Lakeside View Global Vision
CEGEP JOHN ABBOTT COLLEGE

ENGINEERING TECHNOLOGIES DEPARTMENT

244-586-AB – Technical Report for Project 1

Title: Upright double bass

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Submitted to:
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Date:
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Contents

Introduction

The Technical Report for Project 1 (TRP1) should contain technical information on the product, its development, lessons learned, and proposed improvements for the problems encountered in all phases of the design, manufacturing, and testing/use.

All projects will be voted on by both the students and the faculty to determine which reports and media will be made available for display as well as used as reference to posterity. The voting will take place immediately after the final presentations. To be selected a product need to get ½+ of votes of either faculty or the students.

The TRP1 should contain all sections present in this template. Do not delete any section, even if you do not add any content to it. *Do remove the italic text explaining what you should place in each section.*

Problem Description

Electric musical instruments have existed for some time now and have a few advantages over the traditional acoustic ones: they are usually cheaper and easier to manufacture, they take up less space, they offer a bigger range of sounds & usages.

Proposed Solution

My solution to the problem of the cost of musical instruments is to design and construct an electric double bass for a fraction of the cost of the market price. It also has to be a modular build for easy repair and modifications.

Technical Product Description

The bass uses a 1"x1" aluminum bar as a foundation base. All the components are connected to it. The main goal of this construction was to design a modular instrument, where each module could easily be adjusted, removed or replaced. A number of sources was used for designing the dimensions of the parts [22][23][24][25][26].

As the coils are very easy to break, due to the copper wire being so thin, as well as ease of manufacturing, it was decided to permanently fix them into the neck. This means that they will no be able to be replaced individually, however it also guarantees their long-term usage without breaking.

The manufacturer can also choose to cover the magnets in order to better depict the playable part of the string [27].

Operation:

Safety

The product should not be used for any other purposes other than performing music. If strings are tightened too hard, they, or a plastic part of the build can snap, resulting in high possibility of injury for the user.

Use

By plucking the strings too hard the user may damage the instrument, just like in any other musical instrument. The user should pluck them in between the two magnetic coils as to obtain the best sound quality.

Maintenance

The device is not designed to be exposed or kept under extreme conditions. While it will have no effect on the metal, the plastic and wood can deform with extreme heat, cold or exposure to water. For storage, it is better to release the tension from the strings as to not keep the instrument under constant stress.

Troubleshooting

The main troubleshooting should be done with the electronics system as they are the easiest to verify. Make sure everything is properly connected.
If this does not fix the problem, verify the coils for a potential break. There will either be a open circuit, which can be detected with a Multimeter, or a short circuit, which could be identified with the coils showing no resistance (0-10 Ohms).
Other breaks in the building should be visible with a naked eye (ex: snapped string, breaking print , etc.).

Lifespan

This device is not designed to be exposed to water or other extreme weather conditions. If well kept, it should not break for a while (5-10 years). If used often, the strings may require changing. Also, since it is mainly modular, it will be easy to replace a single part without changing the entire device.

Final OPPM

See: One-Page Project Manager v2.xlsx

Lessons Learned.

The initial design had a 1”x1” aluminum bar as the base, with the wooden and printed parts attached to it [1][2].

However, after calculating the stress on the plastic parts as well as the difficulty of printing them, it was decided to simplify the bottom two parts to be replaced by 1 single detail.[3]

This would allow the usage of a smaller amount of material as well as easier assembly. For the final design, the stress applied by the strings was calculated from the data table provided for different strings [7] with the Taylor’s formula, as it describes the relations between the string tension, string frequency and string length [8]. This gave us the total force of 280 lbs, which translates to 1245.5N of force [9]. This was used to approximate the load on the plastic parts by using the Solidworks simulation feature [4][5][6] and to determine the right dimensions.

As for the coils, two loops, wired at reversed polarity. This cancels out the noise created by single coil pickups [10]. The resistances of the two coils are at 32 & 44 ohms. The potentiometers allow to adjust the total resistance to alter the sound [11].

However, after having assembled the bass, I’ve realized that there were two problems: I did not simulate the stress on the top plastic part [12], as it began to bend, and the print de-layered [13].

In order to sustain such a high stress, Carbon fiber nylon was chosen as the material [14]. Unfortunately, it requires a very dry environment to be kept and printed in. Since we do not have a special room like that at the college, I assume that some water got into the filament, and it did not properly stick together. To combat this problems, metal bars & shield were installed in order to stiffen the printed material and allow it to better support the tension of the strings [15][16].

Lesson learned from this: taking into account the method of manufacturing of parts as well as making sure all parts are properly and fully designed.

