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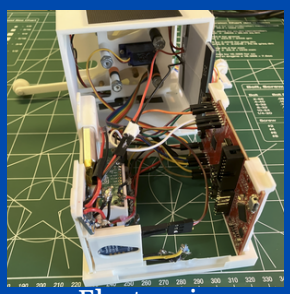
Project Portfolio

Pennsylvania State University
Mechanical Engineering
Graduating May 2029

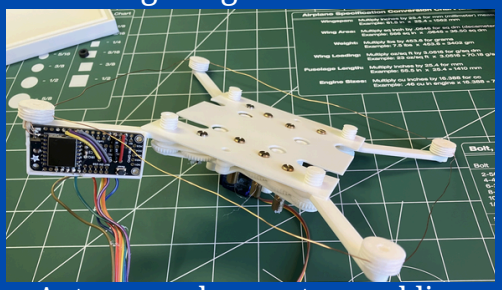
CubeSat Design Project

Extended breakdown on:
sites.google.com/view/cubispace

- A 1U CubeSat prototype with a 706.6 mm 433 MHz LoRa loop antenna targeting 480km altitude
- Designed to be manufacturable by 3-axis milling or 2-axis turning operations
- Analyzed failure points through FEA, DMTA data, and TID calculations
- Used a ratcheting 1-motor antenna deployment system
- Had a LoRa SF7 broadcasting range of a half-mile



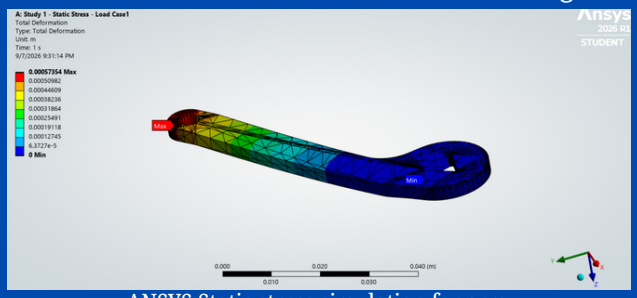
Electronics



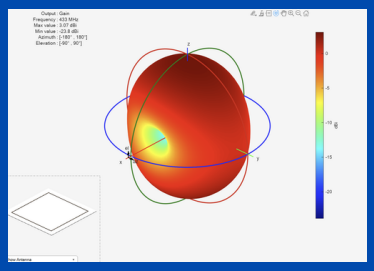
Antenna and gearset assemblies



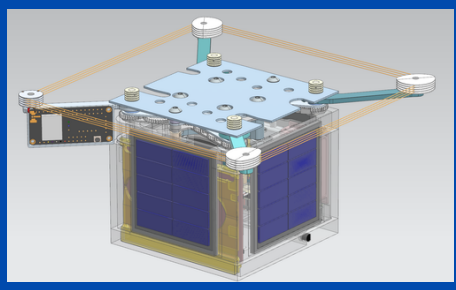
Complete built assembly



ANSYS Static stress simulation for arm
Max deformation 0.5mm, 2.63N force for extending antenna, average of 5 tests
PLA Material Properties from JOM, Polymaker 2021-4-22



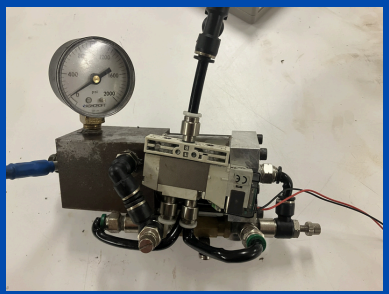
MATLAB antenna simulation
3.07dBi peak, -23.8 dBi minimum



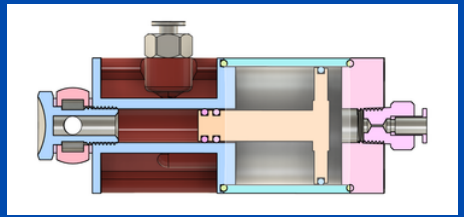
Full assembly CAD

Pneumatic-Hydraulic Brake

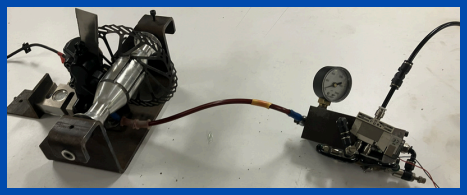
- Intakes 80psi of air and sends 1.1ksi of hydraulic pressure
- Enabled testing of center-of-mass and deceleration rates generating data to inform robot control algorithms in order to stop tipping
- Diagnosed extrusion failure and redesigned using validated compression, clearance, and materials



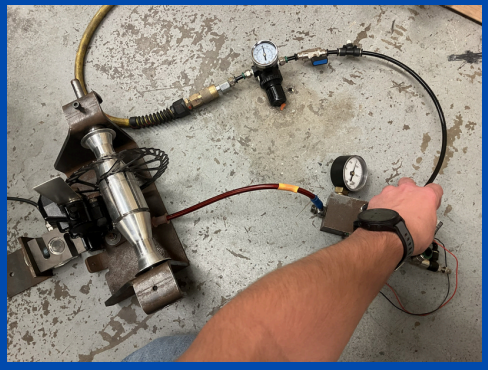
Converter assembly



Cross-section of the converter



Winch and Converter



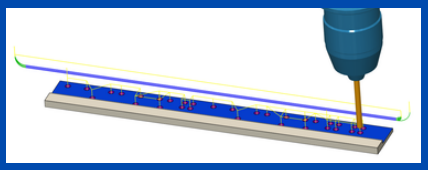
80psi on air in and 1.1ksi on hydraulic out



