



Trine University
Biomedical Engineering

Hero's Guitar Project

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Introduction:

Shane Heath is an Army veteran that stepped on an IED while in service, resulting in the loss of left extremities. Shane loved to play the guitar before serving and is ready to get back into it once again. Through Quality of Life Plus (QL+), this group got to meet Shane and learn about his project: providing a prosthetic device that would allow him to play the guitar once again.

To do this, some boundaries were set; the prosthetic had to have a double strap design and hold a guitar pick without the pick slipping out of the clamp. While general prosthetics fit well, there are some limitations. When the person wearing the prosthetic undergoes anthropometric changes, the prosthetic does not fit as well as it had when it was custom made. Using the double-strap design would allow for the prosthetic to be more securely attached to Shane's arm.

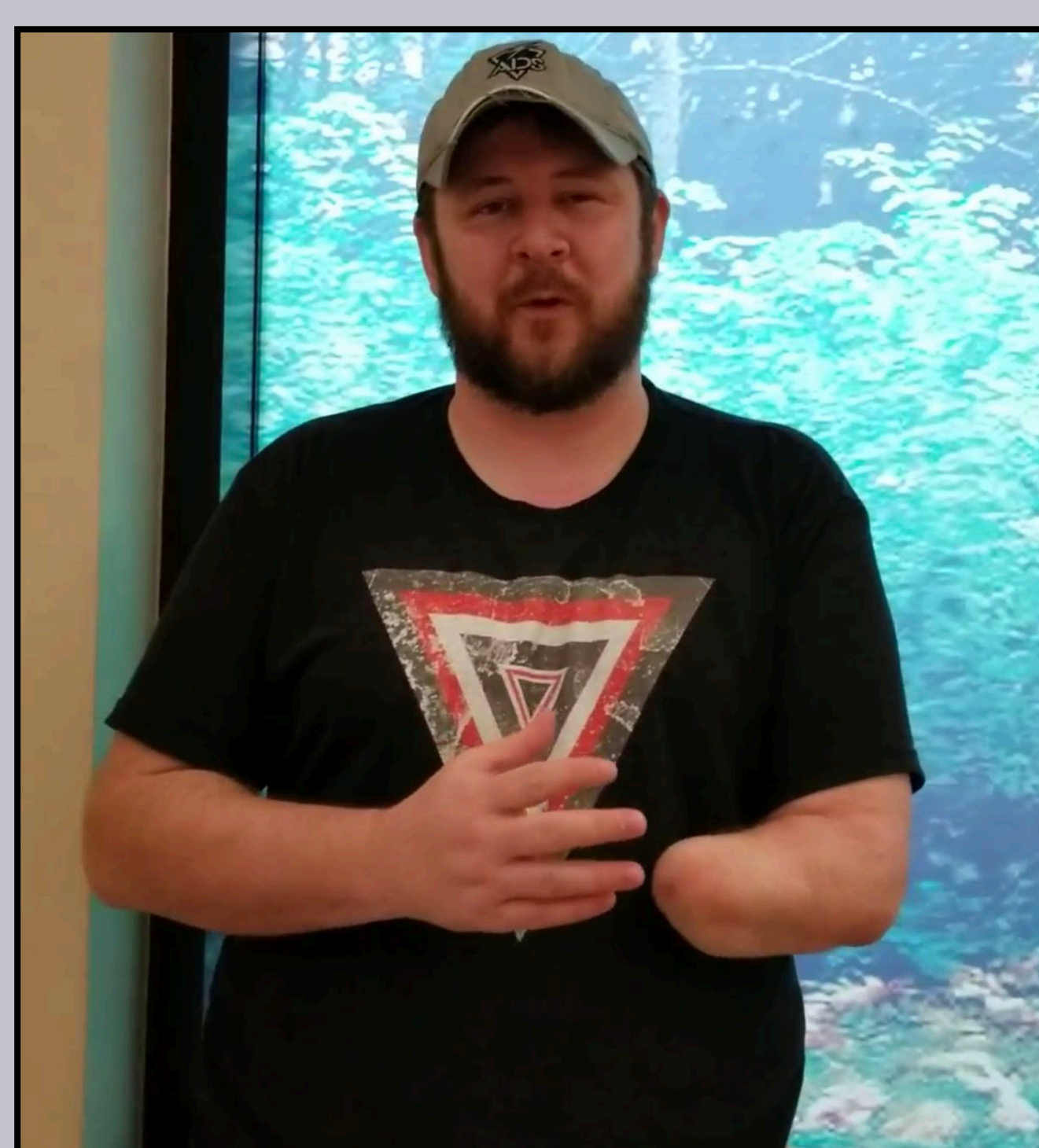


Figure 1: Shane Heath (left) and his current guitar pick clamp and single strap design (right).

