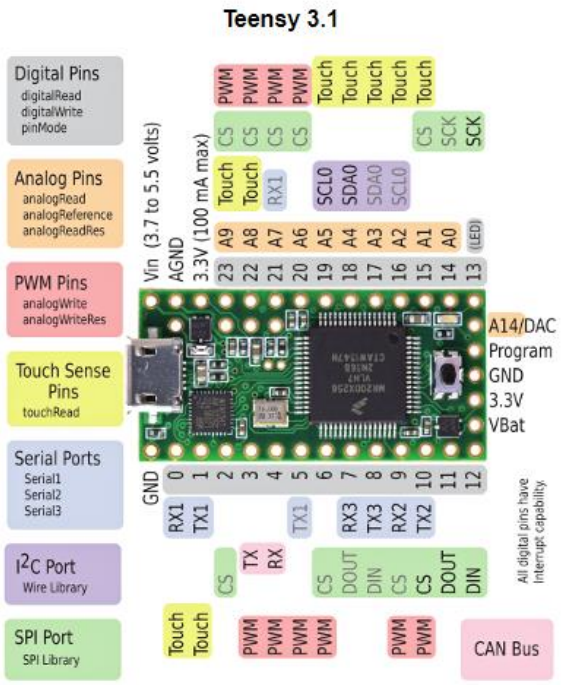
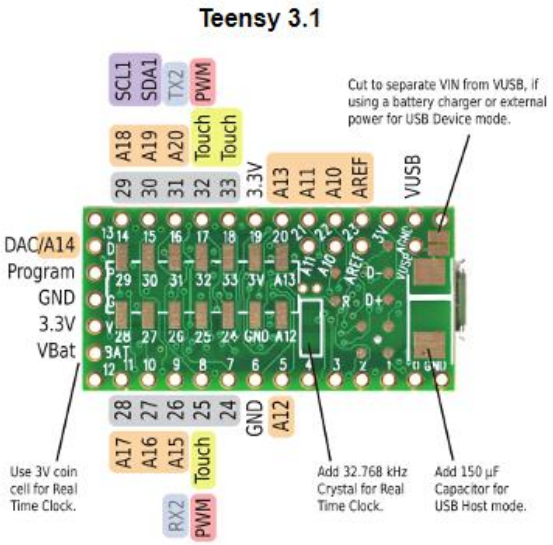
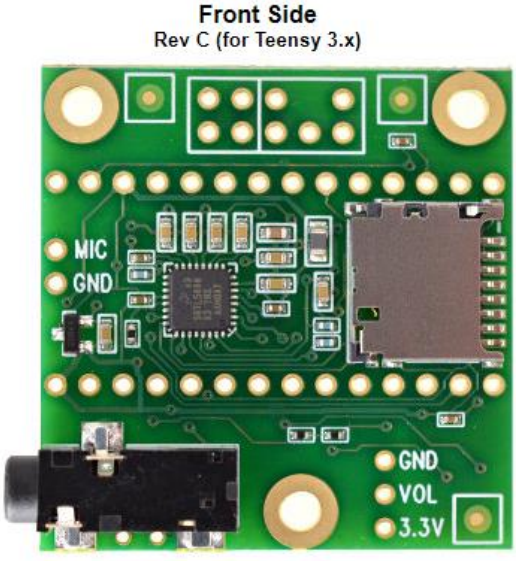
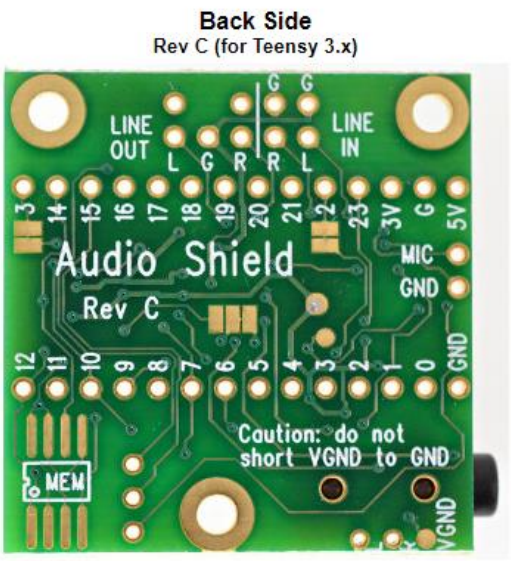
BYU Laser Harp Hardware Documentation

