

Walking Cane Project Presentation

PROCTECH 4MS3: Manufacturing Technologies

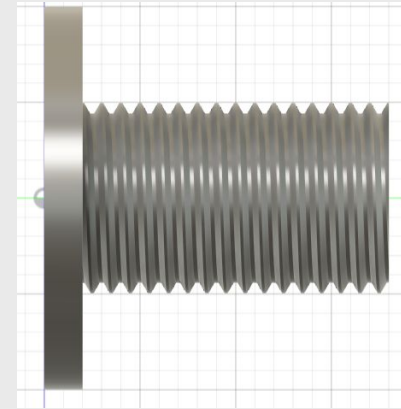
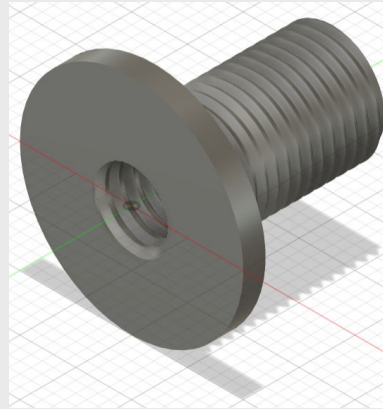
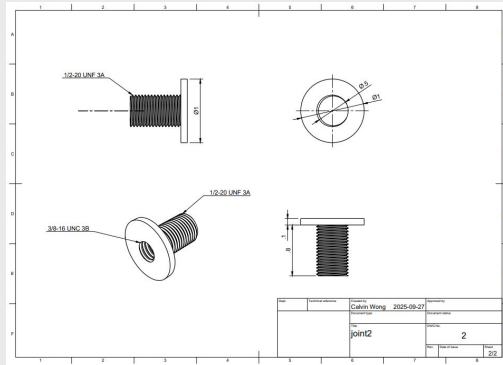
Calvin Wong, Josh Arboladora, Bradley Tennant, Jack Michie, Derek Koppelaar

Today's agenda

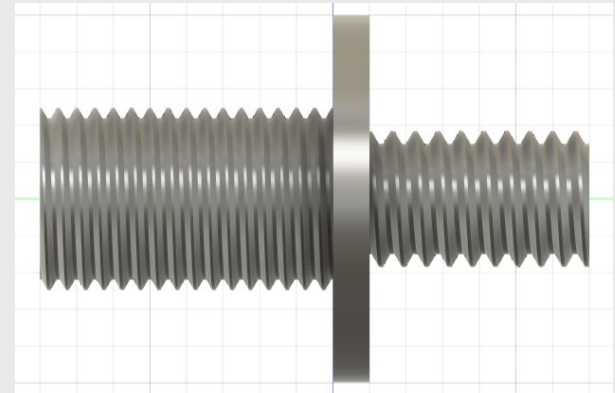
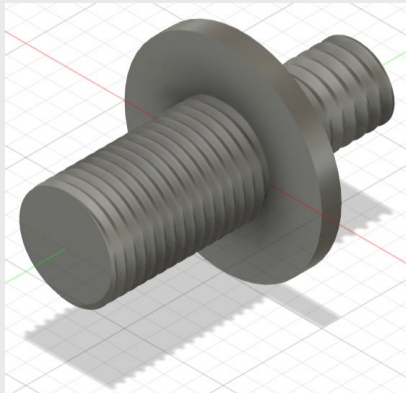
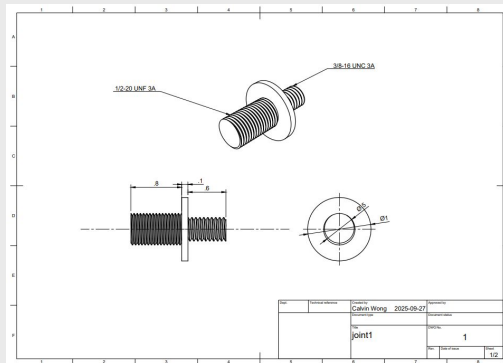
- Initial Design and Lessons Learned
- New Design
- Simulation Results
- CAPP
- Assembly
- Future Recommendations

Initial Design

First Joint:

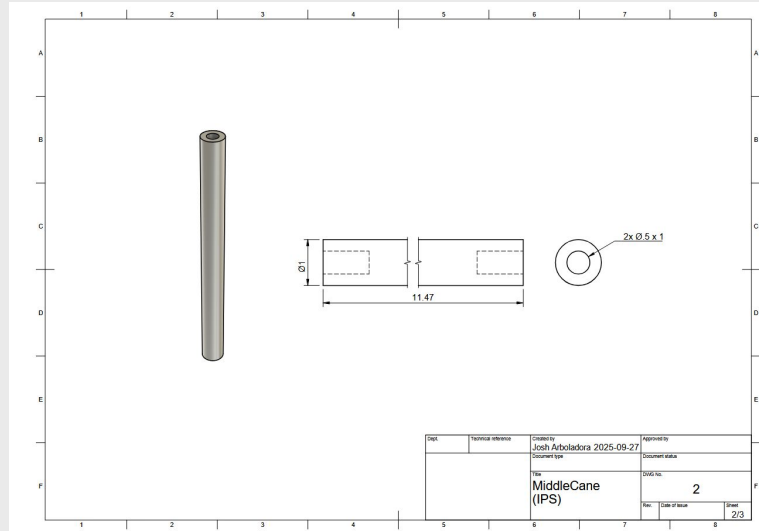


Second Joint:



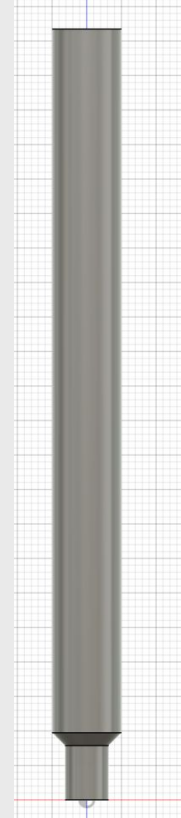
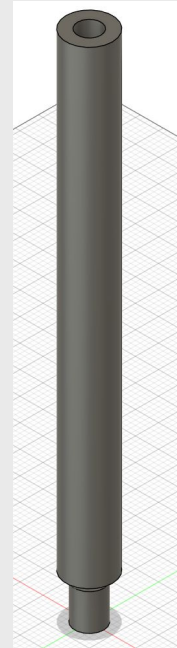
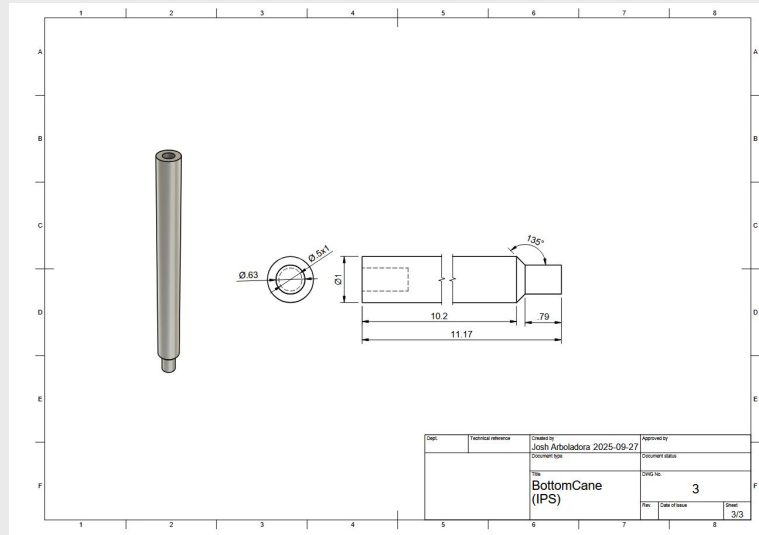
Initial Design

Middle Shaft:



Initial Design

Bottom Shaft:



→ Lessons Learned

1

Assume for
worst case
scenario of
300 kg

2

Buckling
factor

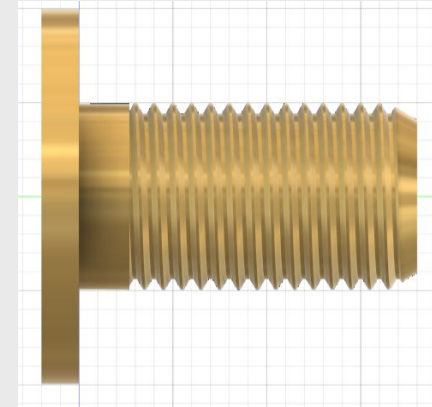
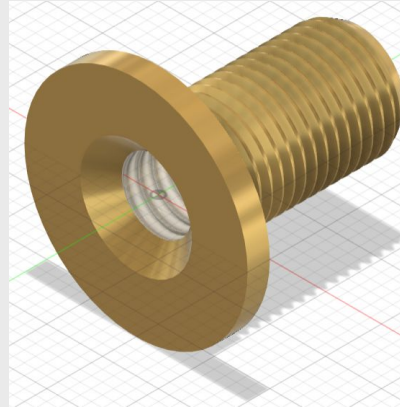
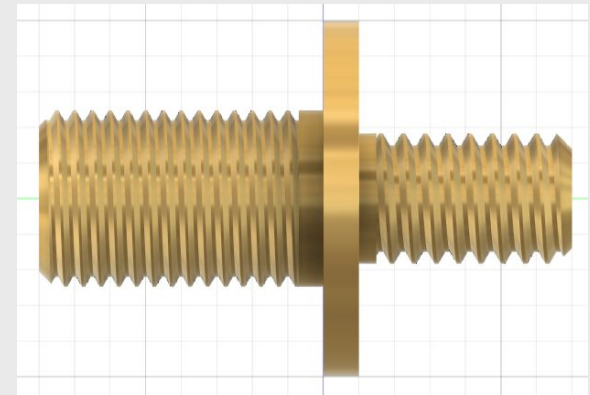
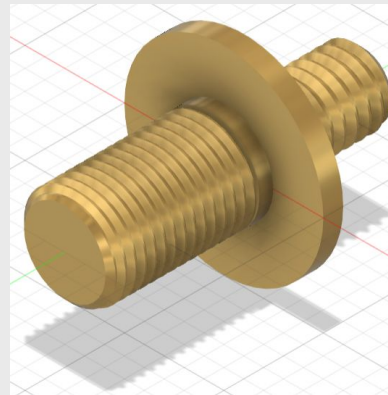
3

Machine time

4

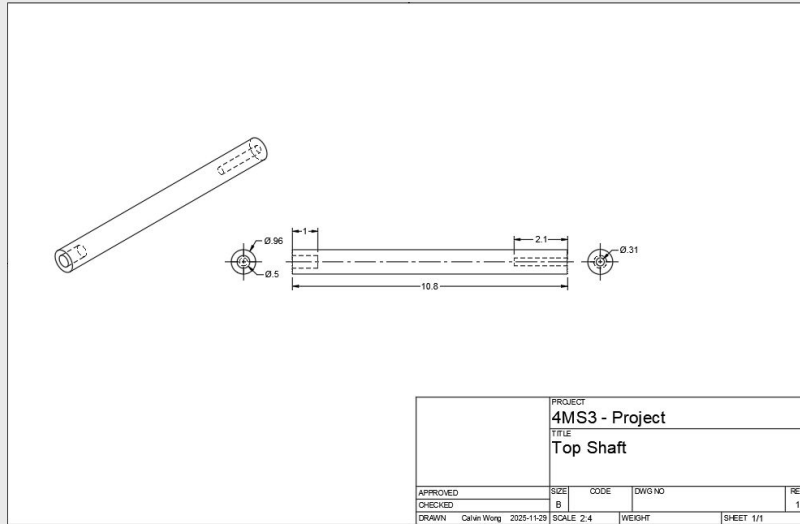
Incorrect
joints
modelling

First Joint:

[illegible]

