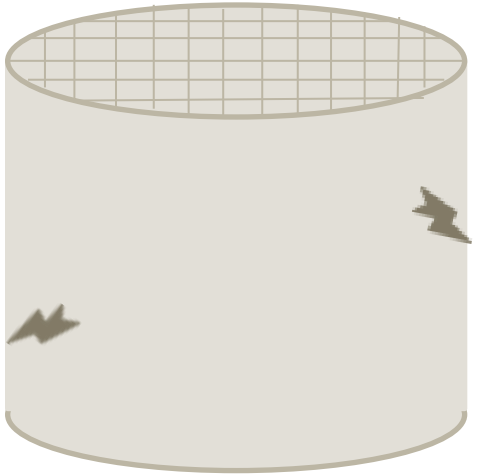
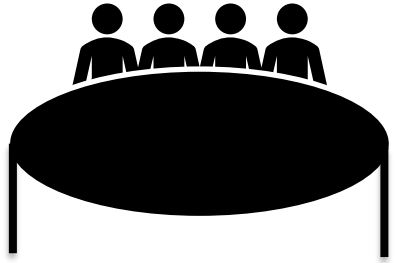
DR5

Material Handling of Ceramics



Team 502: Makada Browne, Erich Noack,
Charles Stubbs, Amelia Veith

Team Members



Makada Browne

Industrial Engineer

Erich Noack

Mechanical Engineer

Charles Stubbs

Mechanical Engineer

Amelia Veith

Mechanical Engineer

Sponsor & Advisor

Tevin Smith
Process Engineer at
Corning Incorporated

Alexander Richter
Process Engineer at
Corning Incorporated

Dr. Shayne McConomy
FAMU-FSU College of Engineering

Sponsor

CORNING

Tevin Smith

-Process Engineer at Corning

-B.S., Material Engineering, Rensselaer Polytechnic Institute (RPI)

-Point of Contact for Team 502

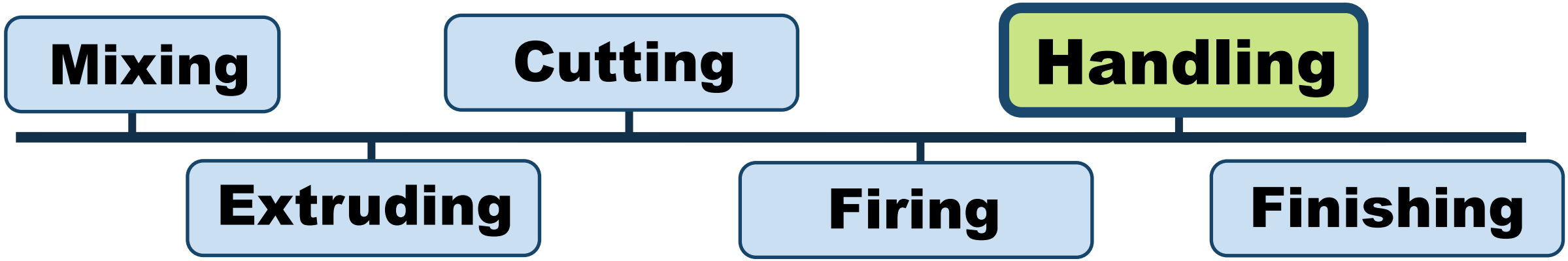
Alexander Richter

-Sr. Process Engineer at Corning

-PhD. Chemical Engineering NC State

-Point of Contact for Team 502

Manufacturing Process



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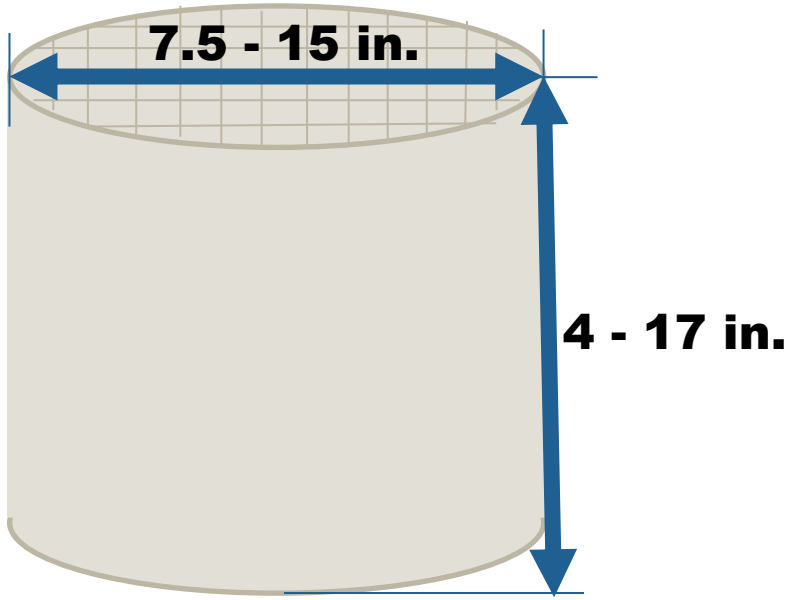
Ceramic Filters

