

# Walking Cane Project Presentation

PROCTECH 4MS3: Manufacturing Technologies

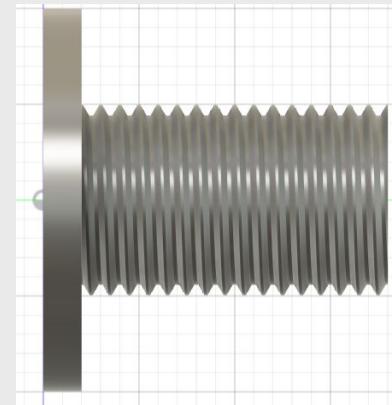
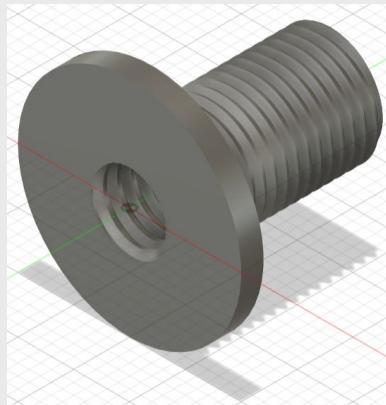
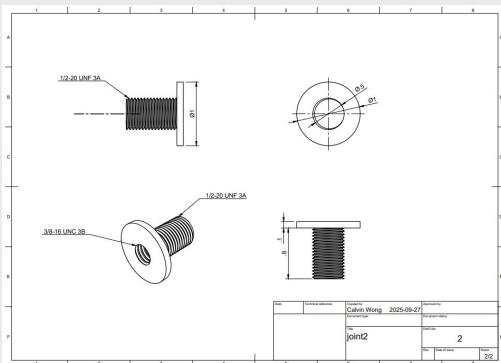
Calvin Wong, Josh Arboladora, Bradley Tennant, Jack Michie, Derek Koppelaar

**Today's agenda**

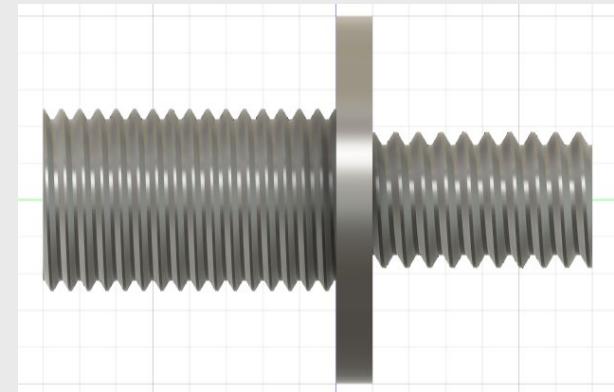
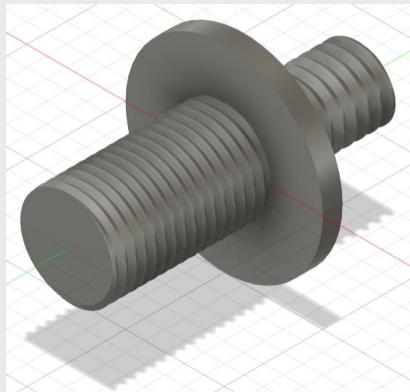
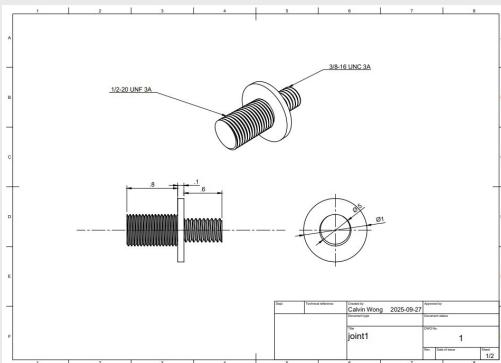
- Initial Design and Lessons Learned
- New Design
- Simulation Results
- CAPP
- Assembly
- Future Recommendations

