

Music from the computer

by Stephen A. Lucius

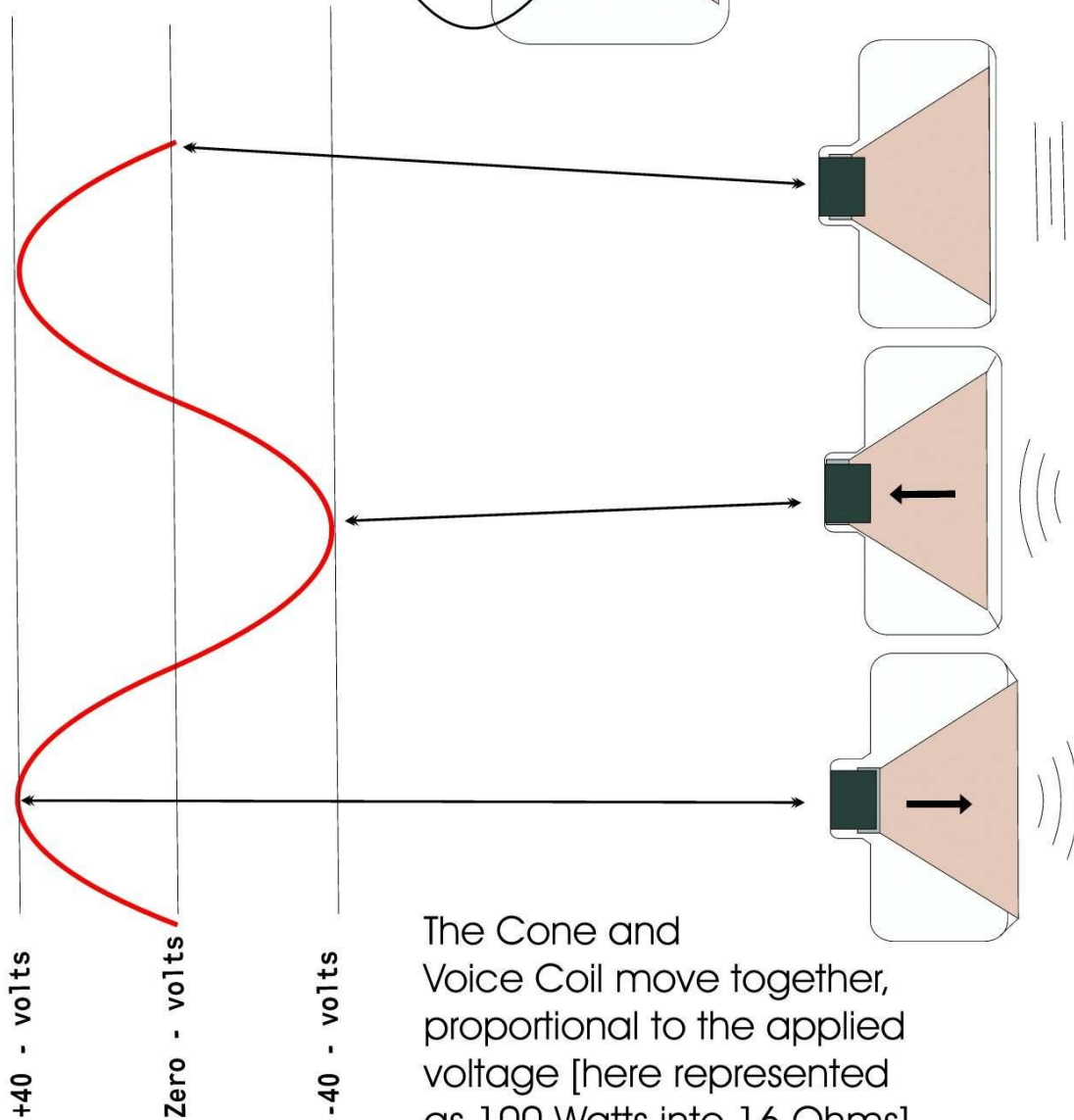
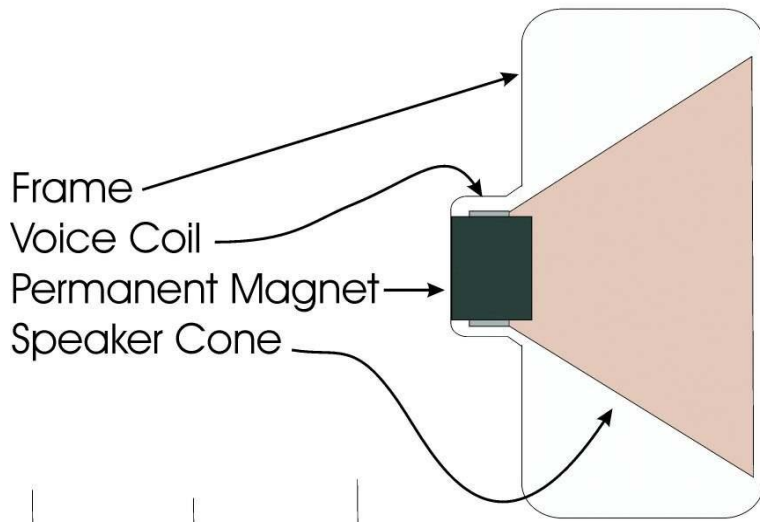
I happened to notice this year, at the WASCA festival, that every caller seemed to be using a laptop computer to generate their music. While I have been using a laptop for more than five years and digital music for more than ten, today's computer user has many more sophisticated tools. I will not go into this subject here but simply the aspects of converting your tapes/records etc. to mp3 files (the most popular form in use today.)

