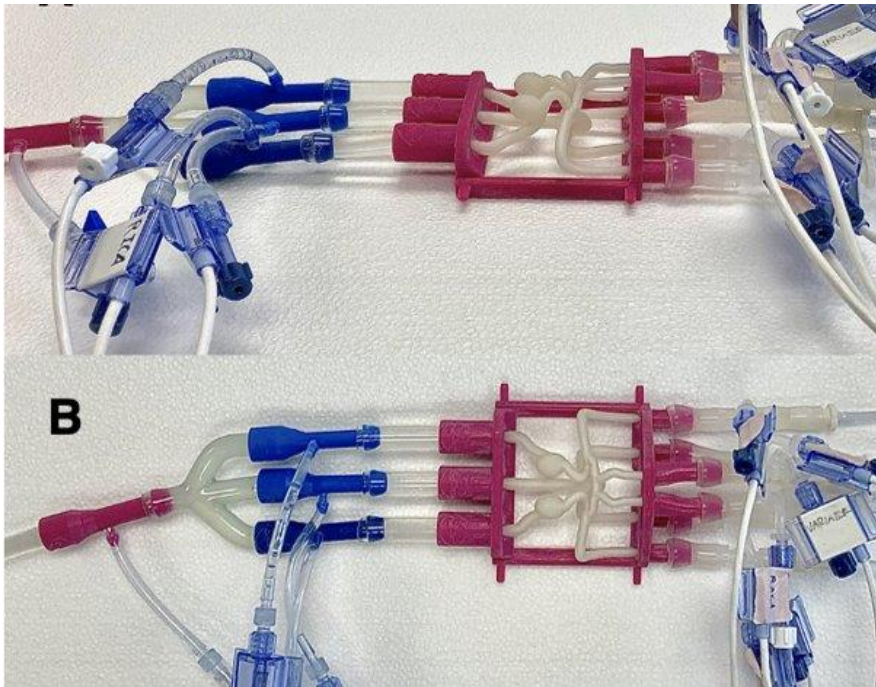


Introduction and 33% Update



Team BDL/Aneuvvas

Isaac Smith - Project Manager

Luke Nelson – Website & Data Manager

Kathryn Nelson - Budget Manager

Aditya Ponugupaty - Testing Manager

Project Background

3D Printing

3D printing changed the speed, materials and functionality with which prototypes could be efficiently produced, leading to faster overall production, fewer prototype iterations and lower overall costs.

With the advent of 3D printing equipment, every shop/designer can have a 3D printer right on their desk.

Bioengineering Testing

Creating a more property accurate model of brain vessels can assist:

- Medical students
- Neurosurgeons
- Bio-Engineers
- Researchers

Future Aspirations

Allows for neurosurgeons to practice before performing the operation which leads to:

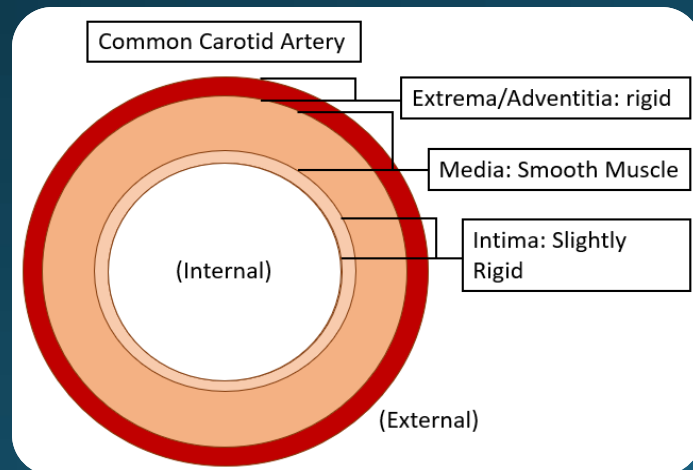
- More clear direction of the veins
- Less mistakes during surgery
- Increases the safety of the patient
- Cheaper costs for the patient

Project Description

Task

Create a 3D printed model that replicates organic tissue measurable to the human carotid artery.

