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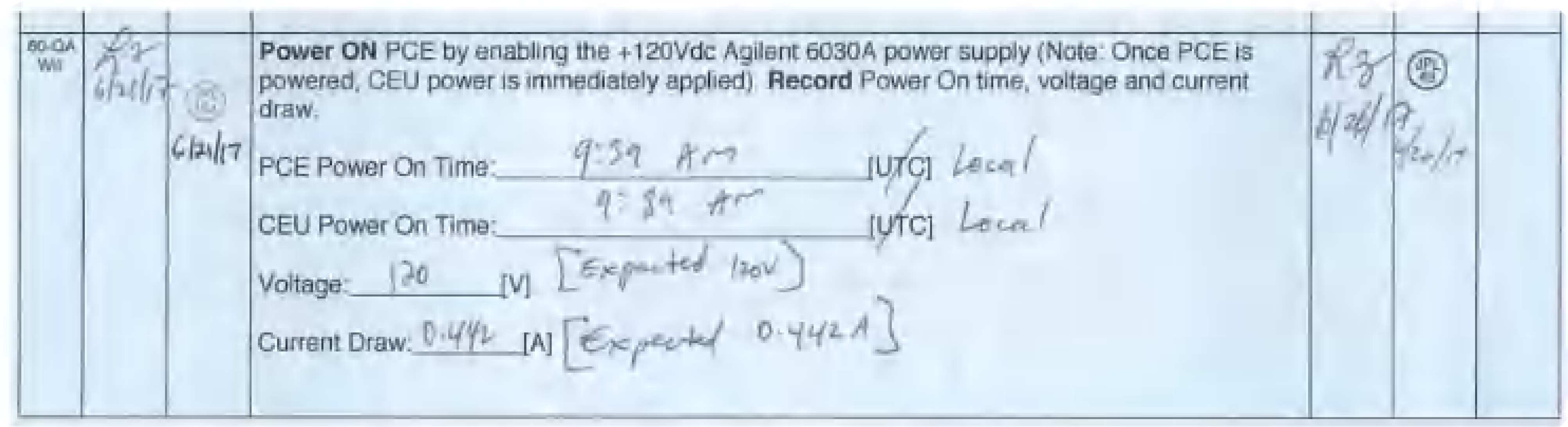
Jet Propulsion Laboratory

Orbiting Carbon Observatory 3

Electrical Engineering Intern


Power ON PCE by enabling the +120Vdc Agilent 6030A power supply (Note: Once PCE is powered, CEU power is immediately applied). **Record** Power On time, voltage and current draw.

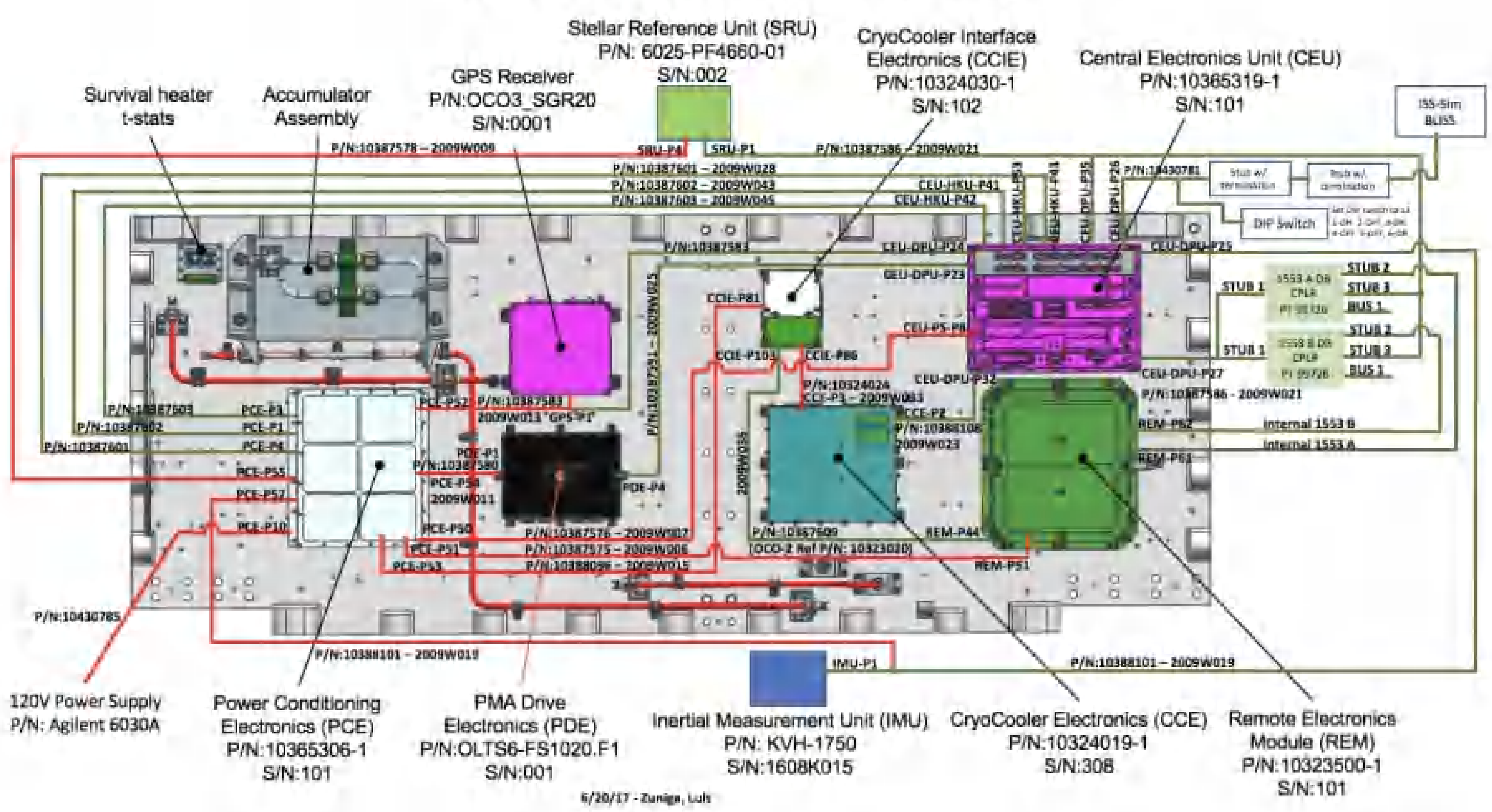
PCE Power On Time: 9:39 Am [UTC] Local

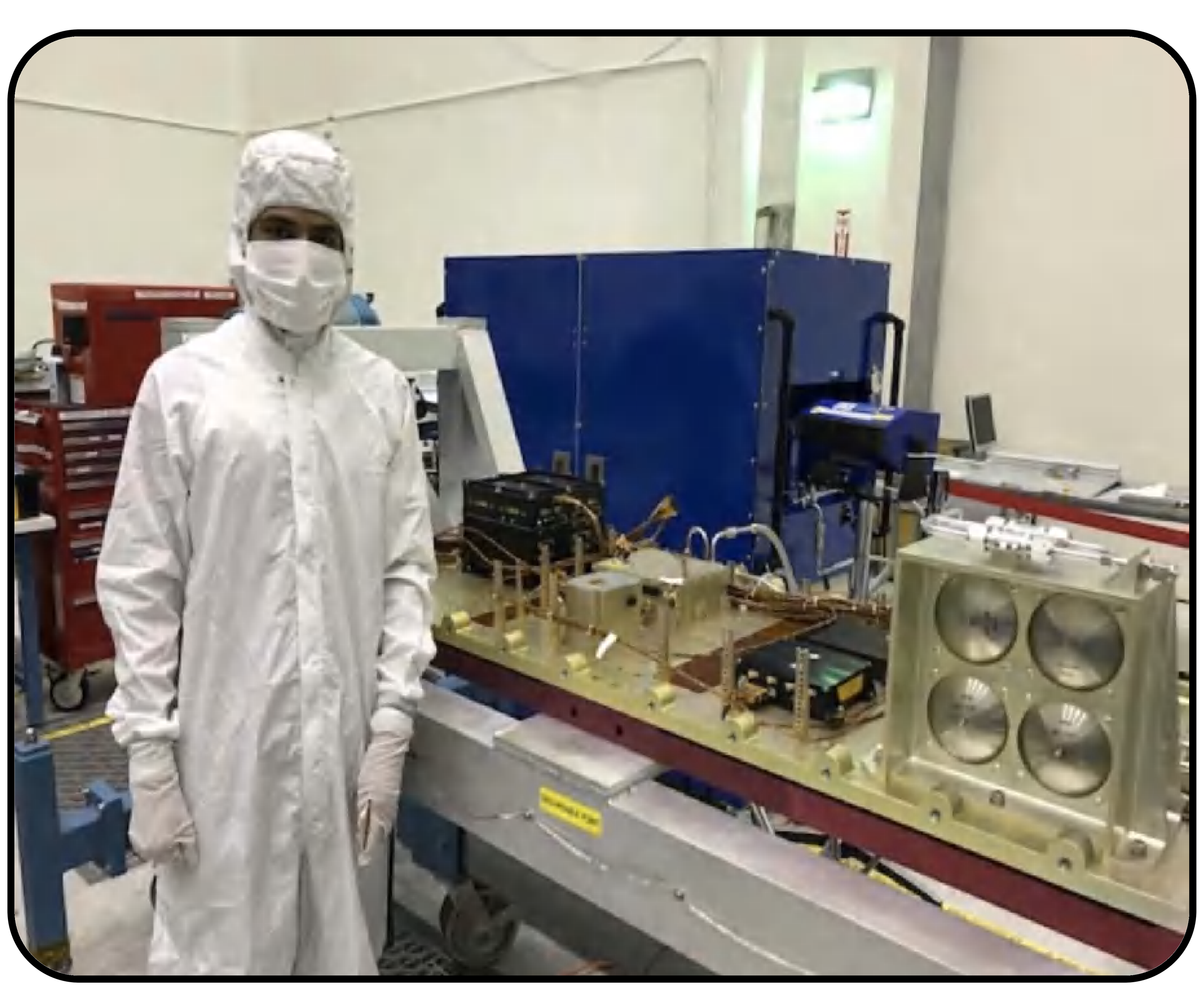
CEU Power On Time: 9:39 Am [UTC] Local

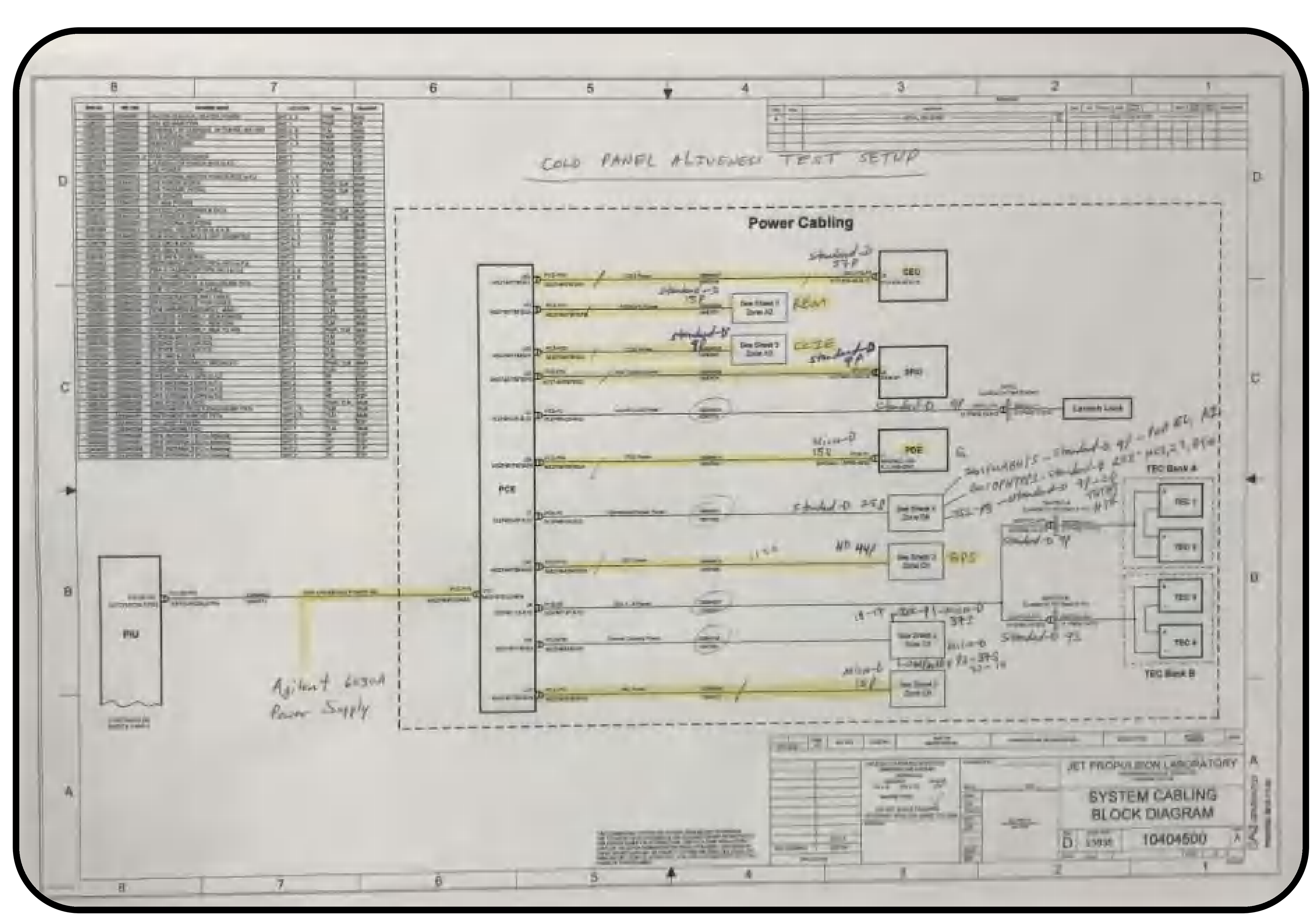
Voltage: 120 [V] [Expected 120V]