Before I get started on the actual process, I would like to express some of my observations. The music from a record is analog and in its purest form is better than all other sources. The problem is that records get scratches, dust clicks, pops etc. Digital recordings maintain their quality indefinitely. Eventually one has to replace their records if they wish to maintain any reasonable quality. Don't fool yourself, "VINYL IS ON ITS WAY OUT"! Many of the record producers are already generating a parallel product of mp3's or CD's (WAV) files. While vinyl will eventually become un-available, the mp3's and WAV's are here to stay. This is a warning flag for the new caller because the established caller already has a substantial collection of records. Don't forget, records are only a fraction of the total picture. Your P.A. equipment must be able to get the sound out and there is no substitute for TALENT without which there is no performance.

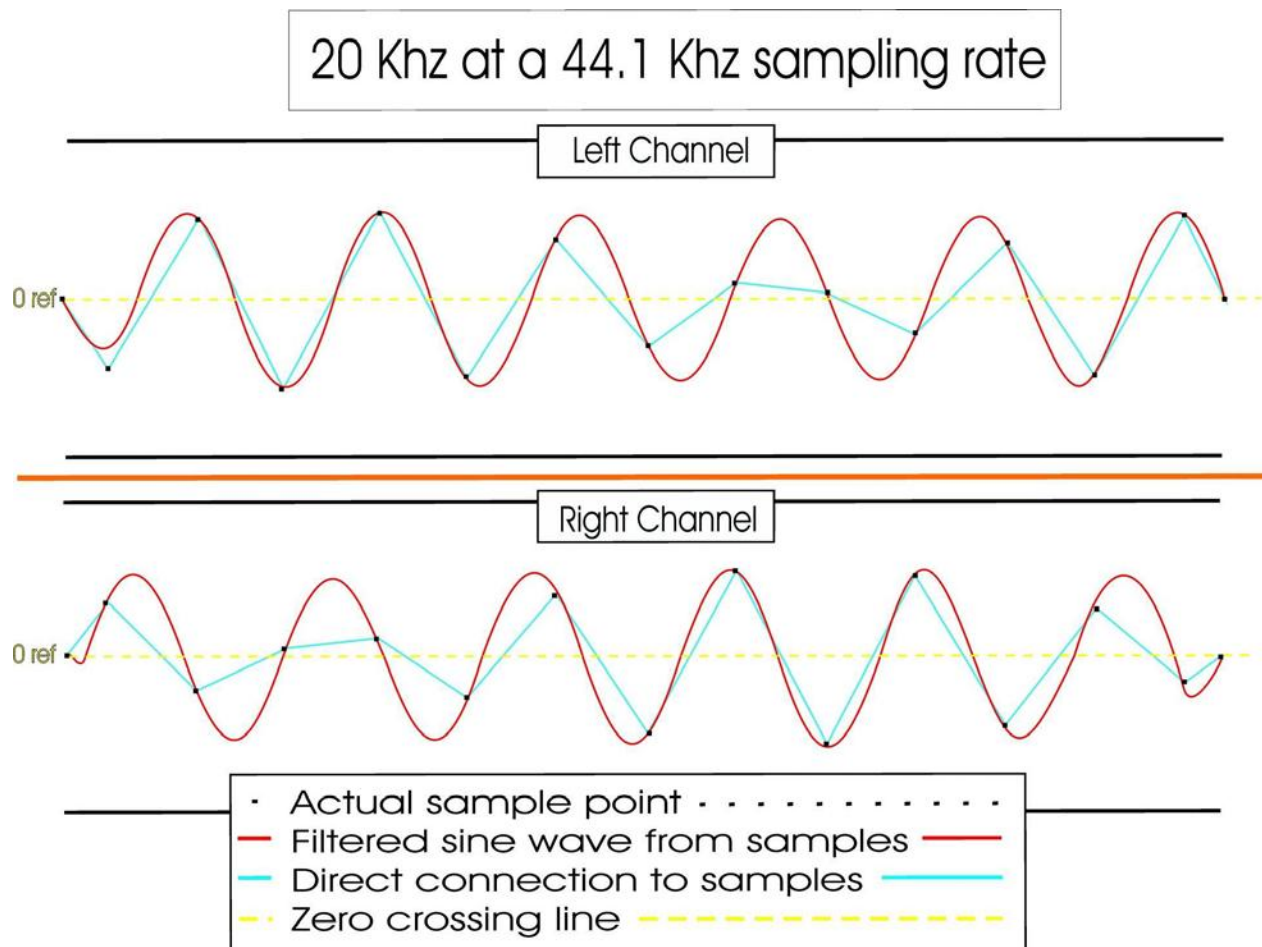
If you already understand the mechanics of music, you may wish to skip to "[Recording the music](#)" on page four. I feel as though the following information will be useful to those who have absolutely no understanding of what is happening to your music between the turntable and speakers.

Your microphone and turntable put out a small signal which represents vibrations into the microphone and from the needle in the groove on the record. The signal strength at this point is in the milli-volts (thousandths of a volt). It is the job of your amplifier to build this up to a signal, strong enough to drive your speakers. Your amplifier must also match the characteristics of your record, phono cartridge, microphone and speakers to obtain a reasonable representation of what you expect the music and voice to sound like. In its purest form, a tone is a simple sine wave as shown in most of my figures. The first figure attempts to show how a simple sine wave drives a speaker(s). (**WARNING**, your system may be putting out as much a 150 volts peak to peak which can hurt and even kill. Always turn the amplifier off before changing any cables.