The laser harp runs on a Teensy 3.1 with the addition of the Teensy Audio Adapter Board Rev B. Both are somewhat outdated, so it may be difficult to find documentation for them specifically, but they are almost equivalent to the Teensy 3.2 and the Audio Adapter Board Rev C. Documentation can be found:
https://www.pjrc.com/teensy/teensy31.html
https://www.pjrc.com/store/teensy3_audio.html
For reference, the following are the pinouts:



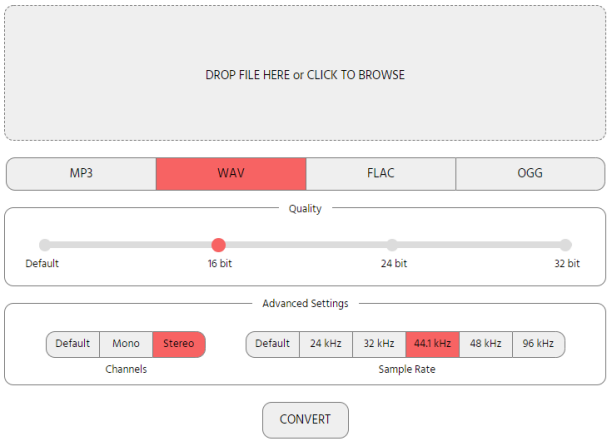






Note that the Audio Shield Rev B has the same pinout as the Audio Shield Rev C.

The Teensy 3.1 plays wav files stored on a micro-SD card that is accessed via the Audio Shield. Note that for the audio files to be playable by the Teensy, they must not only be wav files, but they must also be sampled at 44.1 kHz. Other sample rates won't work. Wav files with other sample rates can be easily converted online at:
https://onlineaudioconverter.com/



Though it is tedious because you have to do one file at a time. After converting, simply save the files to the micro-SD card by plugging it in to your computer and moving the files. Once your files are moved over, then you can insert it into the port on the Audio Shield and so long as the Teensy is connected, it will be able to read the files.

Lasers
There are 8 lasers on the harp, plus we ordered 2 extra as well. They are green dot laser modules that we added longer wires, extra hot glue, heat shrink, and Molex headers to. Replacements can be ordered at:
https://www.amazon.com/Lights88-Green-Modules-GM532-50-Solder/dp/B07PT4X966/ref=sr_1_4?dchild=1&keywords=lights88+green+laser+module&qid=1620931603&sr=8-4
Operating voltage: 3.2 V
Operating current: ~100-200 mA
Output power (light): probably about 5-10 mW

Sensors
Photodiode connected to 5 V. The photodiode controls the base of the BJT, now found on the PCB. The BJT emitter connects to an input pin on the teensy.

Voltage Regulators
Output voltage: 3.3 V
Output current: 800 mA (each)
Pinout: left pin ground, center pin output, right pin input

Circuit Board
A DC barrel jack provides 5V to the teensy, the BJTs, the photodiodes, and the voltage regulators. The voltage regulators provide 3.3V to the lasers. When a laser beam is blocked, the signal on the input pins goes low and signals the teensy to play a note. See schematic for more detail.

Input Pins

The sensors attach to pins 0, 1, 2, 3, 4, 5, 6, and 8. Pin 7 is skipped because this is the pin which the Teensy uses to read from the micro-SD card. The buttons attach to pins 20 and 21.

Frame

The frame is solid aluminum and was previously cut to the shape it is. The holes for the lasers are cut at 60 degrees above horizontal. We added the new mountings which include three mounting screws each, allowing for better aiming of the lasers with a firm, but non-permanent hold. These were attached to the aluminum frame using epoxy. The base was cut in the ELC and then attached to the frame using screws.

Fog

The transducers in the reservoir vibrate in such a way that they vaporize water when submerged. Using this technique, we can create a fog that allows us to see the laser beams more easily. A reservoir was attached to the back of the base and the transducers are placed inside the reservoir. Two small fans pressurize the reservoir and push the fog vapor up the tubes, misting the area where the laser beams are.