Current Draw: 0.442 [A] [Expected 0.442A]

Cold Panel Aliveness Test Setup







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Space Wrench | ME 127: DESIGN FOR ADDITIVE MANUFACTURING

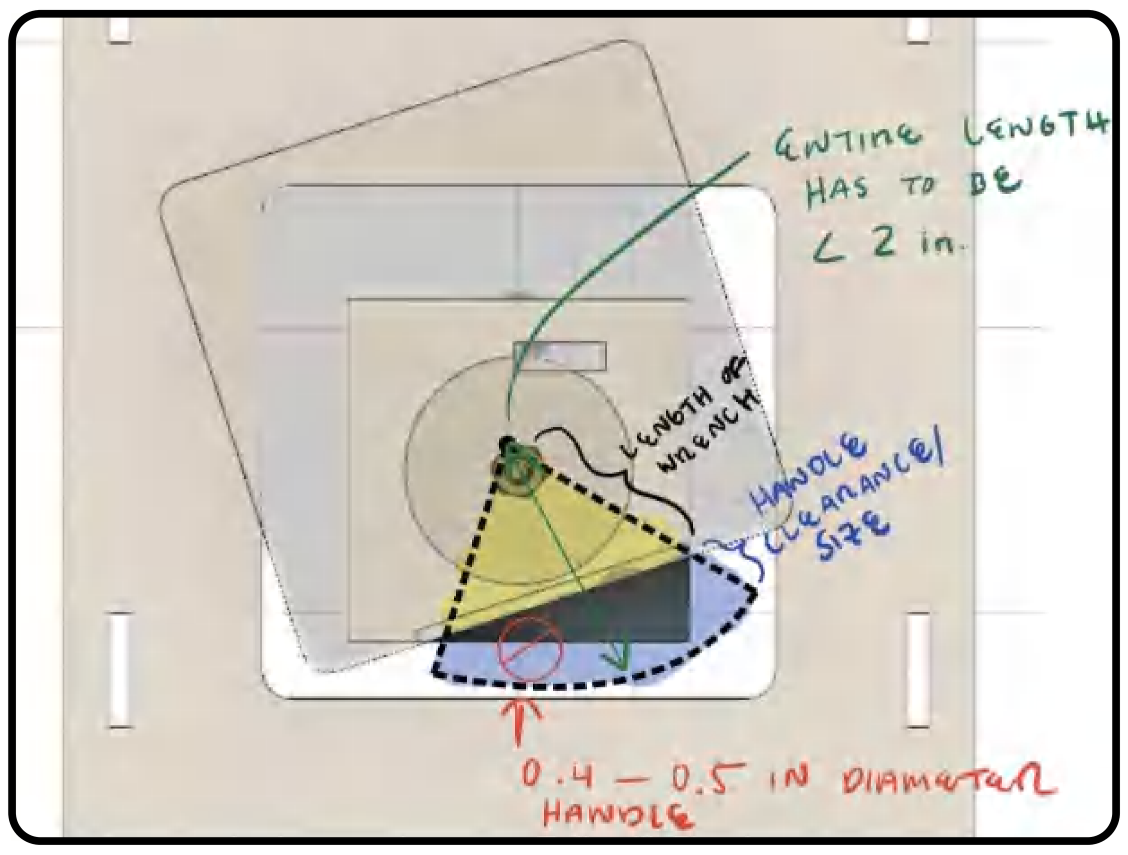
Using Engineering To Create A Space Wrench For Optimal Nut Tightening Efficiency

Design Goals

Create a wrench designed for use with Space Gloves for efficient tightening of a nut in a test rig within one minute

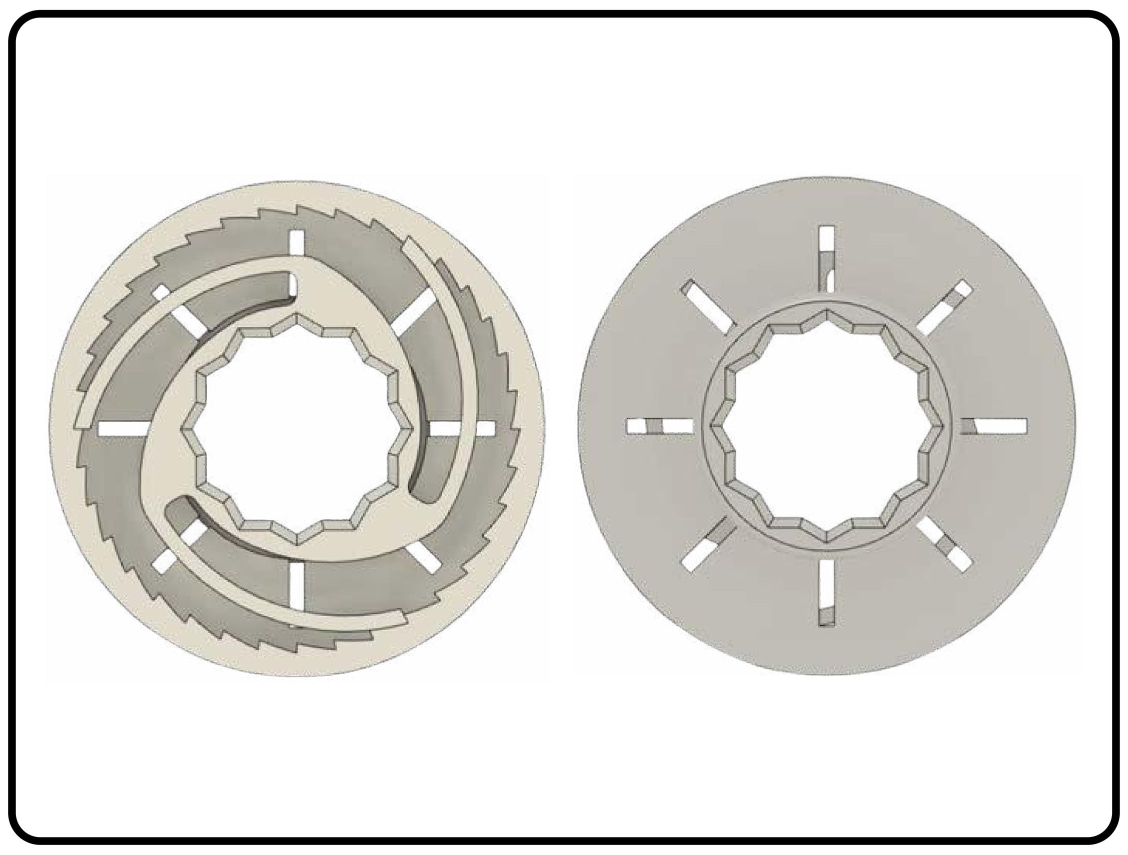
Lessons

Enhanced rapid prototyping, advanced ratchet system manufacturing, adapting designs through generative methods, and ergonomic functionality



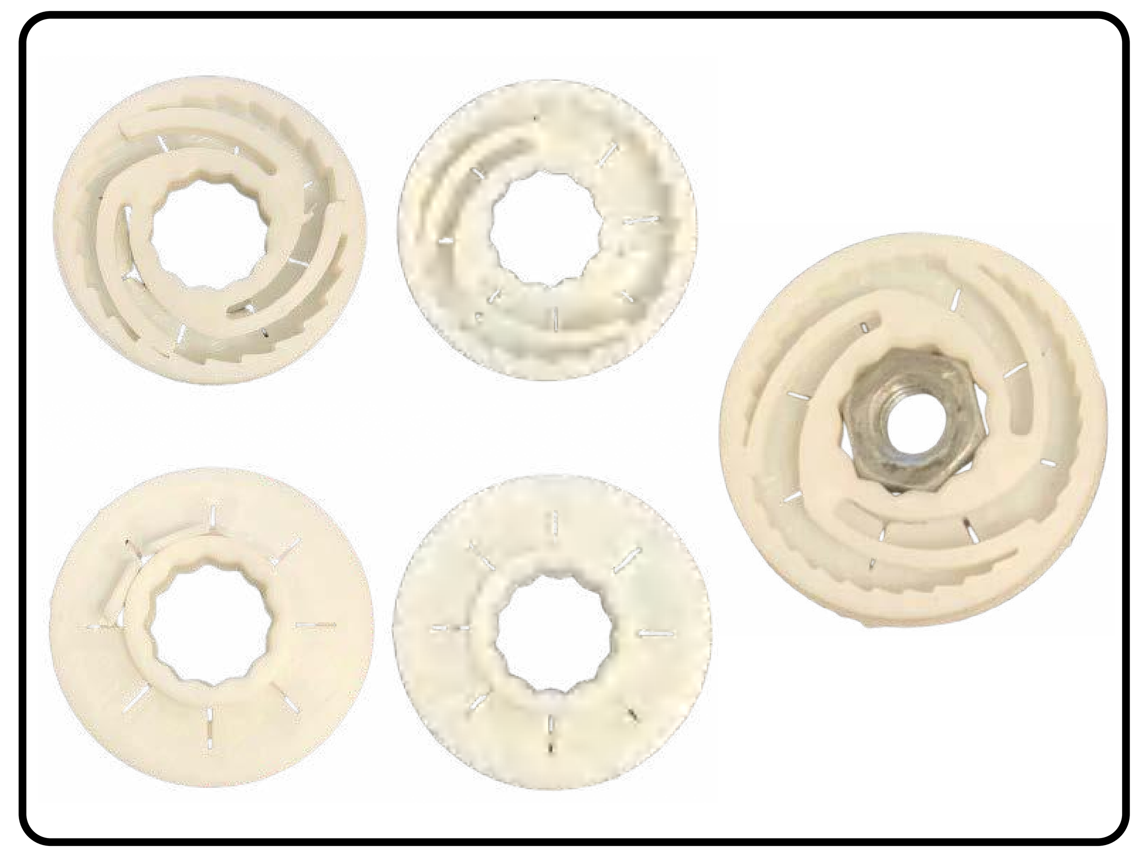
Analysis for Final Design

The wrench was designed for quick, easy nut tightening within the rig, using approximate dimensions.