The Speaker



The next figure shows an actual WAV file created when copying a 20 KHz (thousands of cycles) signal. It can be easily seen that each complete sine wave (red) is represented by little more than four points at this frequency. Each of these points is a digital word representing a voltage to reconstruct the original waveform. It is not possible to do this perfectly, but with the use of filters we can achieve a good reproduction. The red wave form is the reproduced sine wave and the blue is what would be present (and totally inaccurate) without reconstruction filters. It is the quality of this reproduction that separates the good and bad sound cards.



A WAV file like the one above, 3.34 minutes in duration, is represented in the computer by a file of 37MB (millions of bytes). Of course the size varies with the length of the music. Because the music is in stereo and our callers equipment is in mono, it is in our best interest to cut this file size in half by converting it to a mono file. When I converted this WAV file to an mp3 file, it was reduced to less than 10% of the original file, ending with a 3.28MB mp3 file at a sampling rate of 128 kbps. 128kbps is considered to be the minimum sampling rate for 'near CD quality.'

I feel as though it is important to mention at this time that you can leave the data as stereo in the computer but must mix it coming into the amplifier. All of our callers' equipment is mono and you may lose information from the unused channel. I always convert it to mono and never have to worry about it. An added advantage is that some records emulate stereo and mixing the channels can sometimes cancel information. It can be gotten around by playing with the WAV file before converting it to mono. Whatever, the choice is yours.

