Choosing a Game Console to Make Portable

T he purpose of this chapter is to familiarize you with each gaming system that this book covers and to explain the advantages, difficulties, and special challenges you'll encounter while making them portable. We'll discuss the best (a.k.a., cheapest) ways to acquire these old systems and estimate what you can expect to spend on a portable project.

From this, you can decide which project you'd like to tackle first, although this may also be determined by what equipment you have access to, an issue that will come up in Chapter 2, "Knowing Your Tools," and in Chapter 5, "Using Computerized Cutting Equipment." It may be tempting to just jump in and start ripping things apart, but if you don't want to end up with a pile of game-systems-turned-paperweights, it's best to plan ahead and know your systems. Let's get started!

The Nintendo Entertainment System (NES)

The year was 1984, and video games were dead. There had been good times in previous years. A company with its first factory in an old skating rink grew to become a billion-dollar behemoth; game programmers were suddenly making hundreds of thousands, if not millions, of dollars a year; and anyone with the right equipment could make games for the Atari 2600.

And therein lay the problem. Anyone could make games for the Atari 2600, and apparently everyone did. The market became flooded with a deluge of low-grade junk. Consumers didn't know how to tell the good from the bad, and they were tired of getting burned. Bargain bins began to fill with excess cartridges while systems sat unsold. The Atari 2600 was showing its age and the company was slow to create a worthy successor. They tried with the Atari 5200, but by then the public didn't seem interested. Video games seemed destined to become just another quirky footnote in history.

Meanwhile, in Japan, a playing-card company called Nintendo had moved into video amusements. In the early 1980s, they had had tremendous success with the arcade game "Donkey Kong," which starred Nintendo's mascot-to-be, Mario. By 1983 they had released their own video game console in Japan called the Famicom (short for Family Computer).

Realizing its potential, they approached Atari with the proposition of handling the worldwide release. Nintendo wanted a name synonomous with gaming on their system, and Atari seemed the perfect choice. However, in a strange twist of fate, Atari declined, and Nintendo chose to go at it alone.

Redesigned into a gray VCR-like box and renamed the "Nintendo Entertainment System" (Figure 1-1), the NES came to American shores in time for the 1985 Christmas season. Certain bundles even came with a robot, whose main purpose was to make retailers think this was something completely different from the Ataris they were having trouble selling.

FIGURE 1-1: The Nintendo Entertainment System and two controllers (gimmicky robot sold separately).

Sales in the early years were good, propelled by the high quality of games such as The Legend of Zelda, Super Mario Bros, and Mega Man. By 1988 the NES was red-hot, with stores clamoring to keep enough games in stock to meet the demand. The NES had become more than a mere video game system — it was a cultural phenomenon that had single-handedly brought gaming from the brink of extinction to the forefront of home entertainment. And for that we should all be grateful. That said, let's rip one apart and make it portable! The NES shown in Figure 1-1 is the type you'll need for the projects in this book.

Advantages in making the NES portable

There are several advantages to making the NES portable:

- **Very popular system with a huge variety of games.** Back in the late '80s and early '90s, everybody had a NES. While it's best known for advancing the side-scroller genre with classics like Ninja Gaiden, Contra, and Castlevania, you can still find practically any type of game for the system. By the time it was officially discontinued in 1995, around 800 titles had been released.

- **Simple controllers.** The controllers for the NES are fairly simple, consisting of eight buttons (up, down, left, right, select, start, B, and A). Inside, there's a chip that sends the state of the buttons as data bits to the NES. (This is why there isn't one wire per button inside the cord, as with the Atari or the Sega Genesis.) This small number of parts allows the controllers to be hacked up quite a bit.

- **Low power requirements.** Believe it or not, the main CPU of the NES is fairly similar to the one in the Atari 2600. Therefore it doesn't use a heck of a lot of power, which gives you more play time and lets you have a nicer screen.