A metal clam had also been installed to bring the strings to the body [16].

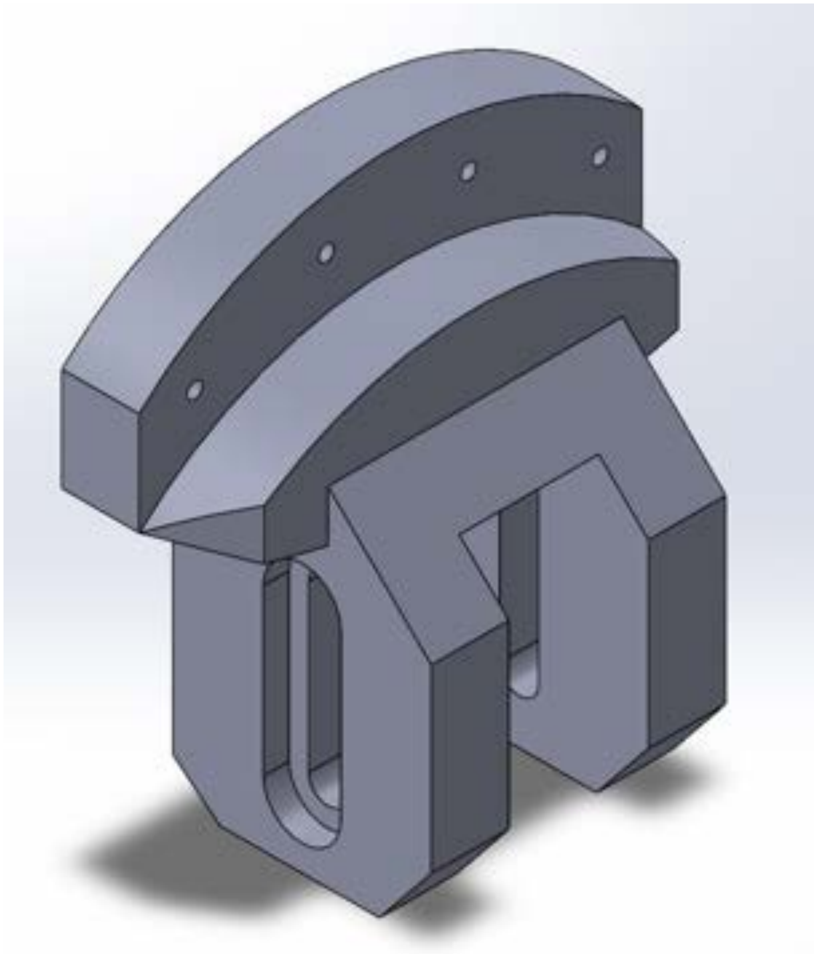
References

List your numbered references here. The numbers in [braces] should correspond to the numbers in the text.

