### COMPETITIVE PRODUCTS CORP.

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PHONE: (215) 547 - 7520

(800) 562 - 7823

FAX: (215) 547 - 7577

No Web Site Available

Microswitched Button (Fire, Thrust, Jump, etc.):

White	STOCK# 02-3060	\$1.25ea	\$.99 L/50	\$.79 L/100
all other colors available				

Mini-Pushbutton (Start and select buttons)

Red	STOCK# 02-2150	\$79es	\$.59 L/50	\$.31 L/100
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## Microswitched Competitor Plus Joystick

Black	STOCK# 15-1050	\$7.49ea	\$6.49 L/10	\$5.49 L/20
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## Leafswitched Joystick (not as desired)

Black	STOCK# 15-1000	\$5.49ea	\$4.99 L/10	\$4.79 L/20
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The second supplier is **Marlin P. Jones & Assoc. Inc.**. Old Atari 2600 tracballs are available for \$1.95 each. A \$15 minimum order is required. I have only placed one order (8 tracballs), and it came through without a problem. A short list of products which might help you add up to \$15 follows. I would suggest 3 tracballs, as some spin better than others.

## Marlin P. Jones &amp; Assoc. Inc.

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PHONE: (800) 652 - 6733

FAX: (800) 432 - 9937

WEB: [www.mpja.com](http://www.mpja.com)

E-mail: [mpja@mpja.com](mailto:mpja@mpja.com)

Atari Tracball	STOCK# 6465-MI	\$1.95ea
Soldering Iron	STOCK# 3028-TL	\$3.95ea
Helping Hands	STOCK# 1006-TL	\$4.00ea
Breadboard	STOCK# 4443-TL	\$5.95ea

A list of other sites follow. I have never used any of them for anything. They seem to carry games, information, and parts. As I mentioned, MAS Systems sells parts. MAS also sells complete cabinets, joystick controllers, and emulator packages. I also mentioned that the prices are pretty high. They sell Joysticks for \$15, and buttons for \$3.50. A complete joystick is about \$90. You can build the same thing for about \$20. The sites are included for your benefit, but do not feel obligated to use them. I find parts cheaper elsewhere, and the flea market guy cannot be matched for buying used games. If he doesn't have it, EB is close enough in price to avoid mail order.

<http://www.massystems.com>

<http://www.spies.com/arcade/info/index.html>

<http://www.startechjournal.com>

<http://www.therage.com>

<http://pw1.netcom.com/~jspusa/jspzone1.html>

<http://www.qis.net/~vgm/>

<http://members.aol.com/psxdirect/index.htm>

[http://www.gamex.com/cgibin/var/gamex/index\\_20.htm](http://www.gamex.com/cgibin/var/gamex/index_20.htm)

<http://www.impress-ny.com/exchange>

<http://www.mediaport.org/~simmie>

<http://www.geocities.com/TimesSquare/Arcade/8315/cheaters.html>

<http://members.aol.com/chikong/index.html>

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## Final thoughts

When I started my project, I was trying to emulate my classic arcade games in only 2 boxes. Many methods are available. I chose to go with Playstations. I have since set my arcade up to play both the classic games, and the new generation of games. Everyone seems to like the way it turned out, and I am pretty pleased with the exchange of my old cabinets for the Playstations. I hope that the next generation of Sony Consoles will be backward compatible to allow me to upgrade for the cost of 2 consoles. If not I suspect I will upgrade the entire system when HDTV consoles become available and affordable (2 consoles and 2 HDTVs).

This project has been in progress for about six months now, and is finally about done. I owe credit to a great many people including: the arcade.classic.collecting on-line people who gave initial comments to my sanity; the various people who commented on my design ideas and helped refine the cabinet; the many people who offered technical help before I tried to hack various pieces of equipment together; MadMaxx who initially built a web-page from my plan; Erik and the crowd who helped build and test the cabinets; those people who gave me money for the arcade games I sold so that I was able to do this; and you for visiting my web page. Feel free to forward the address to any video game addicts.

I hope I included enough information for the project to work out for you. I tried to be comprehensive without rambling too much. If you build a cabinet, and wish to thank me, you are welcome to send a donation (\$5 will get me a beer to toast you with, \$10 will get a round for Erik and I.). If you have trouble, comments, or want to offer me a high-paying job designing toys I am available at:

William Powers  
3835 Summerwood Court  
Raleigh, NC 27613  
(919) 783 - 7024  
e-mail: wpowers@nortel.ca

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