Human Carotid Artery



Analysis

Conducted Tests:

- Tension of specimen
- Lubricity of interior
- Compressive Modulus
- Shear Modulus
- Specimen Hardness
- Poisson's Ratio

Future Tests:

- Specimen compliance
- Repeat Shear Modulus

Deliverables

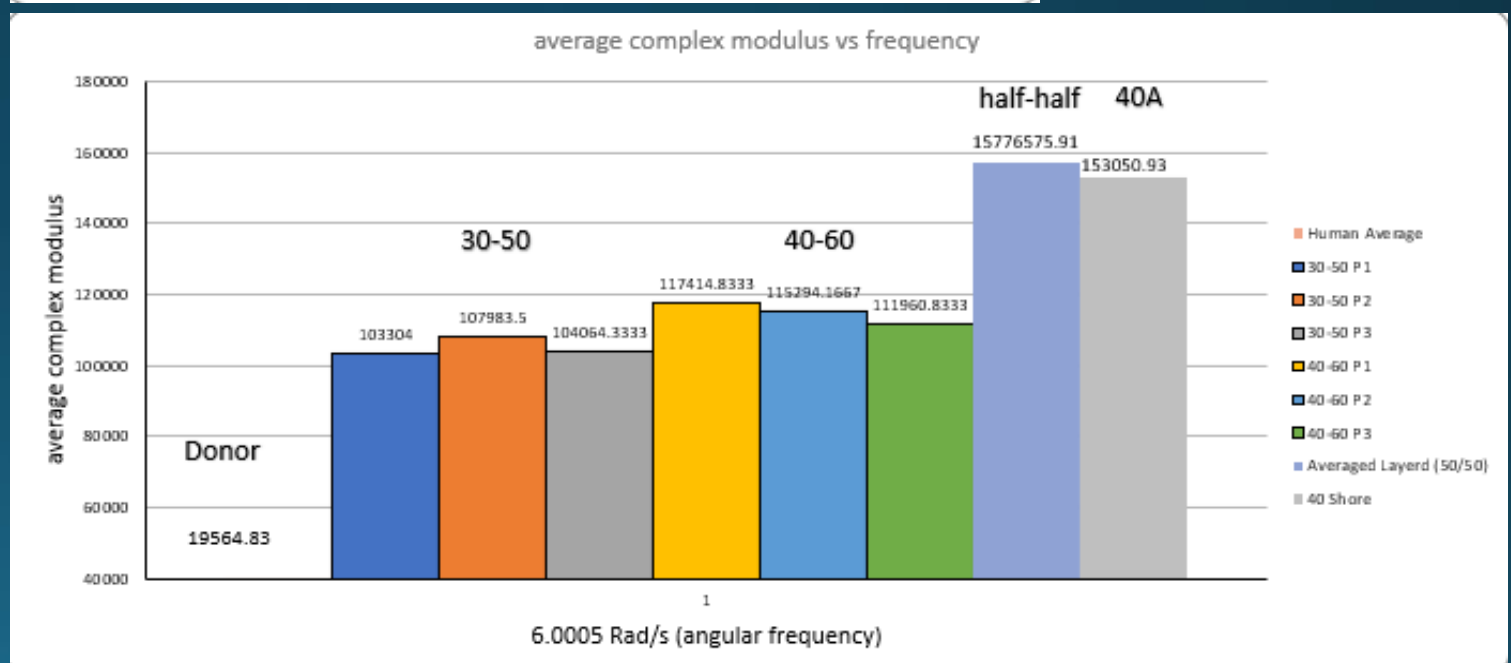
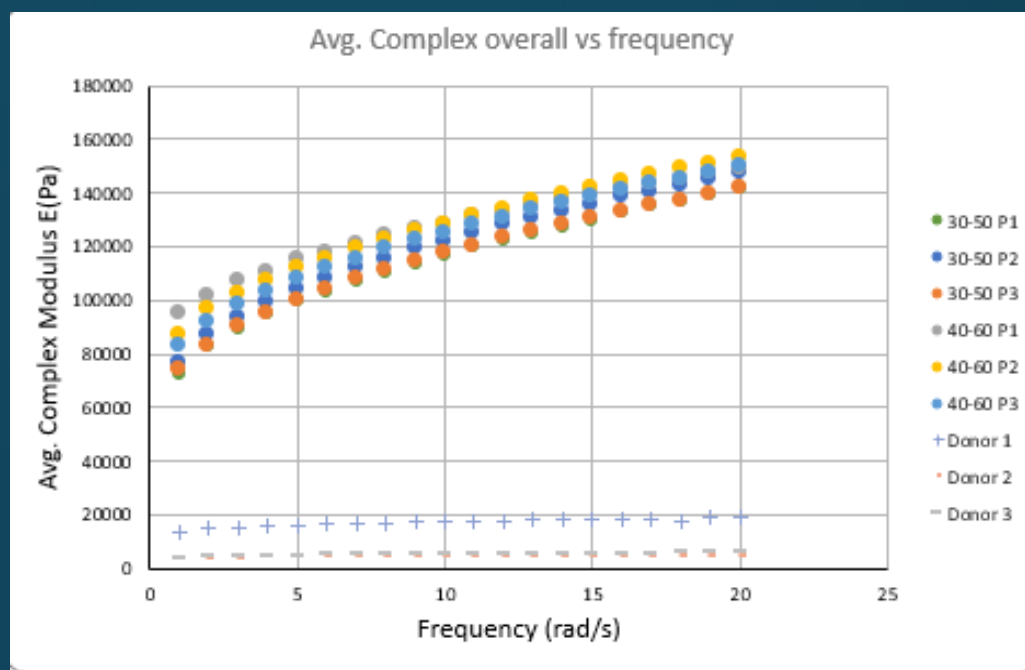
- Qualitative Data
- Final Circle of Willis model
- Integrated flow system

