The Kitting Out Cheap Handout

Version 0.95 (beta), April 2017
mostly by Dara Korra'ti, with contributions from Jeff Bohnhoff.

With this document, we hope you will know *what you need to learn*.

I. Before you do anything, first read up on what exists. You can't make good decisions without knowledge; you can't shop for bargains without knowing what there is to *buy*. Try:

> ***Sound Advice: The Musician's Guide to the Recording Studio*, Wayne Wadhams**

You need to learn about what a recording studio does. You need to know the value of a low sound floor (meaning a very quiet, non-echoing room), and a room that simply *sounds good*.
You need to know about the various types of microphones (large-can condenser, small-can condenser, dynamic, etc.), and about things like XLR connectors and TRS connectors.

Also, for critical advice in setting up a recording space - key to *any* successful studio - read:

> ***Mixing Secrets for the Small Studio*, Mike Senior**

Read the first three chapters before you even consider picking your recording space. You can make several purchase decisions without it, but when it comes to arranging your environment, these three chapters are crucial. As a bonus, this book will teach you a lot about mixing. That's beyond the scope of this handout, but is obviously just as important overall.

II. Learn to recognise quality and what stands out a bit. I talk a lot about this here:

> http://crimeandtheforcesofevil.com/blog/2012/02/thrift-and-pawn-shop-spelunking/

Pawn and thrift shop spelunking isn't what it used to be; all the pawns found eBay, and now price to it. But learning to recognise that an item is not like the others around it is still deeply valuable.

III. Learn to solder. I can't stress this enough. If you want to save money, be ready to DIY and repair things. You're trading *time* to get *value* and save *money*. If you've learned enough from research, it's not much time for a *lot* of value. I spent some time in 2015 restoring a pair of pro monitors. Their components are worth ~$1500. I got them for FREE; I fixed them for $40. See again: *a lot of value.*

This is a reasonable how-to-soldier video for beginners. Use silver-tin solder, rather than the cheaper 60/40 or lead solder. It can require slightly higher temperatures, but doesn't poison your brain:

> https://www.youtube.com/watch?v=Qps9woUGkvI

IV. Here's a list of what you need, with tips on each item. I have a whole series on this on by band blog. The blog post series also talks about making a room into a good recording space:

> http://crimeandtheforcesofevil.com/blog/2013/06/the-studio-buildout-series/

Or just go to crimeandtheforcesofevil.com, click on blog, then scroll down and look for "studio buildout series" in the left column.

In Studio:

A. Computer, to run studio software
If you're building your own, or upgrading a donor machine, try gamer gear websites' clearance sections. Top of the line gear from 18 to 24 months ago will be 75% off. Unlike gamers, you need more CPU than GPU; spend accordingly.

You'll probably end up using USB 1.1 or 2.0 gear with this machine. There are two standards for USB chipsets: UHCI and OHCI. **You need OHCI, particularly on Linux.** While for most applications there's no difference, the performance difference in audio is shocking - and critical.

B. Digital Audio Workstation software
A digital audio workstation (or DAW) is basically a recording studio mixing board and editing table implemented in software. Good ones also do lots of other things, and support effects plugins. GarageBand is a simple example.

If you have money, Pro Tools is a standard - but it's not the only option. ProTools First is a reduced-capacity version that's given out at no charge. Audacity and Ardour are popular open-source packages. Audacity is much easier to learn, but will limit you. Ardour is *brutal* to start, but does amazing things once understood. There's also Rosegarden, for MIDI-heavy artists.

Here are some well known DAW options; if license status isn't mentioned, it's closed/pay software:

> **Linux:** Ardour, Rosegarden, Audacity (all free/open source)
> **Windows:** Sonar, Pro Tools, Cubase, Audacity (free/open source), Reaper (30-day full-function trial), Pro Tools First
> **Mac/OSX:** Logic Pro, Pro Tools, Cubase, Ardour (free/open source), Audacity (free/open-source), Reaper (30-day full-function trial), Pro Tools First

C. TRS and XLR interface/external sound card with no less than two sockets, and which can supply "phantom power," which is needed by many microphones.
Essentially all usable recording microphones use XLR connectors. They can be seen here:

> http://en.wikipedia.org/wiki/XLR_connector

Most instrument pickups use ¼" TS connectors, or, rarely, ¼" TRS connectors:

> http://en.wikipedia.org/wiki/TRS_connector

A good external sound interface will let you plug in either or both, and will convert the sound to digital and send it to your DAW software digitally over a USB or Firewire cable. You want an external sound card because computers are full of electrical noise, and moving the analogue to digital conversion outside the computer solves many noise problems.

At the low end, the Focusrite Scarlett is quite nice for the price. I also like the M-Audio USB FastTrack Pro, no longer made but commonly found used. Both have only two inputs, but that's enough if you're just recording yourself. I've also used a six-input TASCAM US-800 to good effect, but that's not as easy to find, and its MIDI interface doesn't work with Linux at all - a definite drawback.