Challenges in making it portable

Of course, every project has potential "speed bumps" along the way, and the NES is no exception. Here are a couple to consider:

- **Abnormally large cartridges.** The NES takes some of the largest cartridges of any game system ever. Why, you ask? Well, not because they have a lot of guts in them; in fact, they're 75 percent empty space (see Figure 1-2)! Nintendo didn't want the American version of the NES to look like a video game system because video games were still considered to be dead when it was released. Therefore, the cartridge was made to insert like a VCR tape and was sized to look quite different from the Atari 2600 or the Colecovision cartridge. A portable unit can be only as small as its biggest part, and the giant NES cartridge requires the case of your portable to be bigger, and also takes up valuable space that could be used for other things, such as batteries. This creates an interesting challenge in building the portable.
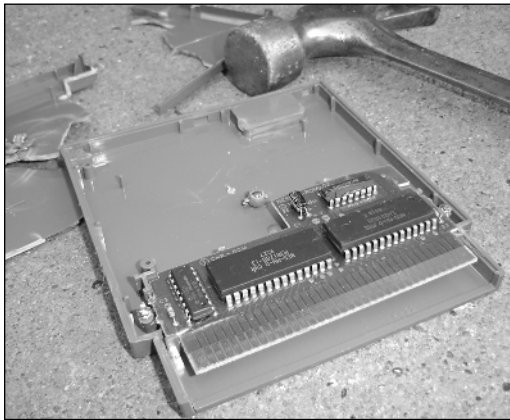

FIGURE 1-2: The guts of a NES cartridge.

- **Rewiring the cartridge slot.** The darn cartridges again! Not only are they big, but they have a lot of contacts — seventy-two of them, in fact. There are a few you can skip, but still, if you are rewiring the cartridge slot, this can be a real pain in the rear. Not to mention monotonous.

The Super Nintendo Entertainment System (SNES)

By 1990, the NES had enjoyed nearly five years of supremacy on the videogaming market. One hit game after another had been released for the system, and special cartridges were allowing them to utilize more memory and graphics than ever before. The NES was being pushed to its very limits and holding up well.

There were challengers on the horizon. The Sega Genesis had come out in 1989 and had already established itself as a worthy contender, especially with third-party developer Electronic Arts behind it. In Japan the Turbographx 16 was gaining ground, and its snazzy CD-ROM add-on gave gamers a whole new dimension of play.

To counter these scrappy newcomers, Nintendo released the "Super Nintendo Entertainment System" (SNES) in 1991 (Figure 1-3). Its processor was only a few megahertz faster than the NES, but it had vastly improved graphics that allowed for huge on-screen game characters, rich color palettes, cartoon-quality graphics, and three-dimensional immersive worlds (well, three-dimensional immersive worlds by 1991 standards).

FIGURE **1-3: The original Super Nintendo Entertainment System. (This is not the model SNES we'll be using in this book.)**

The processor speed did plague the system a bit during the intial wave of games, which was jokingly referred to by some as the "free slow-motion" feature. But programmers soon learned their way around this limitation and created many fantastic games (most of them with the word "Super" in the title). Specially enhanced cartridges such as "Star Fox" gave the SNES added speed and three-dimensional graphics, prolonging the life of the system.

In 1997, Nintendo released a smaller, redesigned SNES that used a single motherboard (see Figure 1-4). This is the type of Super Nintendo that we'll be using for the projects in this book.

Figure 1-4: The mini-SNES we'll be using in this book.

Advantages in making the Super NES portable

The small size of the mini-SNES is a built-in advantage, but there are other great reasons to make it into a portable as well:

- **Popular system with a wide variety of games.** Having to share the market with the Sega Genesis didn't hurt the availability of games for the SNES — there are hundreds of titles available. The system really shines when it comes to role-playing and adventure games, but action and sport lovers have a lot of choices too.

- **Fairly simple controllers.** The SNES controllers have a few more buttons than the NES, but the internals are still pretty reasonable to manage. Instead of one chip to send the data, there are two, and also little subboards for the shoulder buttons.

- **Low power requirements.** One advantage to having a, hmm… "speed impaired" processor is that it doesn't take a whole lot of juice to run. Also, the second-edition SNES that you'll be using is about 6 years more modern than the original-model SNES, with increased efficiency.