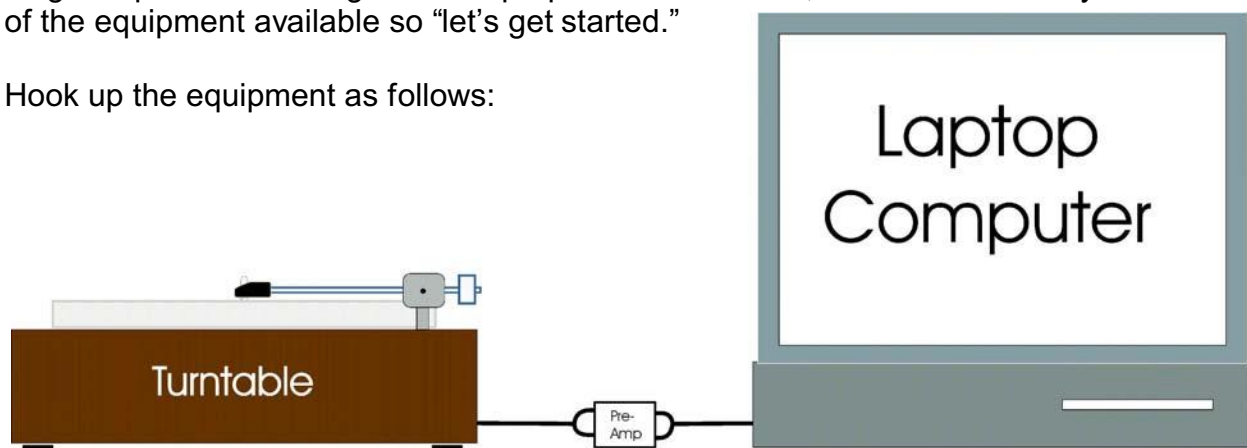
Recording the music

Before we record, we need to have some specific equipment. In most cases, the laptop computer will have the required equipment if it plays music. Be aware, quality is important. The following is a list of equipment and software needed.

1. A good quality turntable. I would not depend upon a caller's type turntable for this purpose. I use a speed controllable Stereo High Fidelity turntable with a magnetic phono cartridge.
2. If you use a magnetic cartridge, you will need a preamplifier to raise the signal level to "line" for the computer and to accomplish the "RIAA" compensation.
3. A stereo cable to go from the amplifier to the "line" input on the computer.
4. A sound card (in the computer) to convert the incoming analog signal to digital (typically 44.1KHz for WAV files) for storage and editing.
5. A program in the computer to control the conversion, file storage, etc.
6. Sufficient hard disc space to contain all final files and of course the one that you are working with.
7. A music player (I use WINAMP) to produce the sound for the dance.

I won't go into the playing phase here. It should be obvious that the work to this stage is quite intimidating. For the purpose of this article, I will assume that you have all of the equipment available so "let's get started."

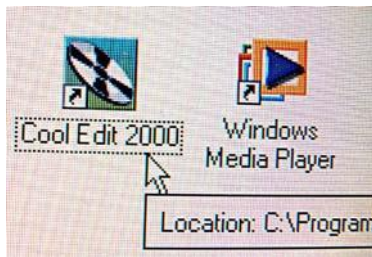
Hook up the equipment as follows:



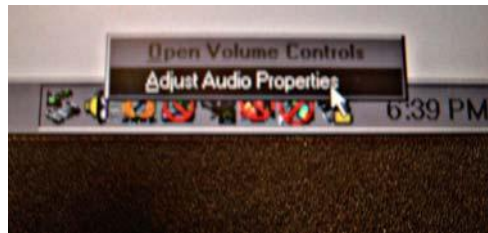
Turntable to Preamp to Computer "Line In"

Turn on all of the equipment (computer last)

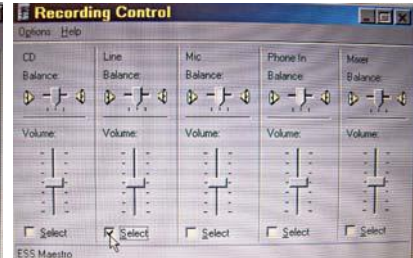
Load your edit program (I use Cool Edit)



Set up the computer to accept a signal from the "Line In."