- After the firing process and before the finishing process
- Brittle, low impact strength and very thin cell walls
- Samples vary in weight and size



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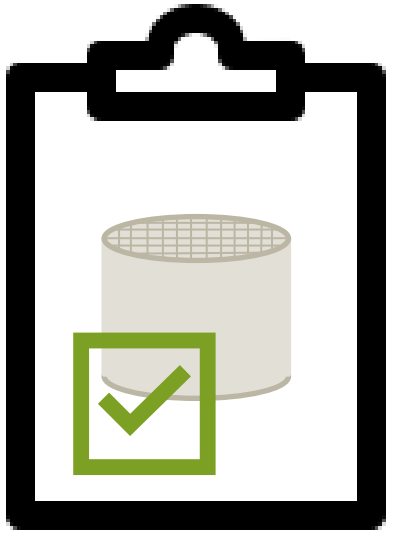
Objective

Propose and develop an alternative solution for successful manipulation of ceramic parts without observed damage



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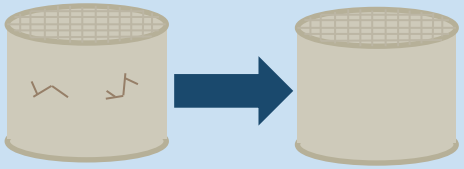
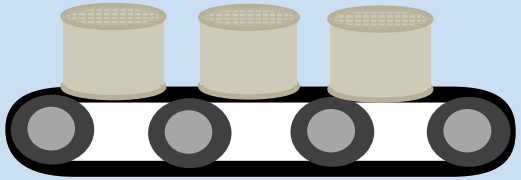
Key Goals

