FAMU-FSU College of Engineering

Virtual Design Review 4
Team 505

Danfoss Stepper Motor Lifecycle Fixture

01/28/2025

Team Introductions

Bradford Andrews
Mechatronics Engineer

Presenter

Albert Auer
Mechanical Design Engineer

Chaney Bushman
Manufacturing and Test Engineer

Presenter

Joseph Garvie
Systems Engineer

Mason Herbet
CAD Designer

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Sponsor and Advisors

Sponsor
Cole Gray
Senior Mechanical Design Engineer

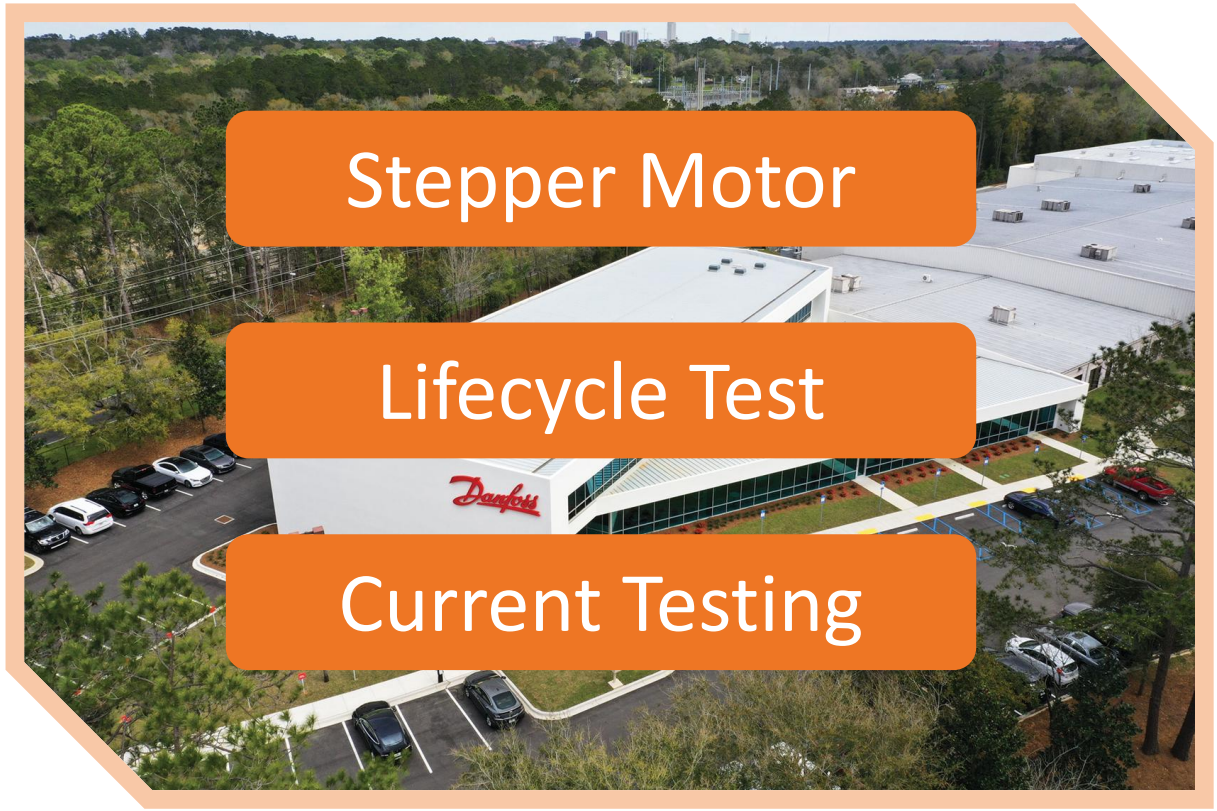
Academic Advisor
Patrick Hollis, Ph.D.
Associate Professor & Undergraduate Coordinator

Academic Advisor
Shayne McConomy, Ph.D.
Senior Design Professor

Bradford Andrews

Project Description

The objective of this project is to design and produce a stepper motor lifecycle test fixture for Danfoss Turbocor to improve user-friendliness and reliability over their current testing procedure.



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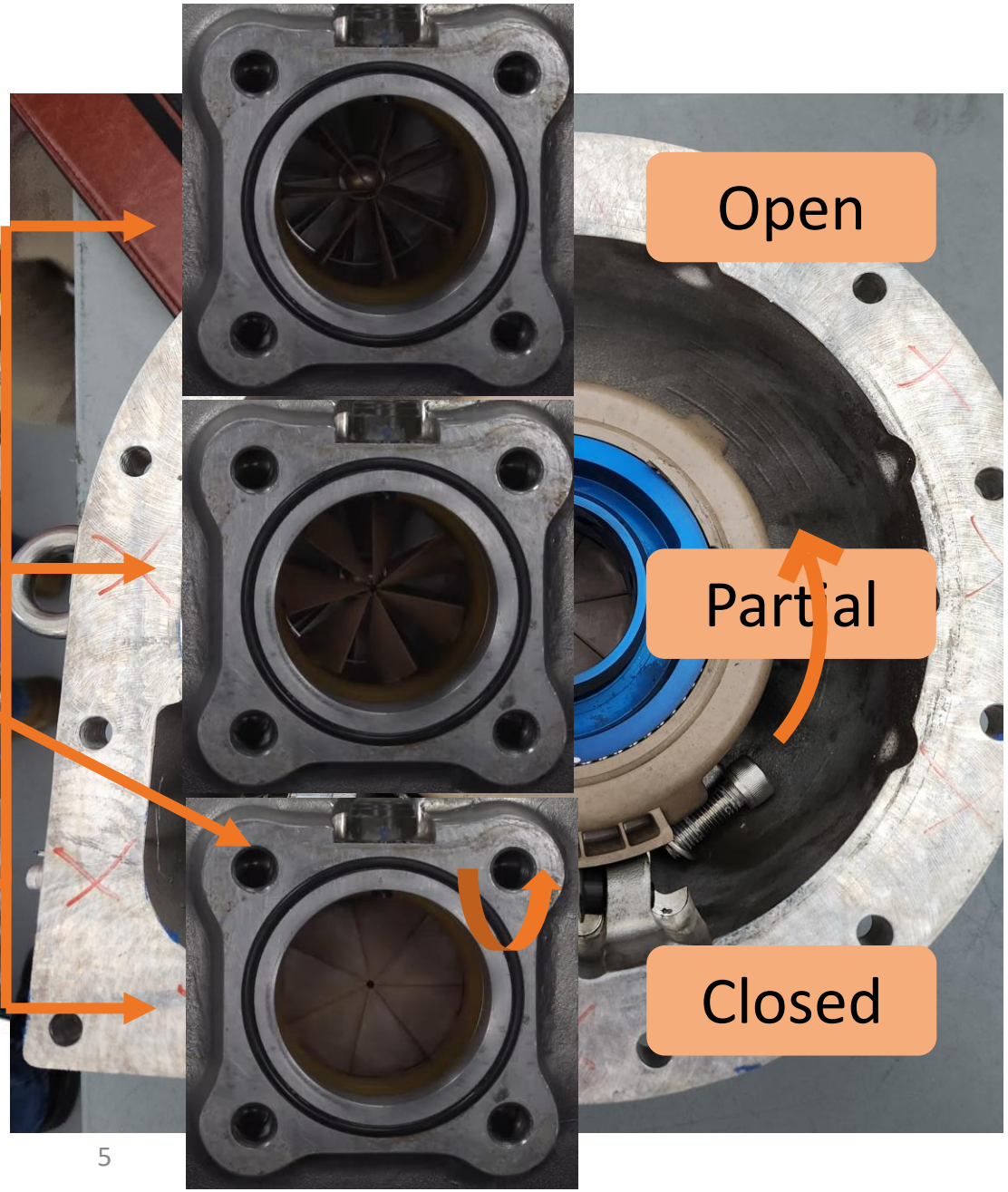
Stepper Motor