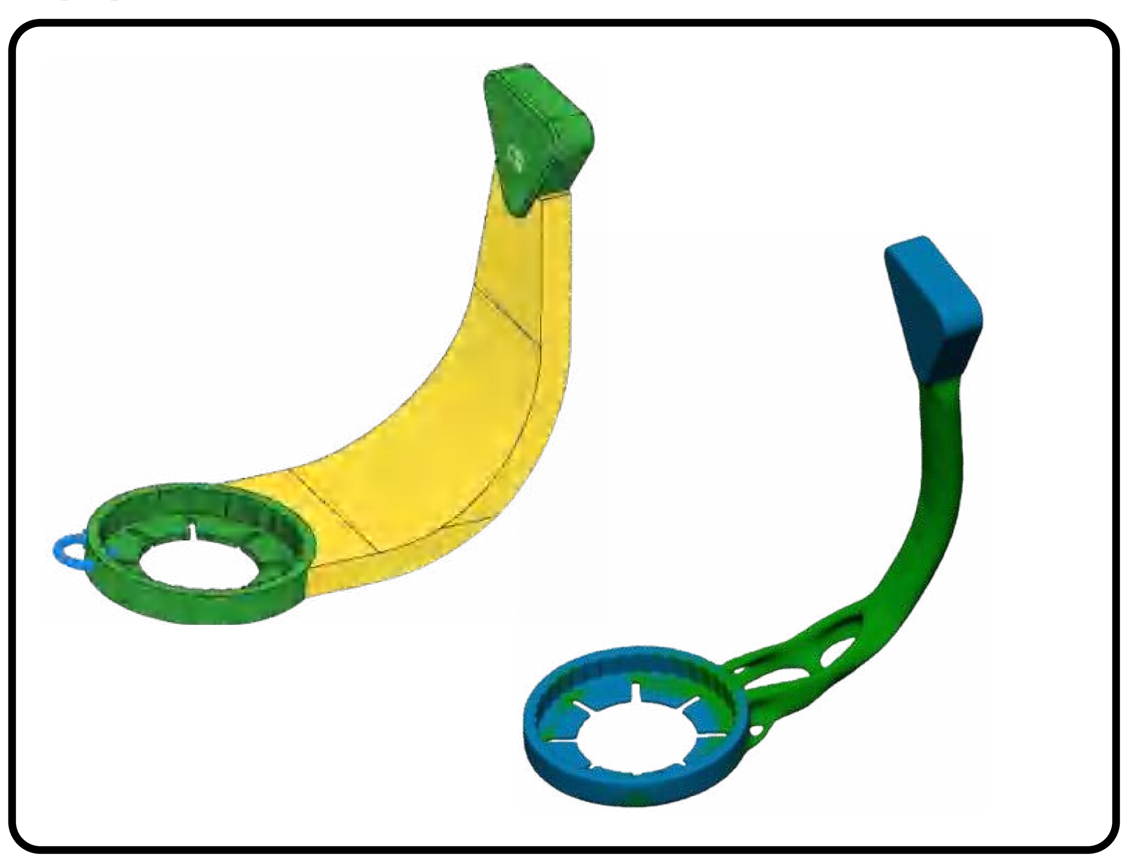
Ratchet Design

Features a 36-teeth ratchet with a 10-degree engagement angle for speed, designed for additive manufacturing.



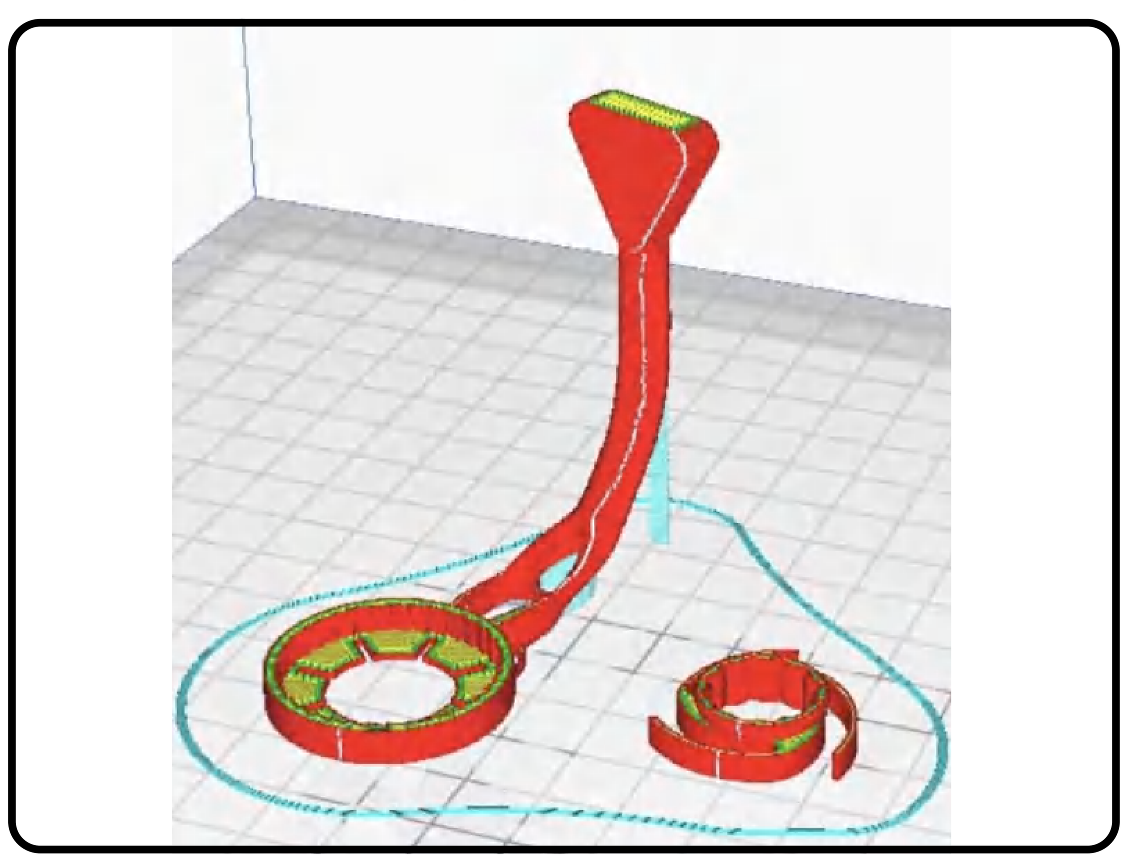
3D Print Ratchet Prototypes

Adjusted print settings resolved issues with snap-fit tension and tooth brittleness, achieving an ideal fit.



Generative Design Simulation

Ergonomic improvements and mass reduction were made for space glove use



3D Print Prototype on Ender

Final printed with 60% infill, 0.12 mm line width, and supports that did not affect functionality.

Final Results

Set a class record by tightening the preload in 5 seconds. Won Best Design.

Processes
- 3D Printing
- Design Ideation
- FBD Analysis
- Stress Analysis

Materials
- PLA

Software
- Fusion360
- Cura

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Candy Dispenser | ME 102: FOUNDATIONS OF PRODUCT REALIZATION

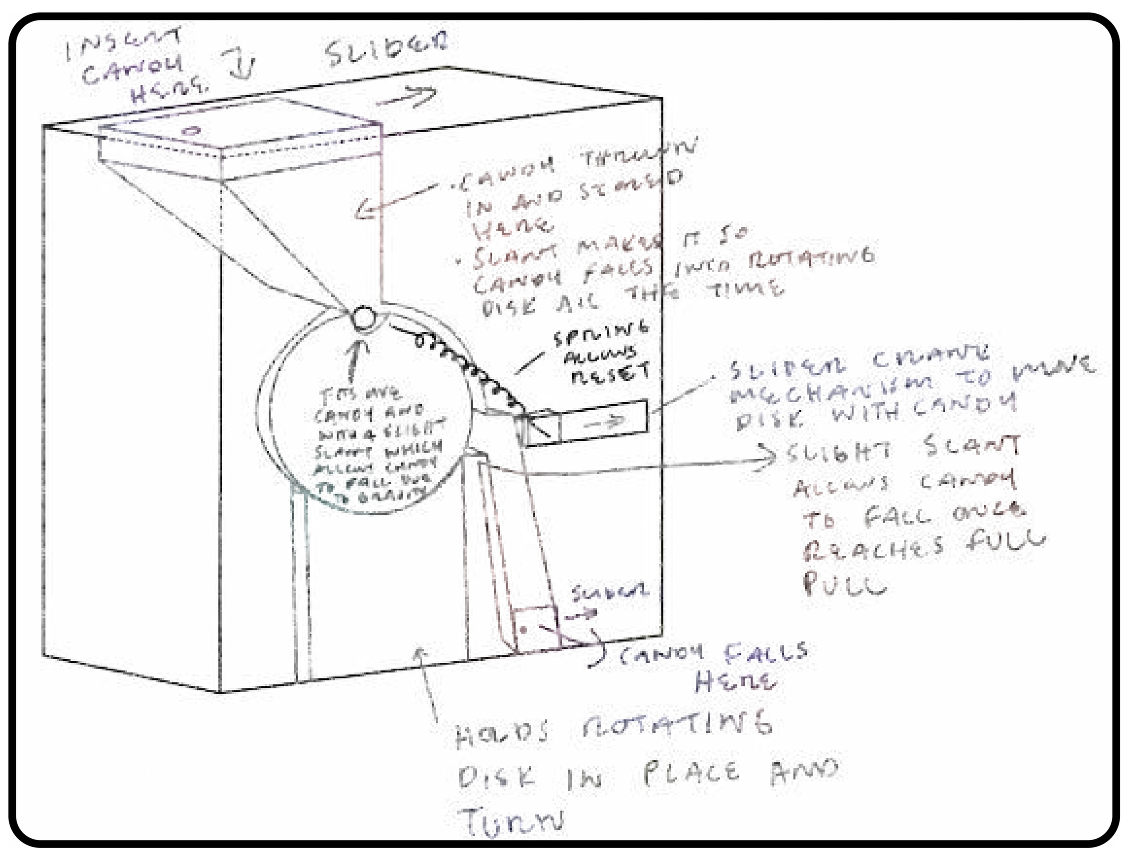
Using Engineering To Create A Candy Dispenser

Design Goals

Develop a one-hand operable candy dispenser, capable of holding and reloading 20 candies.

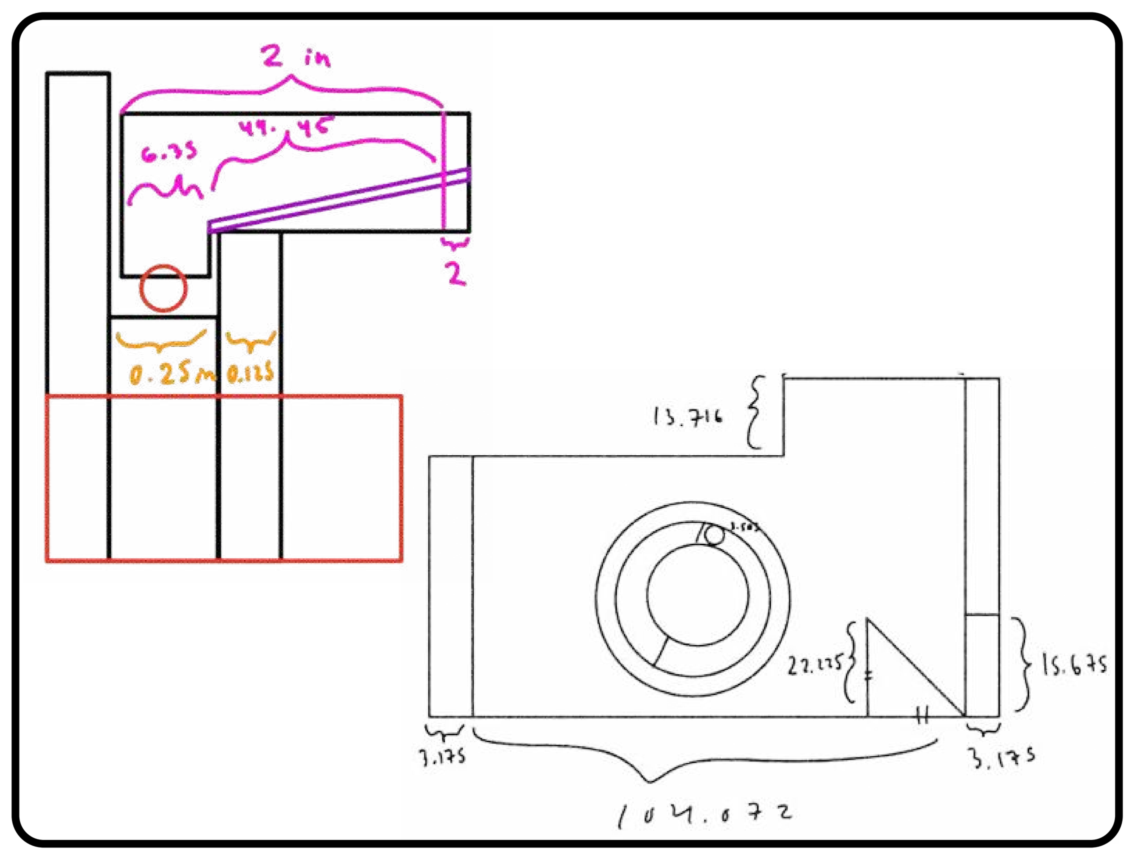
Lessons

Accelerated final design decisions and pre-planned hardware integration were crucial in achieving functional candy dispensation .



Original Design Interpretation

Envisioned a compact holder for candies, preventing immediate dispensation yet ensuring containment.