D. Microphone (preferably a pair), cables, stand

As mentioned, there are many microphone types. The large-can condenser microphone is almost always the cheapest general-purpose solution of quality. The MXL 990 is a popular dirt cheap choice, but wow I am *so not a fan*. (I think it's awful.) Consider the M-Audio Nova, or *maybe* AKG Perception 200 if you want a "darker" microphone. If you have good solder skills and a little more money, consider the RK-47/990B kit from micparts; their kits will give you the best value per dollar I've seen.

You may find "USB microphones" for sale, some of which will be large-can condenser microphones. For music recording, I *do not* recommend them; they are too limiting. But for podcasting, they're everything you need. Try the the Blue Yeti; it has a good reputation as a voice announcer mic.

E. Reference headset

You'll need to be able to listen to your recordings. In particular, you'll need to be able to listen to one track while recording another - say, listen to the instrument part you recorded earlier, while singing a vocal track. You need headsets that enclose your ears, to prevent sound leakage, and you want flat response across both low-pitched and high-pitched sounds.

A cheap quality example: Shure SRH-440, made specifically for this market by a company that knows this world. DO NOT USE NOISE-CANCELLING HEADPHONES OF ANY KIND. They will distort your playback in ways you won't predict.

F. A good room/sound control (A good-sounding room, baffles, etc.)

You need to make your room sound good. I can't stress this enough. If the room isn't quiet, if it's reflective, if it has lots of weird angles and does weird muddying things to sound, *no amount of good equipment will fix it.* Jeff Bohnhoff correctly points out that better equipment will make a bad room *worse*, by more faithfully reproducing all of its flaws.

Here's my article talking about why the room matters. It's in a home-stereo situation, but all of this applies even more to a studio:

http://crimeandtheforcesofevil.com/blog/2012/06/rooms-and-sound/

The room needs to be quiet, obviously. But the "sound" of the room matters just as much. Fundamentally, if you don't like how music sounds when *played* in a room, you won't like how it sounds when *recorded* there either. (Again: *Mixing Secrets for the Small Studio*, Mike Senior.)

Here's my YouTube HOWTO video on making nearly-free sound baffles:

http://www.youtube.com/watch?v=toz0DozVNas

Also, you can make highly effective bass traps for the corners of your room (basically a bass-specific version of the same idea, really important in corners where you get weird standing-wave action going on) by wrapping Corning 702 rigid fibreglass in a couple of layers of thin fabric. If you're getting weirdness in low frequencies, investigate this.

Certainly helpful but not strictly required:

G. Studio monitor amp

Listening on headset is not the same as listening on speakers. For that, you'll need both an amp and monitor speakers.

Cheap amp suggestions: 70s and early-80s Pioneer (particularly SA series) and Harmon-Kardon integrated amps, with their capacitors replaced with new ones of identical value. Bypass the tone knobs. If you really know what you're doing, old tube equipment; EICO if you can find them are cheap but awesome.

This is where soldering saves serious dosh: I have an EICO ST-40. I paid 25 *cents*. My Pioneer SA-5200 cost $20. The replacement capacitors cost about as much.

As a rule, I find older equipment easier to repair than new, just because the parts are bigger and spaced further apart.

H. Studio monitor speakers (multiple sets with different sound profiles, ideally)

The Realistic Minimus-7 is a tiny speaker made by Radio Shack starting in 1978. It was a new and then-radical simplified design and about the best thing they ever made. They're a cult item - particularly the black ones - but you can get white metal pairs on eBay for $20. Buy those and the simpler film-capacitor crossover upgrade kits sold by various people on eBay. ($13ish.) There's no low-end to speak of - particularly below 70hz - but they are laser-like in precision, once upgraded.

The Minimus-11 series were a larger version; maybe worth having as a second sound profile. You'll want to upgrade those crossover circuits as well.

Some junk "computer speakers" are a good third sound profile because many people listen to music on those, you'll want to make sure people can hear you on them. Don't mix to them, but check on them occasionally. Get those free at a yard sale.

OR

G and H: Self-powered monitors

These are basically speakers with amps built in, specifically designed for this purpose. Do not confuse these for self-powered consumer *computer* speakers; these are designed from the ground up for mixing. The cost savings here come from the amps and speaker pairings being specifically built around each other, and they're an effective solution.

In closing:

The best extra dollar spent is spent improving your recording space, not your gear.

Once you have the basics, if you have a dollar left over to spend on a better mic, vs. one improving your iffy room, *spend it on the room.* I know I harp on this, but it's true. Why?

A good *room* will make *poor equipment* sound *better*.
Better *equipment* will make a *poor* room sound *worse*.