IGV Assembly

910098 Stepper Motor

Danfoss Turbocor TG Series



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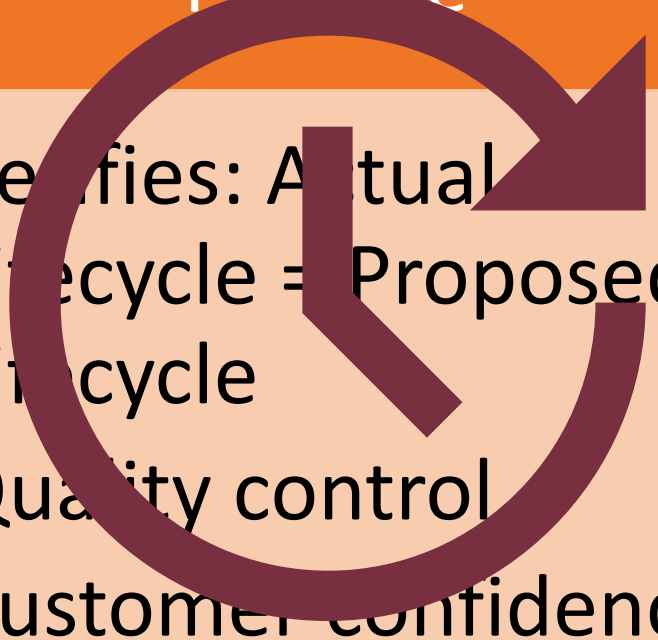
Lifecycle Test

Function

- Simulates the real-time stress on the motor
- Identifies the failure point of the motor
- Varied motion profile

Purpose

- Verifies: Actual Lifecycle = Proposed Lifecycle
- Quality control
- Customer confidence



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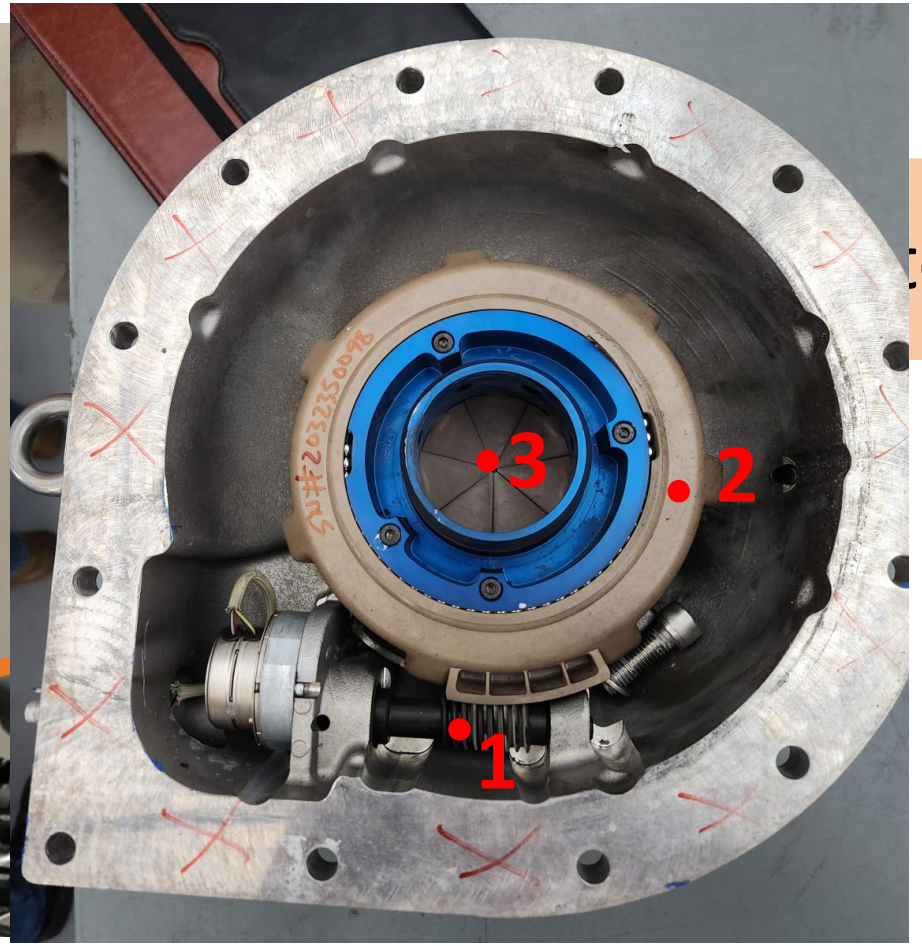
Current Testing

Friction
1. Worm gear
2. IGV drive
3. Weight on vanes

Does not notify upon failure event

IGV Blades powered by Stepper Motor

Not user friendly



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Starting Point

Perma-Tork

- Uses permanent magnets to apply a constant torsional load to the central shaft

Reasons to Use:

- Eliminates unnecessary friction
- Requires no power supply
- Allows manual torque adjustment
- Stepper motor manufacturer gave Danfoss six units to use for testing

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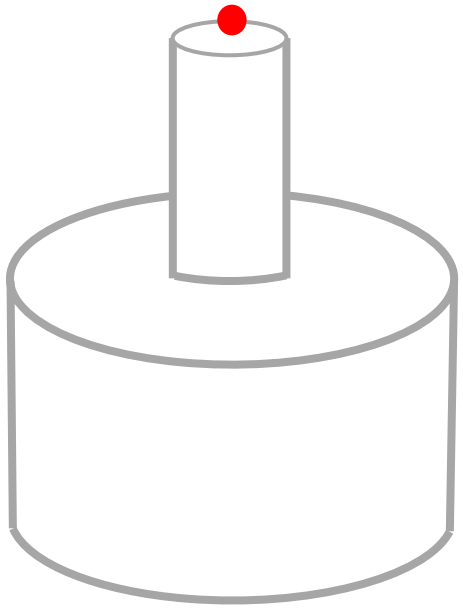
Customer Needs