# Initial Design

## First Joint:

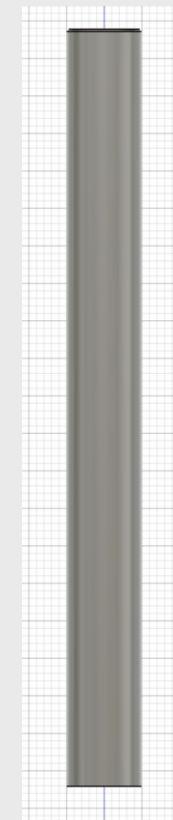
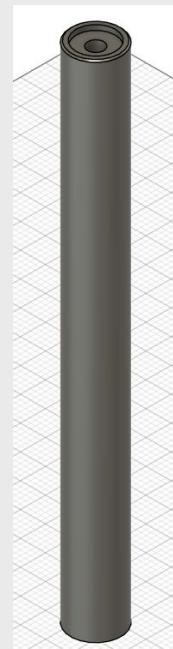
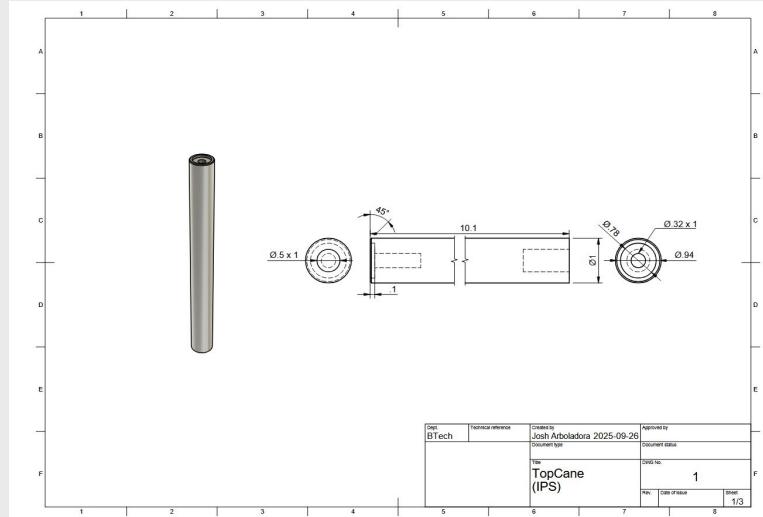


## Second Joint:



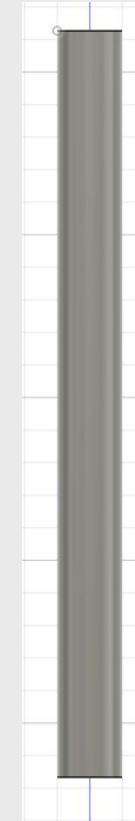
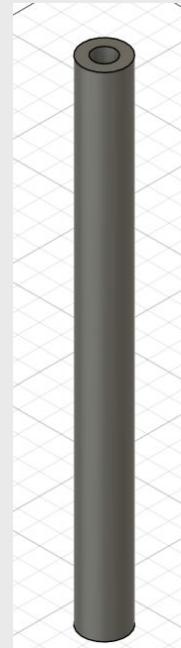
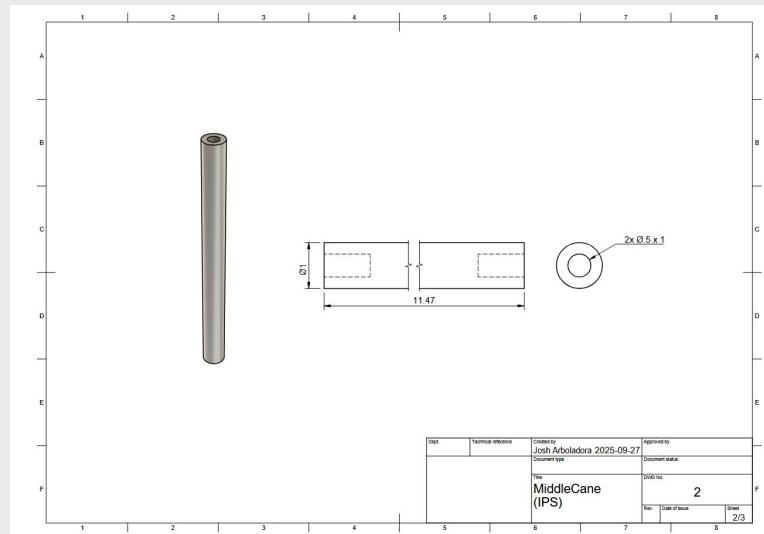
# Initial Design