Challenges in making it portable

Of course, every rose has its thorn, and the mini-SNES is no exception. Luckily, these challenges, listed below, are nothing project-threatening, just things to consider:

- **Locating a mini-SNES to use.** Of all the systems that are covered in this book, the second-edition "mini" SNES is probably the hardest to find. This doesn't mean it's overly expensive — just that you can't walk into your average used-game store or garage sale and expect to find one. I'll list places to find one later on in the chapter.

- **Working with the cartridge slot.** The cartridge slot on the SNES is pretty hard to desolder and move. I know — I've tried. The best course of action is to leave it where it is, which causes the cartridge to stick out from the board at a 90-degree angle. This will cause a few interesting challenges for the case that will have to be worked around.

- **Dealing with the shoulder buttons.** Just to forewarn you, I'm going to complain about these on the Playstation as well. The tricky thing about shoulder buttons on a portable is that you're holding a device that is heavier than just a controller alone. You need as many fingers wrapped around a portable as possible, especially a heavier home-built one. So instead of having them on top, as on the controller, we will be moving the shoulder buttons to the back of the unit (which would technically make them butt buttons, if you ask me).

Playstation 1 (PSOne)

Strangely enough, the Playstation 1 sort of began its life as a proposed add-on for the Super Nintendo Entertainment System. You see, most video game systems since the early '80s have had some sort of expansion port on the bottom or side, and this includes the SNES. However, unlike most systems with ports, plans were actually laid to use the one on the SNES to connect a CD-ROM attachment/upgrade for the system. Nintendo intended to have a partner for this new project, and they teamed with Sony to work on the tentatively titled "Playstation" add-on.

But, in a strange echo of the Atari-Nintendo nonpartnership a decade earlier, it never came to pass, and Sony decided to make the Playstation itself as a next-generation stand-alone CD-ROM–based system. (It's interesting to imagine what the video game scene would be like now if some of these near-deals had actually gone through.)

Arriving in America in the early fall of 1995, the Playstation (Figure 1-5) immediately caught the attention of the twenty-something crowd. The games were more advanced and in many cases more violent than what had typically been seen until then. Sure, there weren't a whole lot of release titles to start with, but hey, they had blood!

FIGURE 1-5: The original Playstation 1, lying on a carpet in clear defiance of the instruction manual.

A couple of years later, Final Fantasy 7 was released for the system, drawing huge new crowds of RPG fans to the Sony camp and broadening its appeal. Propelled by this and by other hit games like Resident Evil, Tomb Raider, and Gran Turismo, the Playstation sold in record numbers and Sony took the lead of the videogaming market. As of this writing (Fall 2004) it still hasn't let go.

There are two basic types of Playstation 1. The original model (as seen in Figure 1-5) came out in 1995 and ran directly off wall power. The second model (see Figure 1-6) was released in 2000. It was much smaller than the original and used a wall adapter for power, and therefore actually ran off 7.5 volts. It's commonly referred to as the "PSOne."

FIGURE 1-6: The PSOne. It's the Playstation we all know and love, only smaller. Use this one with this book.

This second, smaller model of Playstation 1 is the type that you'll need for the projects in this book. Later on in this chapter we'll discuss the best places to find one.

Advantages in making the Playstation portable

If you're wondering what's so great about making a Playstation 1 portable, consider the following:

- **Large library of great games.** As stated above, there are a lot of classic hits for the system, and chances are you're hankering to play your favorites while on the road.
- **Fairly modern 3D graphics.** The Playstation is the most advanced system covered in this book, and if you're looking for snazzy-looking portable games, this is it.
- **Makes the Gameboy Advance look like Pong.** What else can I say?

Challenges in making it portable

With all portable projects come challenges, of course, and the Playstation 1 is no exception. Some of these put the Playstation 1 project a little higher on the difficulty scale than other systems in this book, so consider the following before you begin:

- **Working with the CD-ROM drive.** As you probably remember, the Playstation 1 used regular, full-sized CDs, and so will your portable. Therefore, the challenge is to reconfigure the CD-ROM drive to work in a portable configuration and be protected from skipping. It's also going to take up more room than a typical cartridge would.

