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Sense Scanner

- 360° 3D Sense scanner used on the head and helmet for real life images
- 5-10 thousand triangular data points per scan are collected from scans
- Import head scan into Solidworks along with scan of helmet
- Outputs parameters for custom fit padding in terms of optimal thickness



3D Printed Padding

- Designs Modeled in Solidworks
- Designs Imported into Makerware Software
- Parameters Specified in Code for 3D Printer
- Makerbot Replicator 2x used to Print out Individual Foam Sections
- Padding Assembled to Helmet with Velcro Attachments

Results

Final padding assembled in helmet and tested on drop test rig. Data is currently being collected to evaluate the performance of 3D printed padding compared to other commercial padding materials currently on the market.



Background

Currently head protective equipment for concussions in athletics is limited to helmets and wearable headbands for non-helmeted sports. Emerging technology in 3-D printing has presented us with the ability to print Thermoplastic Urethane (TPU) in localized cell structures in order to reduce the risk of concussions. These custom fitted TPU inserts will allow for a reduction in force and impact exerted onto the head during hard collisions to reduce the probability of a concussion.

Purpose/ Goal

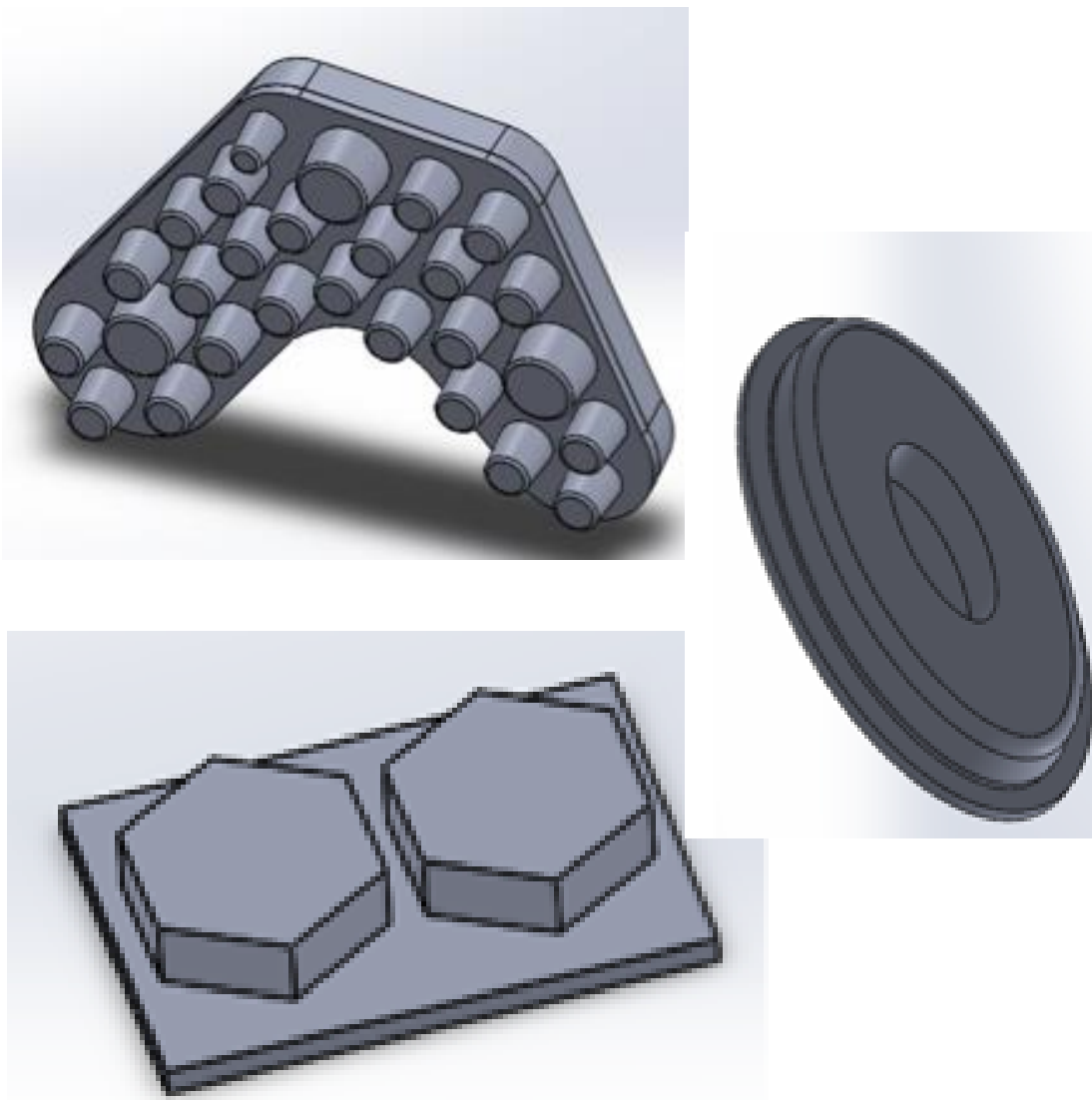
The goal of this project is to combine automated custom scans of an individuals head geometry and import that specific shape into a CAD program to be 3D printed. A simple vertical drop test rig will be built to include quantifiable parameters measuring the localized forces upon impact. The final solution will be cost effective, exceeds all of the standards needed for this type of protective equipment, and will be biocompatible with the user. The purpose of these objectives is to design optimized absorbent foam to use for protective equipment around the world that can be customizable for endless applications.

Project Description



Drop Test Rig

- 80/20 Aluminum Construction
 - Aluminum Carriage
 - Steel Guide Cables
 - 4x3 1/2" Steel Plate
 - Cylindrical Metal Anvil
- Follows NOCSAE Standards
- Capable of 2 Meter Drops Tests
- Head Form Mimics Human Head Weight



Deliverables Completed

- CAD models of different cellular material and densities 3D printed with Makerbot Printer and tested
- Helmet drop-test rig with impact sensor feedback completed
- Helmet customized to mannequin head using 3D printed custom padding
- Final helmet with the highest energy absorption performance as indicated by drop tests
- Semi-automated workflow for capturing athlete's head geometry to drive the design of customized protective padding with 3D Solidworks software



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