## Top Shaft:



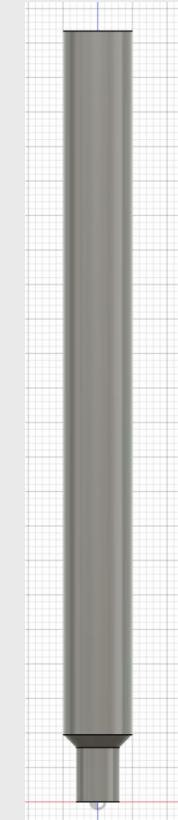
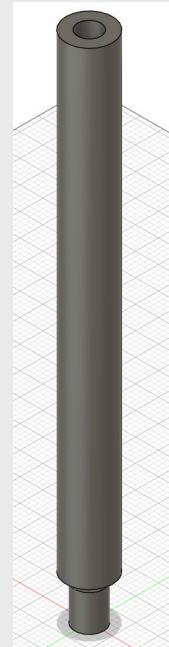
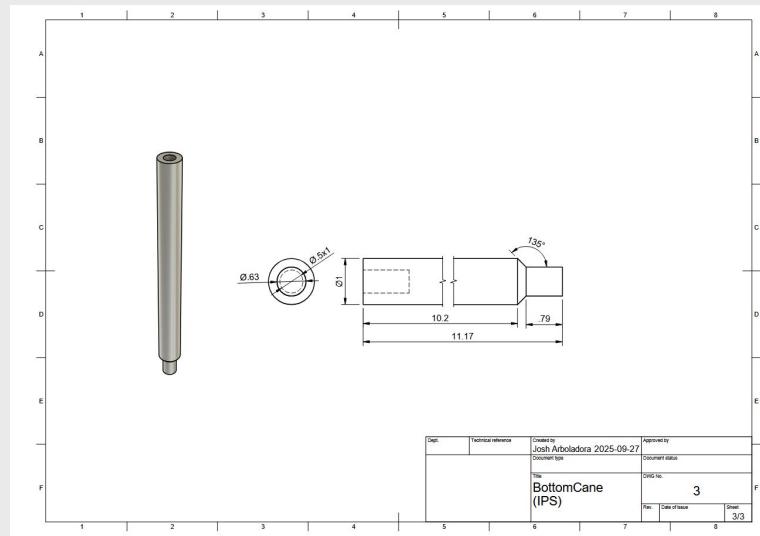
# Initial Design