- select "adjust audio properties"
- select "sound recording volume"
- select "recording control line"

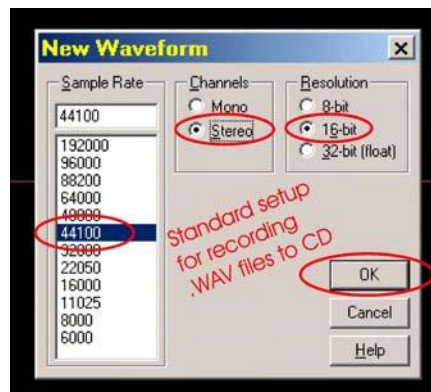


Place a 'cleaned' record on the turntable, set and adjust the desired speed.



If you have a record cleaning brush, as pictured above, place it on the rotating record.
(in the example above, the record is 33 1/3 RPM)

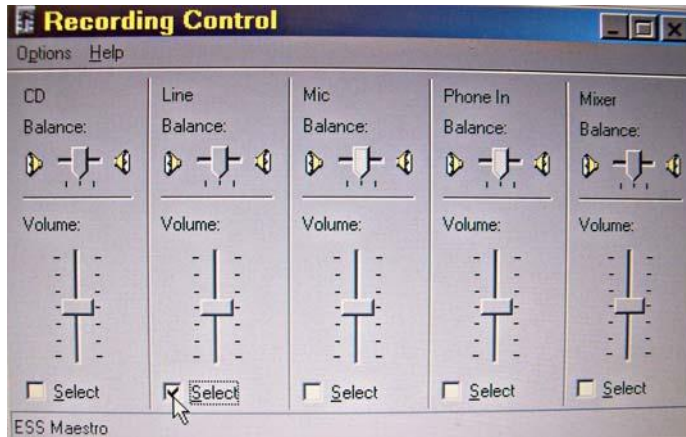
Start the "record" function and if this is the first time, you will have to set up the parameters for your WAV file as:



Place the phono needle on the record and observe the recording level and balance in the program. If the level is too high, adjust it on the 'Line In' level on the computer. If the balance between left and right channels is off, adjust that now.