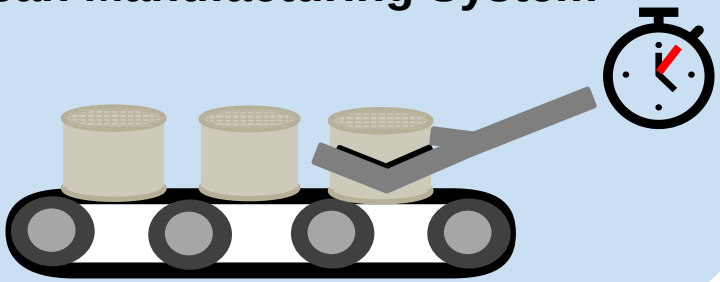
Eliminate Part Damage



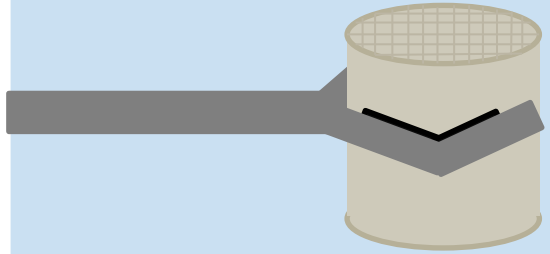
Test with Part Samples



Lean Manufacturing System



Pick and Place Capability



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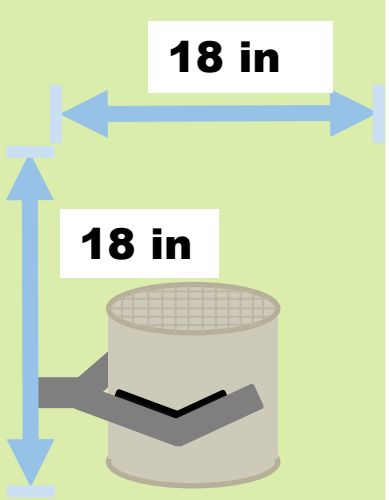
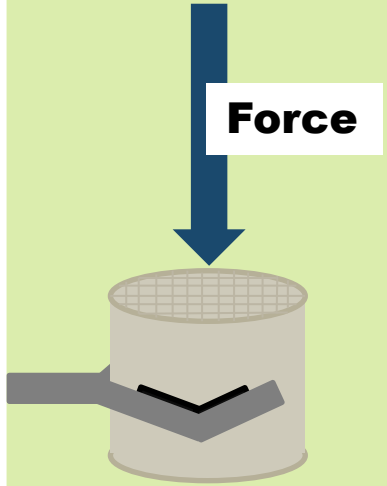
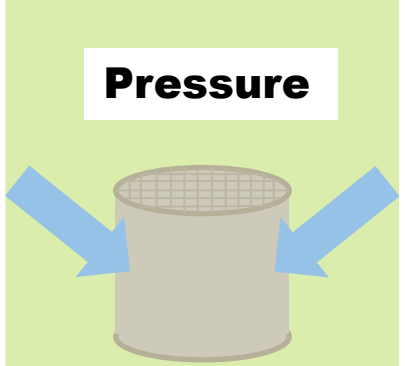
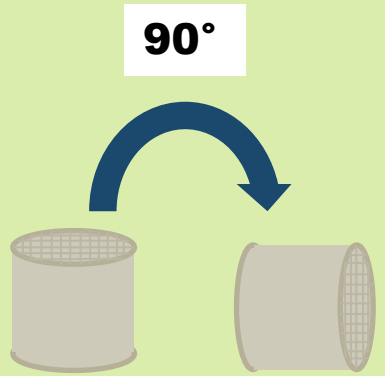
Targets and Metrics

Part Displacement	Support Part Load	Regulate Pressure	Part Misalignment	Part Orientation	Engagement Time
					

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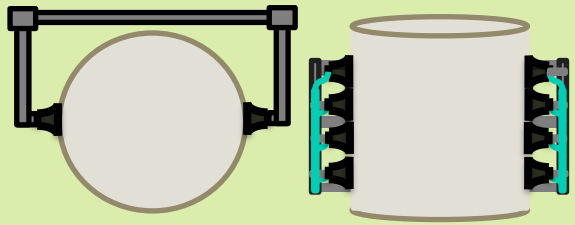
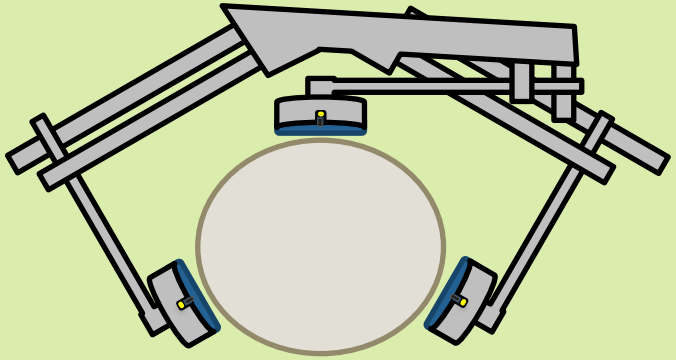
Concept Selection