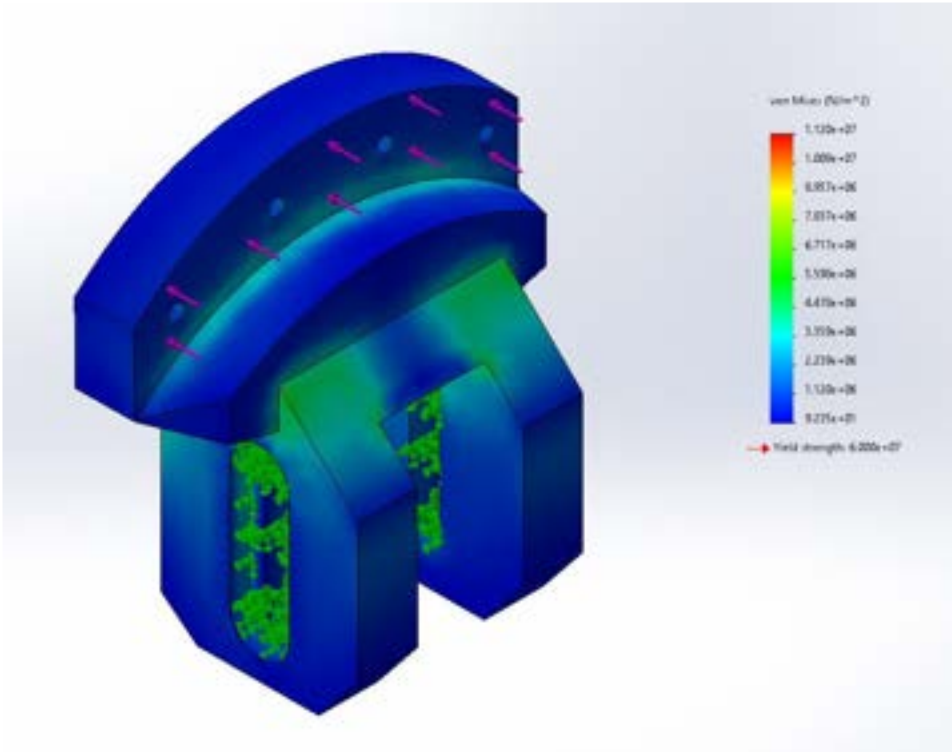
[1] Initial full project

[2] Initial bridge

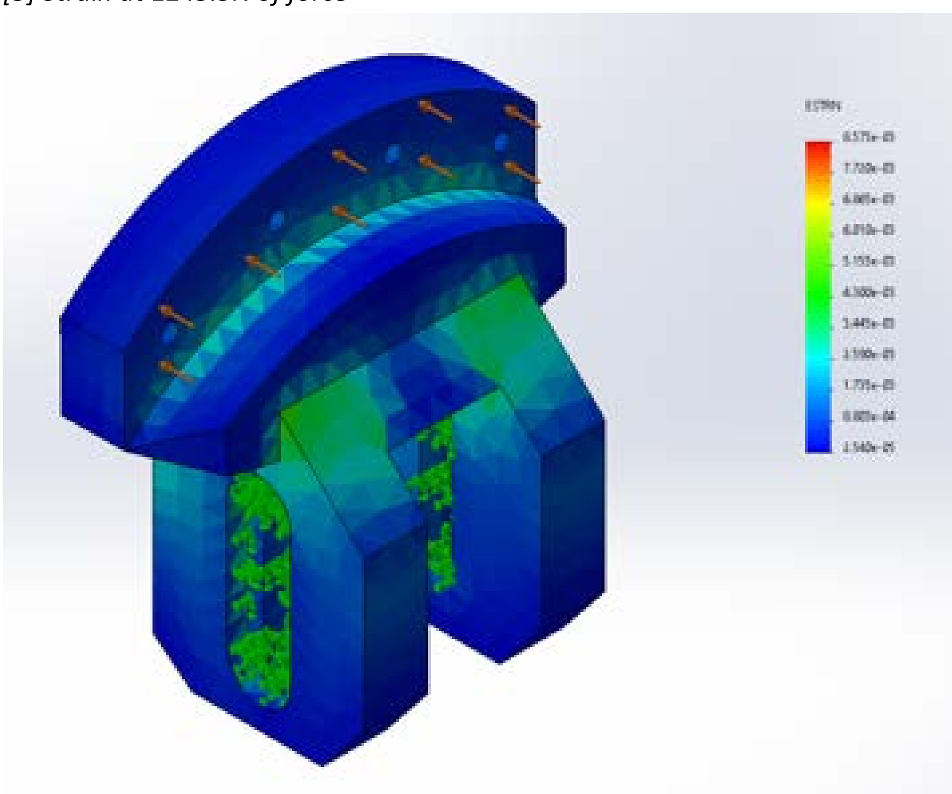
[3] Final design for the bridge



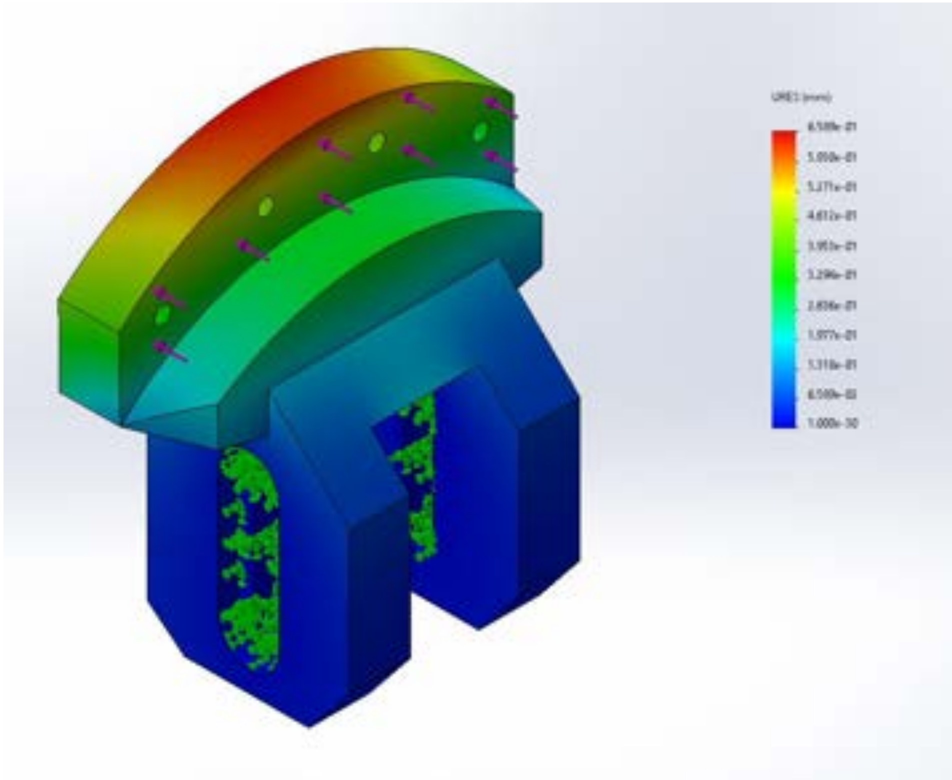
[4] Stress at 1245.5N of force



[5] Strain at 1245.5N of force