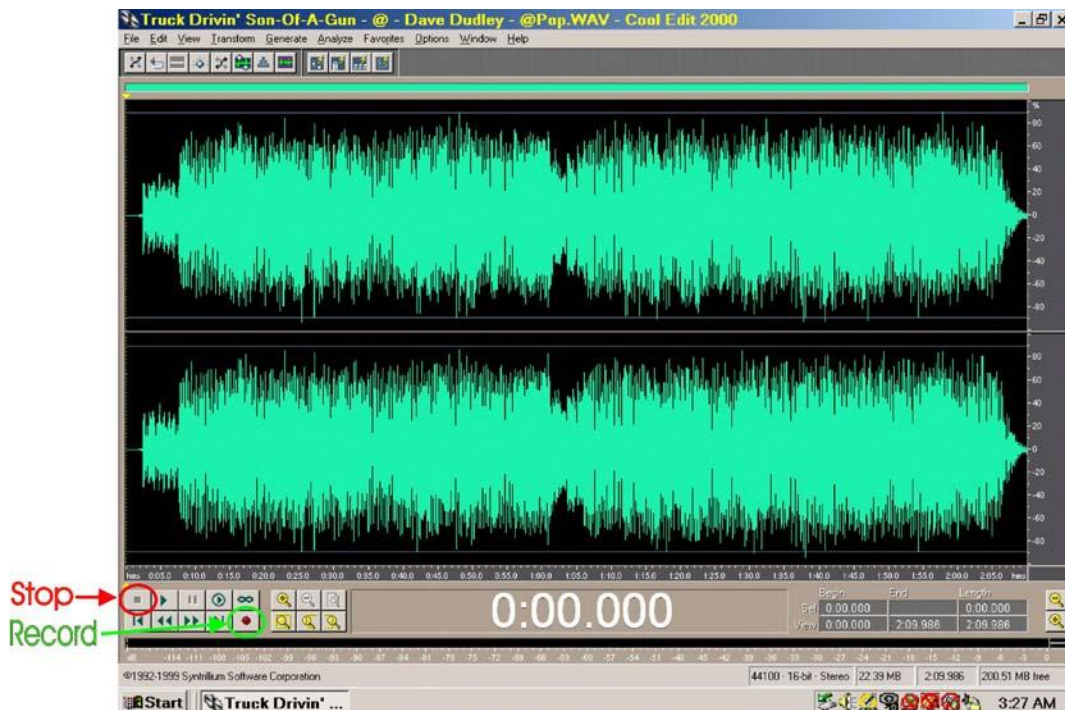
Left and right balance and level



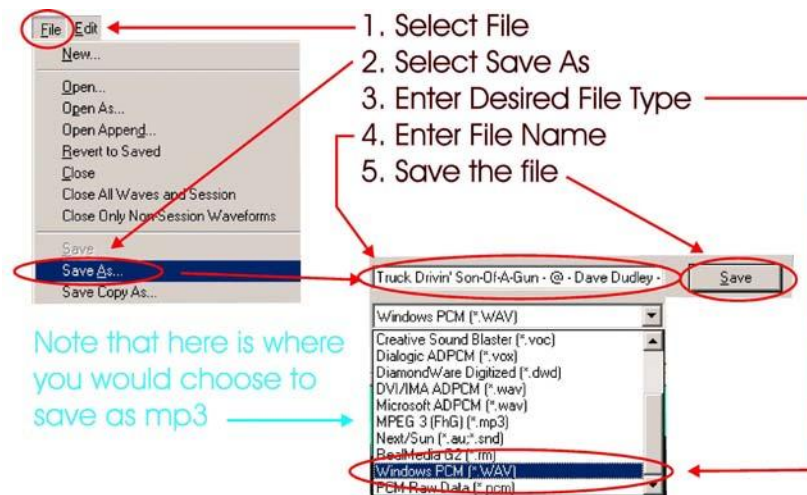
If you had to adjust any of these settings, you should **stop** the recording, delete the recorded waveform and restart from “**start the record function**” again.

Now you will have to wait until the record is complete (I usually record the entire side before stopping. I later clip them apart and individually name the files on the computer.)

When the recording is complete, click on the “**stop.**”



Before going any further, save the file under the name of that recording. This will allow you to make some mistakes and recover without having to go back to ground zero. To save the file, select 'File' then select 'Save As' and then direct the file to the desired directory and enter the file name. Save the file as a 'PCM Wave file'



At this point we are ready to clean up the recording. Don't kid yourself, you will recognize the scratching/popping etc without any effort. If you care about the quality of your recording, you will clean these up. Be careful to check to insure that your clean up efforts don't introduce additional distortion. It is not only possible, it is there more often than not. You will learn how with time. Don't be discouraged. After you have done this enough times, it will become second nature to you.

After removing the noise, you will want to save this version (probably over the first save.)

Reload the same file using "Open as" and specify 'mono.' This will combine the two channels into one.

Do not immediately save this over the stereo version. You will want to listen to this version with a critical ear. As a mono file, it may sound terrible. You may have to invert one side of the stereo file, save it and try again. If it is still bad, you may have to decide if the left or right track only sounds better and use that only. Whatever the case, you can get very good at this eventually.

When you decide that you have the final mono product, you will want to clip off the silence at the start and end of the file and save it (over its stereo file.) If you are planning to do noise reduction, do not trim off the leader and trailer. They will contain a sample of noise that was generated by your equipment. You will want to sample this and extract it from the file. I will discuss cleaning up your music in another article. If you are anything like me, you will save a copy of the final WAV file for future work e.g. setting the tempo and pitch. All of this should be done on the WAV file before generating the mp3 files.

When you are satisfied with the WAV product, you will want to convert it to an mp3 file. This is

done directly in Cool Edit but there are rippers and programs like “Music Match” that will do the job for you. Just remember that you want the mp3 file to be greater than or equal to 128 kbps. The greater the number the larger the file.