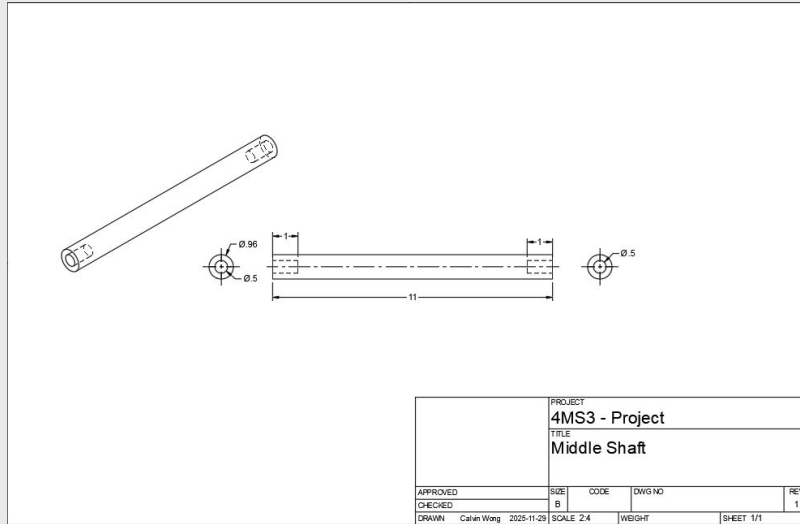
New Design

Top Shaft:



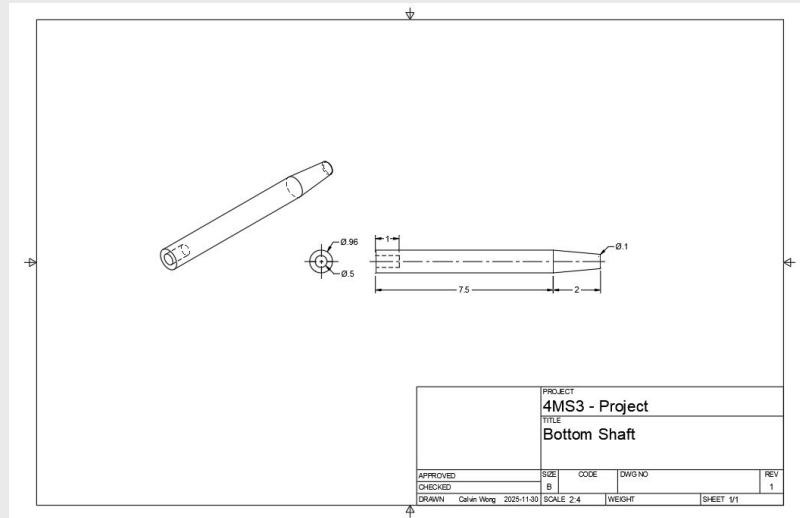
New Design

Middle Shaft:



New Design

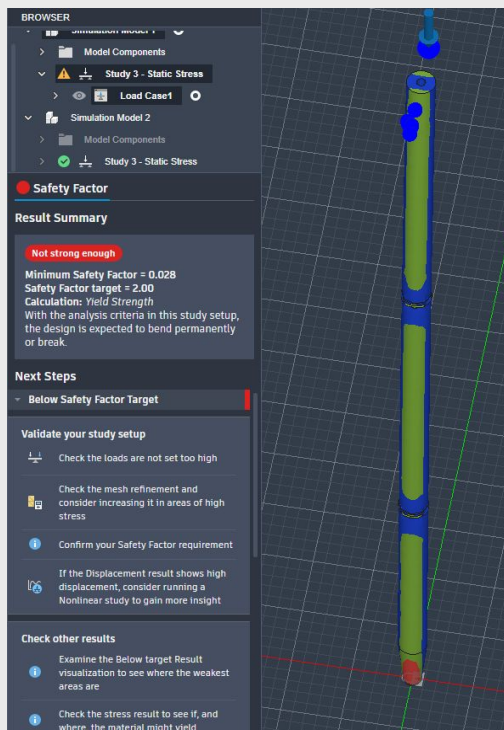
Bottom Shaft:





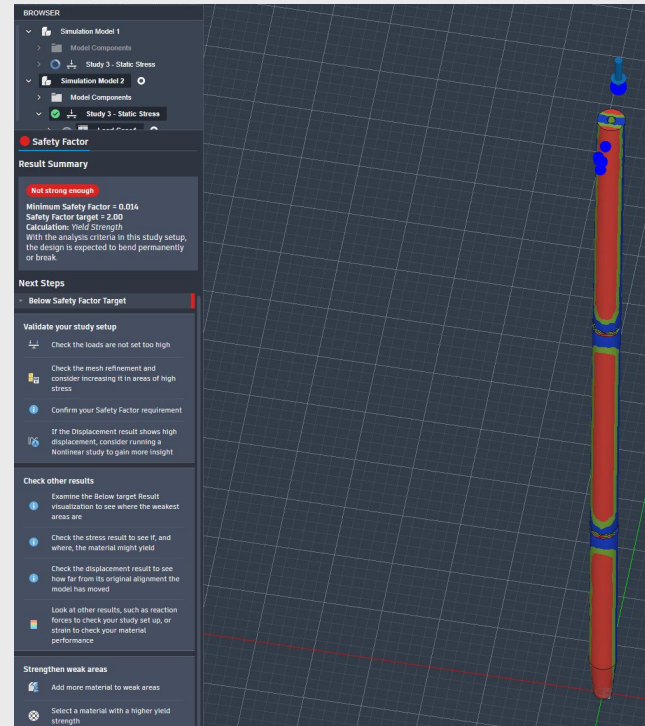
Simulation Results

Static Force: 330 lbf



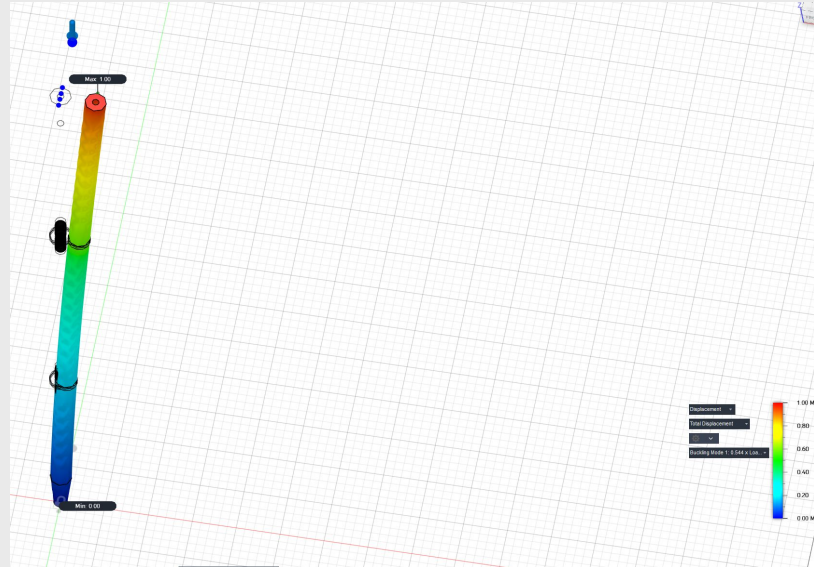
→ Simulation Results

Static Force: 622 lbf

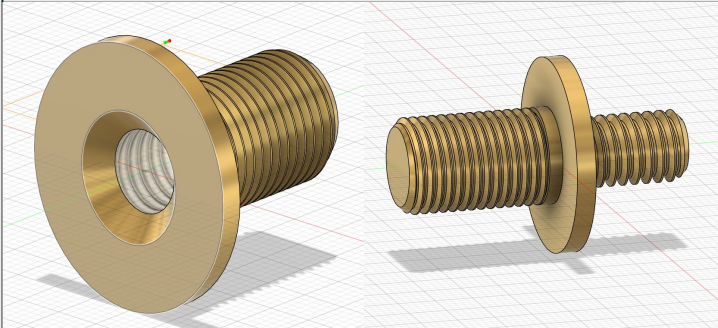


→ Simulation Results

Buckling Force: 573 lbf



CAPP



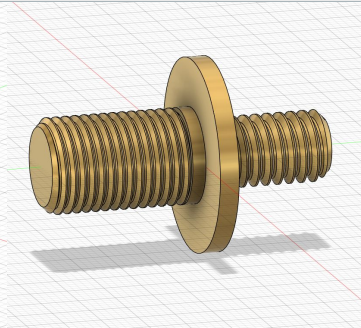
First Joint

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



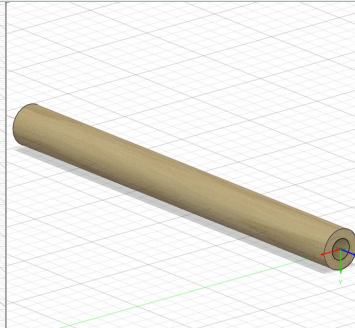
Second Joint

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



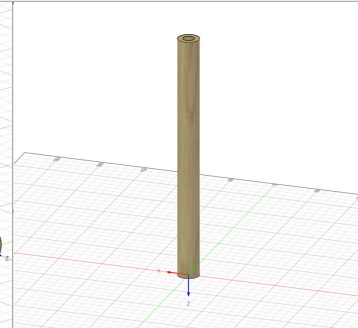
Top Shaft

Setup 1

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

Setup 2

- 1 - Facing
- 2 - Tapping/drilling



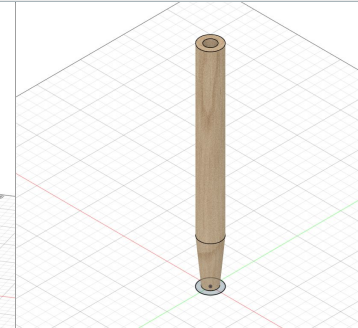
Middle Shaft