Repeatable:

- Manufacturing
- Laboratory implementation

Shear

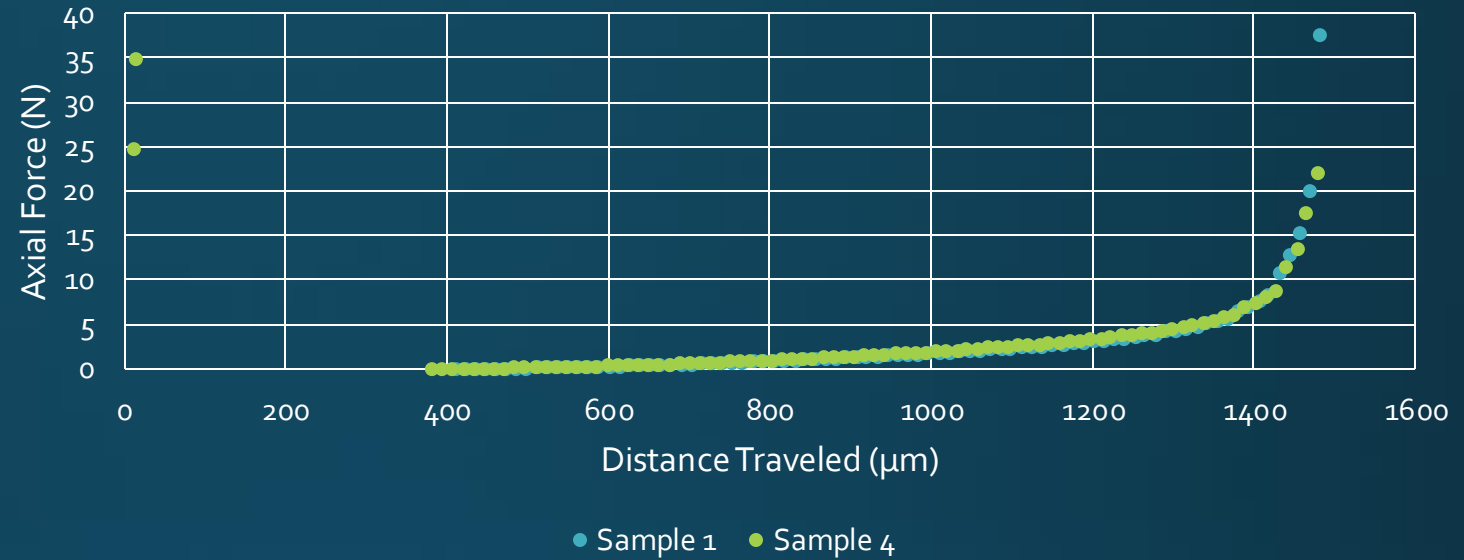
- Shear in polymers is significantly greater than shear in vasculature.
- Our ratio came closer to human shear than previous studies.
- Proof of concept: Validated that ratio change may influence the polymer reaction to be closer to human vascular response.



