

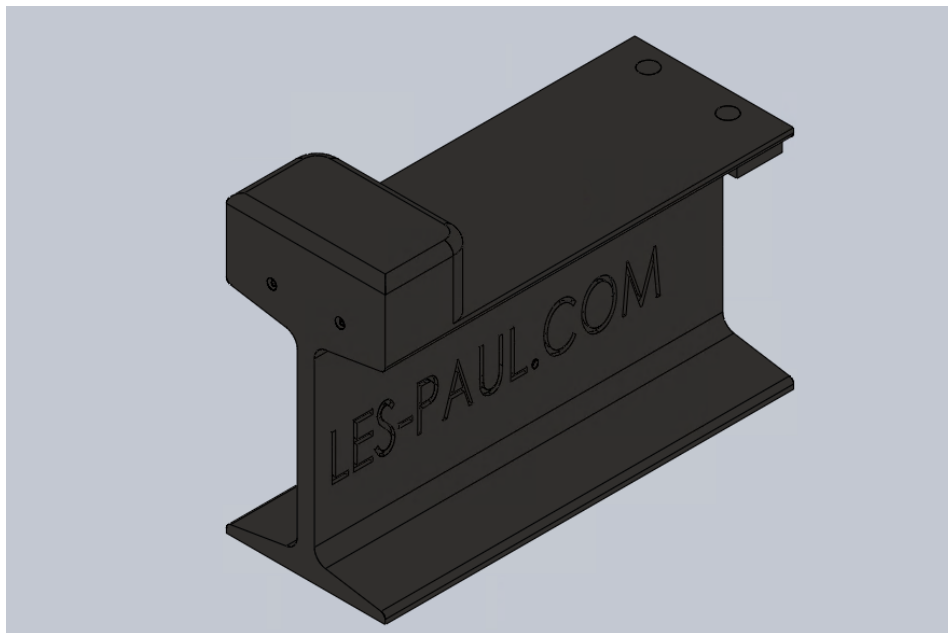
Les Paul Rail Kit

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Background

The Les Paul Rail kit was inspired by a piece of railroad rail found by Les Paul. The artist and his friends took a 2 foot long piece of discarded rail and attached a microphone from a phone and a piece of guitar string along the length of the rail. The rail was able to sustain notes for a large amount of time as Les discovered when experimenting with his contraption. Though the rail was not a practical guitar, it proved a great way to experiment with tuning and notes played on the guitar (*The Electric Guitar*, 2016).

Goal

The goal of this project was to create a rail kit for Professor Manzo's Les Paul: Experiencing Innovation Summer Camp kids to play with. This was accomplished by making a 3D printable rail that allows the camp kids to learn about the timbre by comparing 3D printing filaments to the existing rail, string tuning and tension, how to 3D print using a 3D model, and how 3D printing differs from machining. Our final submission includes this written paper, along with a "rail kit" that includes the 3D printed rail and other components to put the rail together, such as string and tuning mechanisms. We also included step-by-step instructions detailing how to assemble the rail that are easy for young children to read and follow along.

3-D Printed Rail Design

To start, we had to learn more about 3D printing materials and their strengths. Because the rail needed to be able support the tension of tuning a string, we decided that PLA was suitable. We looked into other materials, but others didn't have as high strength or weren't easily printable with the resources we had. After looking at the model given to us in gitlab, we realized we needed to scale down the model due to printer constraints. We went with a length of 9 inches. Then we added a bridge and holes for the string to go through. Because the rail has a solid piece in the middle, the model was given two holes on either side of the middle where two strings could be attached. This made it so that the tuners were far enough from the center piece that they would not hit it when tuning. Through testing, including stringing and tuning the instrument, we learned that the holes for the tuners needed to be adjusted, and the holes could be angled so that the string would not vibrate the rail. The final model, as shown below the table of contents, has angled holes through the bridge and holes that fit the exact tuners used.

Rail Kit

Once we finalized our model, we went along with assembling the rail kit. The kit given to the students should include the following:

1. 3D-Printed Rail
2. (2) *Sperzel* Tall Tuners
3. (2) Guitar Strings
4. Instructions

The instructions given to the students in the rail kit are as follows:

1. Remove the support material from the rail. This can be done using pliers, a flathead screwdriver, or anything on hand. The support material is the thin material on the side of the rail. This can be discarded.
2. String the rail by placing the strings through the holes on the rail until the nut at the end of the guitar string rests on the back of the bridge.
3. Remove the top from the tuner by twisting it counter-clockwise. Insert the tuner into the bottom of the holes on the opposite side of the rail with the bridge. Secure it with the top by inserting it back on the tuner and twisting clockwise. Do this for both tuners.
4. Insert the string into the tuner and twist the string around the metal part. Twist the knob clockwise until the string experiences some tension. Do this for both strings.
5. Feel free to use any tuner application to experiment with what notes are being played by either string! Free tuner apps include *Pitchlab*, *Pano Tuner*, and *Martin Tuner*.

Instructions for the supervisor printing the 3D rails using 3DPrinterOS are as follows:

1. Upload the model in an .stl file format.
2. Once the file has uploaded, adjust the layout of the model so that it optimally fits within the printer.
3. Once the layout has been finalized, select the slice button to adjust the slice settings.
4. Finally, once the slice has been created and saved, it can be sent to the printer.

Preferences, such as color, can be printed with respect to each student. Foisie's Makerspace has many different filament colors that can be used to print the rail. If students in Manzo's summer camp would like to choose their own color, we think that it would be a good idea to help personalize their instrument.

Although we believe this is the end to the project, more could be done in another seven weeks. For example, other teams could think of more ways to personalize the instrument for students, such as easy ways to write their name on the rail. Others could be creating new versions of the rail and making it easier for younger kids to assemble.

Work Cited

The Electric Guitar - Les Paul. LesPaul.com. (2016, June 15).
<https://www.les-paul.com/timeline/red-hot-red/>.