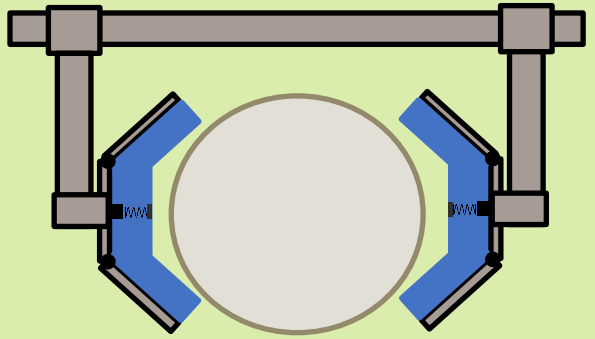
Vacuum Suction Grippers



Three Point Gripper



Parallel Sensing Grippers



3rd

1st

2nd

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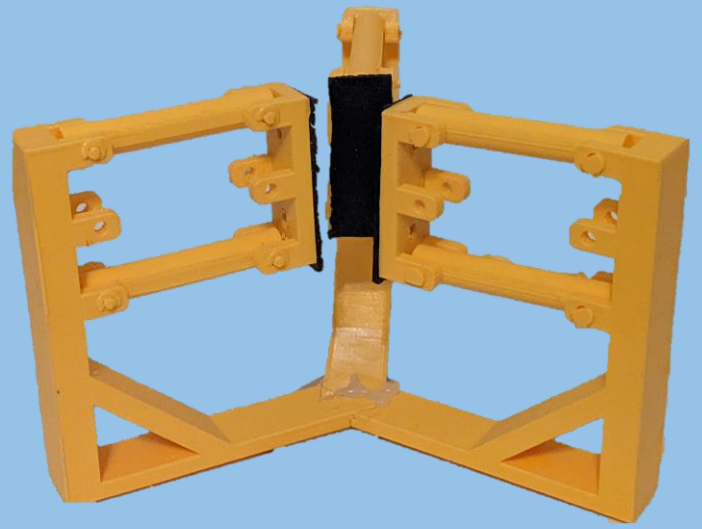
Preliminary Prototype

- 3D Printed Preliminary Design
- Parallel Linkages
- Rubber Gripper Padding



NOT TO SCALE

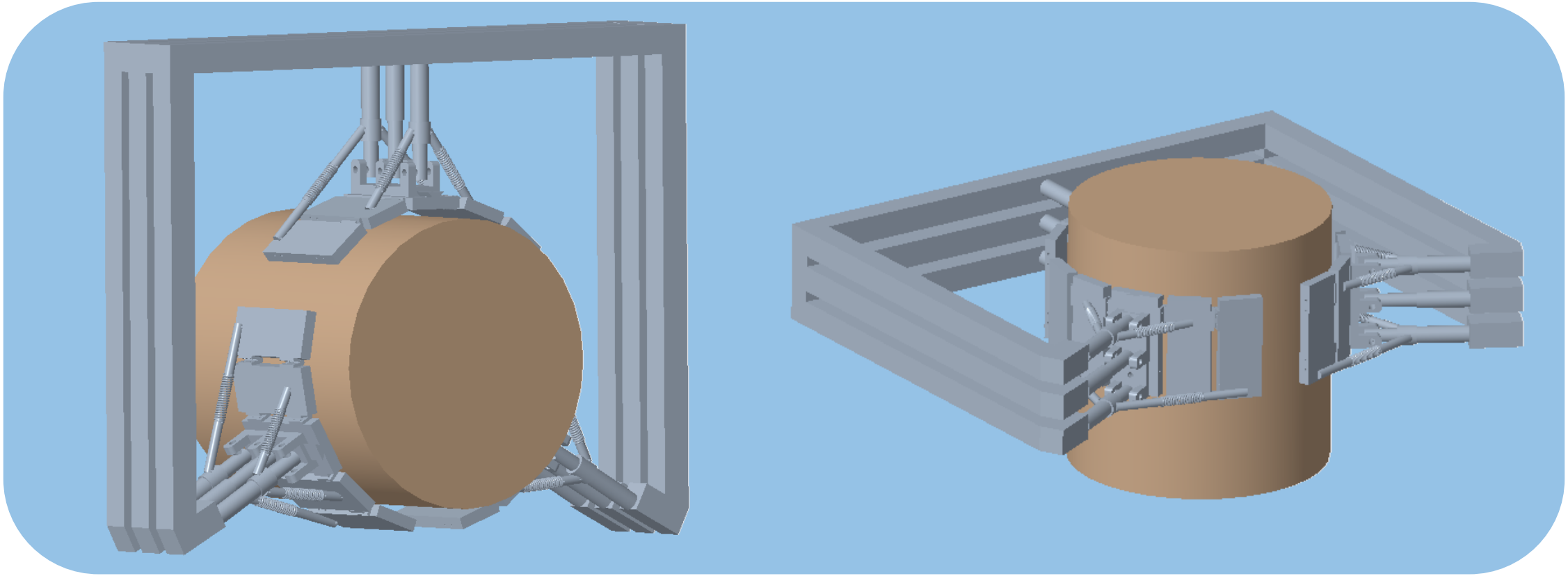
Erich Noack

Design Changes

Sideways chassis design (along the part axis)	Allows unobstructed motion for horizontal loading and unloading
Linear actuators instead of DC motors	Higher static and dynamic force transmission, and easy to control
Multiple Pads included on grippers	Better force distribution and improved surface contact contour
Compression springs and collars to be included	Supports load with compliance and accommodates changing part diameters