- **Rewiring and using the analog controllers.** The Playstation controller is loaded with all sorts of great buttons and analog sticks — and you'll have to rewire every one! In addition, the analog sticks take up quite a bit more depth than your average directional pad, so that must be worked around as well.

- **Working with the four shoulder buttons.** If you go back a bit, I mention this as being a problem with a portable SNES. For the Playstation, simply take that rant and multiply by 2. Not only that, but the shoulder buttons have to be out of the way of the CD-ROM drive as well.

- **Higher power requirements.** With its 33 MHz processor and CD-ROM drive, the PSOne will suck up more power than any other system we'll cover.

The Atari 2600 Video Computer System

The year was 1975. The Viking landers were on their way to Mars, the movie *Jaws* was number one at the box office, and as far as video games went, Pong was king. Atari had recently released a home version of the popular arcade game and it was a smash hit, but there was a problem. Everybody else was making it too! The market was becoming saturated with home consoles that were specialized — that is, they could play only one or two games with a few "variations" (such as select paddle length or ball speed).

Atari realized that in order to survive in the home video game business, it was going to have to come up with a machine that was programmable, meaning the owner could buy cartridges of different games and plug them into the machine to play. This may sound obvious now, but back then it was pretty revolutionary. Other programmable cartridge-based systems existed around that time, such as the Fairchild Channel F and the RCA Studio II, but Atari wanted to make something better that would hold up for the long haul.

They began development of the most advanced programmable color video game system at that time. Codenamed "Stella" after one of the engineer's bicycles, it was a make-or-break project for the company, even requiring Atari to be sold in order to obtain sufficient development funds for its completion.

Shedding the moniker of a bicycle for something far more bland, the "Video Computer System" (VCS) arrived in time for the 1977 Christmas season, with enough extras packed in to keep you busy for hours. Sales were pretty good, though not earth-shattering.

During the next few years it enjoyed continued success, but newer and more advanced systems were on the horizon. The VCS was very simplistically designed — the idea was to put most of the burden on the programmer, rather than having all of the graphical functions already built in. This proved to be the system's greatest strength, as programmers were then able to trick the system into doing things it was never intended to do.

In 1980, a programmer managed to "trick" the VCS into displaying thirty-six invaders from outer space. The resulting "Space Invaders" sold like gangbusters — people bought the system just to play the game. And with that as its stepping-stone, the VCS (now called the "Atari 2600") rocketed into to the annals of videogaming history.

The most common type of Atari 2600 is the four-switch model, as seen in Figure 1-7. It's so called because there are four silver switches on the front. This is the model of Atari 2600 you'll need to use for the projects in this book.

FIGURE 1-7: The four-switch Atari 2600 Video Computer System.

The following types of Atari 2600s will *not* work with the portable projects in this book:

- **Six-switch Atari 2600.** Has six silver switches instead of four and is somewhat heavier. This is the original model Atari from 1977. It doesn't work for these projects because the insides are completely different from the four-switch model, and it has two boards instead of just one.

- **Atari 2600 Junior.** Sleek-looking with a black shell and brushed aluminum across the front. The layout of the motherboard is quite different, however, making it unsuitable for these projects.

As mentioned before, these Ataris aren't nearly as common as the kind that *does* work, but double-check what you're getting nevertheless.

Advantages in making the Atari 2600 portable

There are actually a lot of avantages to making an Atari 2600 portable. Even if you think the system is just "too old" and out of date, consider the following:

- **It's a classic system with timeless games.** The Atari 2600 is easily the most well known and beloved classic gaming system in the current classic video game market. Anyone who was alive and beyond the pacifier-sucking age in the early '80s has memories of the sys-

tem, whether it was theirs, their older brother's, or a friend's. By the same token, the games are simple and nostalgic. They weren't terribly complex, but therein lay their beauty. Unlike modern games that often get bogged down with storyline, graphics, and gore, the classic Atari games were simply about reaction, timing, and skill. They were the essence of gaming, and their universal themes still hold up today. It's like escaping your high-tech office to take a leisurely stroll through the park (but with a joystick).

