

# FINGER 2.0 Thumb Exoskeleton

## Mechanical Design

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### Background

- FINGER 1.0 was designed to aid in the rehabilitation of the forefinger and middle finger of stroke victims
  - Guiding and aiding the fingers in movement and building strength
- FINGER 2.0 added a thumb module to the current design to help rebuild the connection between the fingers and the thumb

### Objective

- Adapt the current FINGER project to be changeable to a left-handed configuration
- Reduce friction and play in thumb module joints

### Value Proposition

- Augmented design of the FINGER robot
- Aid simple motions of the fingers and thumb
- Measures user input to aid

### Key Requirements

- Quick and efficient switching from left to right
- Comfortable fit and function when completed
- Minimal slop (play) in all of the link-bearing connections

### Current Designs

Fixed Link:

- Bearing placement same as previous
- Aluminum machined upper
- ONYX printed base

Adjustable Thumb Piece:

- Follows an axis from the sphere's center through the middle of the thumb

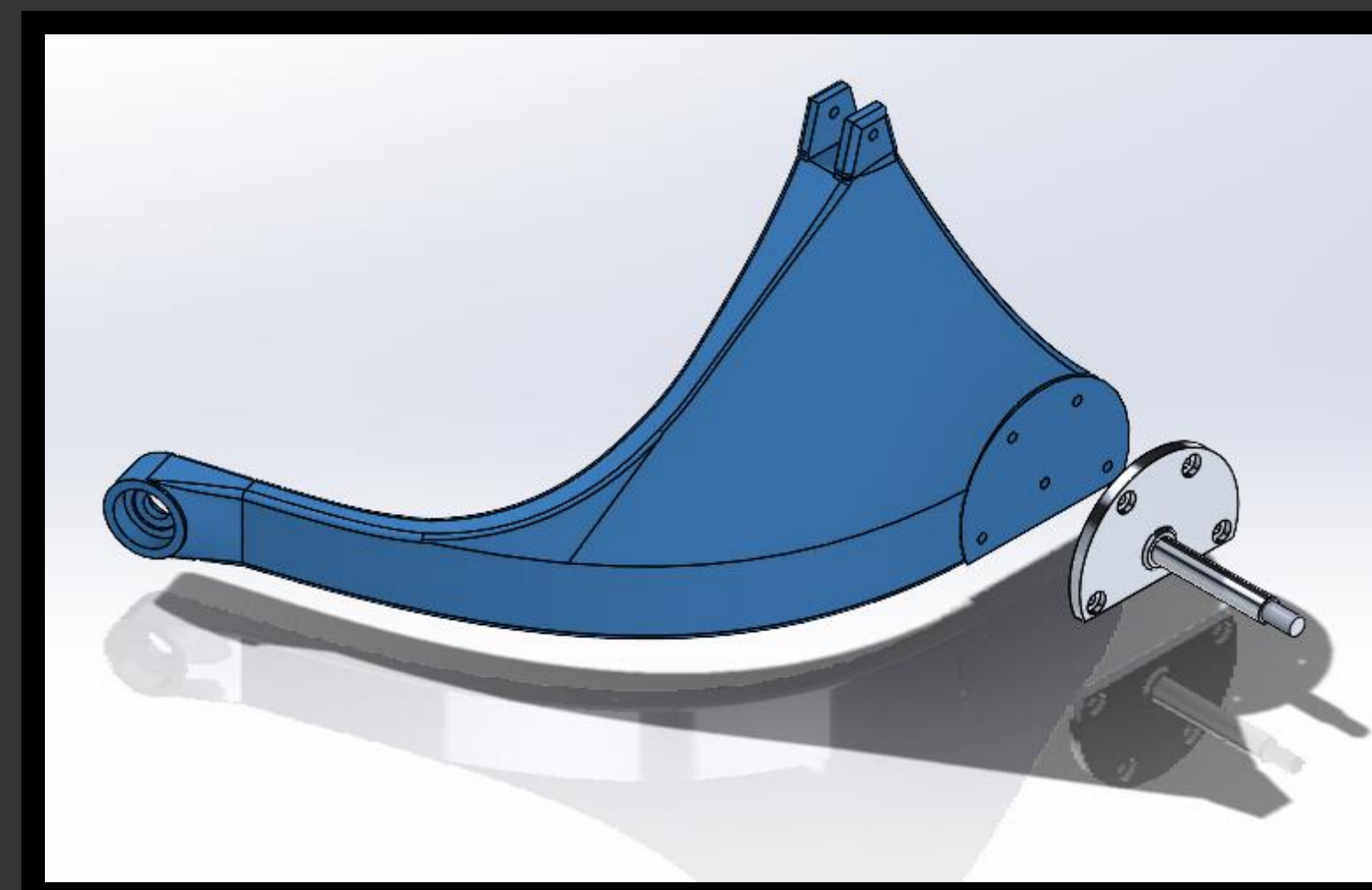
Actuator Mounts:

- Combining machined top with printed ONYX base

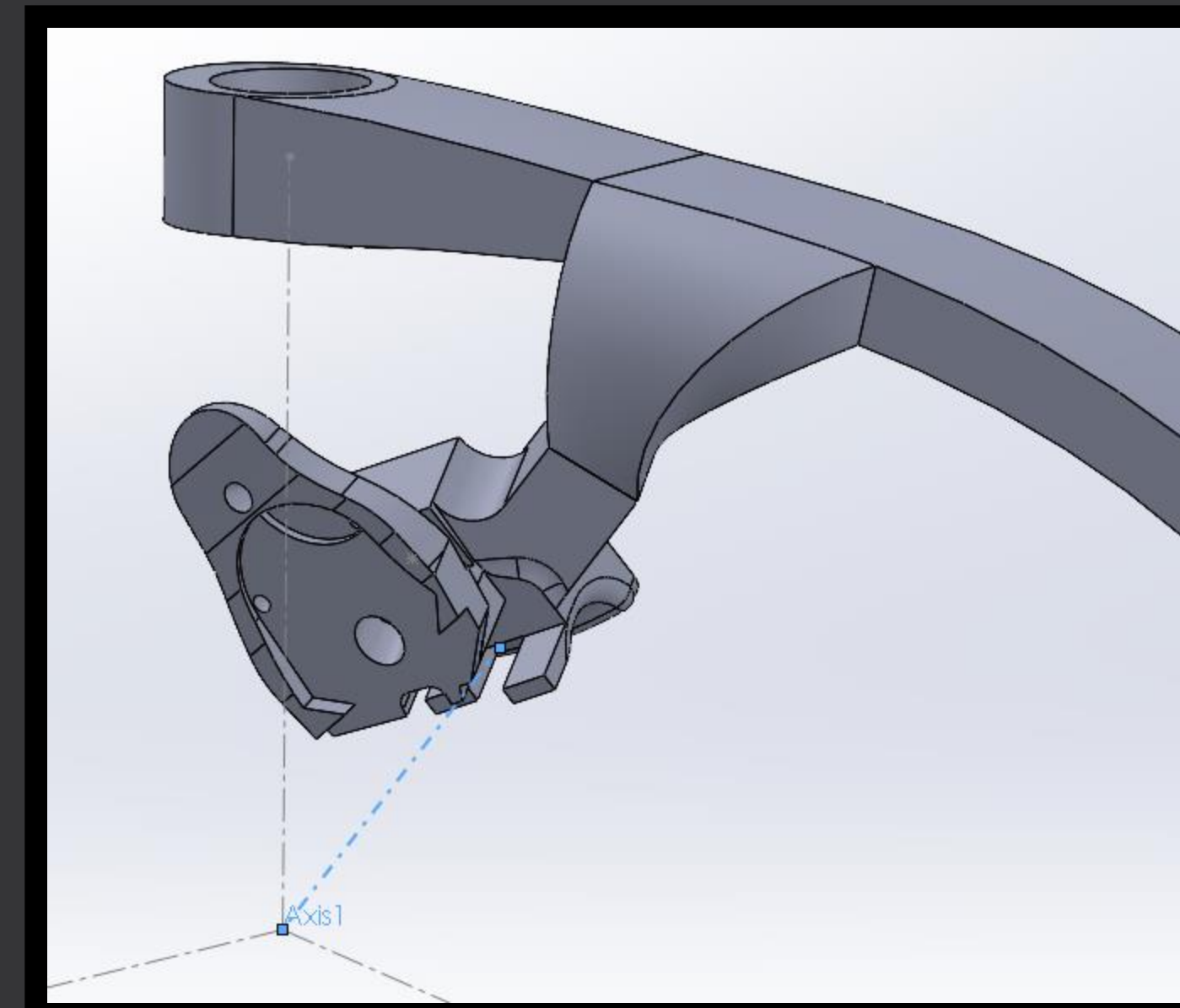
### Conceptual Development

Joint connection redesigns:

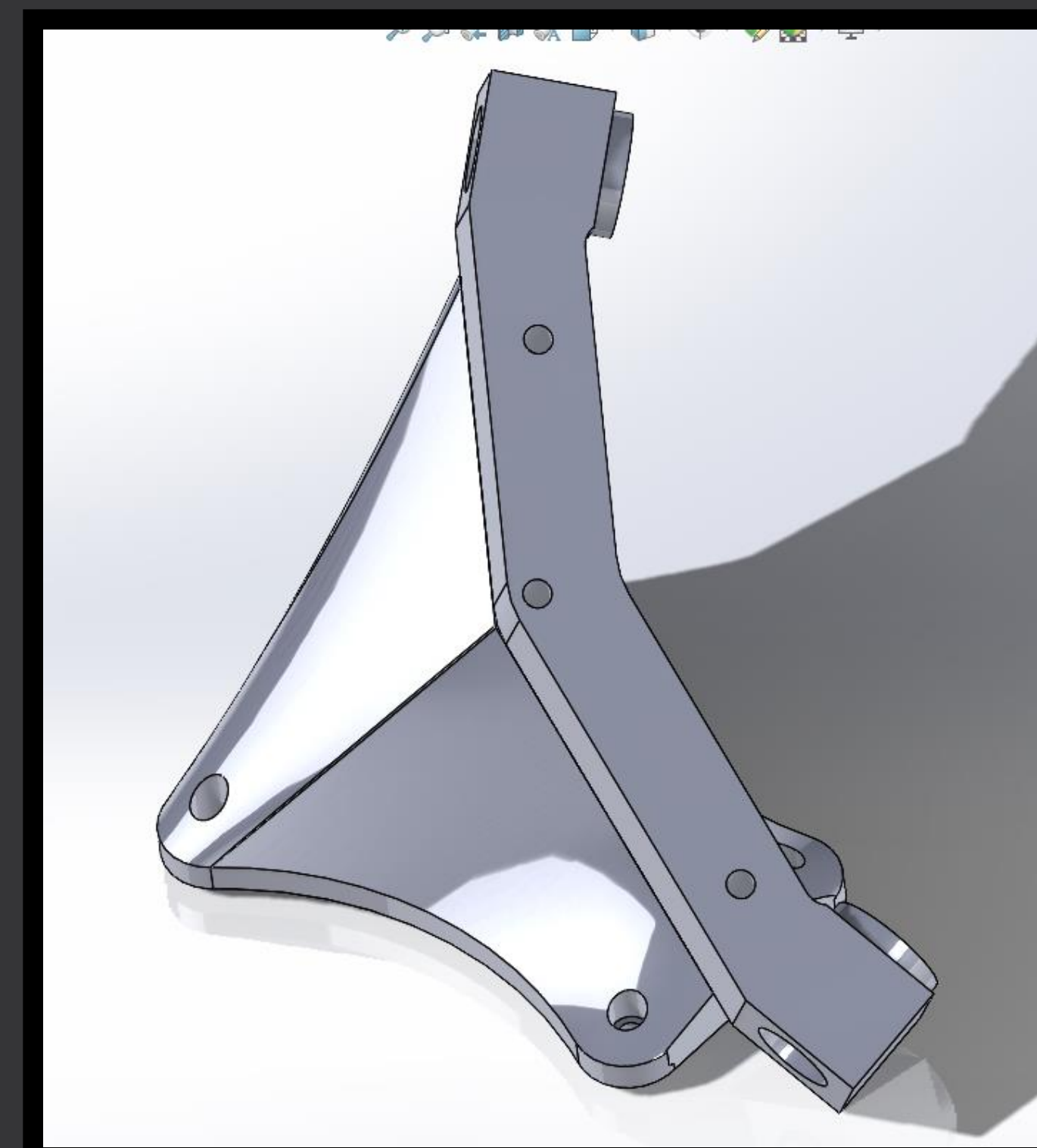
- Face Mount Joint
  - High precision
  - Large contact area for stability
- Custom Snap-Ring and Clamp Shafts
  - Rigid attachment to clamping link
  - Compressive fit on bearings with use of spring washers