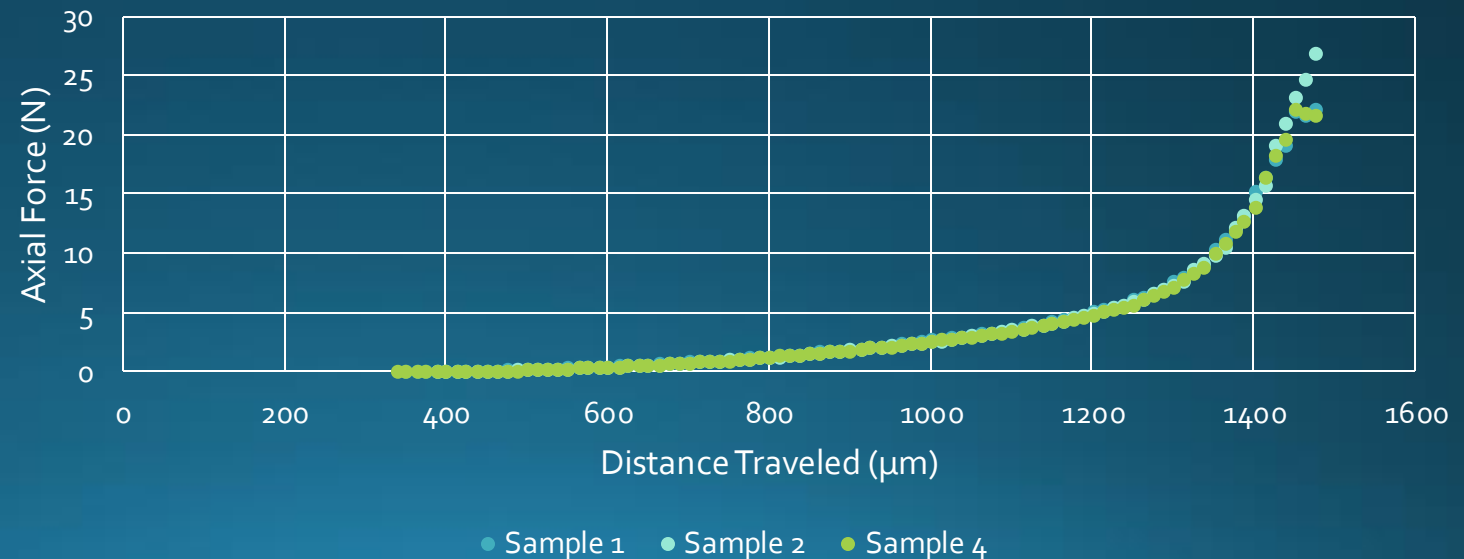
Hardness & Results

- Uses small metallic ball to compress, creating an indentation into the material
 - The amount of force applied and the distance between plates is measured
- Donor samples resulted in 800-1200 μm at roughly 7.5N of force

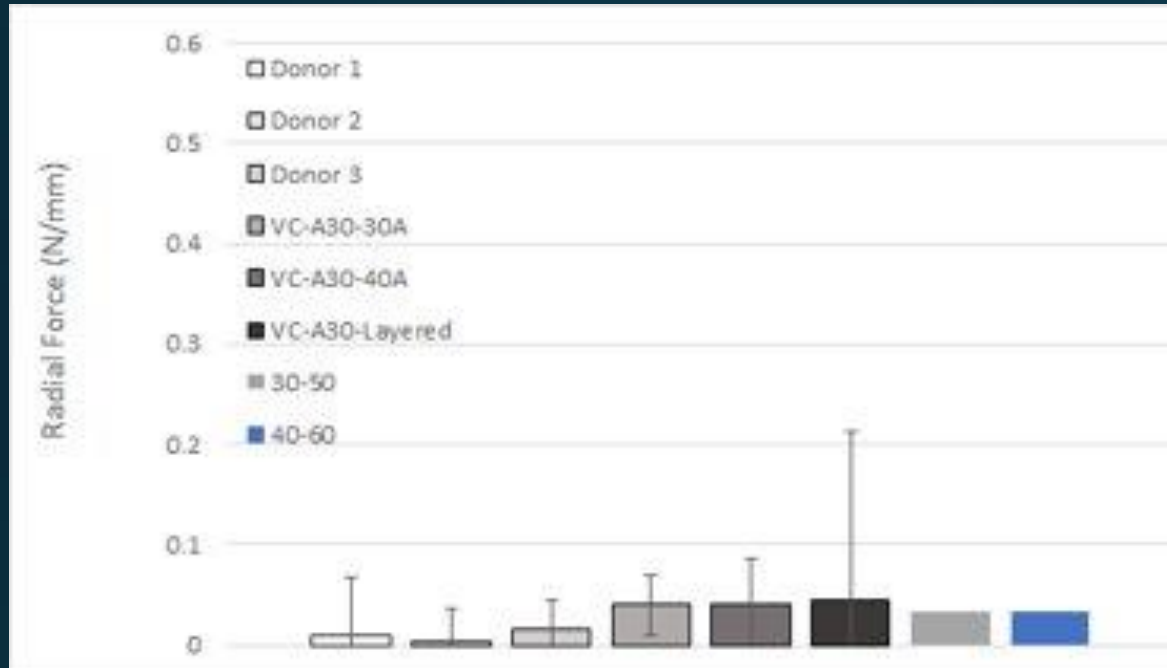
Hardness Test (30-50): Force vs. Distance