## Middle Shaft:



# Initial Design

## Bottom Shaft:





# Lessons Learned

1

Assume for worst case scenario of 300 kg

2

Buckling factor

3

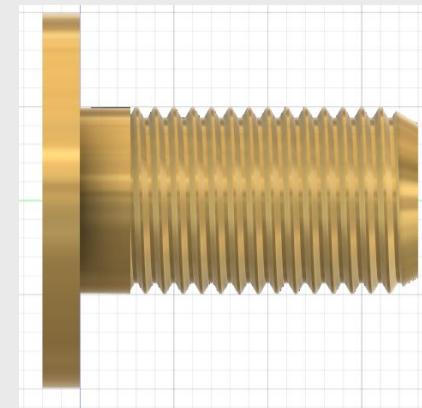
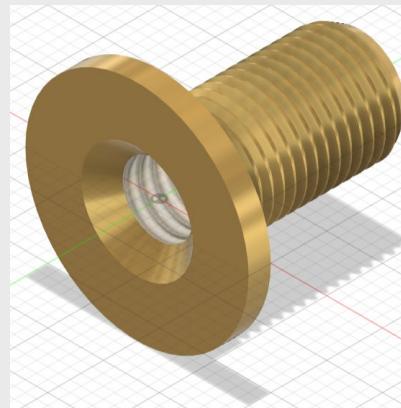
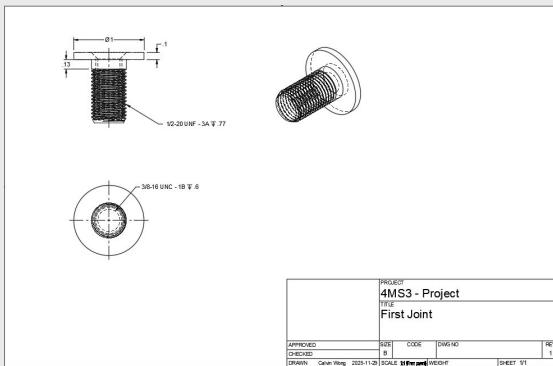
Machine time

4

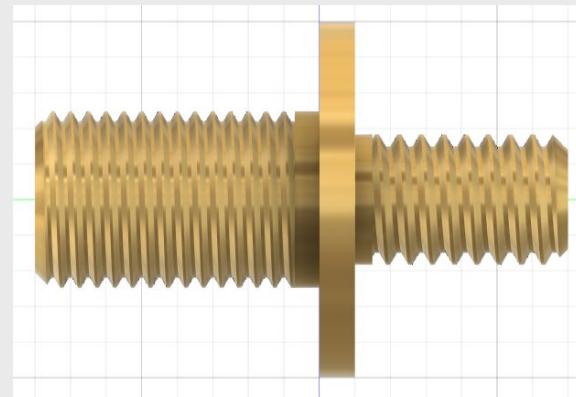
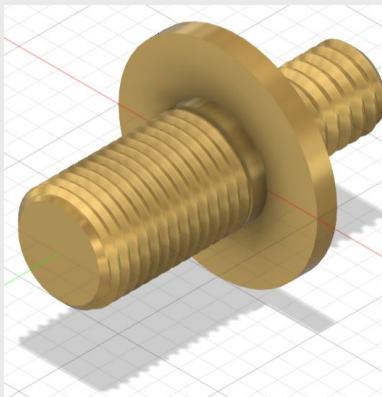
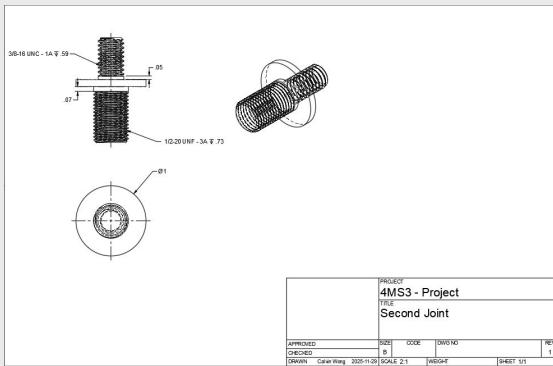
Incorrect joints modelling