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

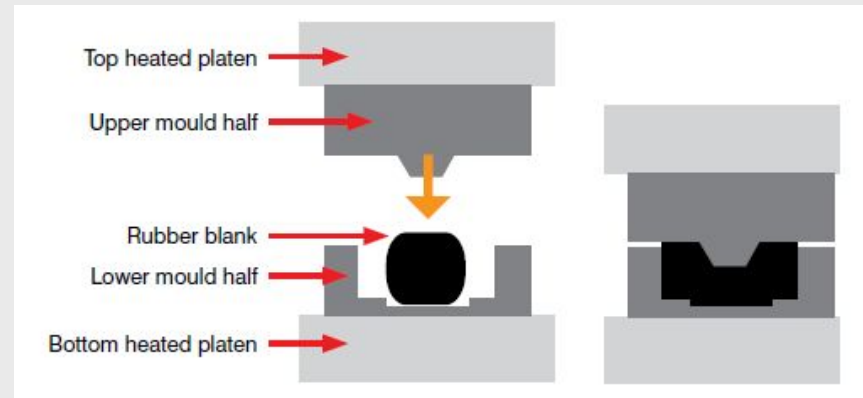




Cane Foot



Compression Molding

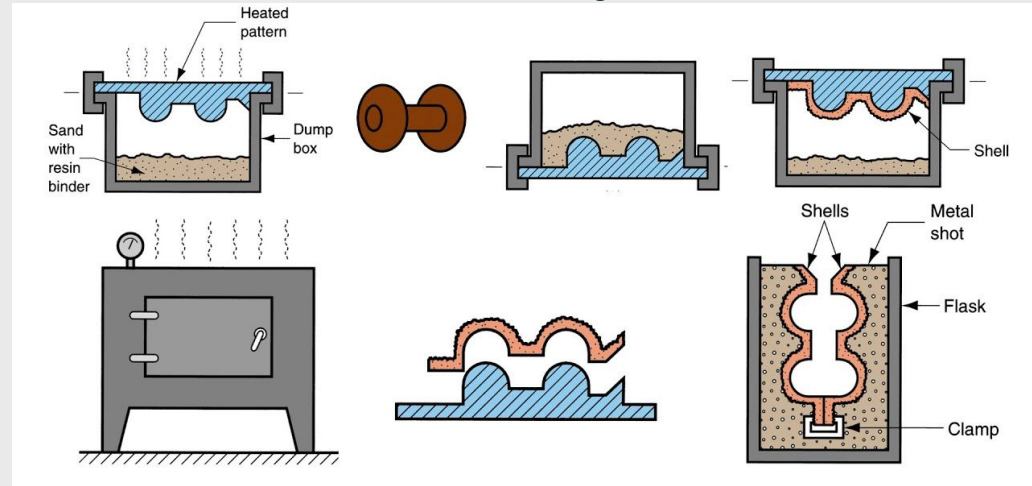




Cane Handle



Shell Molding





Future Recommendations

Field Testing and Validation

Future validation should include:

- Performing drop tests and lateral stress tests on each wooden section.
- Conducting user trials with participants of varying weights and heights.

Enhanced User Features

Future versions could incorporate:

- An ergonomic handle to improve wrist comfort.
- Adjustable height via telescoping or folding segments.
- An optional quad-foot attachment for increased stability.



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!