Erich Noack

Previous Design Configuration



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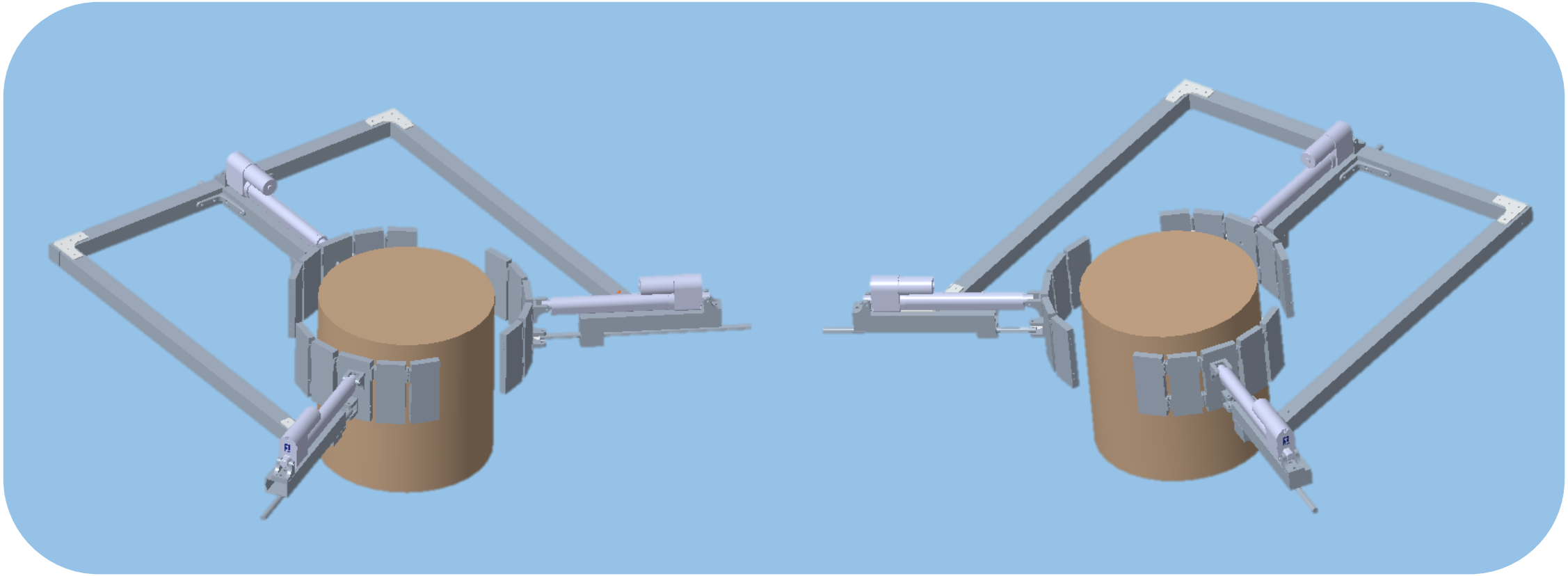
Current Design Configuration