Refined Design

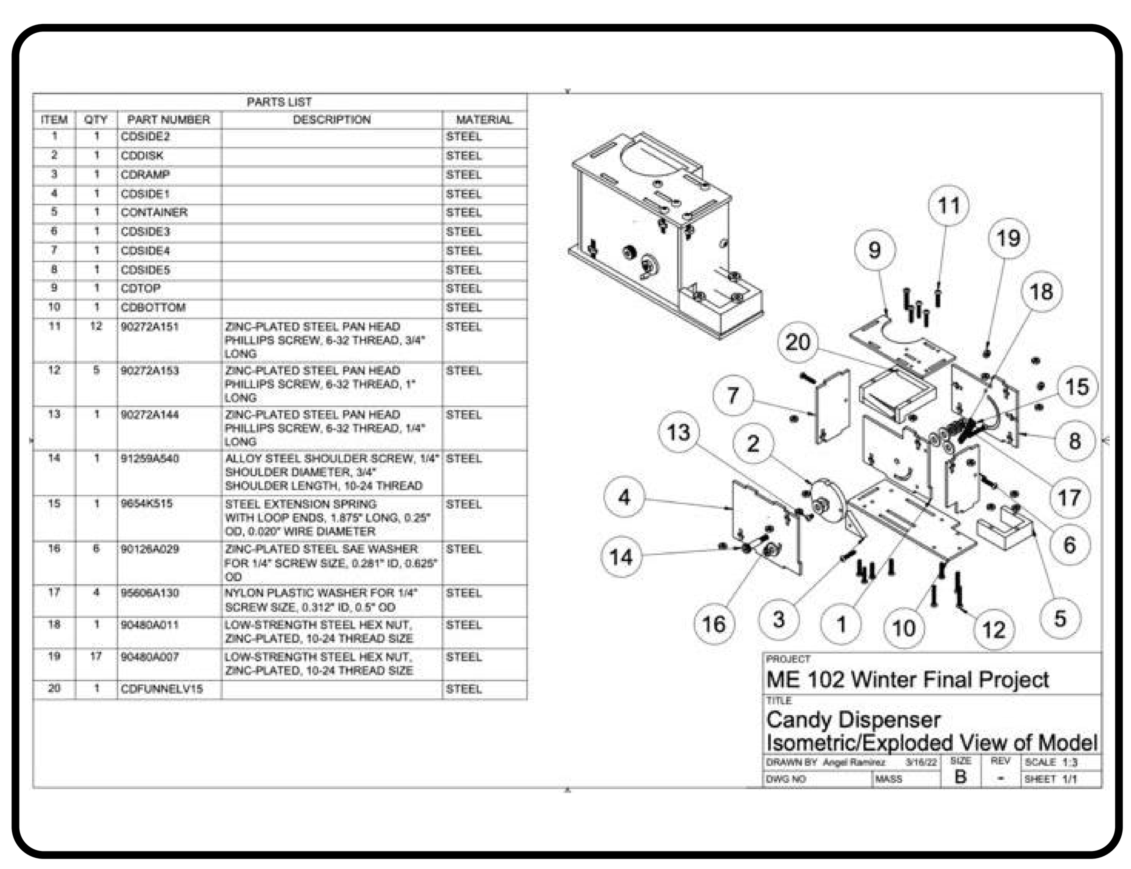
Integrated a spring-loaded funnel for reloading, with candies dispensed through a disk to a container.

Rapid Prototype

Evaluated the mechanism's functionality; identified the funnel's design as a bottleneck.

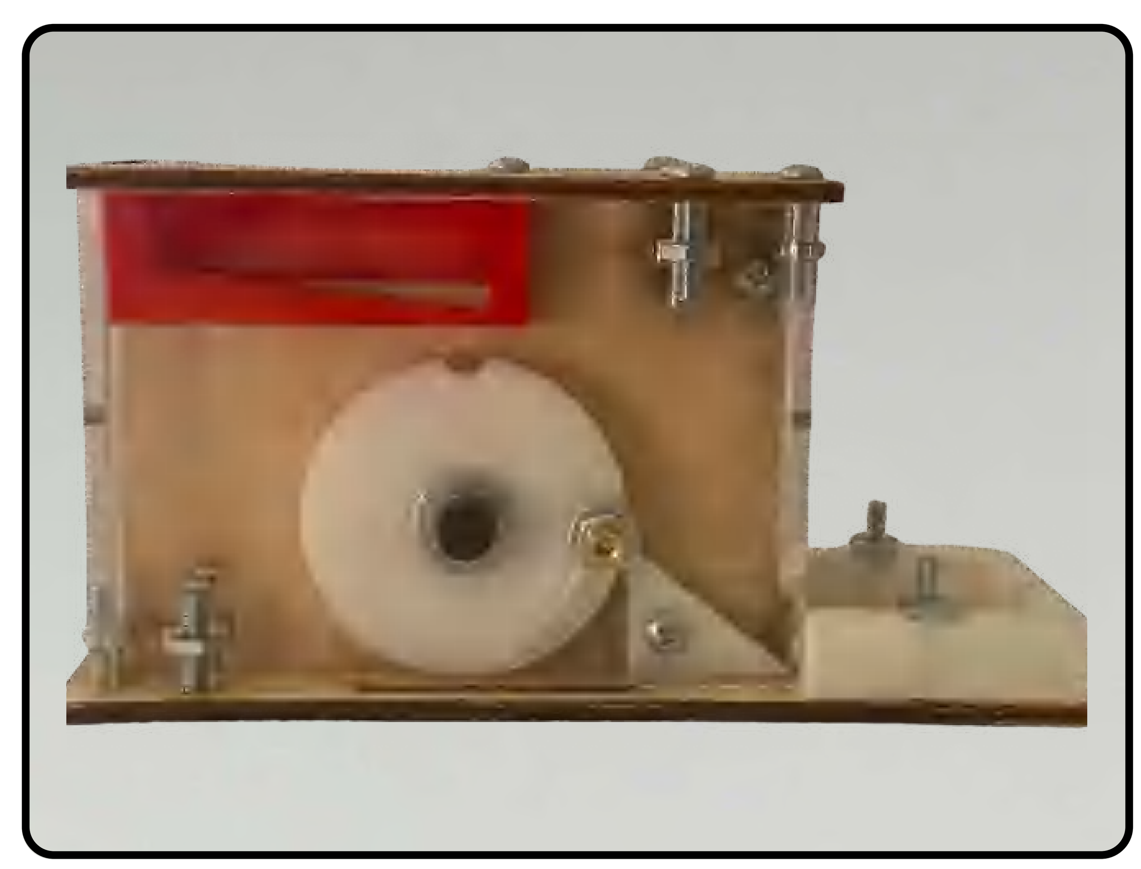
Funnel Prototypes

Redesigned the funnel to prevent candy jams, employing a ramp design for smooth dispensation



Exploded View of Model

Illustrated the assembly sequence and components involved in the construction.



Hardware and Assembly

Utilized laser-cut wood, acrylic, and 3D printed parts, achieving a functional dispenser with one hand

Processes
- 3D Printing
- Mechanical Assembly
- Laser Cutting
- Stress Analysis

Materials
- Acrylic
- Plywood
- PLA
- McMaster-Carr Hardware

Software
- Fusion360
- Adobe Illustrator
- Cura

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Travel Ukulele | ME 103: DESIGN & MAKING

Backpacker Ukulele For Portability And Practice

Design Goals

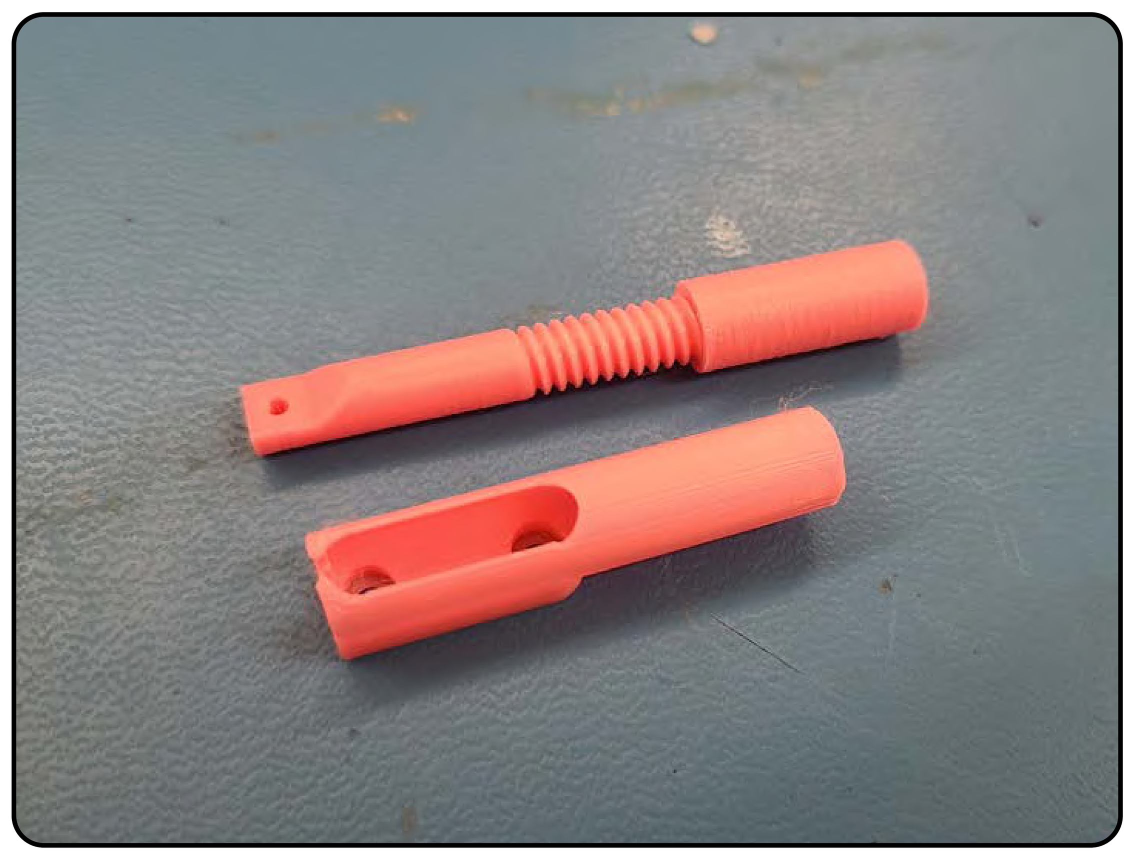
Create a small, lightweight ukulele that can fit in a backpack and be played anywhere using 2 machining processes

Lessons

Difficult final assembly and functionality due to prototype oversight, redesigning tuning mechanism halfway through project

CAD Model

Modeled design in Fusion360 to produce engineering drawings for prototyping and fabrication

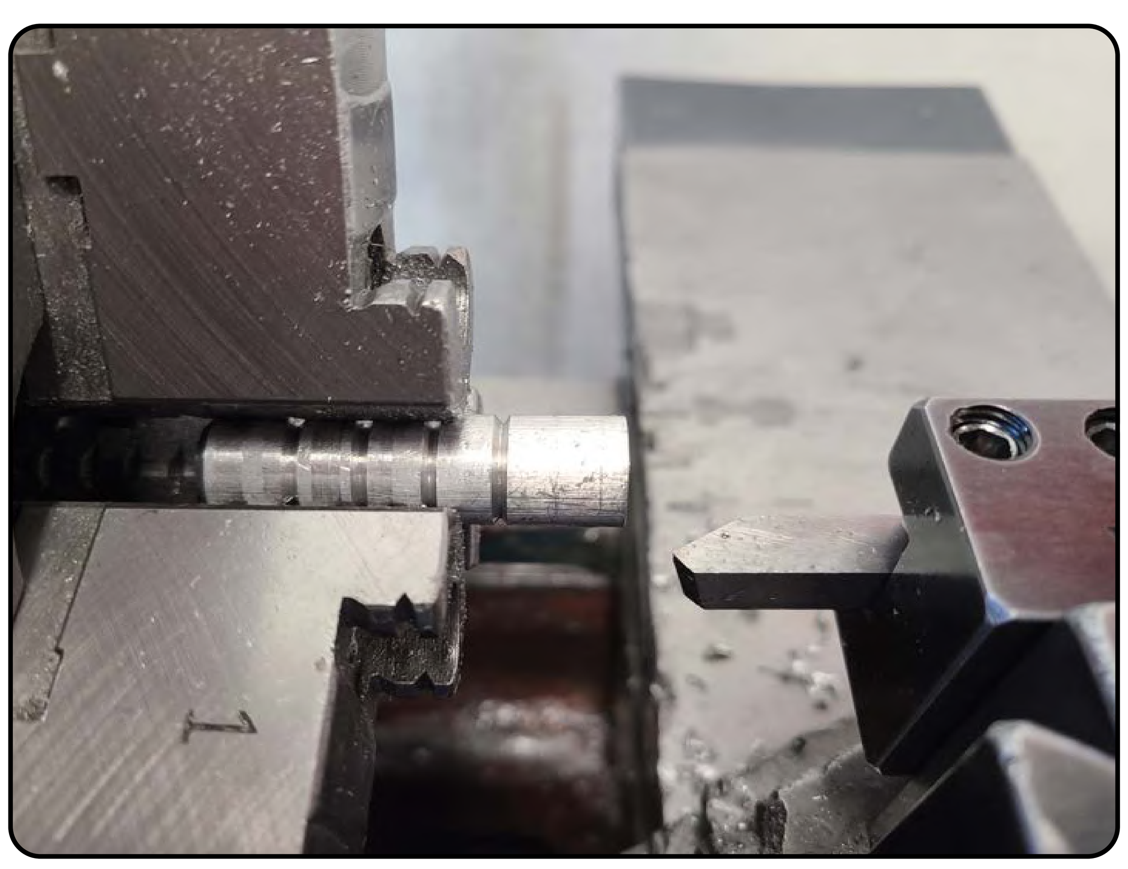


3D Print Prototype

Rapid prototype of headless tuning machines using a screw thread to tension strings