Hardness Test (40-60): Force vs. Distance



Radial Force



Radial Forces of Previous and Current Samples

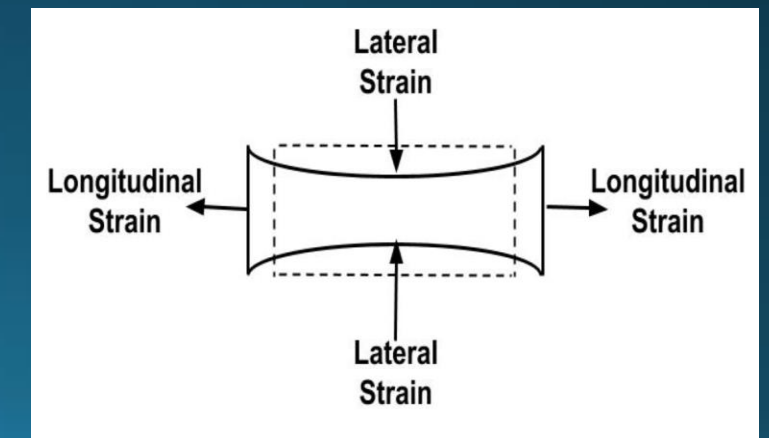
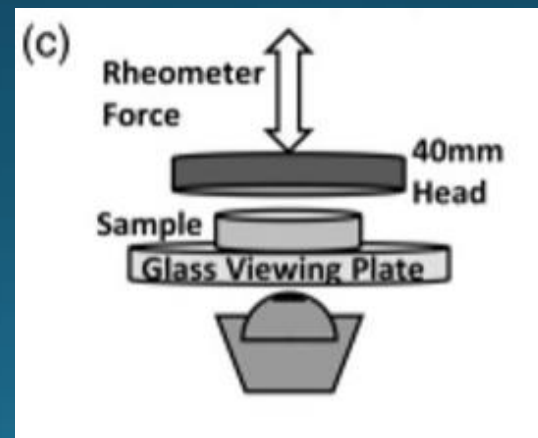
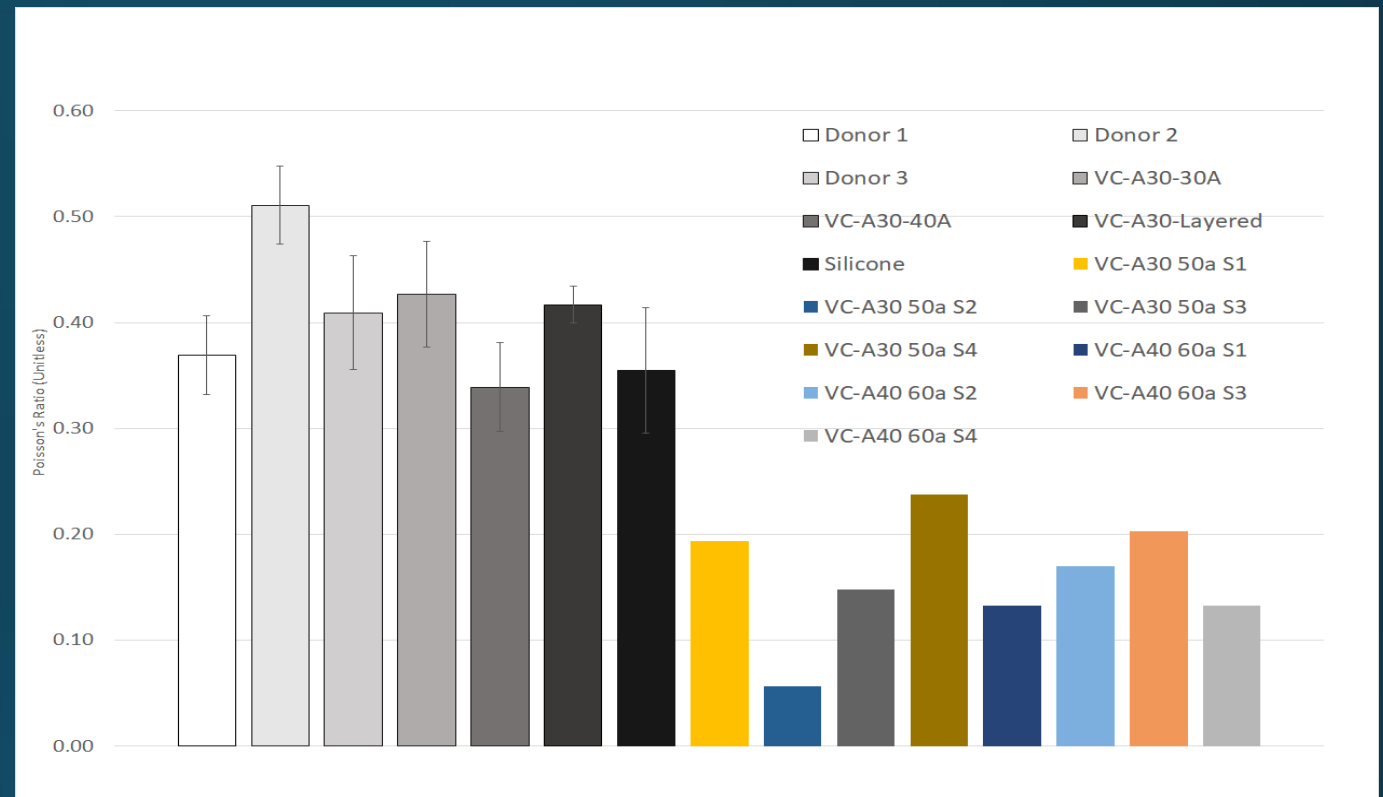
- A hollow cylinder is placed on its side and compressed between two plates
 - The amount of force applied and the distance between plates is measured
- 8 samples are shown, the last two are our capstone's samples
- Donor samples ranged from 0.003-0.01 (N/mm)
- Current samples average at 0.03 (N/mm)