- **The cartridges are small.** When you're out and about with your newly built portable system, you'll probably want to carry at least a couple games with you. The Atari 2600 has fairly small cartridges, making game toting a breeze! (In fact, the results of my personal testing show that you can fit two changes of clothes, an Atari portable, and eight cartridges in your average carry-on bag and *still* have room for deodorant. If you skip the deodorant, you can fit one more cartridge, but I wouldn't recommend it.)

- **The motherboard can become small.** The Atari 2600's motherboard (it's pretty old; shouldn't it be called a GRANDmotherboard?) starts out at a size of 10" wide by 5" high. Using the hack-and-slash methods in this book, you can get that down to a $4" \times 4"$ square and it will still work. This allows you to build a smaller portable than the other game systems, and it's also interesting to see just how much of it can be hacked off.

- **Simple controllers.** Or "joysticks" as we called them back in the days of old. When it comes time to rewire and rebuild the controllers, the Atari 2600 joystick is the easiest because it's so simple. No special chips or anything, just five switches — up, down, left, right, and the trigger button. Just think, you'll be able to tell your grandkids/robots, "When I was your age, we had Atari. And they only had one button on 'em! And we liked it! And we didn't complain!"

Challenges in making it portable

There are a few challenges in making the Atari 2600 portable, but they're mostly things you have to do in order to get the full benefit of the system's advantages. (That makes sense, when you think about it.)

- **Working with the cartridge slot.** The Atari cartridges are small, but they have an annoying feature — the door (as seen in Figure 1-8).

FIGURE **1-8: The pesky door that protects the Atari cartridge's guts from the outside world.**

The cartridge slot on the Atari itself has two little tabs that push into the slots on either side of the door, allowing it open. Most cartridges made after 1981 don't have this door, but if you want your portable to play the older cartridges, you're going to need to either include the entire Atari cartridge slot assembly (the easiest but bulkiest method) or manually attach some tabs to make the door open (the harder but more compact method).

Note Even though the Atari cartridge slot is kind of large with a lot of excess plastic, we'll leave it intact in its original form for the two Atari 2600 projects in this book.

■ **Getting a modern video signal.** If you're a fan of the Atari 2600 from "back in the day," you probably remember those RF switch box things (Figure 1-9). This took the RF signal from the Atari and channeled it into your TV. The switch was there so that you could go back to watching *The Dukes of Hazzard* or *The A-Team* when you got tired of games.

FIGURE 1-9: The RF switch box.

Although you probably could attach one of these to a pocket television, you certainly wouldn't want to. The preferred input for a pocket TV is the audio/video input jack, which uses the same kind of signals as the RCA jacks on the back of a regular TV or VCR. By default, the Atari 2600 doesn't output these types of signals, and it will have to be modified with a circuit in order to do so.

■ **Slicing up and rewiring the board.** The standard Atari 2600 motherboard is too large to be used in a portable; therefore, you will need to slice it apart. This can be done with an X-Acto knife or a band saw.

Finding These Game Systems

Now that you've had an overview of each game system and its advantages and challenges, let's talk about where to find these old things. The purpose of this section is to point you in the

right direction for the system you're looking for, and hopefully save you a buck or two along the way. I'll list the place, store, or resource first, followed by which video game systems you can expect to find there (in order of likelihood) and at what price (circa 2004).

- **Used–video game stores.** Large chain stores have some systems, but your best bet is a smaller, locally owned kind of place. Systems that they're likely to have include

  - **PSOne.** The previous generation of game system is always the easiest and cheapest to find. You should be able to get a PSOne and Dual Shock controller for $30 or less.

  - **Nintendo 8-bit.** Stores usually get these pretty regularly, but they also sell rather fast once they're in. Checking the store often or reserving a system is a good way to get your hands on one. They usually sell for $30–$45.

  - **Atari 2600 four-switch.** As with the NES, they sell fast when in stock, so frequent checking is a must. They're also about the same price as the NES.

  It's also not a bad idea to ask the manager of the store if they have any "broken" Nintendos or Ataris. If you can get one cheap (say, under $10), it's worth a shot, as the modifications we'll be doing on these systems in later chapters will often get them working again. This also applies to any "broken" systems you may already own.