Results and Discussion:

There were six areas of testing for this project:

- Vicon testing for Dynamic equations:
 - Forces placed upon the prosthetic during strumming
- Charpy testing for extension material:
 - Tested wood (cedar and poplar) and 3D printing material (ABS and PLA with and without resin)
- Guitar pick and clamp:
 - Tested hole size and location for the pick
 - Tested effectiveness of clamp
 - Tested pick and clamp effectiveness together
- Proper adherence between silicone and prosthetic base:
 - Tested different glues for adherence (wood, hot glue, plastic, Gorilla, and double-sided tape)
- Prosthetic strumming durability:
 - Testing the durability of the prosthetic strumming a guitar for specified durations of time

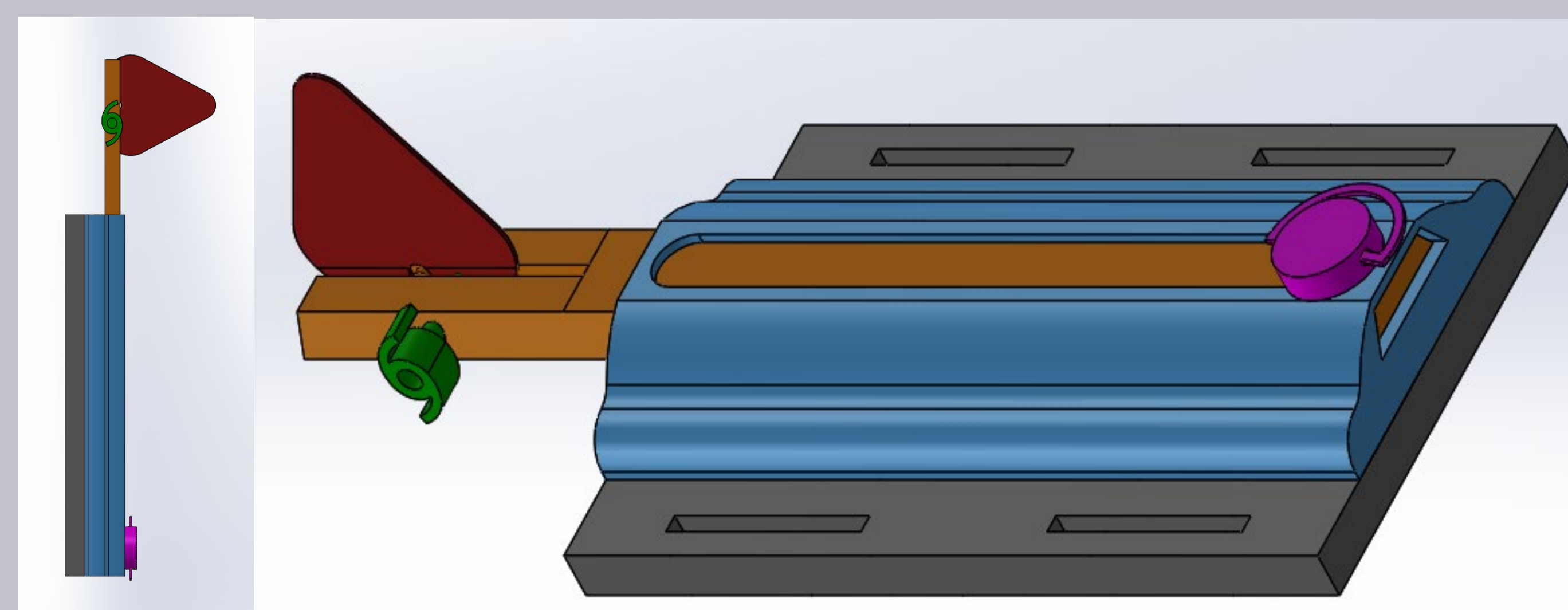


Figure 2: Side & Isometric View of First Semester's Final Design

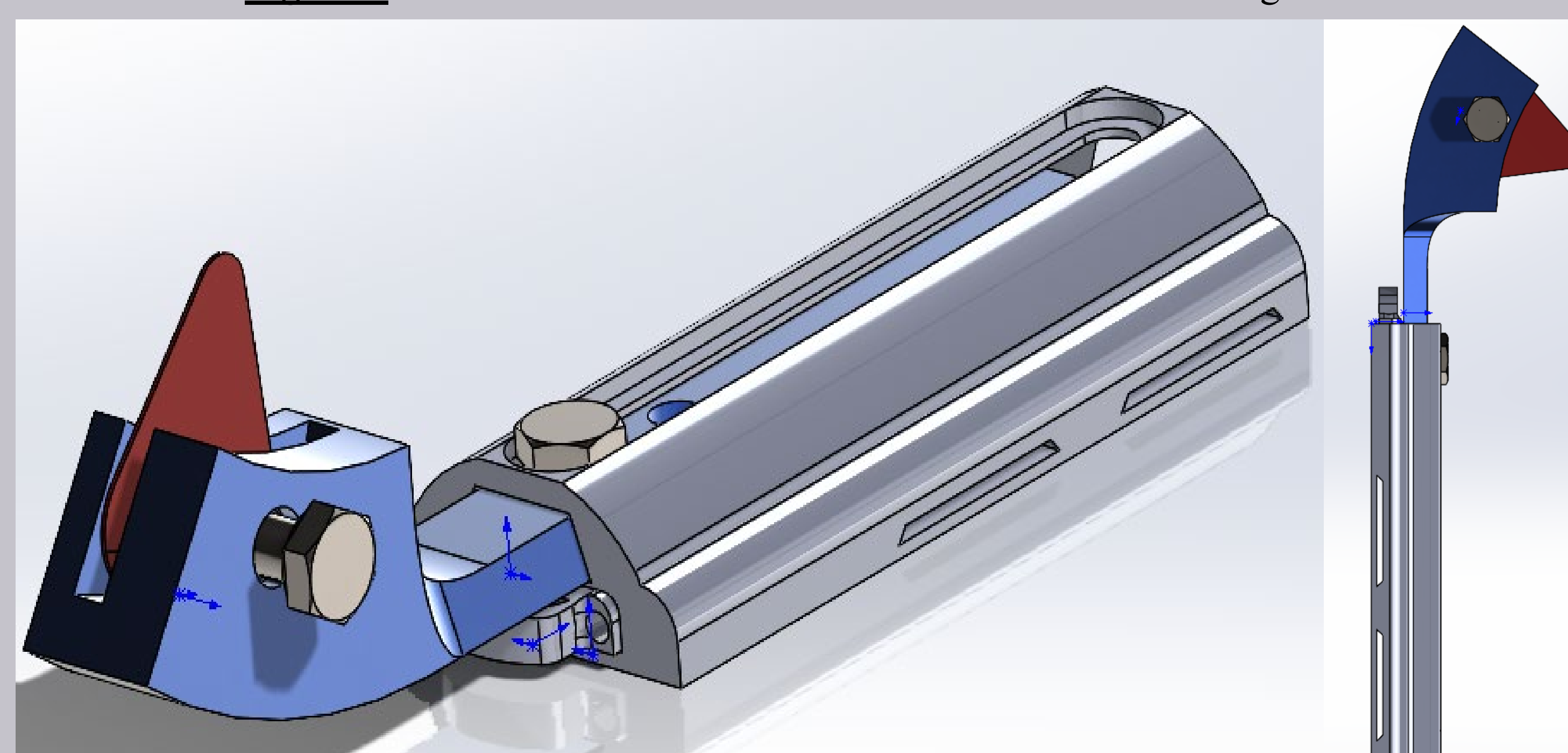


Figure 3: Design after testing & Shane's critiques

Materials and Methods:

There are three 3D Printed Components:

- Base : 4.3"X1.75"X0.75"
- Extension: 6.74"X1.45"X0.73"
- Tray: 1.76"X0.7"X0.24"