One Direction Test

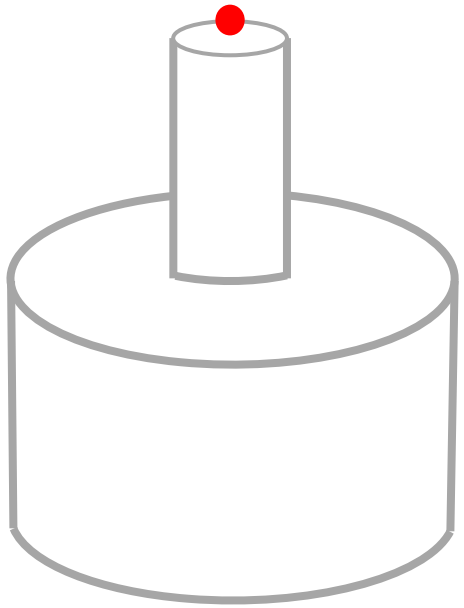


Runs continuously in one direction (CW CCW)

Similarities

- Constant speed (pulses per second)
- Constant resistance torque (N-m)
- Run until failure (motor cannot rotate)
- Track total runtime and total rotations

Alternating Test



Switches direction after a designated period of time (cycle time)

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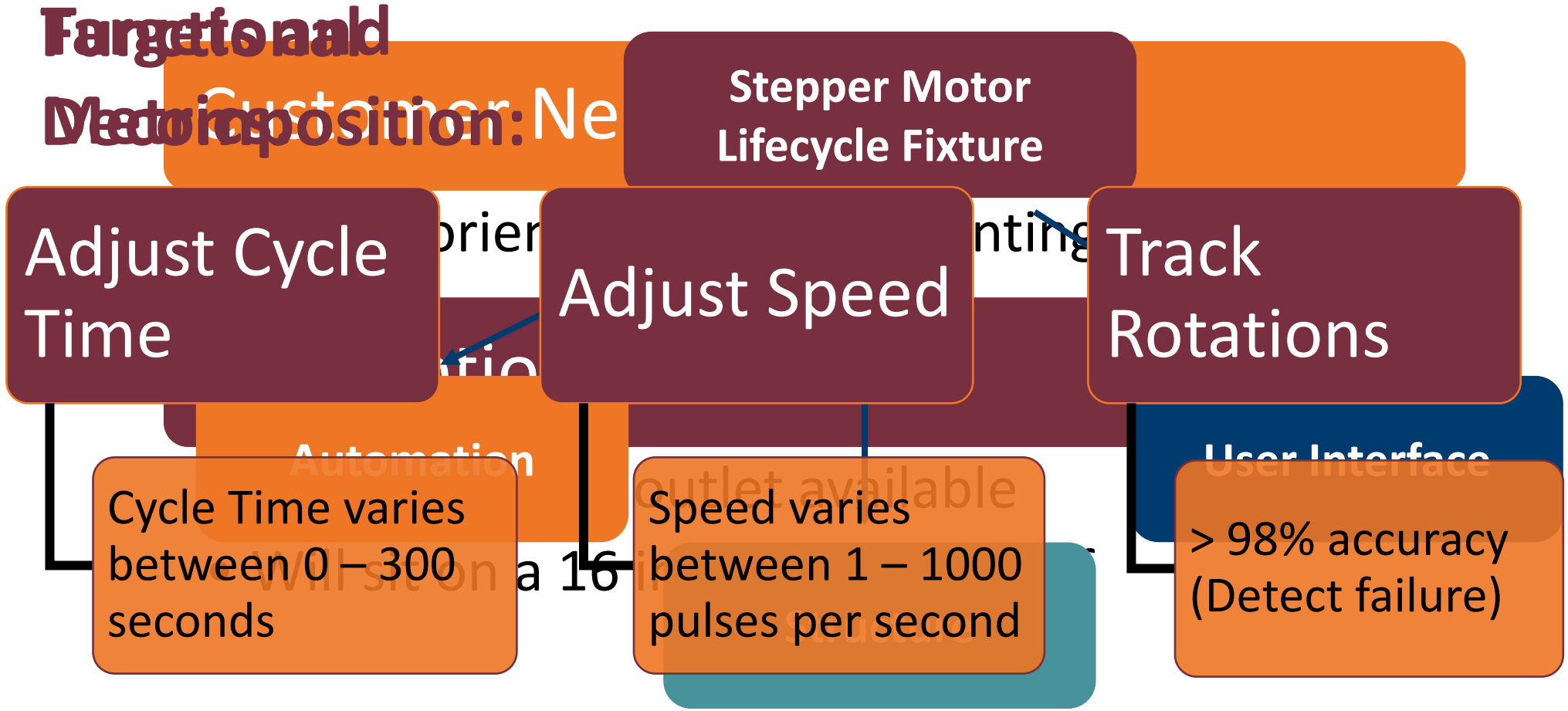
Additional Details