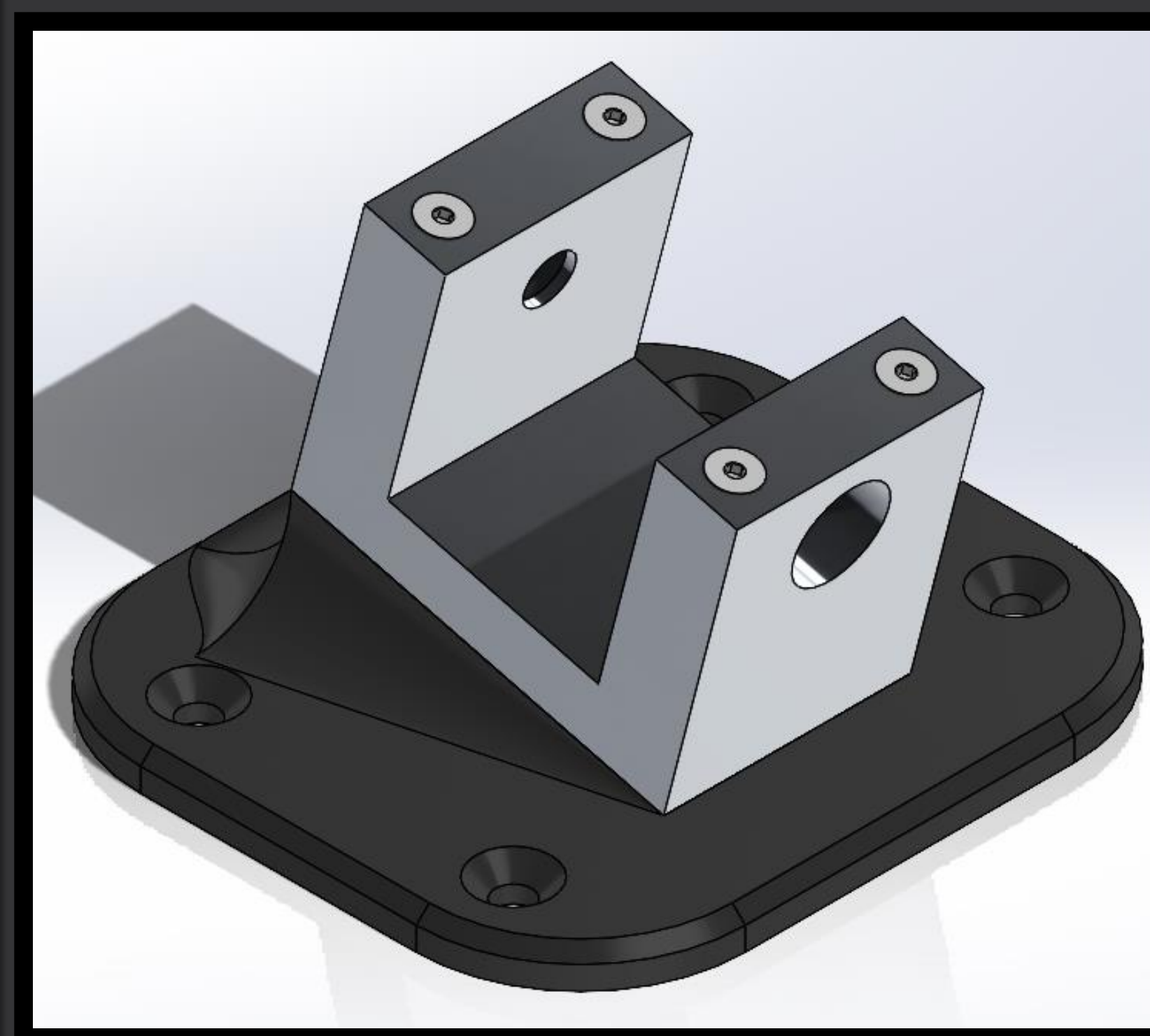
Link 12 and Face mount



Adjustable Thumb Piece



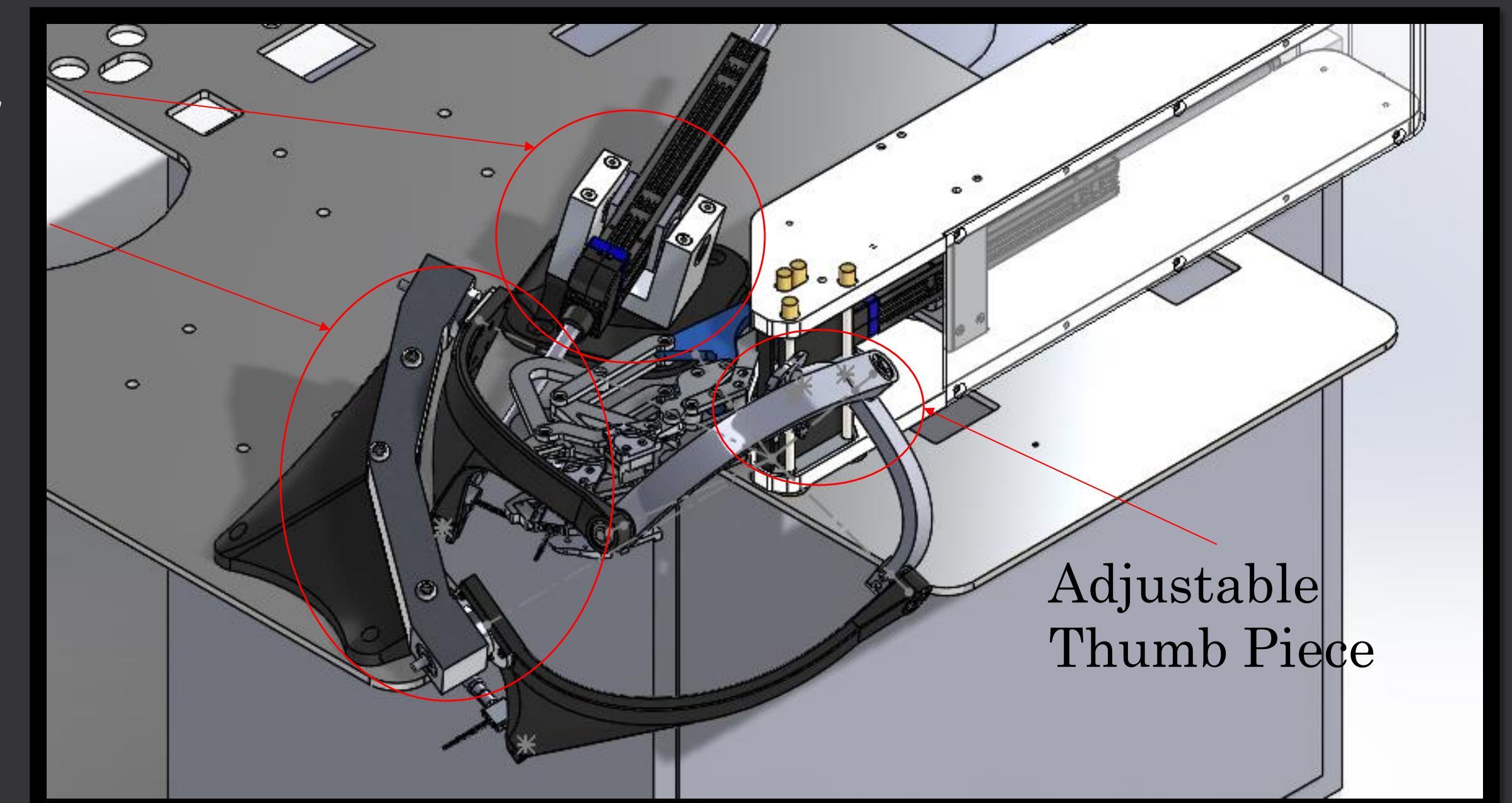
New Fixed Link Design



Actuator Mounts

Actuator Mount

Fixed Link



FINGER 2.0

### Validation

Fixed Link:

- Bolt hole alignment with new baseplate
- No deflection in machined part when in use
- Bearing axes line up with common vertex

Thumb Size Adjustment:

- Matlab Model
  - Track Thumb piece for different sizes and follow them in Solidworks Model

Links:

- Deflection tests
  - Hang weights off end of different infill percent links

### Summary, Conclusion, Recommendations

- Working on getting all the 3D parts printed for the left side
- U of I machine shop building fixed link and actuator mounts
- Vish working on completing code and making all actuators move with each other
- Sending to California when completed

### Acknowledgments

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Mentors:

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- Jacob Brower