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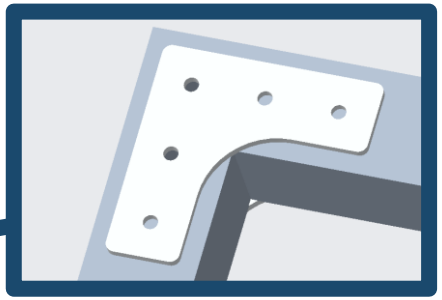
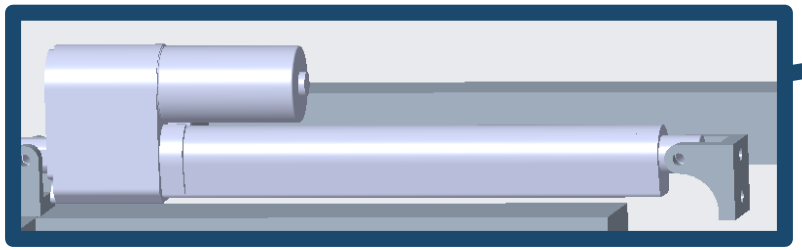
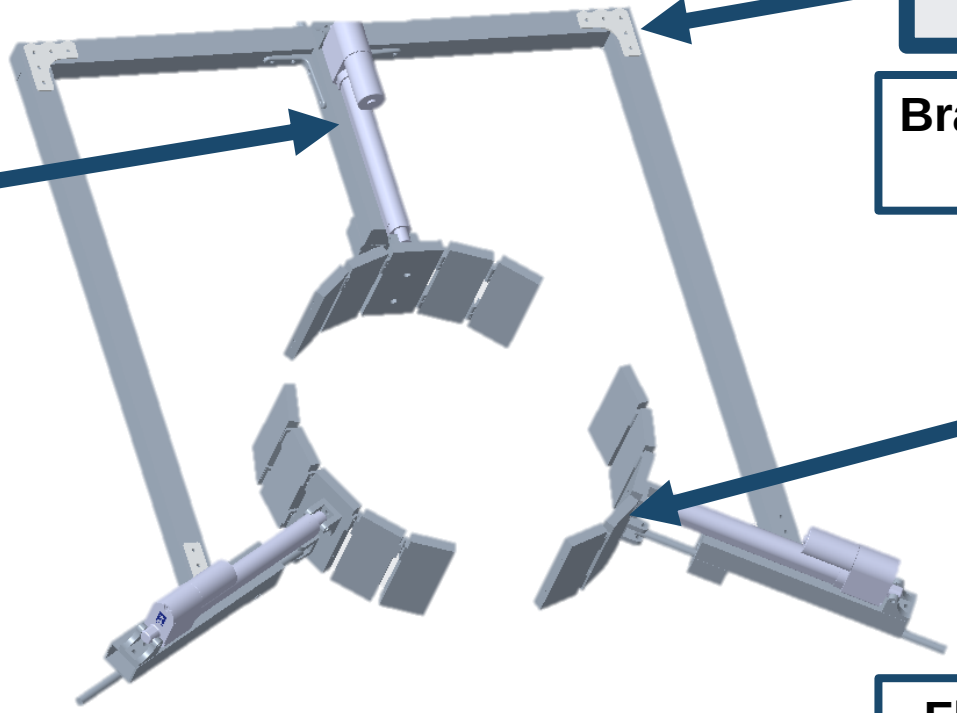
Functional Diagram



Brackets added to joints for extra support



Linear actuators that move normal to the part surface



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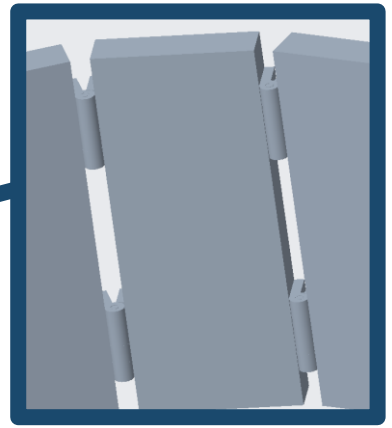
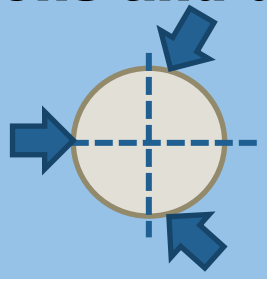


Flaps connected to ends of actuators and rods to contact part

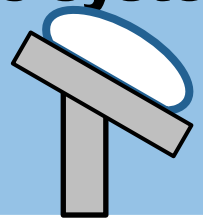
Design Analysis

Use kinematics to define proportions and dimensions



Select springs and design mechanism to improve gripper contour to parts' circumference

Select materials for structural loading and padding from static and dynamic system analysis