Milling

Using Bridgeport Milling Machine to drill holes and carve channels in headless tuners



Turning on Lathe

Using Lathe to turn tuner parts down, knurl, and thread features with tap and die

Assembly

Hand-carved with spokeshave and assembled with screws, miter saw, and fret mallet

Results

Functional, compact instrument with D'Addario nylon strings, headless tuners, linseed oil finish

Processes
- Lathing
- Milling
- Wood Routing
- Wood Carving
- Wood Finishing
- Metal Finishing
- Laser Cutting
- 3D Printing

Materials
- Walnut
- Delrin
- Aluminum
- Nylon
- Brass
- Steel
- Nickel-Silver

Software
- Fusion360
- Adobe Photoshop
- PrusaSlicer
- Inkscape

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Car Phone Holder | ME 127: DESIGN FOR ADDITIVE MANUFACTURING

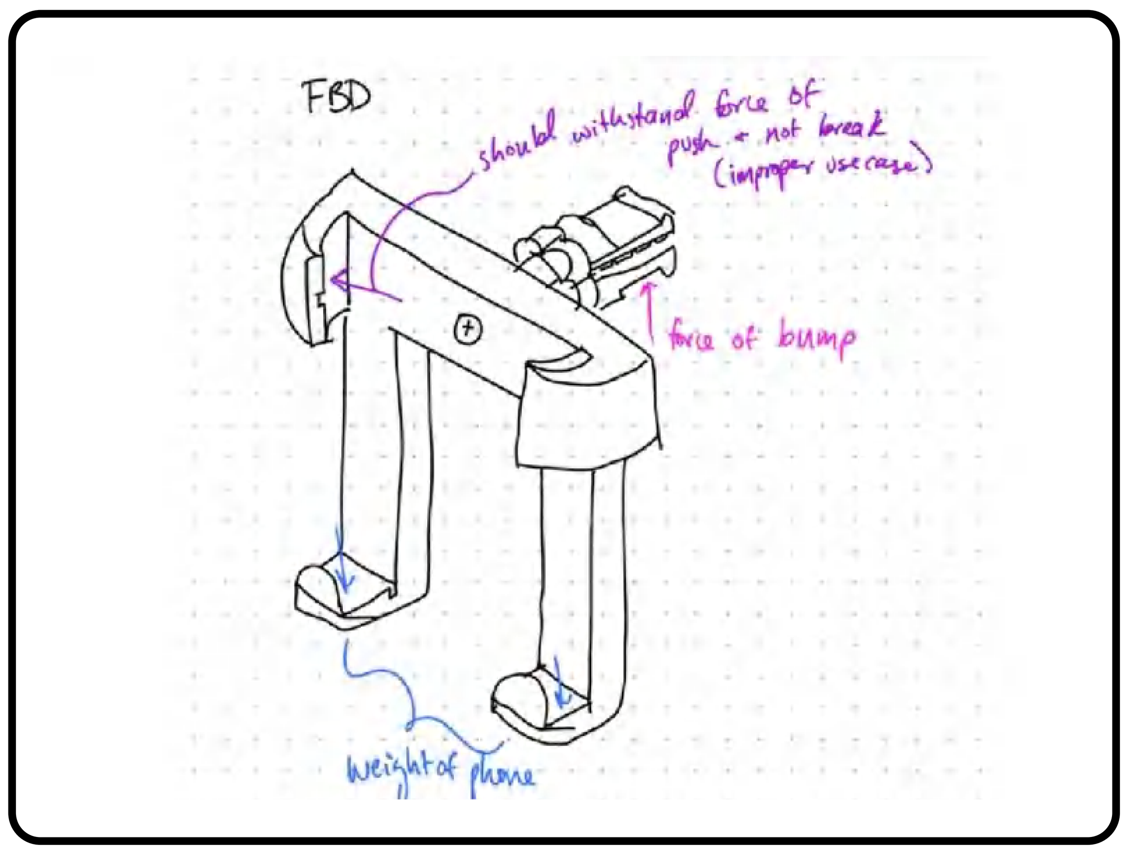
Using Engineering To Design A Car Vent Phone Holder With Vertical And Horizontal Rotation Capabilities

Design Goals

Create a dual-material car vent phone mount, flexible enough to bear a phone's weight and road turbulence.

Lessons

Advancing rapid prototyping knowledge, facilitating multiple iterations, and allowing design refinement pre-print based on simulation data.

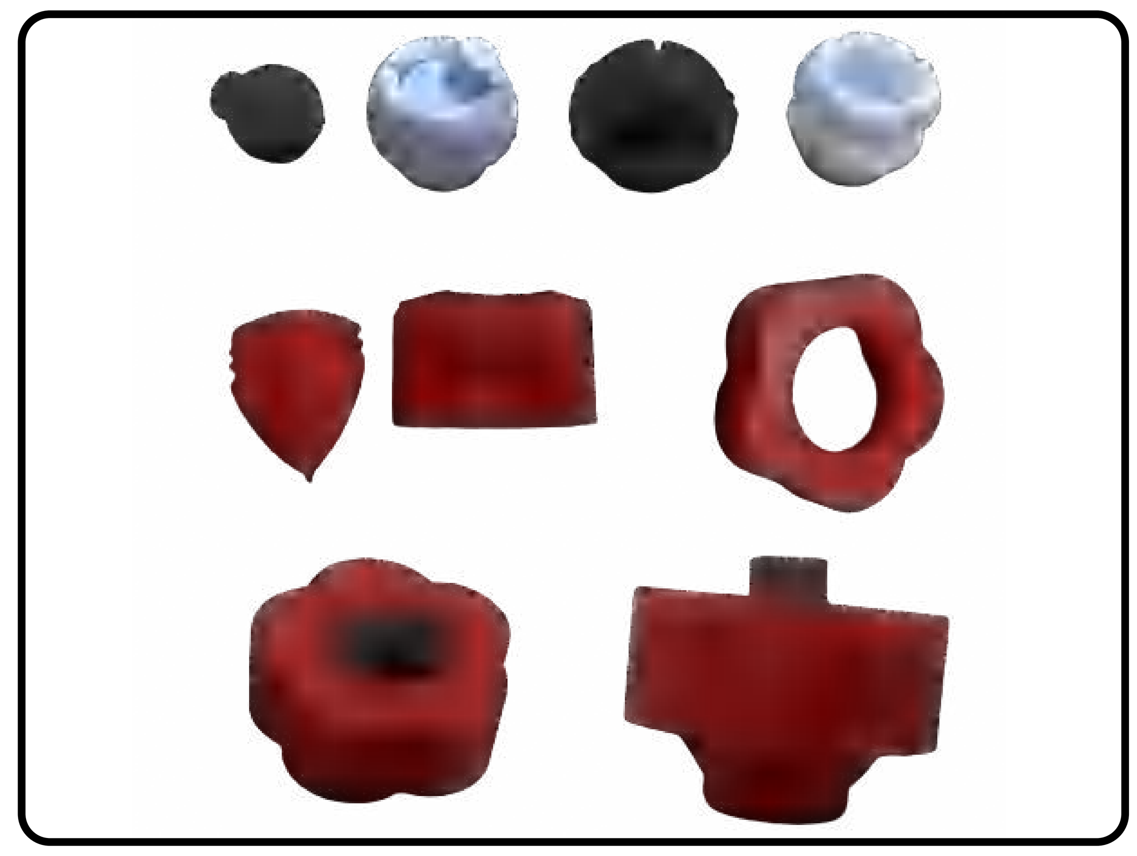


Drawing for Final Design

FBD depicts the phone holder's interaction with external forces from the phone and car vent.

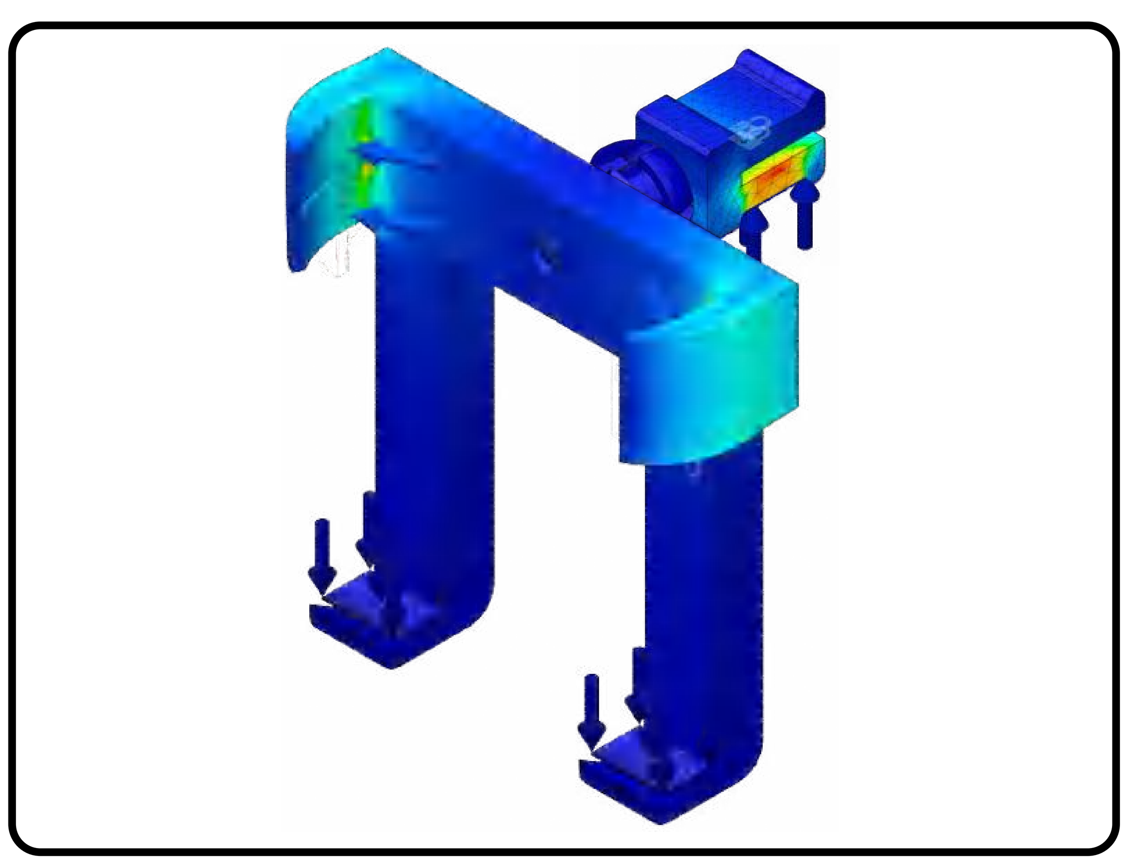
Multi-material Interaction

Integrating Japanese joinery for material cohesion between ASA and TPU phone grip interactions