- **Online auctions such as eBay.** These are great resources because they make it easy to find pretty much anything you might want. However, the prices can tend to be on the high side, and most game systems auctions usually include a bunch of common games you probably don't want. That said, it's a great way to find the following:

  - **mini-SNES.** An online auction is the best way to find one of these. While not the most common system, it's also not terribly rare (despite what the item description might say, of course — I've seen auctions listing the Atari 2600 version of *E.T.* as "rare"), so if bidding goes over $50 with no games, you should try another auction.

  - **Atari 2600.** Online auctions are the second-best place to purchase one of these, though you'll pretty much be guaranteed to get a load of common junk games with it. A bare-bones system usually starts around $20–$30, but if sellers think their junk games are worth anything, expect the price to be a bit more.

  - **Nintendo 8-bit.** If the used-game store fails, you can always find one online, usually for around $20–$30 with no games.

- **Garages, closets, and rummage sales.** I have a saying, "Nothing is cheaper than something you already own," and it certainly applies to any game systems you might have buried in the closet. Ask friends, relatives, and coworkers too; they're usually glad to get rid of junk. It's a great way to find the following systems:

  - **Atari 2600.** This is practically a given, but think about it. Back when people were shelving their Atari 2600s, used-game stores that bought that stuff weren't nearly as common as they are today. Therefore, instead of unloading an old system at GameStop for a couple bucks, they'd just throw it into the garage. The point of this ramble is that a lot of people still have Atari 2600s lying around their homes. They're probably not even going to put them out in rummage sales any more, so you'll have to ask. But it's definitely worth a shot.

- **Nintendo 8-bit.** Along the same lines as the Atari 2600, although by the time people started getting rid of their NES systems, there were more used-game stores around, and so the closet-to-video game ratio won't be as high as it is with the Atari.

What You Can Expect to Spend

The cost of building each of these projects varies depending on how much the game system costs, what type of screen it uses, and how you construct the case for it. This book provides two ways of creating the case for each of the four portable systems:

- Making it by hand using readily available off-the-shelf parts
- Using computer-controlled (CNC) cutting machinery, such as a router or laser engraver, to form it

This results in a total of eight portables you can build using this book. Table 1-1 provides an estimated cost per completed portable video game system. (The cost of having to buy the original game system is included, so if you already own the correct model, you'll save some money off these estimates.)

Table 1-1 Estimated Costs for Building Portables

System	By Hand	By CNC Machine
Nintendo Entertainment System	$175	$330
Super Nintendo Entertainment System	$210	$350
Playstation 1	$150	$340
Atari 2600 Video Computer System	$250	$325

Some notes regarding these price estimates:

- Actual cost will vary depending on your skill level and how easy it is to find parts.
- Estimated cost of paying to use a CNC machine is based on a rate of $60–$80 an hour. In Chapter 5, we'll discuss ways to minimize the routing and laser engraving costs.
- All of the above price estimates include batteries and charger, with the exception of the Playstation portables and the CNC-built Atari 2600.
- The Playstation portables and the CNC-built Atari 2600 will use a Sony Infolithium Type L battery for their power source. You'll also need a separate charger for the battery. The battery-and-charger combo will add, on average, about $50 to the total price. If you have a Sony camera/camcorder with this type of battery, you can use it with your

portable and charge it with your camera. Whether or not you have one of those Type L batteries or will be able to find a good deal on them online should be taken into consideration when you pick your project. (More on this in Chapter 3.)

■ In general, the hand-built systems are cheaper for two main reasons:

   ■ No CNC machine operation time is required.

   ■ Most of the hand-built portables use Sony PSOne screens, which are fairly cheap (around $50–$60 each). We'll talk about these and other types of portable LCD screens in Chapter 4.

Chapter in Review

So far, we've talked about the four game systems that this book teaches you how to hack apart — the NES, SNES, PSOne, and Atari 2600 four-switch. We also discussed:

■ The different versions/models of each video game system and which ones you need for the projects in this book

■ Specific advantages and challenges in making video game systems portable

■ Where to find the old systems at reasonable prices

■ The total amount of dough you can expect to spend on each project.

In the next chapter, we'll talk about the tools you'll need for building portables and how best to use them during the construction process.