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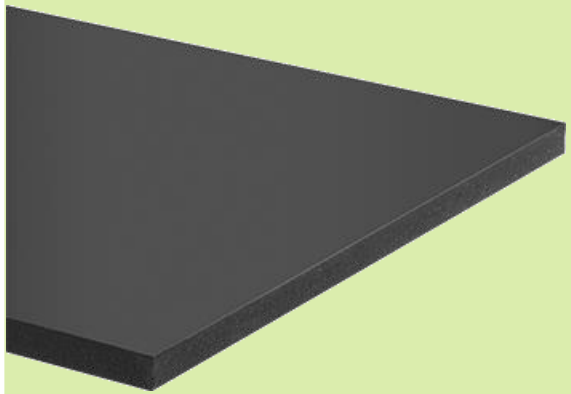
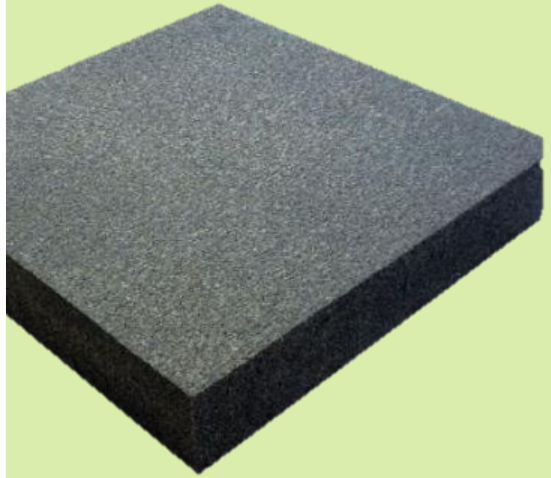
Material Selection

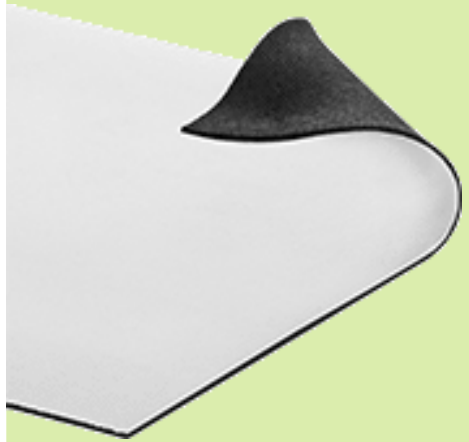
Polyurethane Foam



PORON Microcellular Urethane



Fabric-Faced Wear-Resistant



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Electronic Selection

Linear Actuators

Glideforce Linear Actuator with Feedback: 25kgf, 8" Stroke (3x)

Sensors

Force Sensing Resistor Force Sensor 45.36kgf (1x)

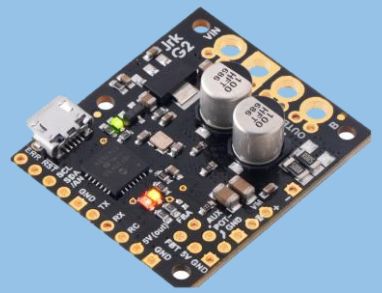
Optical Sensor 0~200cm (1x)

Microcontroller

Arduino Mega (1x)

Motor Controllers

USB Motor Controller with Feedback (3x)



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Testing and Evaluation

- Preliminary testing to verify electrical and software system functionality
- Implement a test encompassing the validation of each target
- Create test fixture accommodating full vertical and horizontal motion
- Ensure safety and data collection fidelity during test procedure

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Industrial Operations

Finances

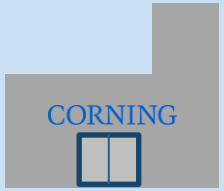
Increase in Overhead cost

Cycle time

Less than or equal to 30 seconds per filter

Facility Layout

Optimize on current layout



Quality

Decrease in scrap rate

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Working Bill of Materials

Part Name	Quantity	Received
Polyurethane Foam Sheet	1	✓
Fabric-Faced Wear-Resistance Natural Gum Foam Sheet	1	✓
Poron Microcellular Urethane Foam Sheet	1	✓
Arduino Mega	1	✓
Teensy	1	✓
12V 10A Power Supply	1	✗
Pivot Hinges	24	✗
Linear Actuators	3	✓
Mounting Bracket Pair for Linear Actuators	2	✓
Motor Controller with Feedback	3	✓
Die Spring: Medium Duty, Chrome Silicone Alloy Steel	10	✓

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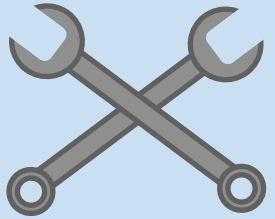
Current Work

Assembly and Fabrication

Project Testing

Project Debugging



Electrical and Software Design

Erich Noack

Thank You

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