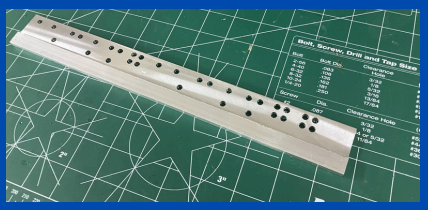
Original piston O-ring extrusion failure

Bolt and Rivet Combined Loading in Shear (ongoing)

- Analyzing bolt vs. rivet shear data to validate fastener choice in FRC robotics
- Collected stress-strain data on an Instron machine, analyzed in MATLAB
- Used CAM to create testing blanks on a 3-axis mill



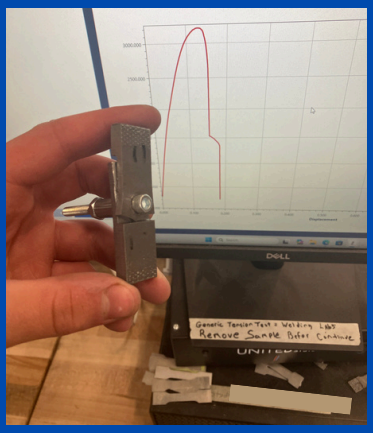
CAM 3-axis simulation



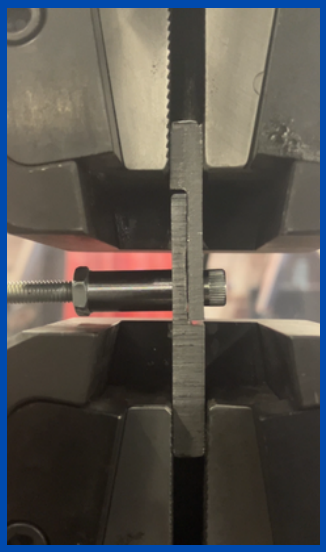
Blanks bar



Sheared Bolts at 3190 lb



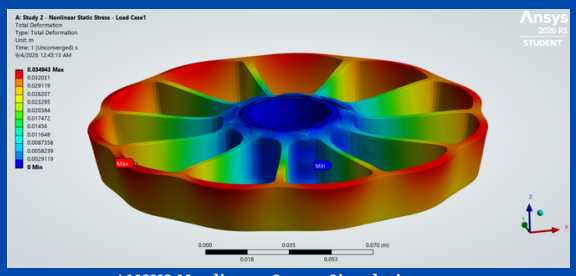
Bearing failure of blank at 3140 lb



Testing on Instron

Characterizing Wheel Expansion at High RPM (ongoing)

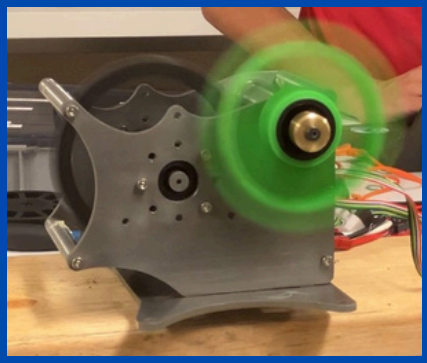
- Performed analysis on ball bearing failure modes and ultimate speed
- Utilized waterjet manufacturing and 2-axis turning
- Conducted FEA simulations to gauge a target of 26,000 RPM



ANSYS Nonlinear Stress Simulation
Projected max deformation of 3.4cm at 26,000RPM



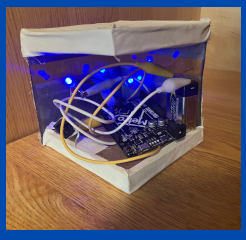
Complete mechanical assembly



Preliminary RPM testing

Cubi

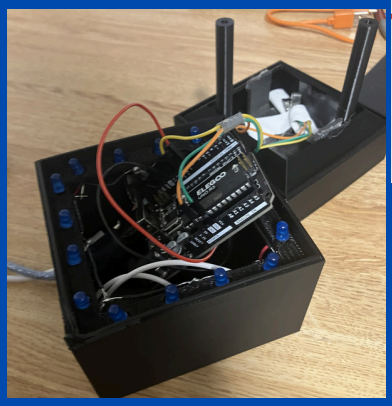
- The prototype connected to a computer to make and receive calls
- The end goal was to make the unit wireless to solve issues faced in hybrid work by adding impromptu conversations back to the workplace
- Awarded the People's Choice Award at the 2026 Penn State Learning Factory Spring Design Showcase



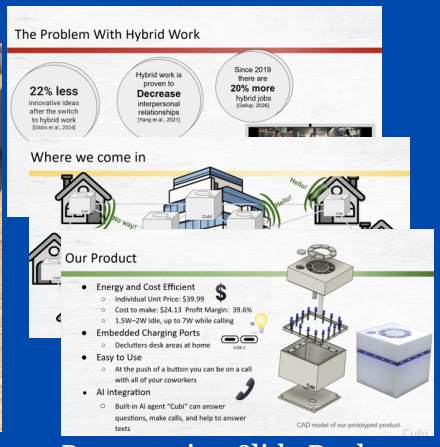
Prototype 1



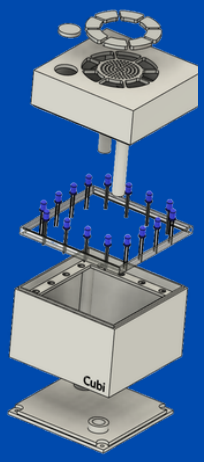
Final Prototype



Electronics



Presentation Slide Deck



Exploded view