[6] Displacement at 1245.5N of force



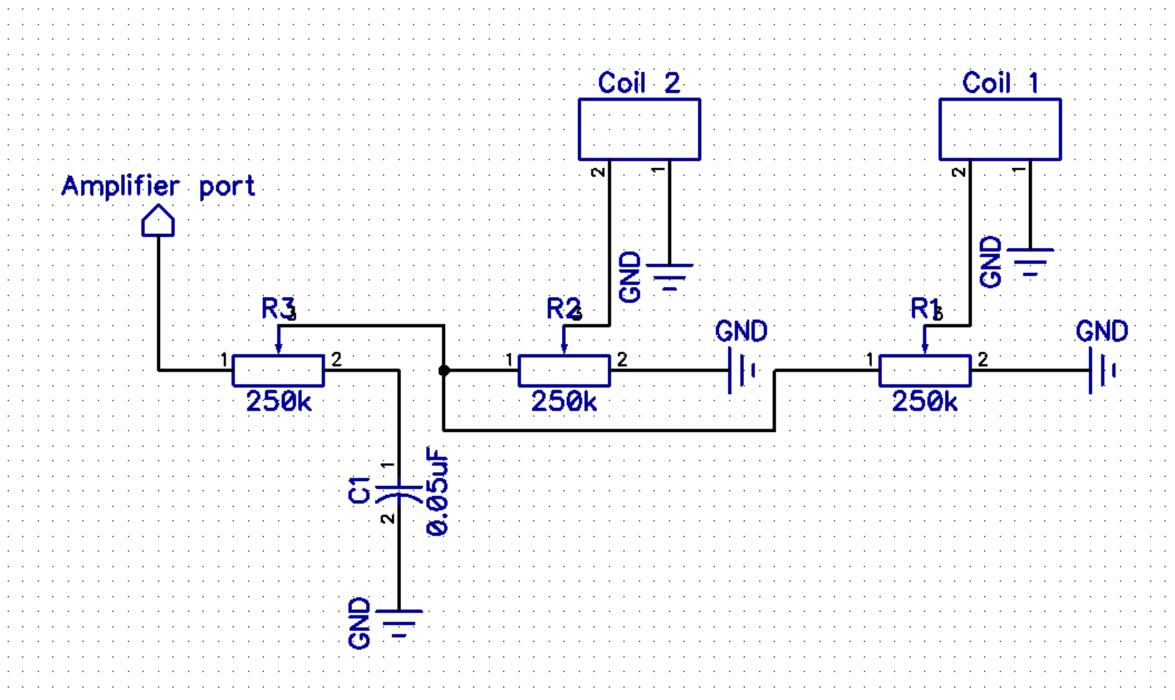
[7] *https://jordankirkness.tripod.com/dbstringtension.html*

[8] *https://www.thestrad.com/accessories/stringtelligence-by-thomastik-infeld-vibrating-string-length-and-string-tension/9132.article*