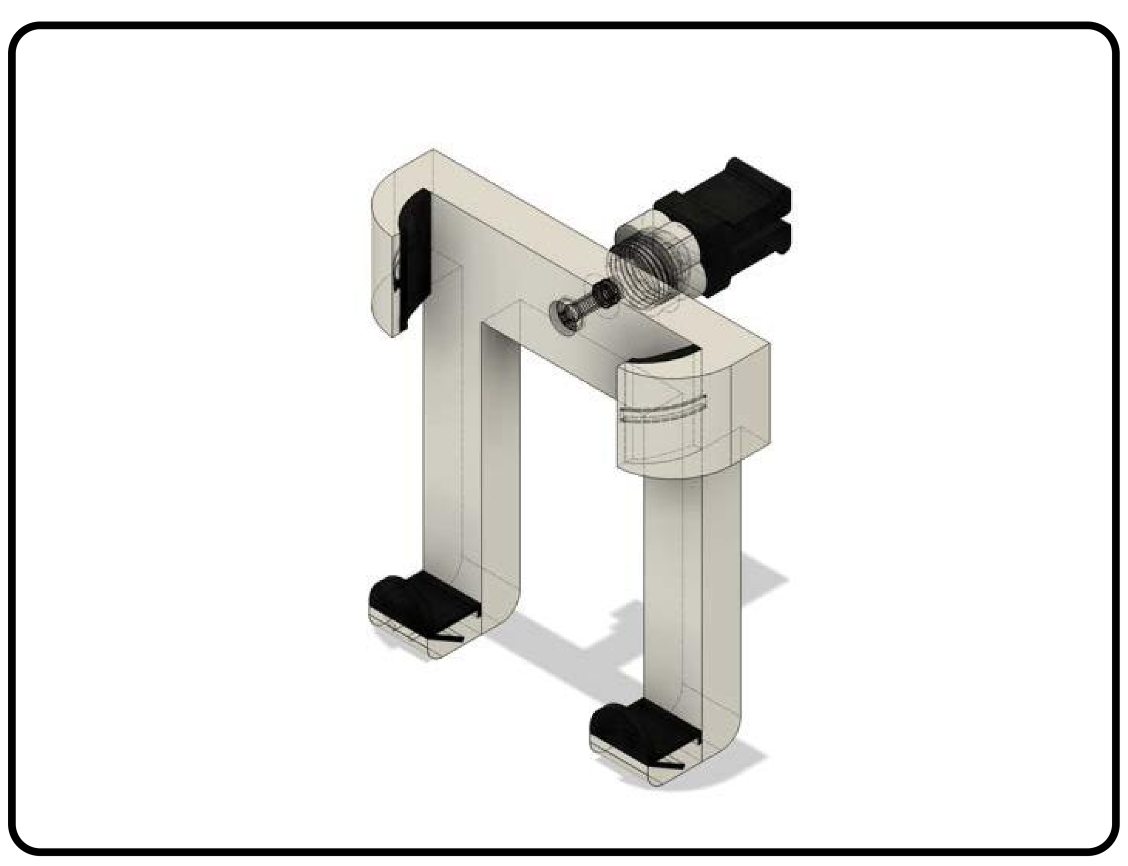
Rotational Dial Prototypes

Developed an intuitive lock-in-place dial mechanism allowing horizontal and vertical orientation



Static Stress Simulation

Conducted simulations to confirm the design's integrity against high loads and misuse



Final Prototype CAD Model

The final assembly connects via a single screw, pairing an ASA case with a TPU ball joint dial system

Final Results

Secured phone vertically and horizontally and did not deform at the added phone weight

Processes
- 3D Printing
- Mech. Assembly
- FBD Analysis
- Stress Analysis
- Design Ideation

Materials
- TPU
- ASA
- PLA
- McMaster-Carr Hardware

Software
- Fusion360
- Cura
- PrusaSlicer
- GrabCad

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Airless Basketball | ME 127: DESIGN FOR ADDITIVE MANUFACTURING

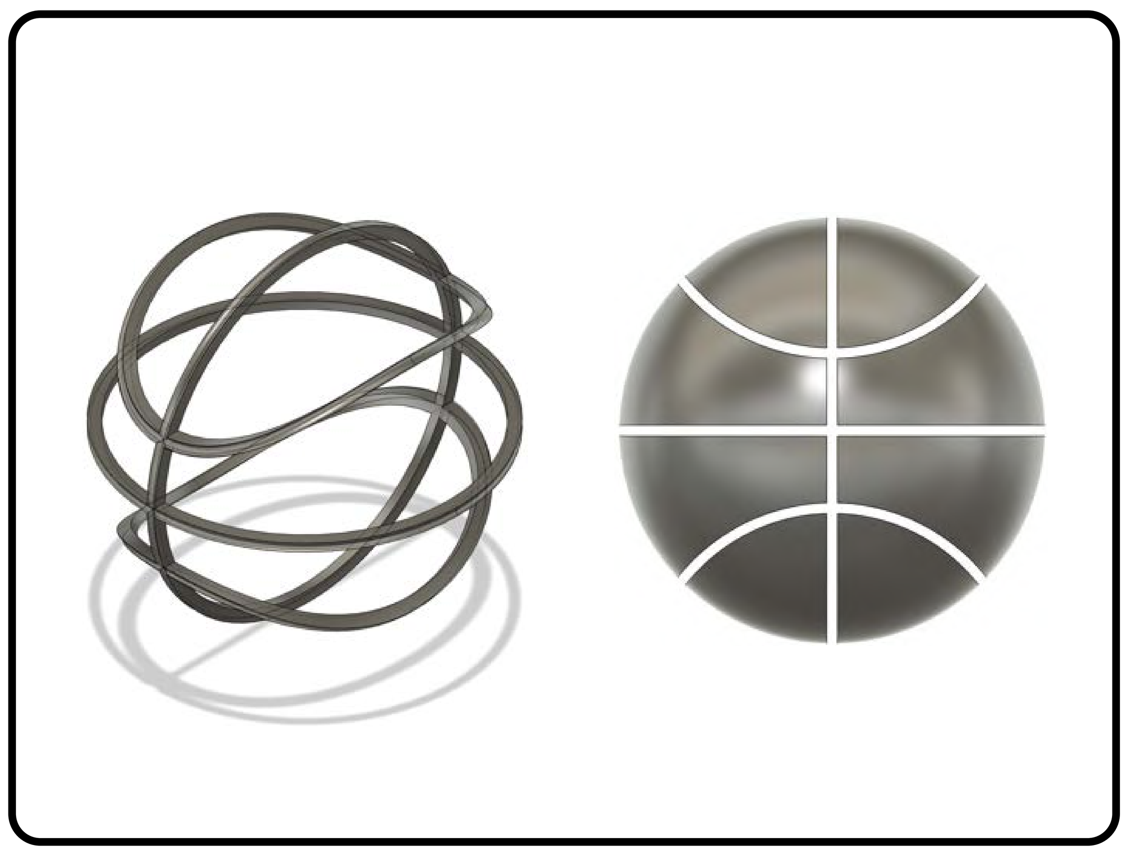
Using Engineering To Create A 3D-Printed, Elastic Basketball And Hoop

Design Goals

Redesign an indoor basketball and hoop with authentic bounce and secure, space-efficient door mounting.

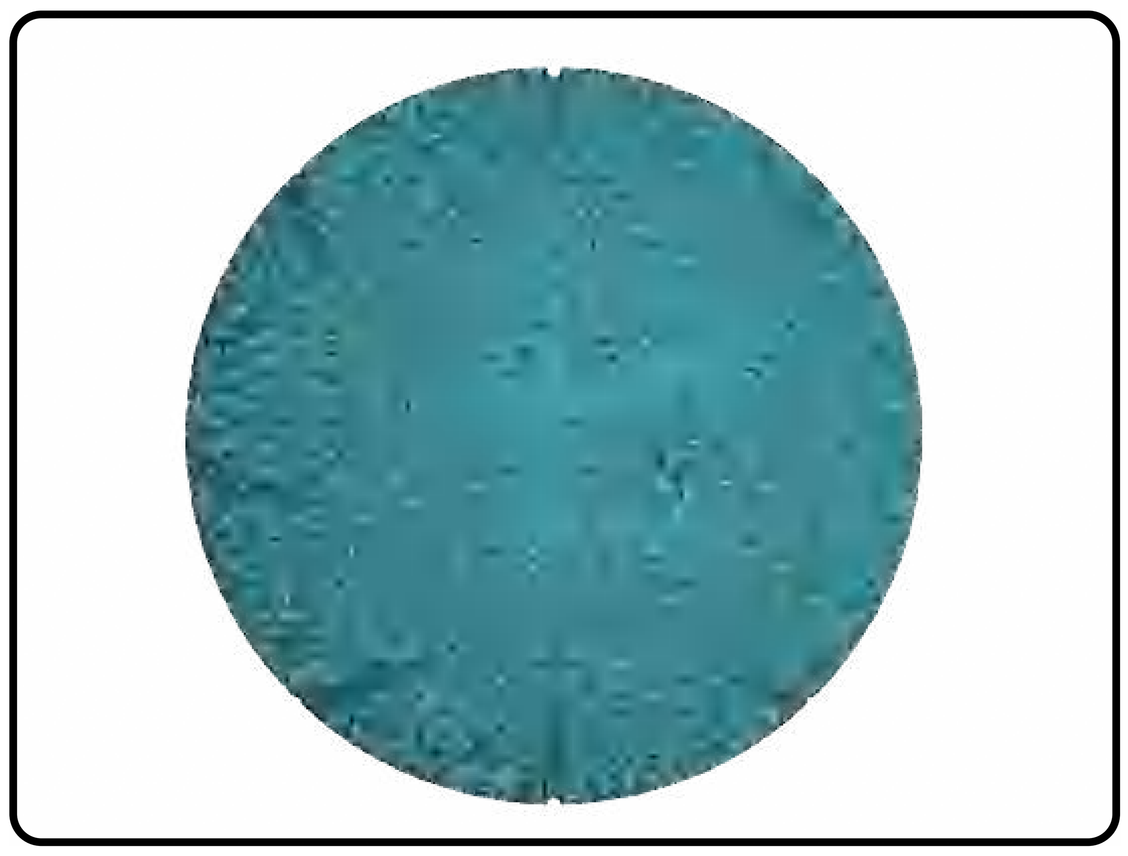
Lessons

Refined hoop iterations for reduced weight, time constraints prevented net addition, and the need for anticipatory design planning.



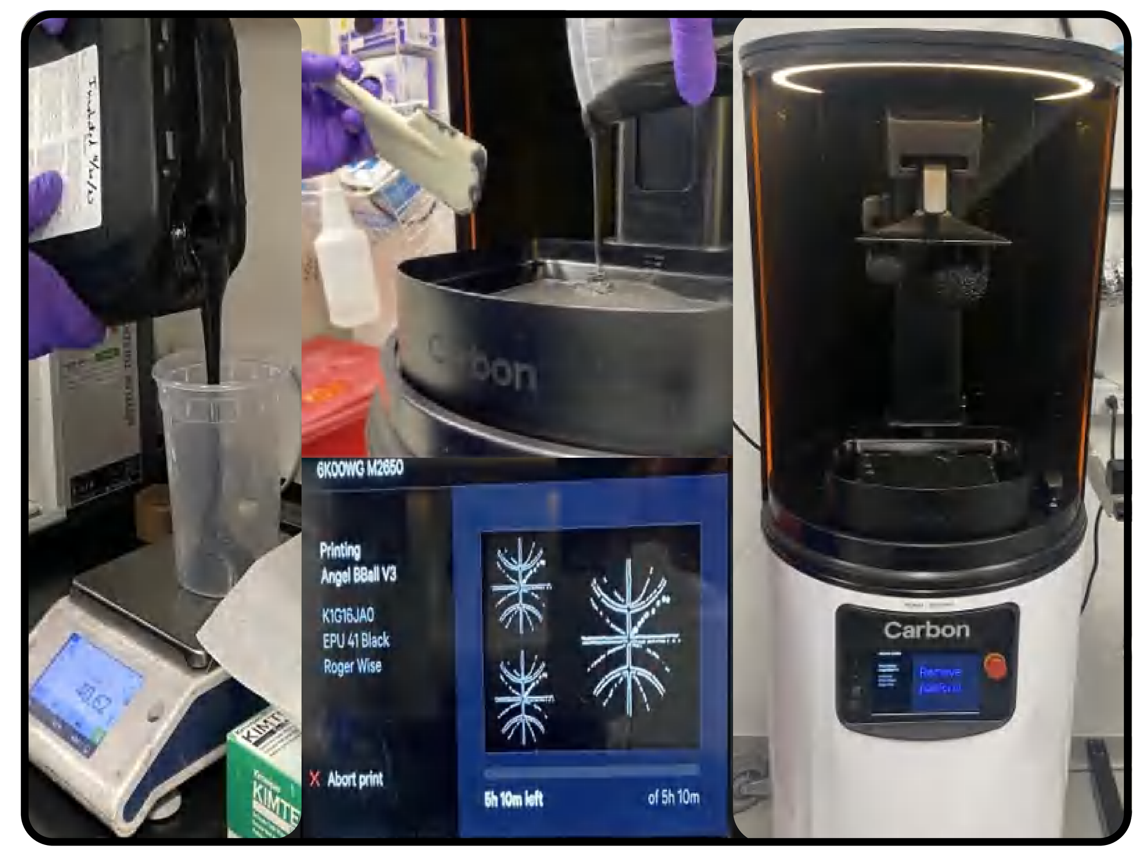
Deconstructed Basketball CAD

Segmented a basketball for later latticing, sculpting grooves using sweep and extrusion methods.



