DEPARTMENT *of* MECHANICAL ENGINEERING

DESIGN DAY

Shelling out innovative ideas!

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SPACE FORCE: The Space Saving Workbench

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ENME 472 – INTEGRATED PRODUCT AND PROCESS DESIGN AND DEVELOPMENT

Objective

Purpose

- To create a full-size workbench that is mobile and collapsible for normal use and easy storage.

Market Need

- Typical full-size workbenches take up a considerable amount of space which can be better utilized while the workbench is not in use.

Benefits

- Full-size workbench
- Complete folding functionality
- Able to be moved and stored with ease

Competitive Advantage

- Folding center table top
- Folding auxiliary table tops
- Locking casters
- Comparable strength to a static table

Concept 1	Concept 2	Concept 3
Eccentric action lock	Spring/ball	Barrel Lock
Casters with Locks	Casters with electronic locks	Solid feet
OTS Folding Bracket	Custom Folding bracket	No Support
Strap hinges	Butt hinge	eye-hook
Pine	Extruded 80/20	Pine
Continuous hinge	Door hinge	Continuous hinge
Custom	Quarter	Full Scale
Supports and Back Brace	Telescopic Brace	3 Supports

Final Design

Customer Requirements

- Strength
- Safety
- Cost
- Large enough for various uses
- Small enough to be stored
- Easy to move around

Engineering Characteristics

- Bracket strength
- Caster strength
- Table top surface area
- Folded position width
- Material cost

Calculations

- Max Screw Stress: **26 kpsi**
- Screw Yield Stress: **30 kspi**
- Factor of Safety: **1.13**
- Max Edge Load For Instability: **87.6 lbs**
- Max Uniform Load for Instability: **0.51 psi**

Prototype Components

- Folding and locking brackets
- Swivel and locking casters
- Front and back supports
- Various hinges

Cost Analysis

- Prototype: $250
- Final Product est.: $380

Underside of Center Fold

Isometric View, Unfolded
57”L X 24”W X 27”H

Front View, Folded
15”L X 24”W X 27”H

Prototype & Testing

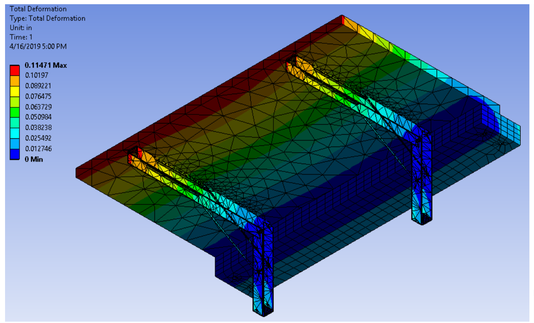
Proof of Concept Prototype

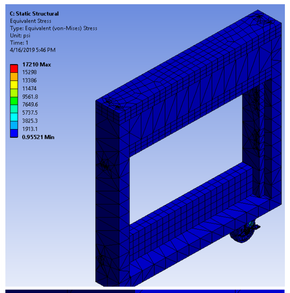
- Center support with a bracket and flap on either side
- Displays tabletop functionality
- Folds and locks into place, as expected

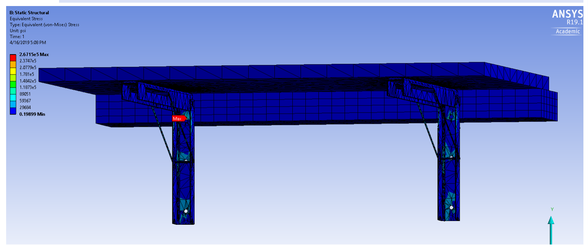
Testing

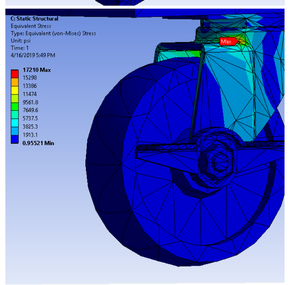
- Center
  - Max Load: **250 lbs.**
  - Max Deflection: **5/16”**
- One Inner Flap
  - Max Load: **210 lbs.**
  - Max Deflection: **1/4”**
- Side Flap
  - Max Load: **150 lbs.**
  - Max Deflection: **3/16”**

Finite Element Analysis (FEA)









Future Work

- Mechanism that allows all four internal brackets to be activated simultaneously
- Upgraded material for the table top
- Larger overall dimensions
- Accessory design implementation, such as electrical outlets, storage, and handles
- Casters that can disengage allowing the workbench to rest solid on the ground
- Additional support in the center for the table top to withstand more weight
- Stronger strap hinge for bottom brace

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