In a future article(s), if there is sufficient interest, I will get into the processing of the file for the following:

1. Removing noise, clicks & pops.
2. Avoiding the introduction of undesirable distortion.
3. Finding the recorded tempo.
4. Finding your key.
5. Retaining your key while setting the desired tempo.
6. Saving the Cue Sheets.

My equipment is:

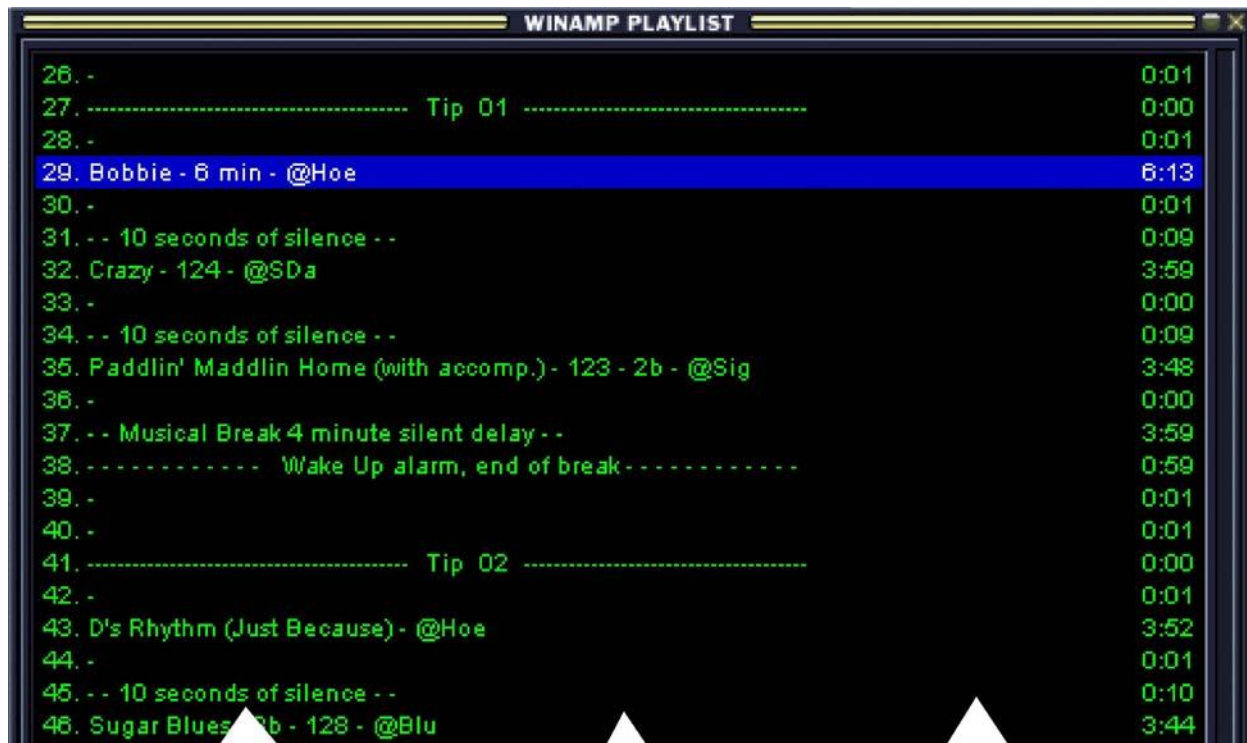
Technics turntable with adjustable speed and Magnetic phono cartridge.

Radio Shack Phono preamp with RIAA compensation.

Inspiron 5000e laptop by DELL with 30 GB hard drive, 512 MB main memory, ESS Maestro sound electronics and Millennium operating system.

Cooledit 2000 by Syntrillium (Internet Shareware)

WINAMP (also available on the Internet) (Special version from Supreme Audio)



May 31, 2005

Since I wrote this article, Syntrillium Software's "Cool Edit" has become a product of Adobe as Adobe Audition 1.5. It is my understanding that many new features have been added. You will have to check this out for yourselves. Good Luck

Steve Lucius