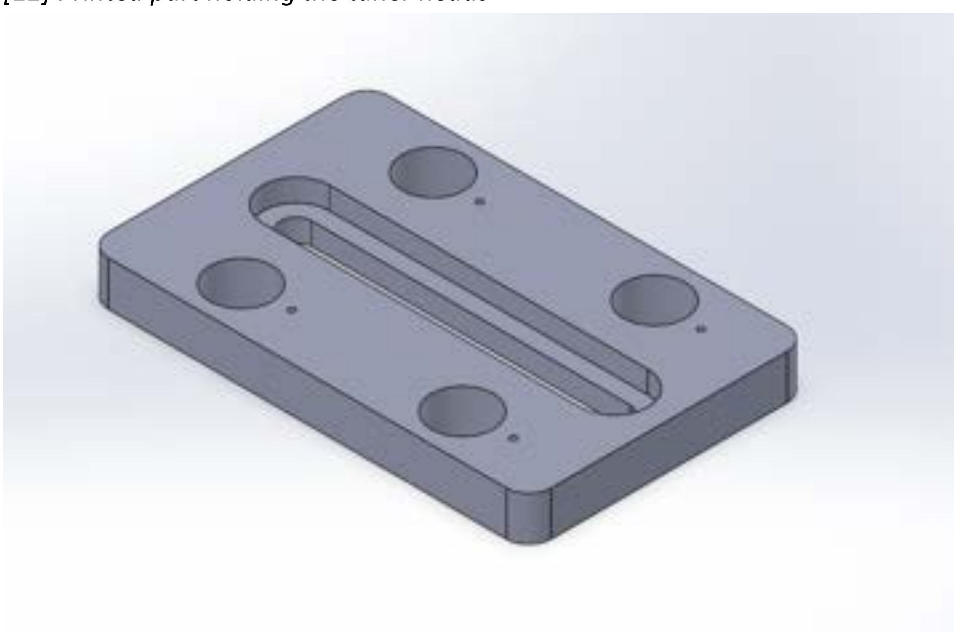
[9] *https://hextobinary.com/unit/weight/from/poundmass/to/nweight/280*

[10] *https://www.masterclass.com/articles/guitar-101-what-is-a-guitar-pickup-learn-about-the-different-types-of-electric-guitar-pickups#different-types-of-electric-guitar-pickups-single-coil-pickups*

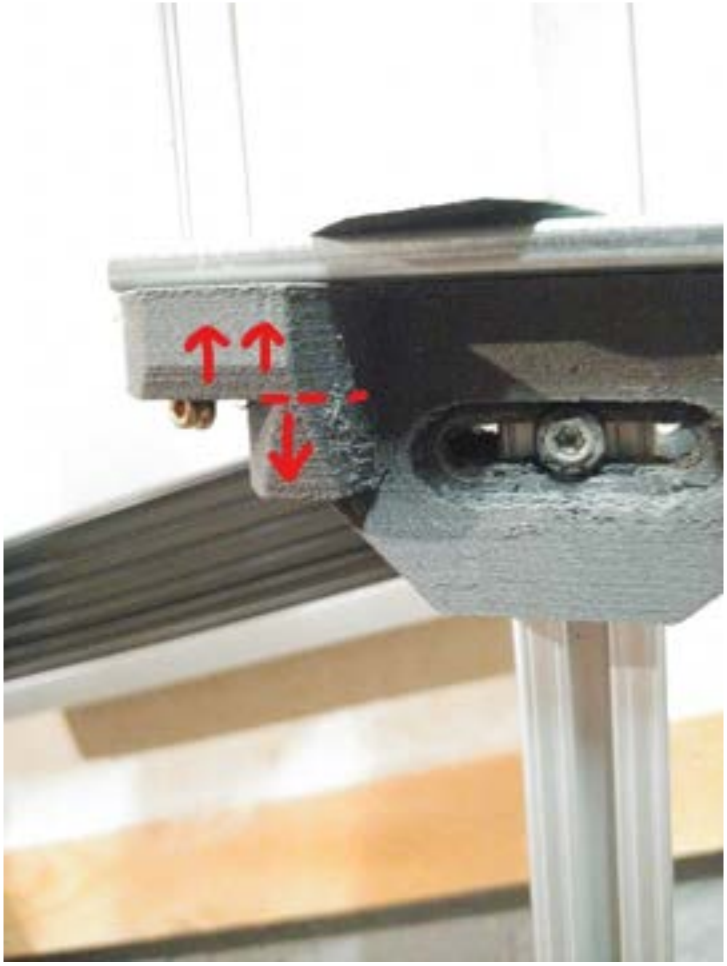
[11] *The schematic of the electronic part of the double bass*