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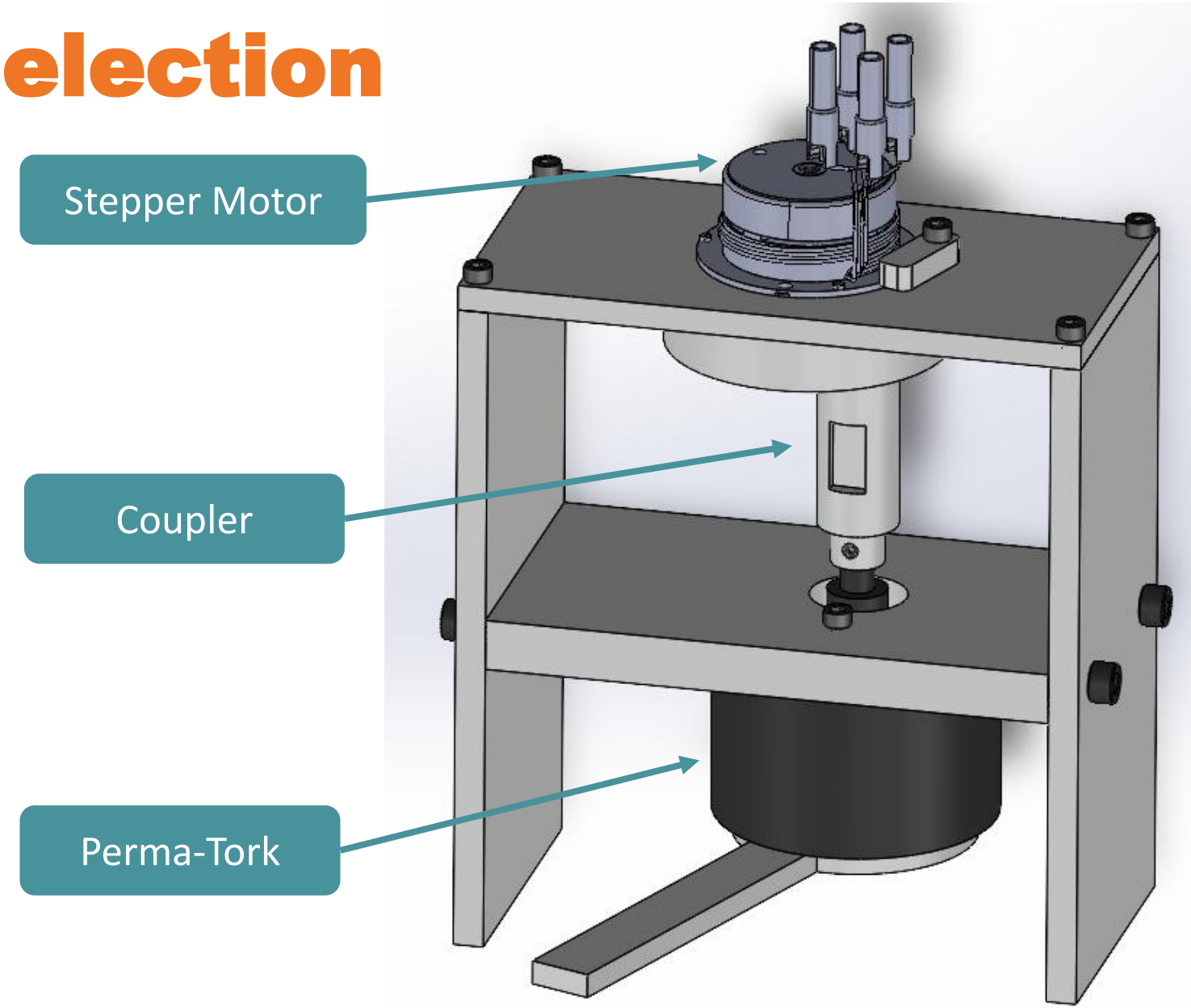
Concept Selection

H-Frame



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Updated Design

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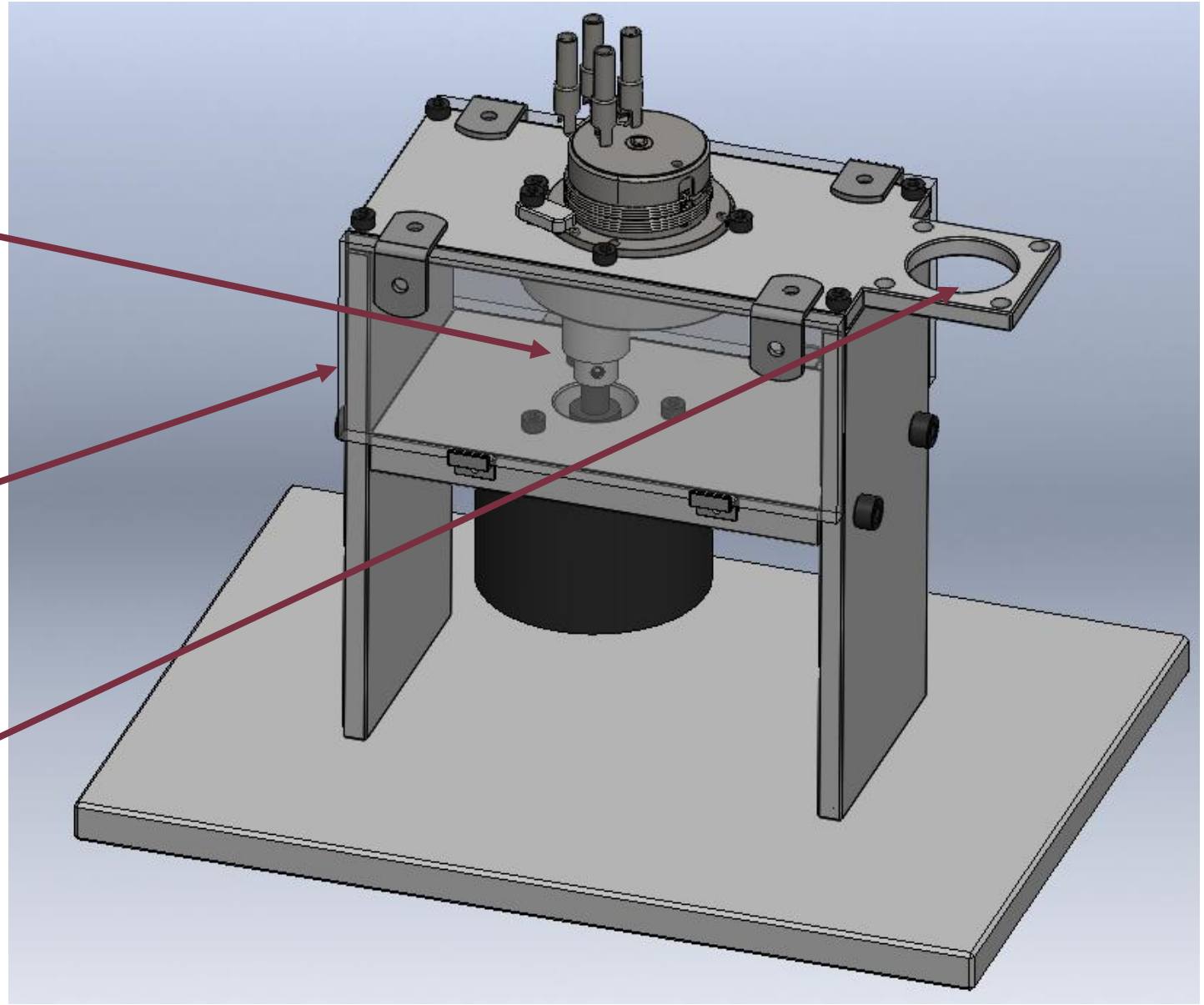
Using Flexible Coupler