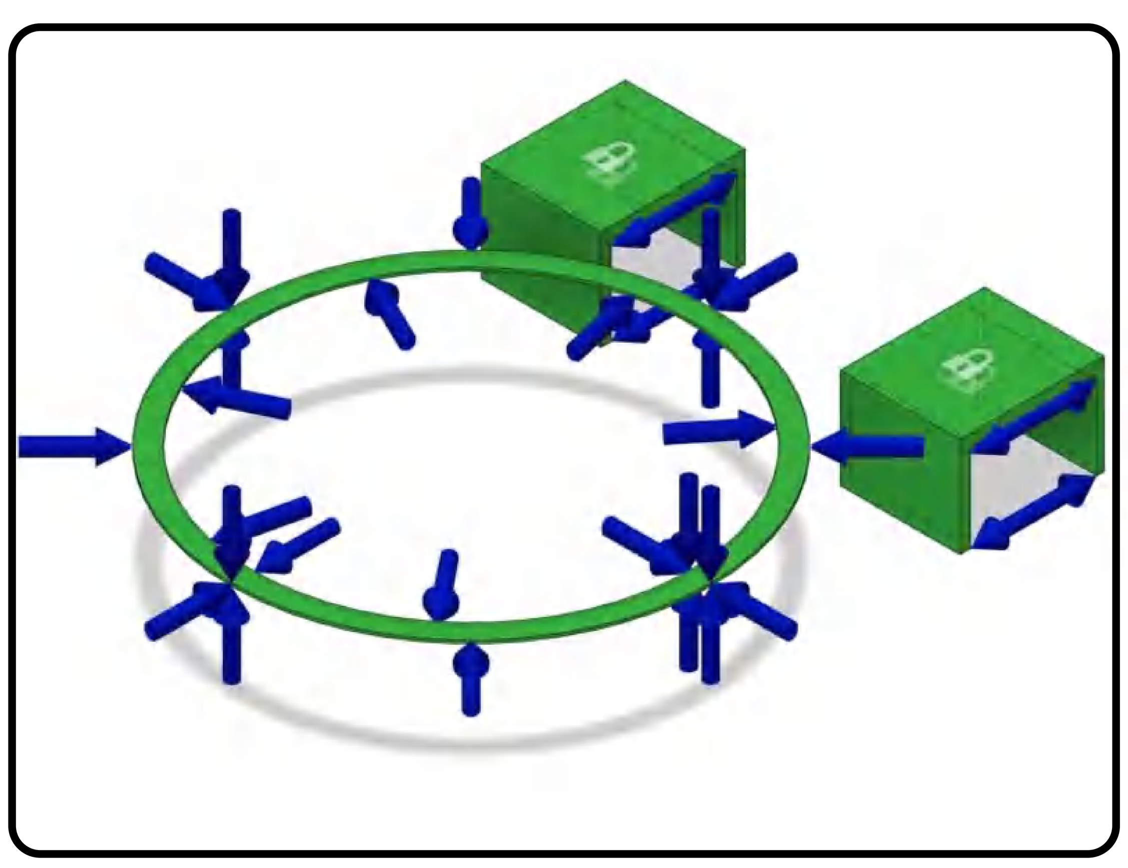
Lattice Structure CAD Design

Assembled basketball model, utilized a Kagome lattice pattern to optimize rebound efficiency.



Carbon Printing Process

Prepared EPU 41 Resin, built custom supports for model, and initiated Carbon 3D printing.



Generative Design Simulation

Simulated uniform loads to ensure durability against misuse, with fixed surfaces to mirror actual use.

Final Results: Hoop

Attaches effortlessly over doors, withstands the force of a slam dunk while allowing the door to function normally.

Final Results: Ball

Achieved high rebound efficiency, withstanding increased force without wear. Has maintained the same rebound.

Processes
- 3D Printing
- Design Ideation
- FBD Analysis
- Stress Analysis

Materials
- EPU 41
- ABS
- PLA

Software
- Fusion360
- GrabCad
- Carbon Design Engine Pro
- Cura
- NTop

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Paintball Cannon | ME104: MECHANICAL SYSTEMS DESIGN

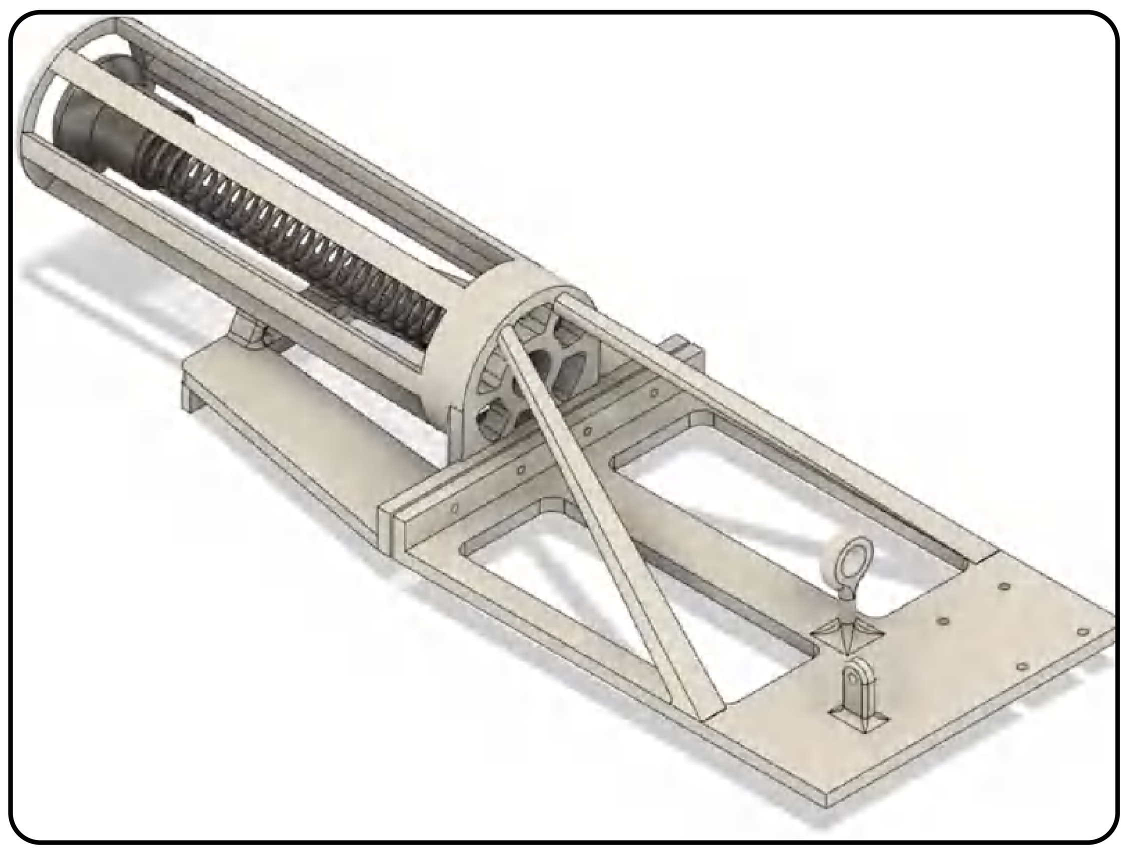
Using Engineering To Create Visual Art

Design Goals

Launch a 100g object using a motor-driven mechanism with mechanical design principles

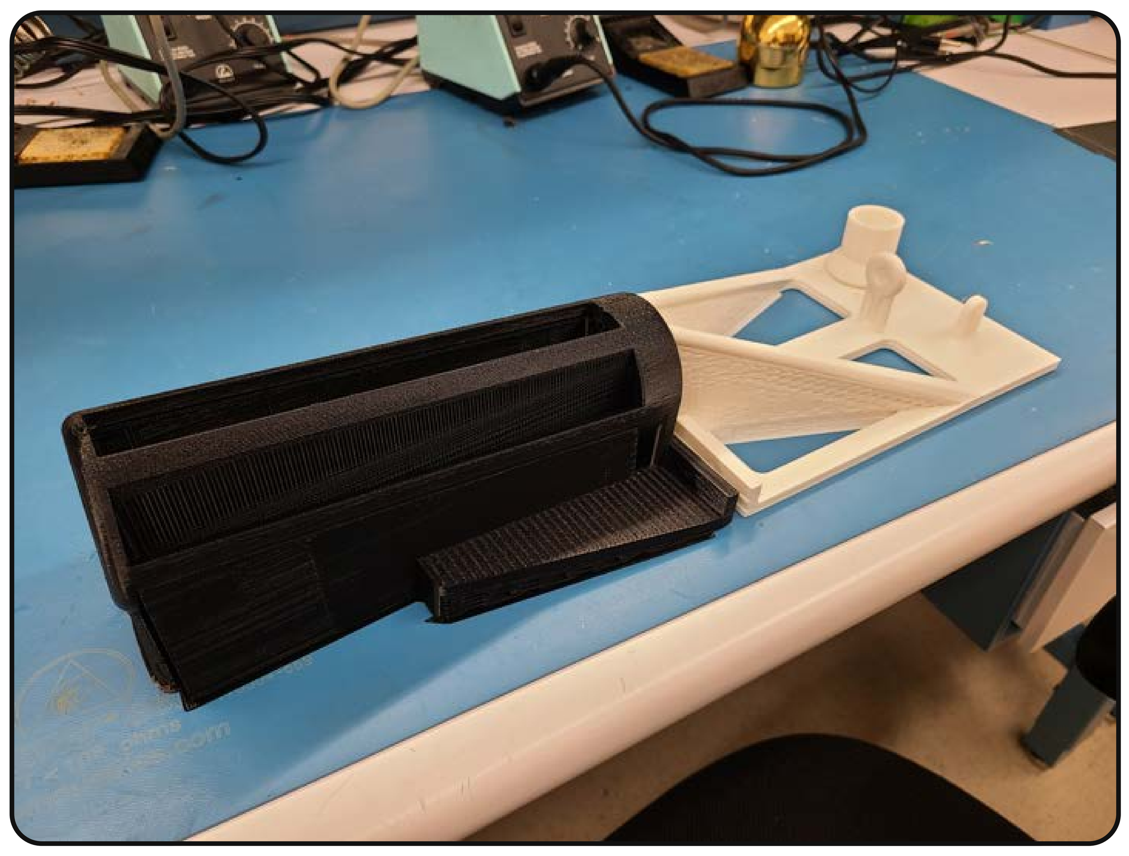
Lessons

Lack of precise idealization, mechanical design, and prototyping led to challenging initial prototype and suboptimal final prototype