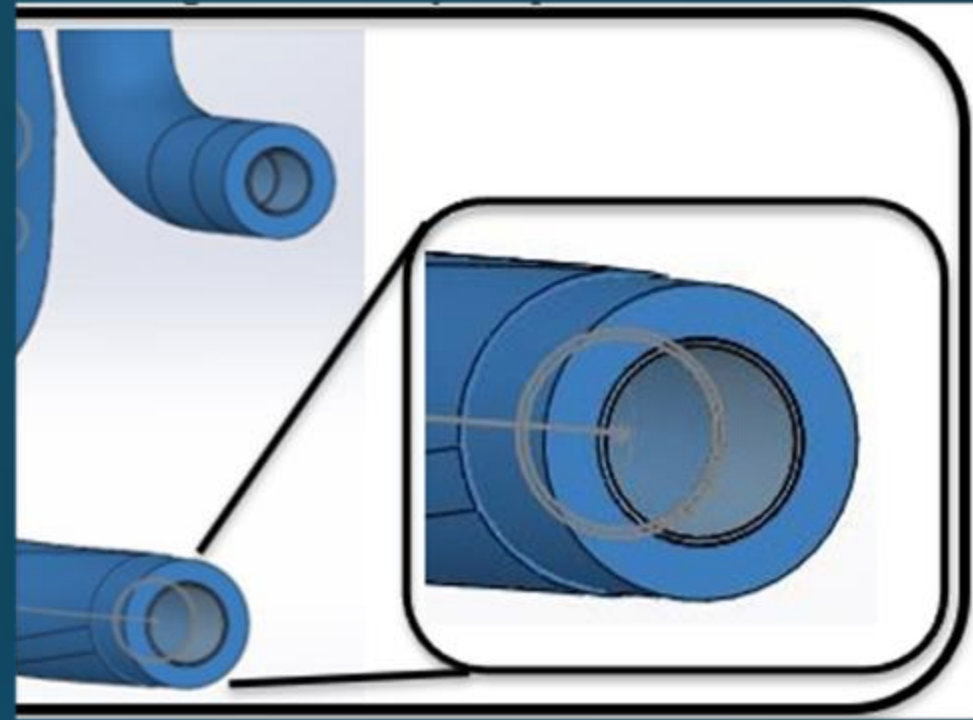