Plexiglass Panels

Motor Power Attachment



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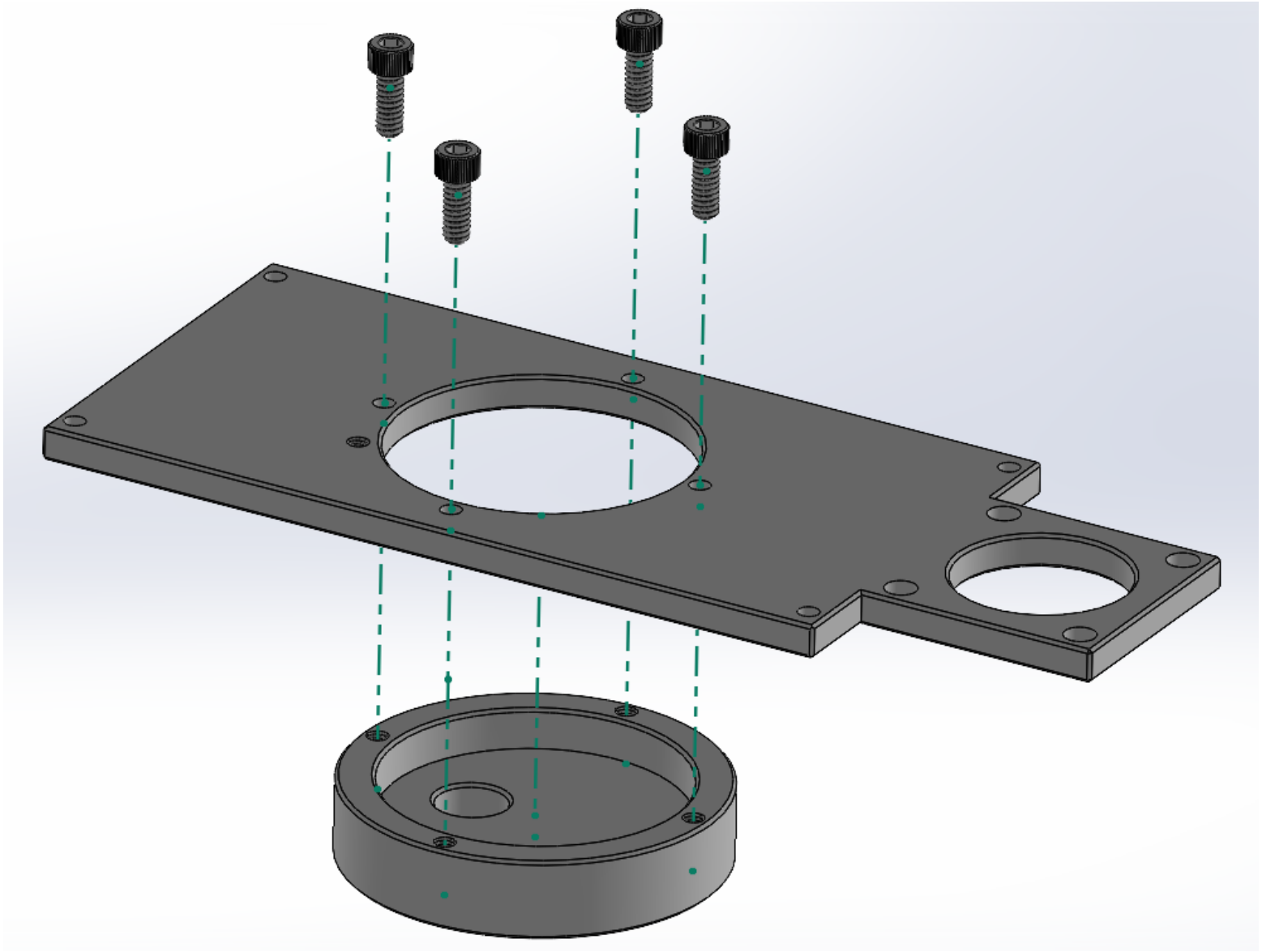
Structure Updates



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Future Improvements

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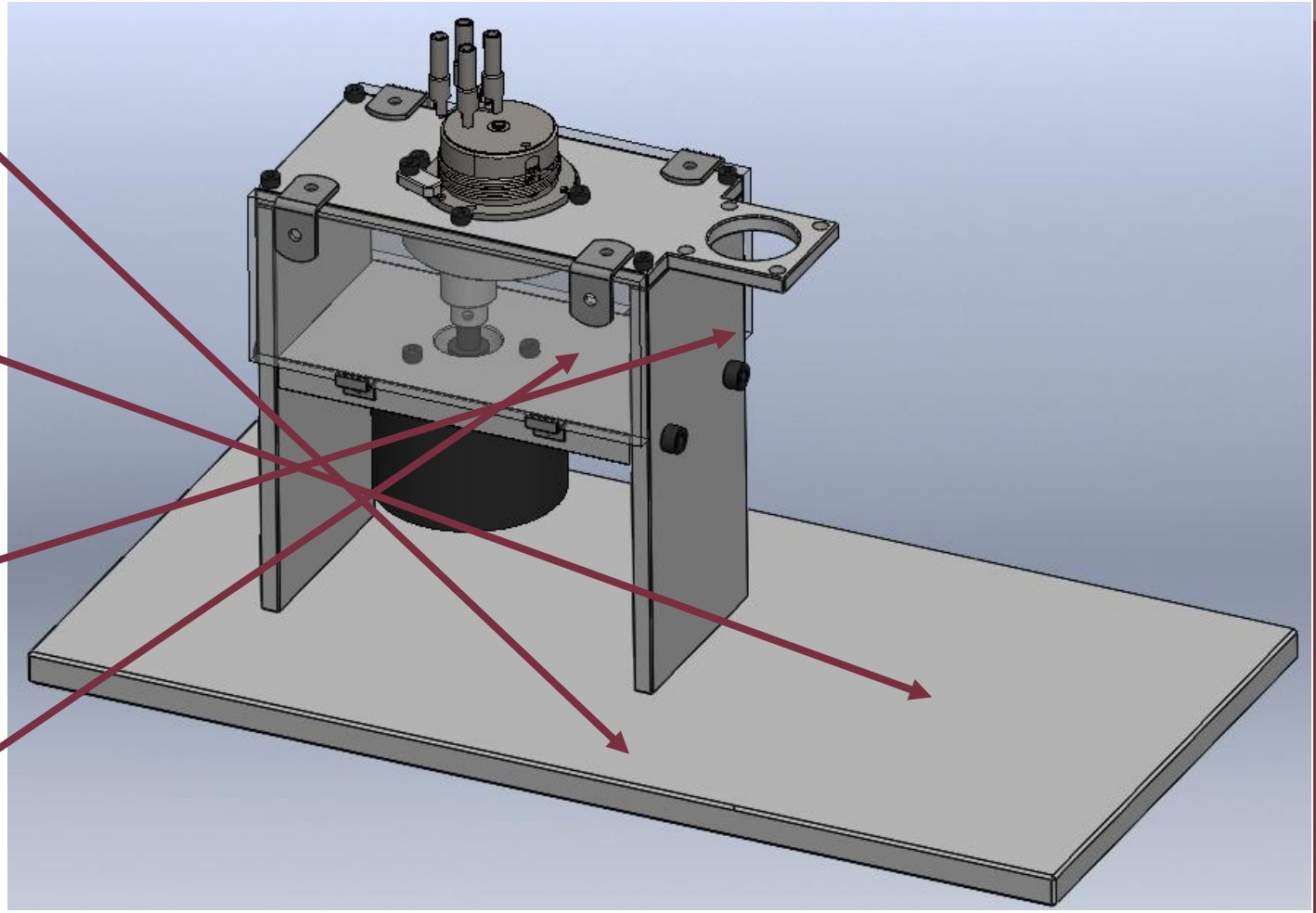
- Baseplate extension
- Integrate HMI assembly into fixture
- Wire management
- Magnetic sensor mount