[12] Printed part holding the tuner heads



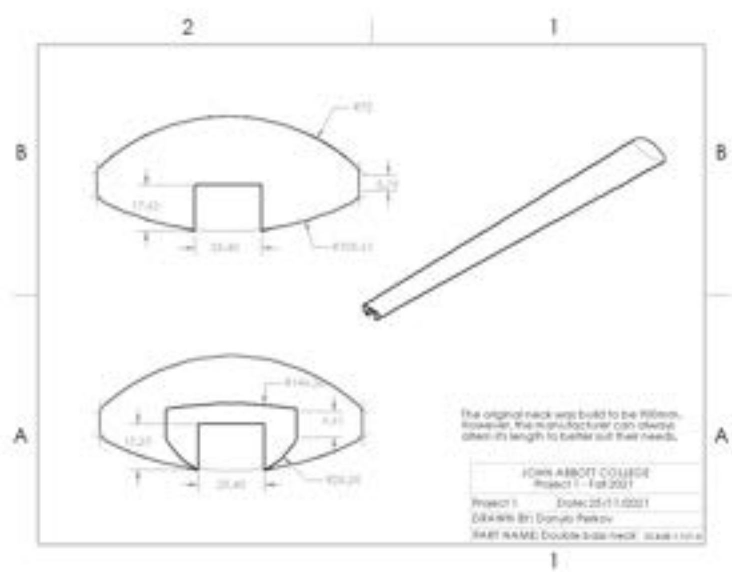
[13] Line at which the printing layers began separating



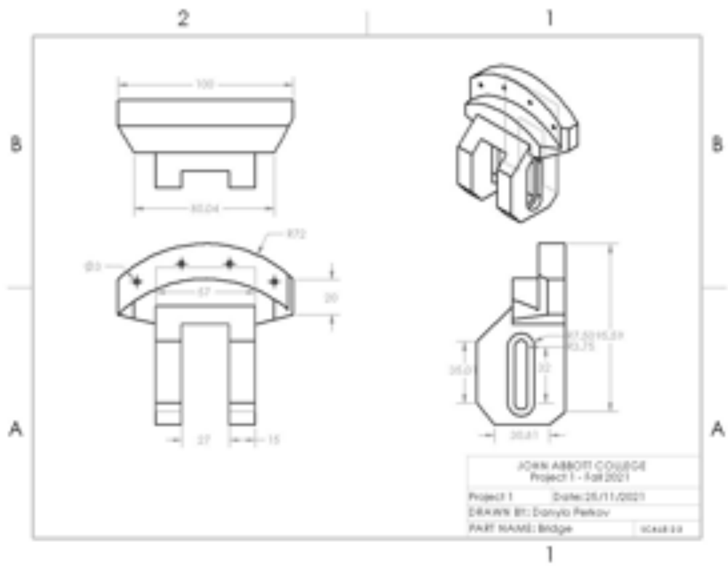
[14] https://www.3dxtech.com/product/carbonx-pa6-cf/
[15] Bridge reinforcement