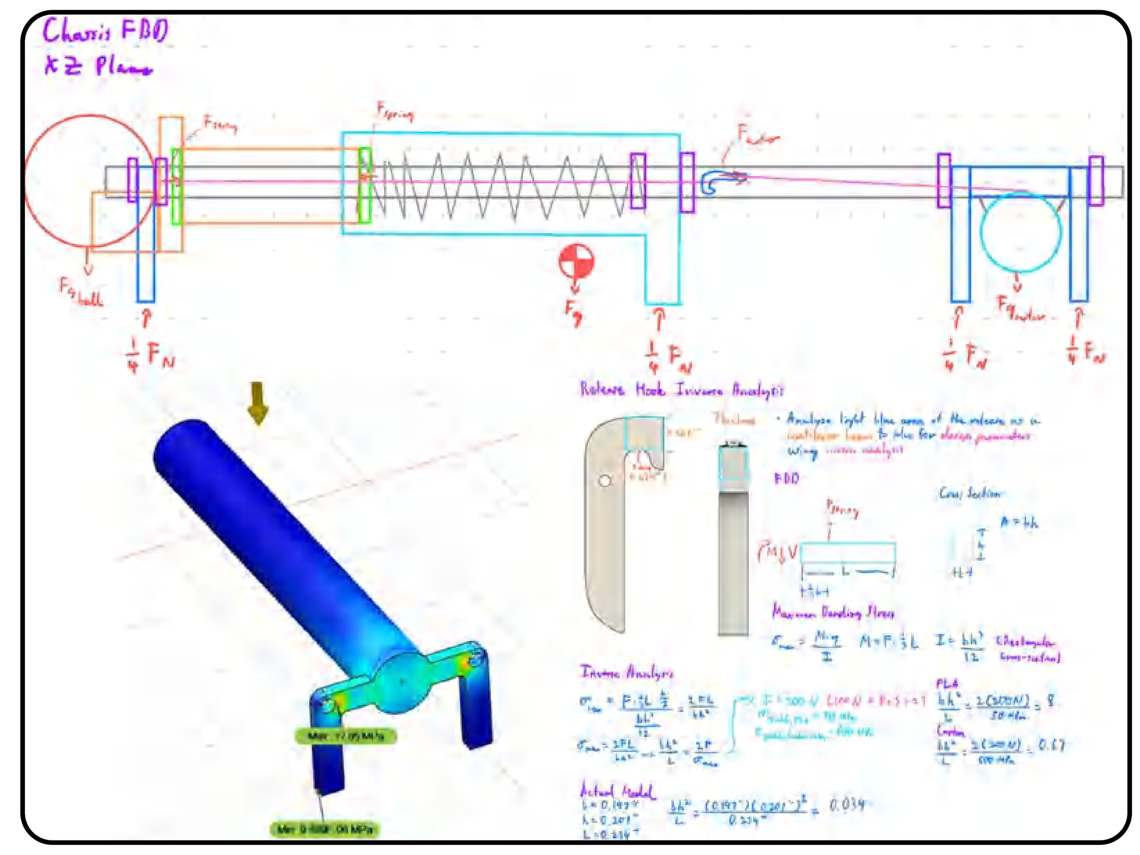
CAD Model

Initial prototype with 3D printed two-part unibody design using a spring and plunger mechanism



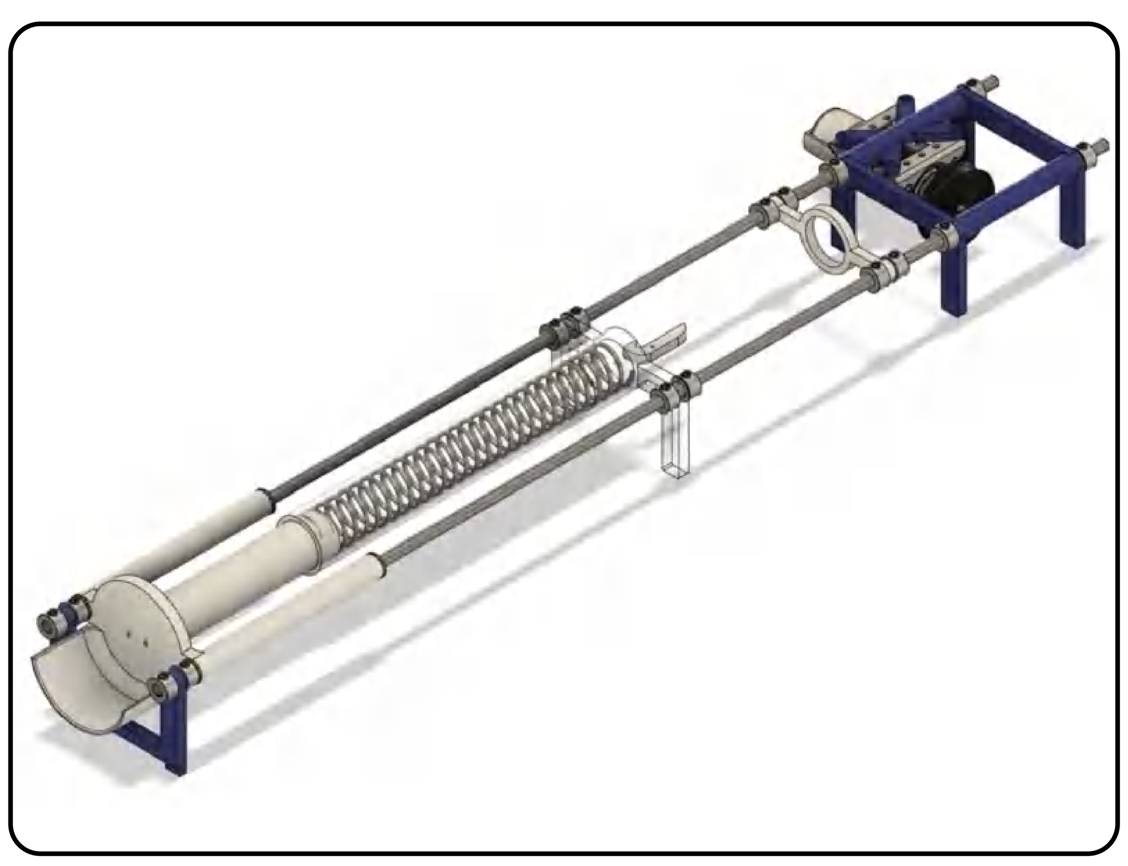
3D Print Prototype

Learned about tolerances, spring constraint, and 3D print design limitations due to supports



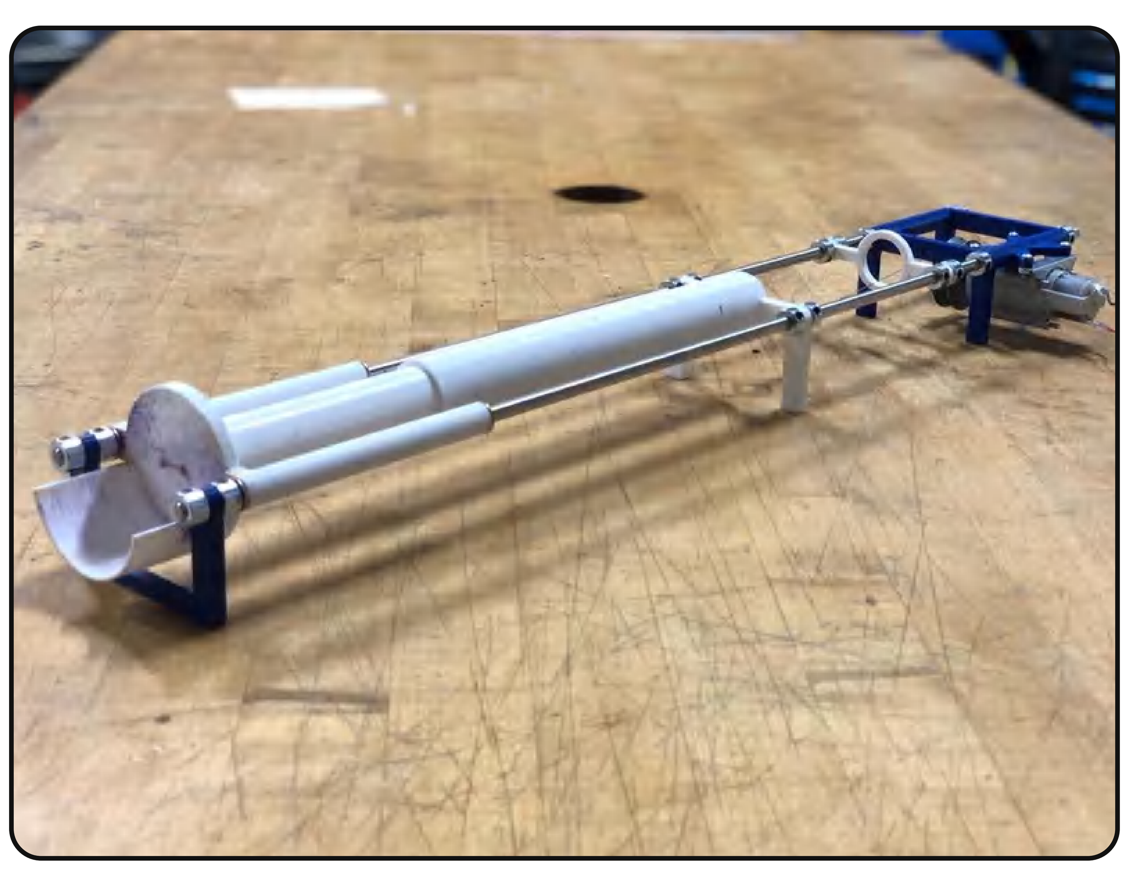
Drawings for Final Prototype

FBD, FEA, and Inverse Analysis of final design, internal forces caused by motor, external forces



Final Prototype CAD Model

Linear rail mechanism to guide spring-loaded launcher and projectile along single axis



COTS Hardware & Assembly

3D printed and assembled with shaft collars, press-fit bushings, screws, and super glue

Results

Launches 100g projectile at 3.56 m/s, robust & repeatable action, received Best Style award in class

Processes

- 3D Printing
- Mech. Assembly
- FEA Analysis
- FBD Analysis
- Inverse Analysis
- Stress Analysis
- Design Ideation
- Power Flow

Materials

- PLA
- Steel
- Aluminum
- Bronze
- Nylon
- Silicone
- McMaster-Carr Hardware

Software

- Fusion360
- Google Sheets
- PrusaSlicer
- GoodNotes

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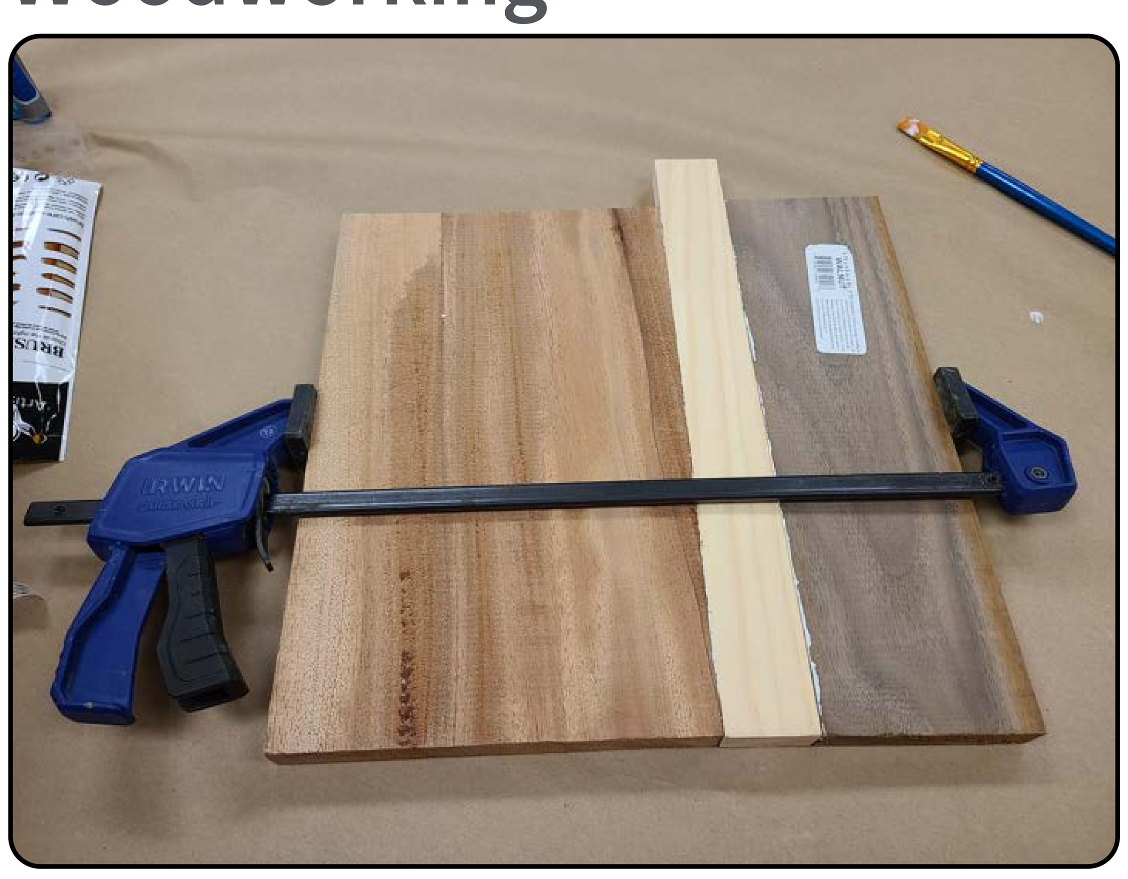
Makerspace Projects | MAKERSPACES

Making For Fun

Laser Cutting

Additive Manufacturing | Print-In-Place, Mid-Print Inserts

Woodworking



Embroidery & Textiles