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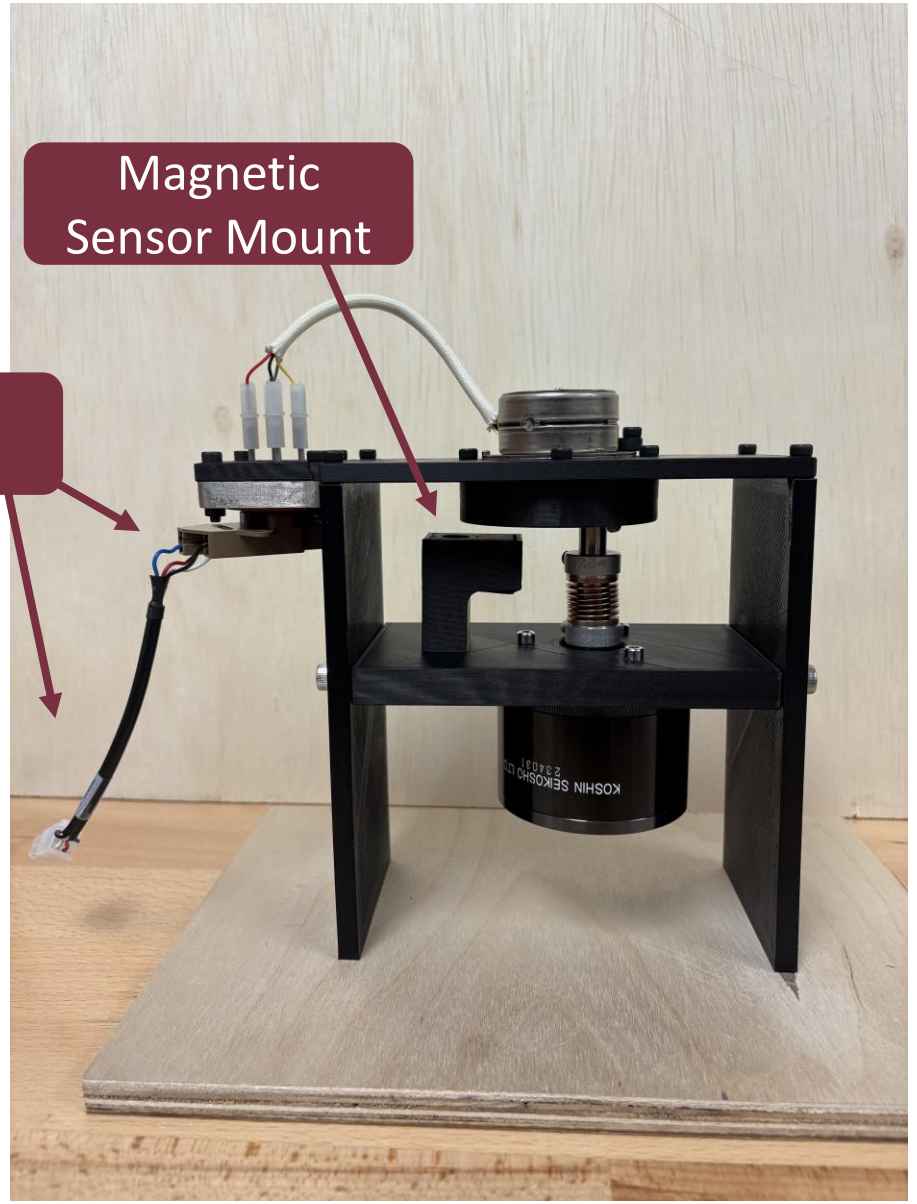
Status for Printed Prototype



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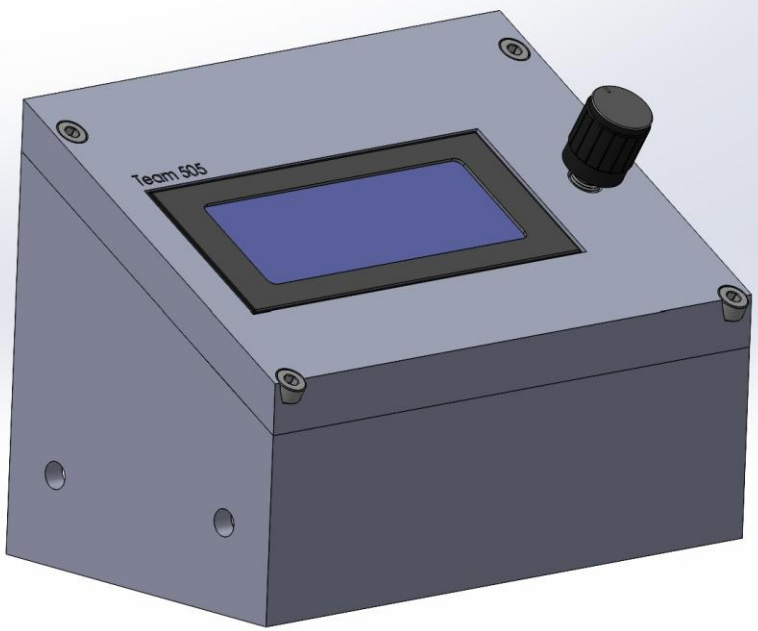
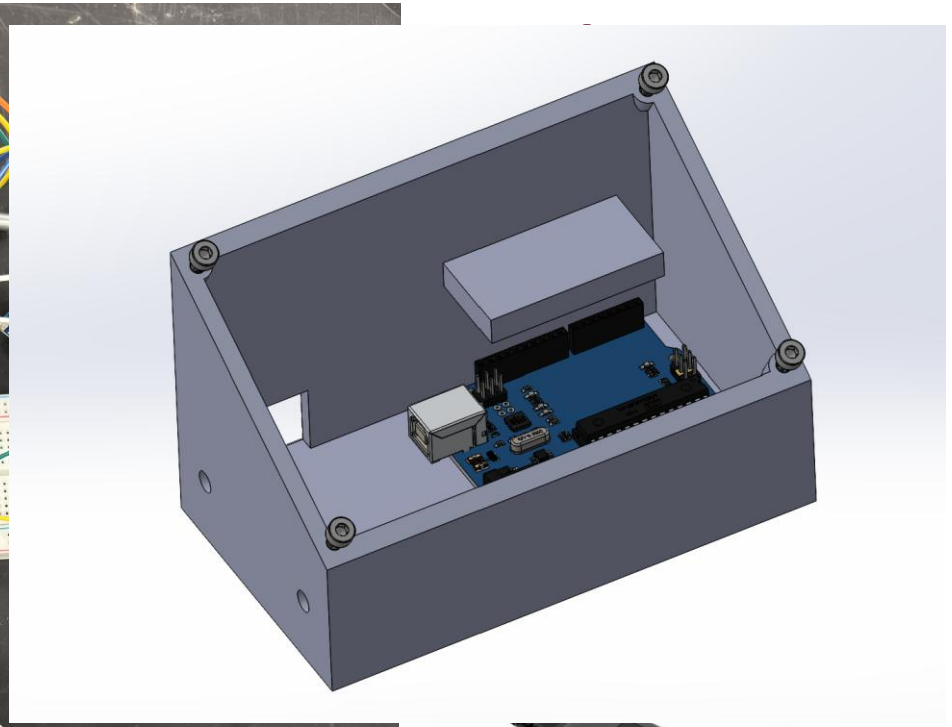
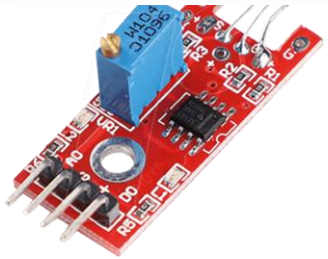
Electronics Updates