[16] Top part reinforcement

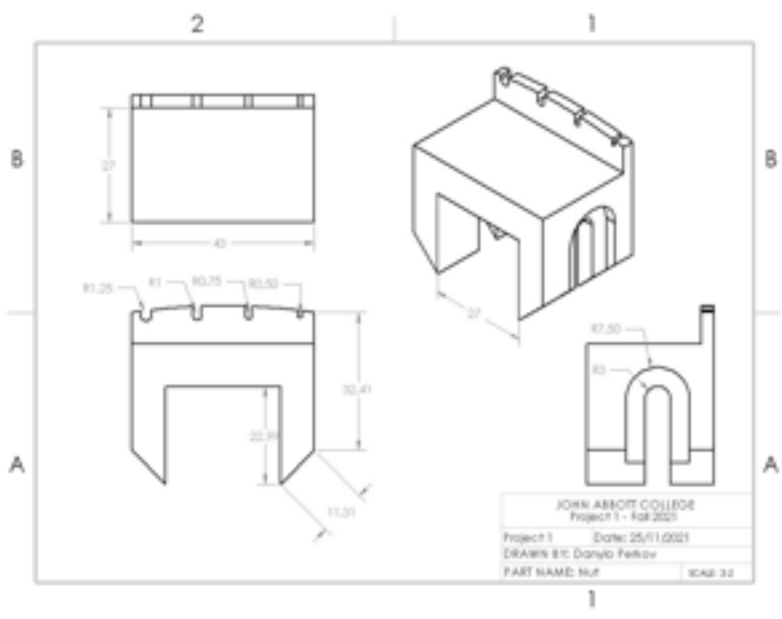
[17] Design for the bass neck



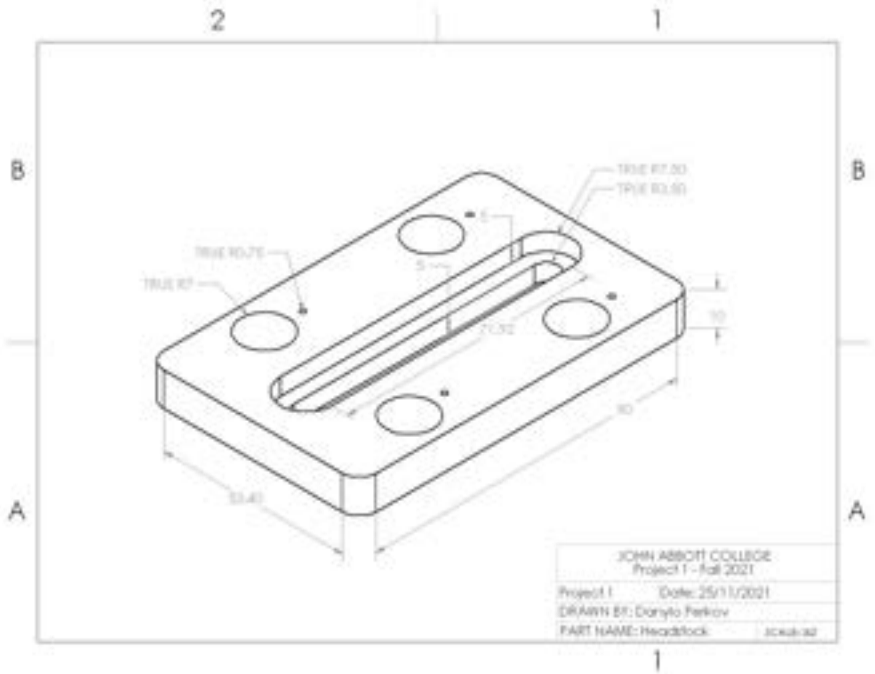
[18] Bridge



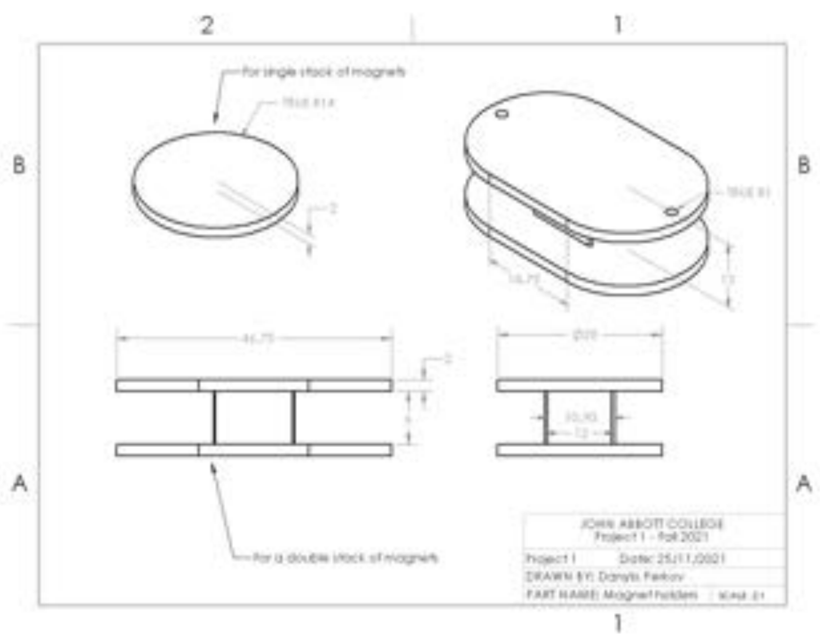
[19] Nut



[20] Headstock

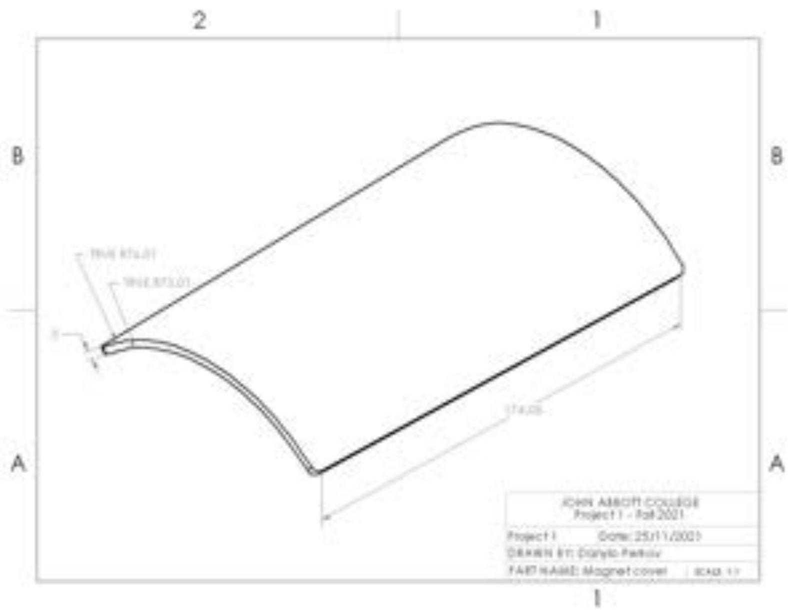


[21] *Magnet holders*



[22] Neck source 1 https://www.talkbass.com/threads/neck-blank-dimensions.1139148/
[23] Neck source 2 https://www.quinnviolins.com/soundwearsizingchartDB.html
[24] Neck source 3 https://gollihurmusic.com/double-bass-sizing-faq/
[25] Bridge source 1 https://www.talkbass.com/threads/fingerboard-and-bridge-relationships.570190/

[26] Bridge source 2 https://www.talkbass.com/threads/bridge-thickness.723566/
[27] Magnets cover



Acknowledgments

Appendix:

A1. Bill of Materials (BOM)

List all components and indicate the sources:

Custom-Built

Refer to its own BOM, with drawings, design notes and calculations, net time to build.

- 2x4x4Maple: https://www.google.com/maps/place/Scierie+J+T+M+Sawmill/@45.3742315,-74.1258974,16.25z/data=!4m5!3m4!1s0x4cc94a39b13ee079:0x6500a574d74f9384!8m2!3d45.3746944!4d-74.1228375. The ordering was easy. They also helped me by making the trench in the middle before the purchase. I then had to shape it into the neck. For design, see [17]. Cost – 60$
- Printed parts: For design, see [18][19][20]. Cost – free (refer to "Off-the-shelf" for filament cost)
- Printed parts for magnets [21]. Cost – 20$ filament.

Off-the-Shelf

Refer to vendor and manufacturer information, data sheets/user manuals, price and date of purchase, procurement difficulties if any (availability, delivery delay, etc).

- 1010 Aluminum bar: https://8020.net/1010.html. It was hard to find a proper place to buy it since there was no shipping to Canada and the store in Montreal closed a couple years ago. Luckily, I've found a warehouse in Ontario and got a 72" shipped with no problems. Cost – 70$
- 3D Printer filament: https://www.3dxtech.com/product/carbonx-pa6-cf/. Shipped with no problems. Cost – 86$