All printed in Blue ABS at 45% Infill Octet Pattern

Charpy Testing: Average Strength 9.88lbs, STD: 0.19



Figure 4: Shane Heath using prosthetic during his Twitch Live Stream



Figure 5: Complete Prosthetic

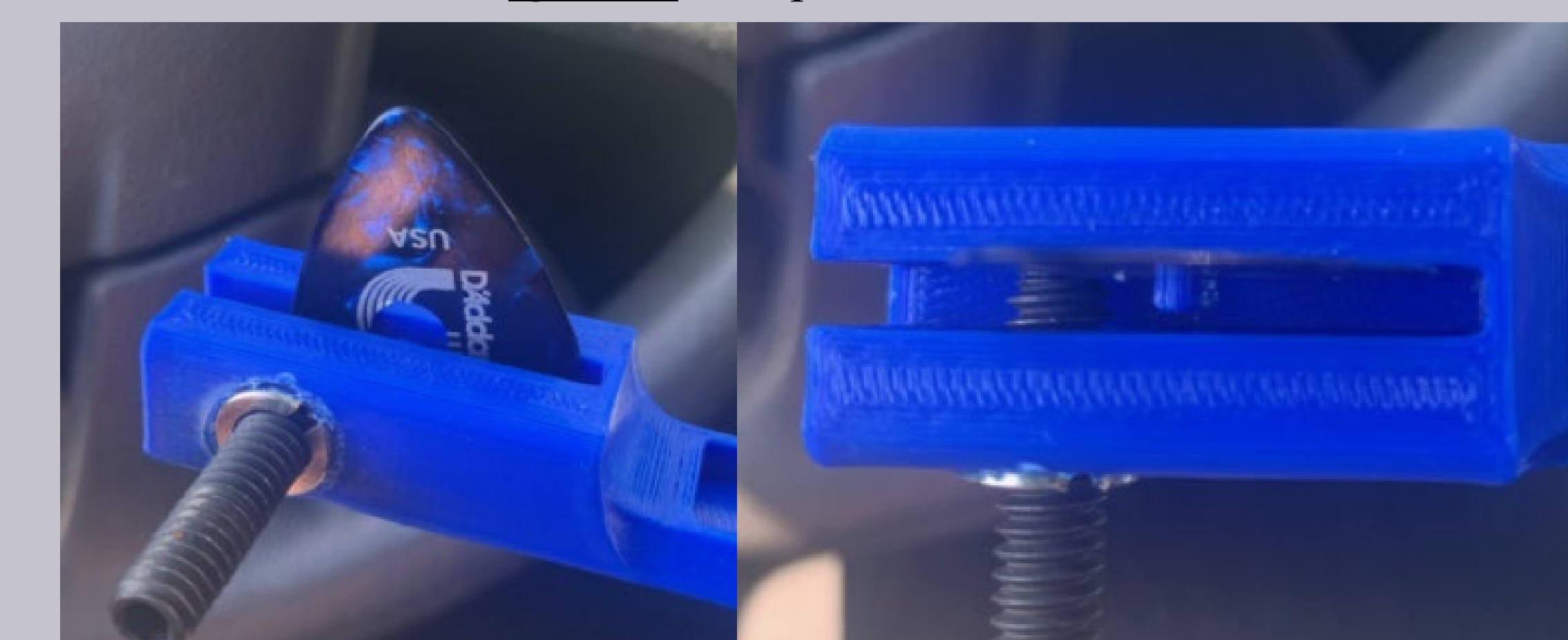


Figure 6: Clamp

Conclusion:

Shane Heath loves the guitar pick prosthetic! The final prosthetic is shown in Figure 4 above. It has allowed him to have a more natural strumming motion while he plays. For the clamp to securely hold the guitar pick, a middle hole location and a standard hole punch for the size was chosen. In order to properly adhere the silicone sheet to the prosthetic base, plastic glue will be used. Overall, the completely assembled prosthetic withstands normal strumming and the forces involved.

Future Work:

The following are ideas to further improve the Hero's Guitar project:

- Research and test materials to make a palm mute
- Identify different extensions needed by veterans/ those with prosthetic arms
- Two-part extension for more natural play
- Run Vicon on Shane for true forces on prosthetic
- Updates to prosthetic as they come up

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