# New Design

## First Joint:

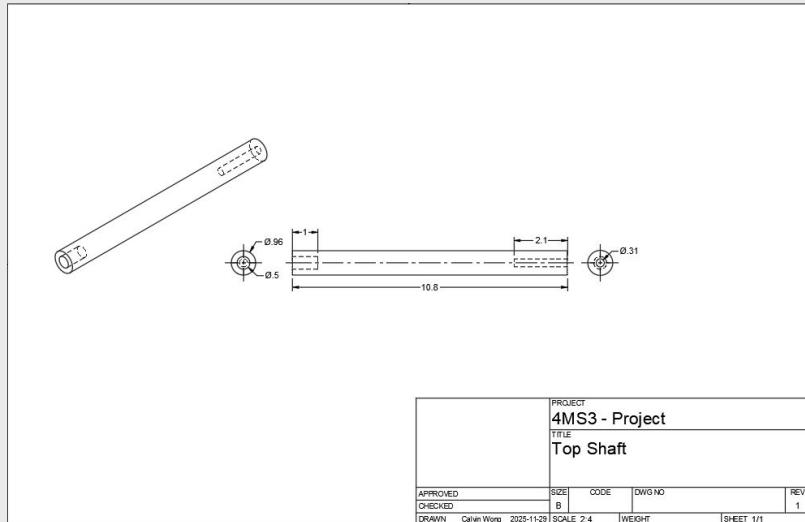


## Second Joint:



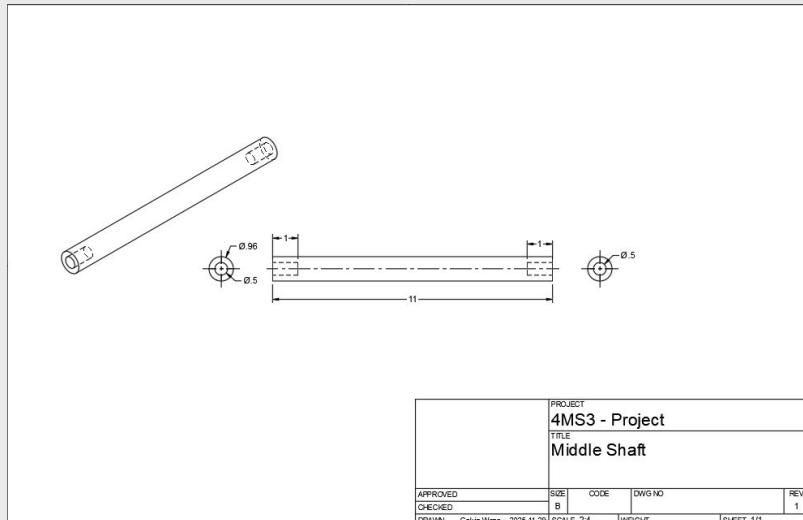
# New Design

## Top Shaft:



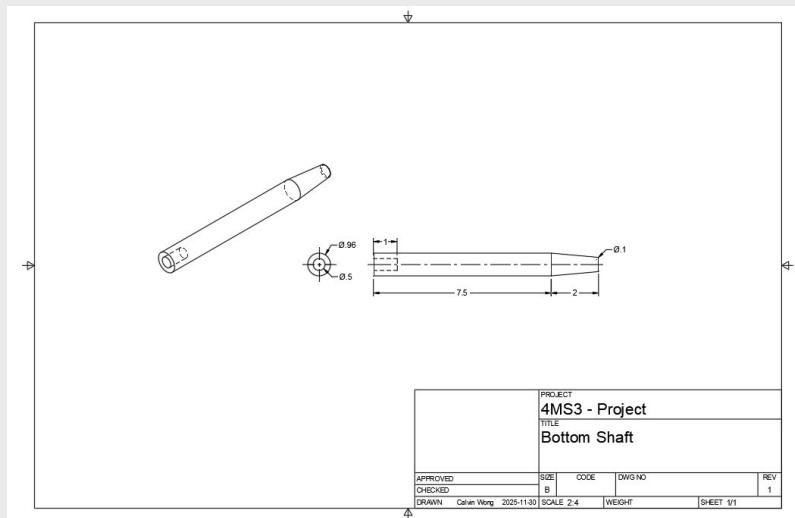
# New Design

## Middle Shaft:



# New Design

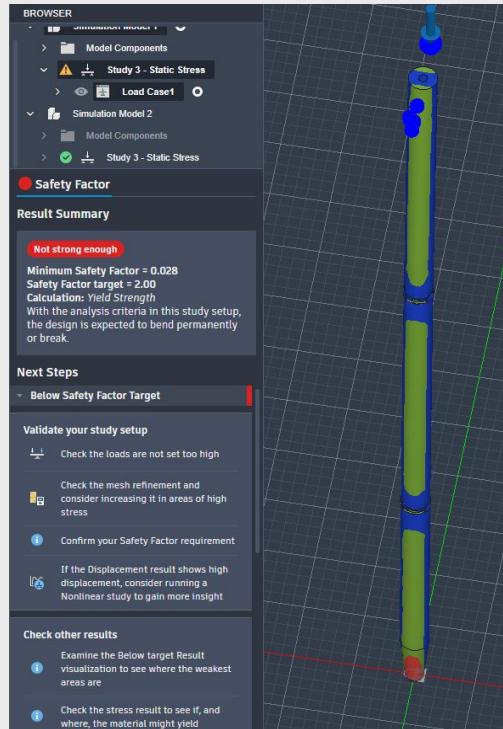
## Bottom Shaft:





# Simulation Results

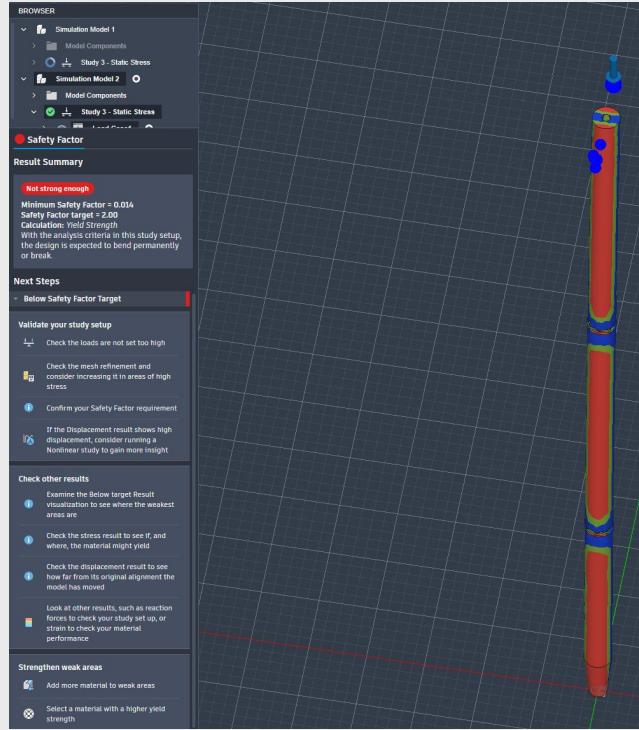
Static Force: 330 lbf





# Simulation Results

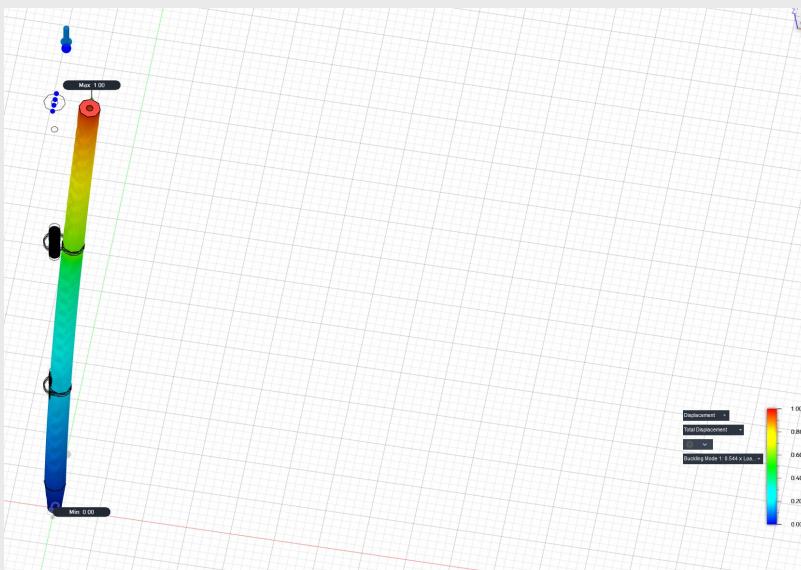
Static Force: 622 lbf



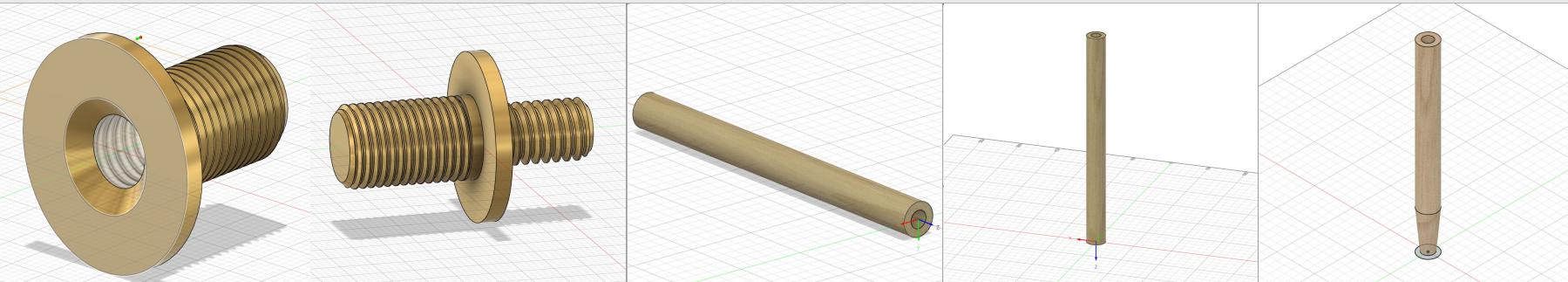


# Simulation Results

Buckling Force: 573 lbf



# CAPP



## First Joint

### **Setup 1**

- 1 - Facing
- 2 - Turning Roughing
- 3 - Turning Finishing
- 4 - Tapping / Drilling
- 5 - Internal Threading
- 6 - Turning grooving

### **Setup 2**

- 1 - Facing
- 2 - Turning Roughing
- 3 - Turning Finishing
- 4 - Threading

## Second Joint

### **Setup 1**

- 1 - Facing
- 2 - Turning Roughing
- 3 - Turning Finishing
- 4 - External threading
- 5 - Turning grooving

### **Setup 2**

- 1 - Facing
- 2 - Turning roughing
- 3 - External threading

## Top Shaft

### **Setup 1**

- 1 - Facing
- 2 - Turning roughing
- 3 - Turning finishing
- 4 - Tapping/drilling
- 5 - Turning grooving

### **Setup 2**

- 1 - Facing
- 2 - Tapping/drilling

## Middle Shaft

### **Setup 1:**

- 1 - Facing
- 2 - Tapping/drilling
- 3 - Turning roughing
- 4 - Turning finishing
- 5 - Turning grooving

### **Setup 2**

- 1 - Facing
- 2 - Tapping/drilling

## Bottom Shaft

### **Setup 1**

- 1 - Facing
- 2 - Tapping/drilling
- 3 - Turning roughing
- 4 - Turning finishing
- 5 - Turning grooving