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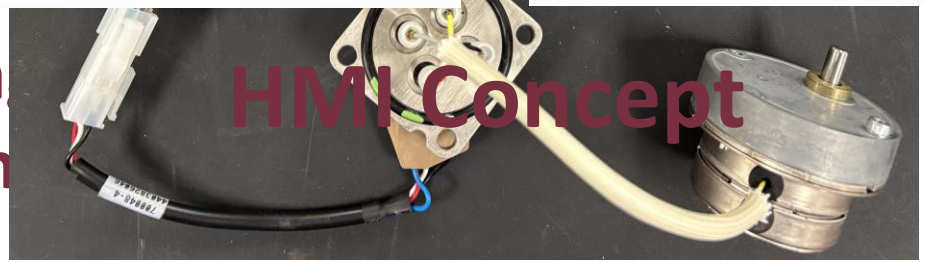

HMI Concept

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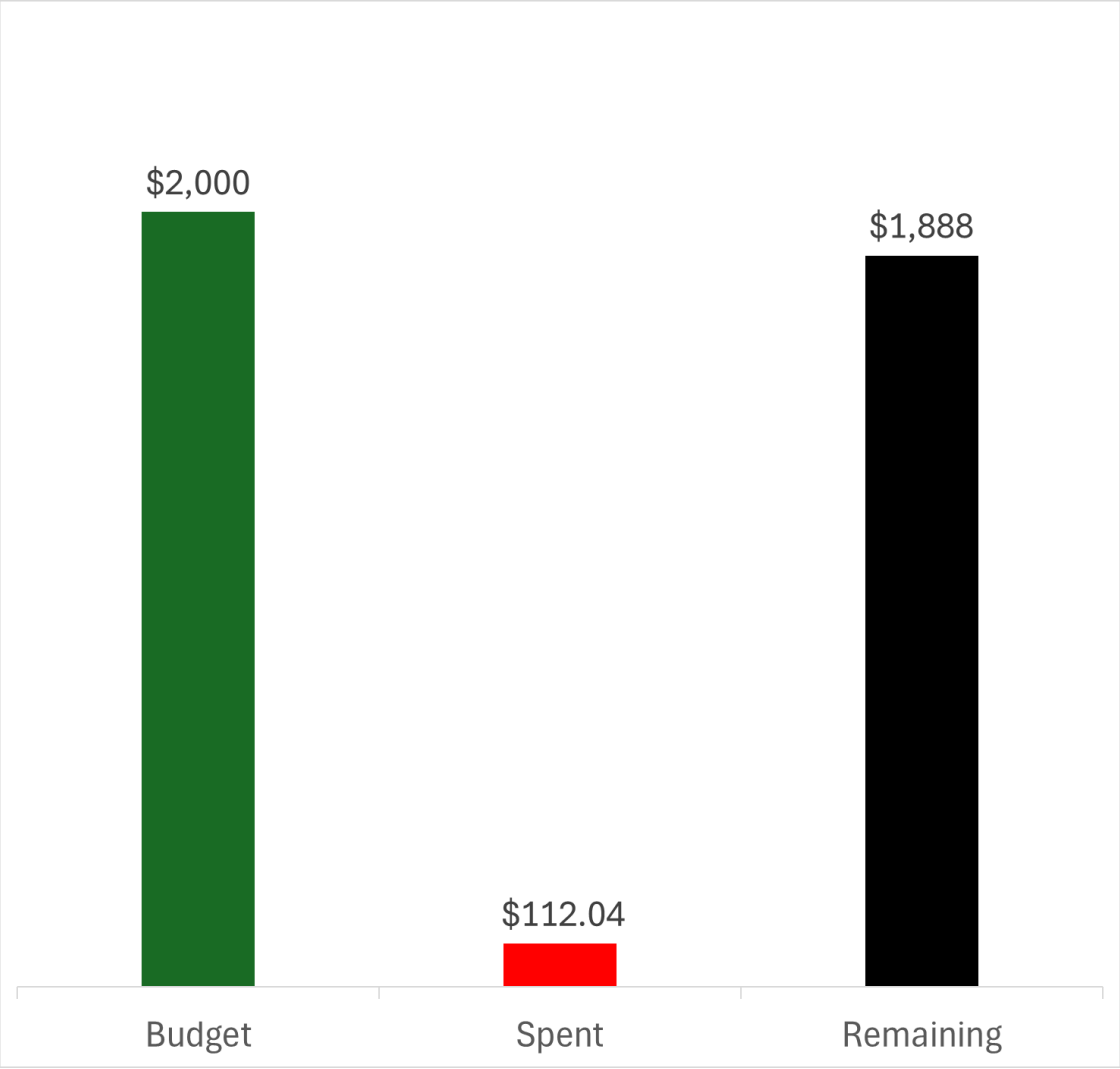
Updated Budget