- 30AWG Copper coil wire: https://abra-electronics.com/wire-cable-accessories/wirecable/magnet-wire/30awgmag-1lb-30awg-enamel-magnet-wire-1lb-30awgmag-1lb.html. No problems with ordering and delivery. Cost – 45$
- Screws, bolts and nuts: taken from garage. Cost – free (if buying anew approx. 15$).
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Second Hand

Provide the source, collected technical documentation, price and date of acquisition.

A2. Media

List links (named for human readers) to on-line videos and other media of the product and its use. Submit the media (ex. pictures, video files) to the "Media" box. Make sure that your files are reasonable in size: the images need be of printing quality, unless higher resolution is necessary for proper illustration (once we received a 15 Mb image of an object that could be fully captured in

0.25 Mb). The videos should be of YouTube hi-resolution quality, so they could be posted on internal web-site/promotional electronic bill-board.

Link to Media	Description

A3. Manufacturing documentation.

Create a table of the submitted file names and their content descriptions. Submit your drawings, CAD models, circuit files, sketches, design notes, and other relevant manufacturing documentation to "Manufacturing Documentation" box.

File Name	Description
Schematic.dch	The schematic of the electronics as a DipTrace file
Bass_Headstock.SLDPRT	Solidworks model for the heatstock
Bass_nut.SLDPRT	Solidworks model for the nut
Nass_neck.SLDPRT	Solidworks model for the neck
Bass_double_magnet.SLDPRT	Solidworks model for the double magnet holder
Bass_single_magnet.SLDPRT	Solidworks model for the single magnet holder (2 required per stack)
Bass_bridge.SLDPRT	Solidworks model of the bridge
Bass_magnet_cover.SLDPRT	Solidworks model of the magnet cover
magnet_cover.SLDDRW	[27]
magnets.SLDDRW	[21]
Headstock.SLDDRW	[20]
Nut.SLDDRW	[19]
bridge.SLDDRW	[18]
neck.SLDDRW	[17]
One-Page Project Manager v2.xlsx	The OPPM for the project
All the .SLDDRW files have also been doubled with .jpeg files	

A4. Miscellaneous.

Other information the author finds pertinent to the project, that does not fit the above specification.