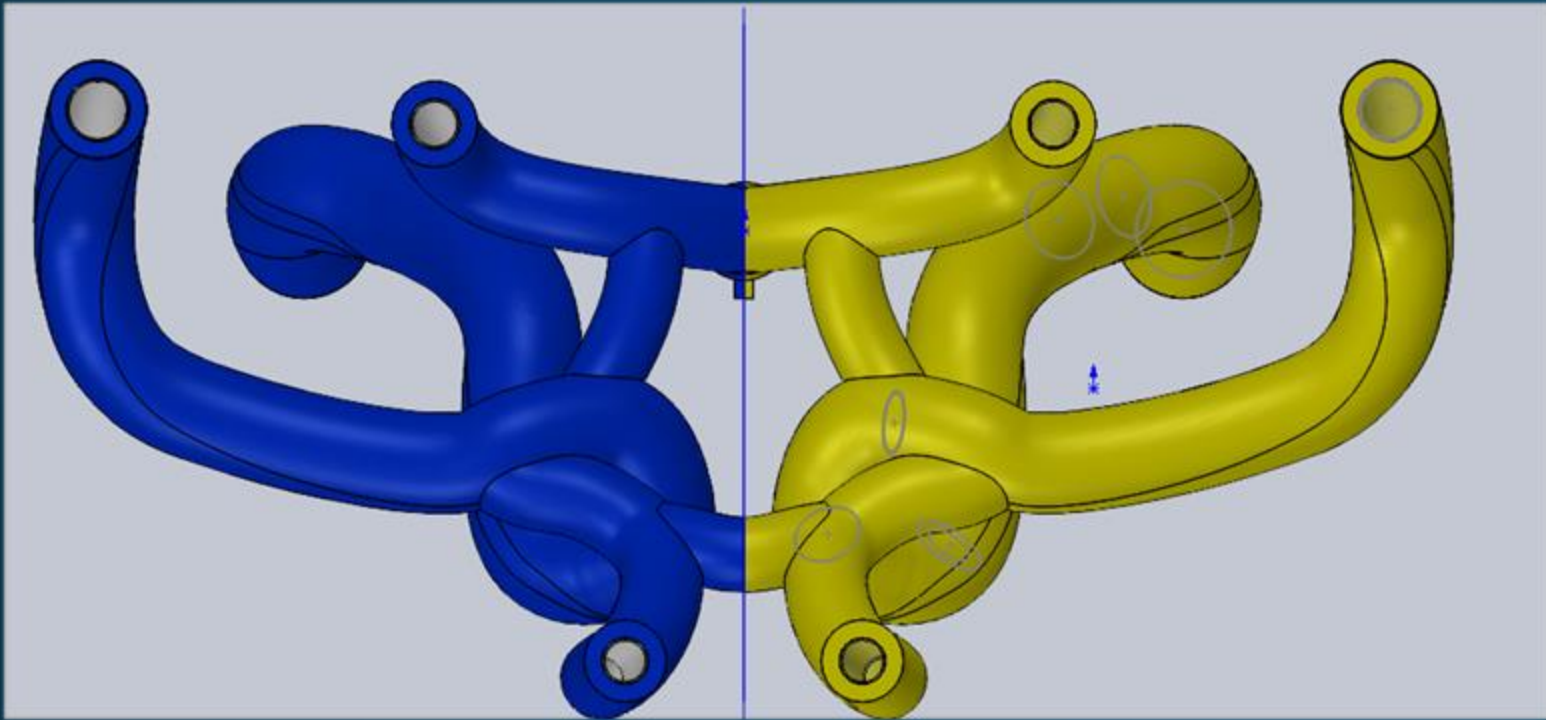
Poisson's Ratio Test and Results