Expected Future Costs

- Cost for machining parts
- Plexiglass acrylic
- Stainless Steel Hardware

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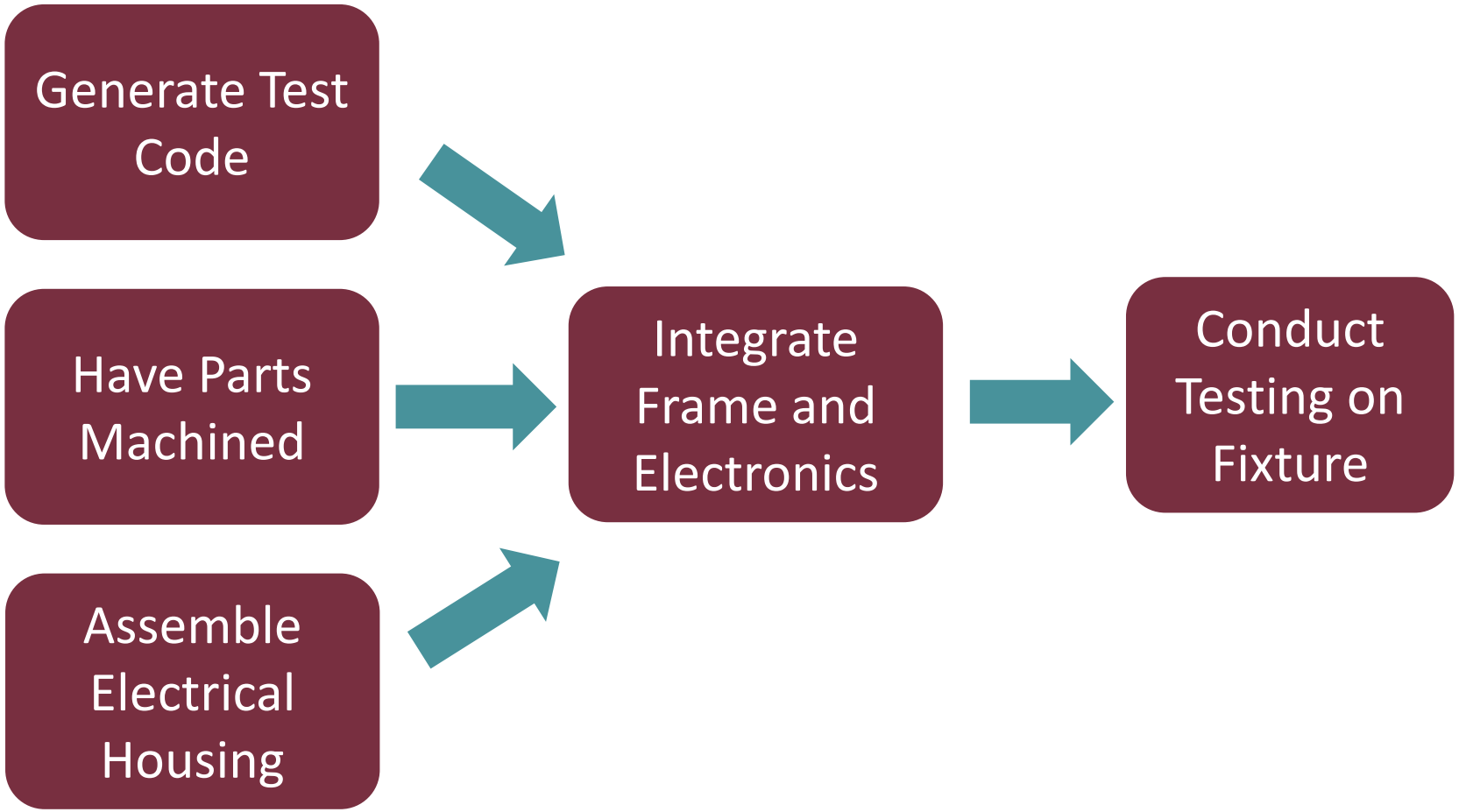
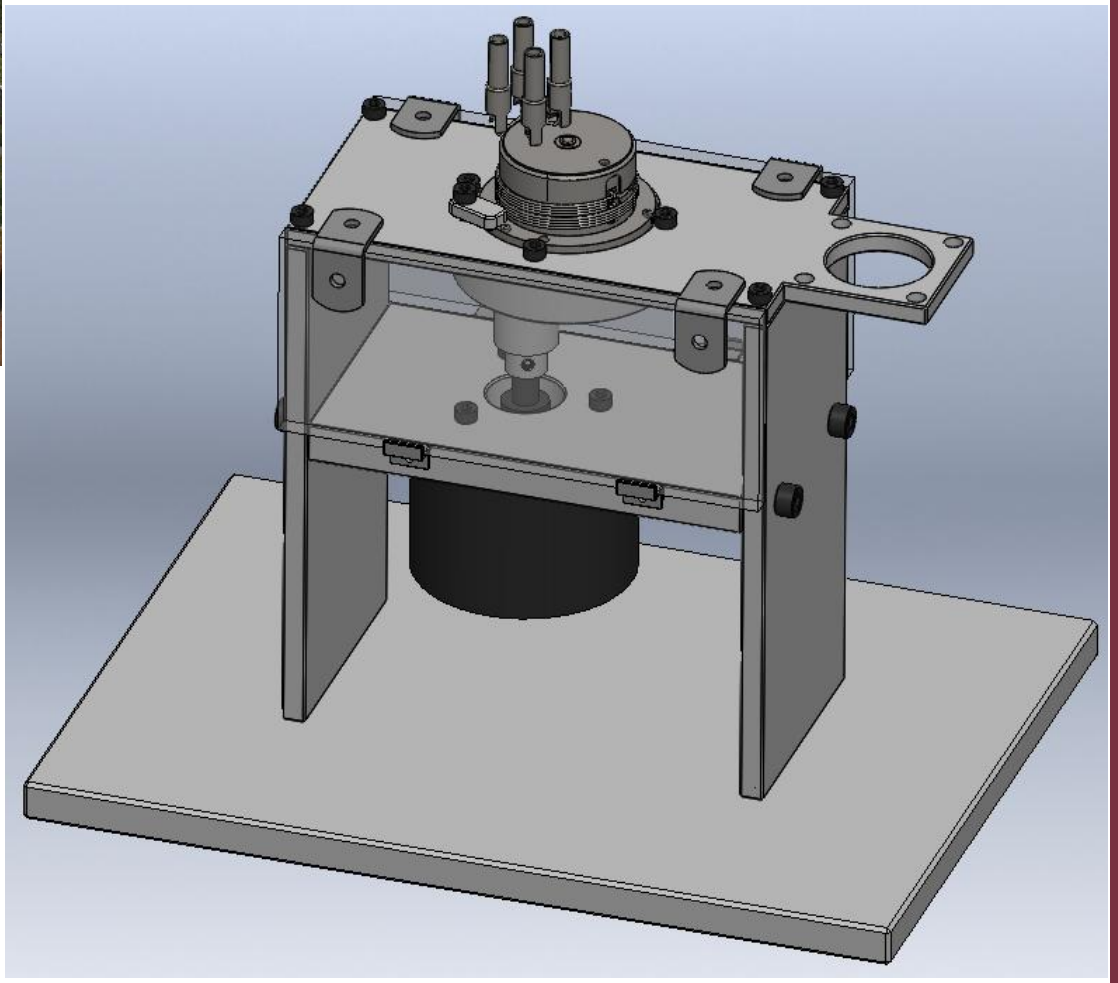
Future Work


Generate Test Code
Have Parts Machined
Assemble Electrical Housing
Integrate Frame and Electronics
Conduct Testing on Fixture

Questions?



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