### **Setup 2**

- 1 - Facing
- 2 - Turning roughing
- 3 - Turning finishing

# Assembly

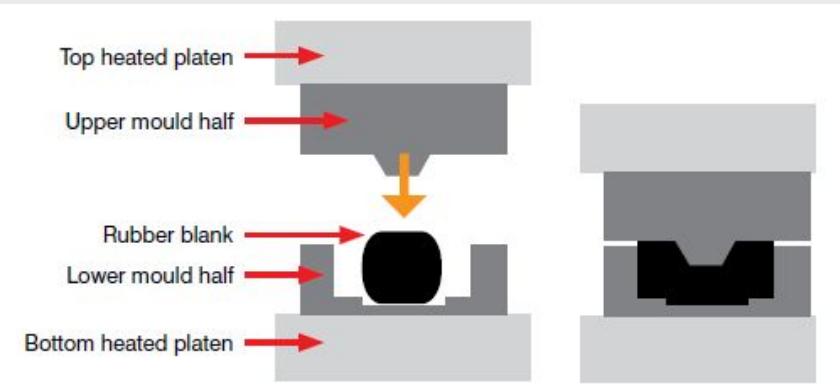




# Cane Foot



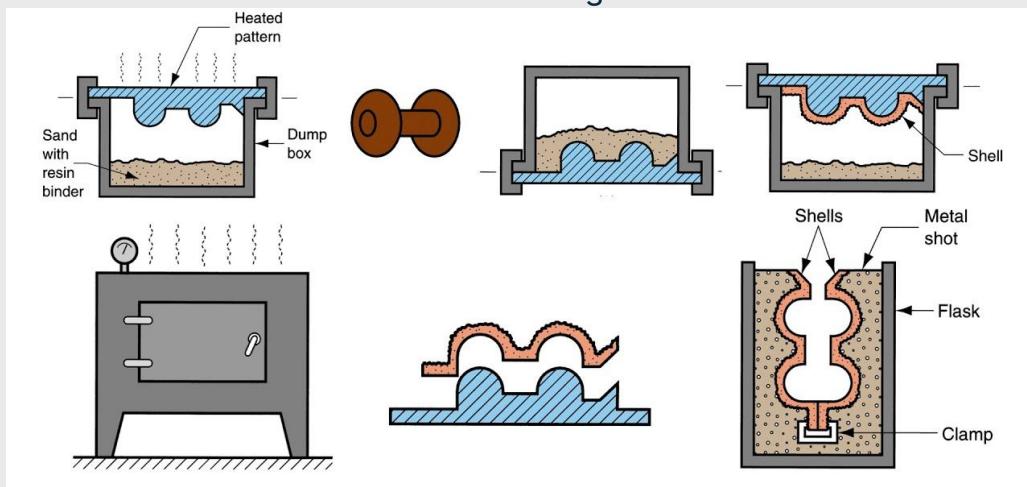
Compression Molding





# Cane Handle

Shell Molding





# Future Recommendations

<b>Field Testing and Validation</b>	<p>Future validation should include:</p> <ul style="list-style-type: none"><li>• Performing drop tests and lateral stress tests on each wooden section.</li><li>• Conducting user trials with participants of varying weights and heights.</li></ul>
<b>Enhanced User Features</b>	<p>Future versions could incorporate:</p> <ul style="list-style-type: none"><li>• An ergonomic handle to improve wrist comfort.</li><li>• Adjustable height via telescoping or folding segments.</li><li>• An optional quad-foot attachment for increased stability.</li></ul>



# Future Recommendations

## Joint Redesign for Improved Reliability

- Increasing the engagement length at both ends of the joints to reduce shear stress.
- Using a coarser thread pitch on the wood side connector to minimize stripping.
- Adding flats or anti-rotation features to prevent twisting under load.

## Geometry Optimization for Buckling Resistance

The current critical buckling load ( $P_{cr}$ ) is 573.6 lbf. To improve this:

- Slightly increase the outer diameter of the wooden shafts.
- Reduce the distance between joints to shorten individual segments, and increase stiffness.



# Future Recommendations

## Improved Safety Factors via Material Selection

The current wooden shafts have slightly low bending and buckling safety factors. Future iterations could consider:

- Switching to laminated hardwood for higher bending strength.
- Using carbon fiber tubes, which would increase cost but dramatically improve stiffness without adding weight.



# Future Recommendations

## Manufacturing Methods

- Improve the lathe machining process by optimizing feed rates and spindle speeds to achieve smoother surfaces on both the wooden shafts and brass connectors.
- Incorporate better quality control steps using digital measuring tools such as calipers, bore gauges, and thread gauges to verify critical tolerances before assembly.
- Explore additive manufacturing for parts that may be difficult and time consuming to machine conventionally.
- Implement batch based manufacturing to reduce tool changeovers and increase efficiency for larger scale production.

# Thank You For Listening!