Donor samples ranged from 0.37 – 0.51

Our 8 samples range from 0.06 to 0.24

A change in mechanical properties is validated through this analysis





Updated Model

- Full Model (Left)
- Layered (Right)

Budget & Manufacturing

| <i>Total Budget</i> | ----- | ----- | ----- | \$1000 |
|----------------------|----------------------------|---------------------------|--------------------|-----------------|
| Rheometer (20/hr) | Status: <i>On hand</i> | \$20/hr | 23 hours | \$460 |
| Material | Status: <i>On hand</i> | \$0.15-\$0.25 per gram | 190 grams | \$33.95 |
| | <i>Total Remaining</i> | \$504.05 | <i>Total Spent</i> | \$493.95 |

- ⊖ Samples for 6 tests have been printed
- ⊖ Samples for 2 tests have yet to be made
- ⊖ Currently 23 hours of testing have been done
- ⊖ Estimated 6 hours of tests left for current design

Gantt Chart

BDL/ANEUVAS CAPSTONE Semester 2

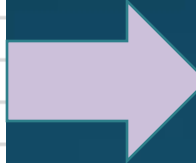
NAU ME Capstone
Project Lead: Isaac Smith

Project Start:

Display Week:

** As of date of making

| TASK | ASSIGNED TO | PROGRESS | START | END | DAYS |
|--|-------------|----------|-----------|-----------|------|
| Semester 2 Start-up | | | | | |
| Talk to client | All | | 1/8/2022 | 1/10/2022 | 3 |
| Delegate testing days until first hardware status update | All | | 1/10/2022 | 1/10/2022 | 1 |
| Project Management Assignment | All | | 1/10/2022 | 1/15/2022 | 6 |
| Reflection | Issac | | 1/10/2022 | 1/15/2022 | |
| Gantt Chart | AP | | 1/10/2022 | 1/15/2022 | |
| Purchasing Plan | Katheryn | | 1/10/2022 | 1/15/2022 | |
| Testing Analysis Plan | All | | 1/10/2022 | 1/15/2022 | |
| <u>Hardness and Poission's Ratio test day</u> | All | | 1/14/2022 | 1/14/2022 | |
| <u>Radial Force Test Day</u> | All | | 1/15/2022 | 1/15/2022 | |
| <u>Lubricity or Compression Test Day (Based on clients approval)</u> | All | | 1/22/2022 | 1/22/2022 | |
| Individual Analytical Analysis | All | | 1/15/2022 | 1/28/2022 | 14 |
| Solidworks Self Learning | Issac | | 1/15/2022 | 1/28/2022 | |
| Poission's Ratio Analysis | AP | | 1/15/2022 | 1/28/2022 | |
| Radial Force Analysis | Katheryn | | 1/15/2022 | 1/28/2022 | |
| Hardness Analysis | Luke | | 1/15/2022 | 1/28/2022 | |
| Hardware Status Update | All | | 2/7/2022 | 2/7/2022 | |
| Peer Eval 1 | All | | 2/11/2022 | 2/11/2022 | |



BDL/ANEUVAS CAPSTONE Semester 2

NAU ME Capstone
Project Lead: Isaac Smith

Project Start:

Display Week:

** As of date of making

| TASK | ASSIGNED TO | PROGRESS | START | END |
|--|-------------|----------|-----------|-----------|
| Semester 2 Start-up | | | | |
| Talk to client | All | | 1/8/2022 | 1/10/2022 |
| Delegate testing days until first hardware status update | All | | 1/10/2022 | 1/10/2022 |
| Project Management Assignment | All | | 1/10/2022 | 1/15/2022 |
| Reflection | Issac | | 1/10/2022 | 1/15/2022 |
| Gantt Chart | AP | | 1/10/2022 | 1/15/2022 |
| Purchasing Plan | Katheryn | | 1/10/2022 | 1/15/2022 |
| Testing Analysis Plan | All | | 1/10/2022 | 1/15/2022 |
| <i>Hardness and Poission's Ratio sample prep</i> | All | | 1/11/2022 | 1/11/2022 |
| <u>Hardness and Poission's Ratio test day</u> | All | | 1/15/2022 | 1/15/2022 |
| <i>Radial Force and Lubricity sample prep</i> | All | | 1/13/2022 | 1/13/2022 |
| <u>Radial Force & Lubricity Test Day</u> | All | | 1/17/2022 | 1/17/2022 |
| <i>Tension Test sample prep</i> | All | | 1/18/2022 | 1/18/2022 |
| <u>Tension Test day</u> | All | | 1/22/2022 | 1/22/2022 |
| Individual Analytical Analysis | All | | 1/15/2022 | 1/28/2022 |
| Solidworks Self Learning | Issac | | 1/15/2022 | 1/28/2022 |
| Poission's Ratio Analysis | AP | | 1/15/2022 | 1/28/2022 |
| Radial Force Analysis | Katheryn | | 1/15/2022 | 1/28/2022 |
| Hardness Analysis | Luke | | 1/15/2022 | 1/28/2022 |
| Hardware Status Update | All | | 2/7/2022 | 2/7/2022 |
| Peer Eval 1 | All | | 2/11/2022 | 2/11/2022 |
| Website Check 1 | Luke | | 1/25/2022 | 2/25/2022 |



IT'S OVER

**THIS MIND NUMBING POWERPOINT PRESENTATION
IS FINALLY OVER**

quickmeme.com

Questions?