FAMU-FSU College of Engineering

Powder Removal in Microgravity Environments (PRIME)

Team 518

Virtual Design Review 5

Team Introductions

Cole Daly
Mechatronics Engineer

Lauren McNealy
Systems Engineer

Alexander Fryer
Project and Test Engineer

Team Introductions

Kyle Evans
Thermal Fluids Engineer

Tripp Lappalainen
Manufacturing and Design Engineer

Chelsea Kiselewski
Quality and Design Engineer

Sponsor and Advisor

Project Sponsor
Justin McElderry
Materials Engineer -
NASA Marshall Space Flight Center

Academic Advisor
McConomy, Shayne Ph.D.

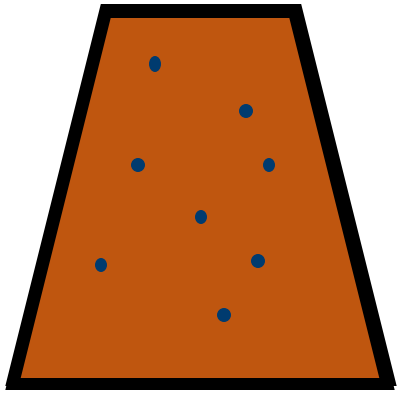
FAMU-FSU College of Engineering

FAMU-FSU College of Engineering

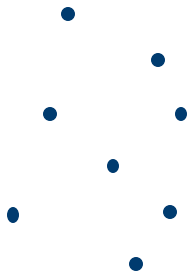
Objective

The objective of this project is to develop a proof-of-concept device for removing powder residue from additive manufactured parts in microgravity environments.

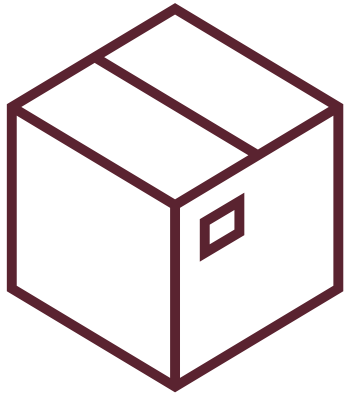
Clean



Remove



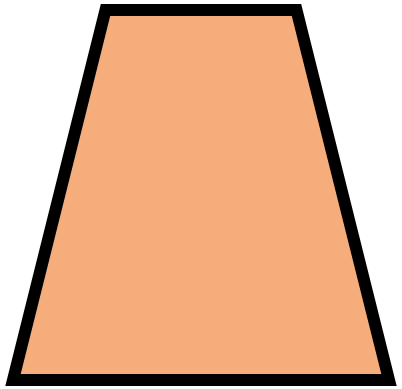
Contain



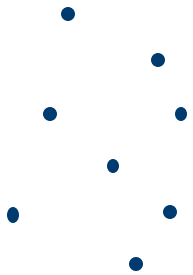
Objective

The objective of this project is to develop a proof-of-concept device for removing powder residue from additive manufactured parts in microgravity environments.

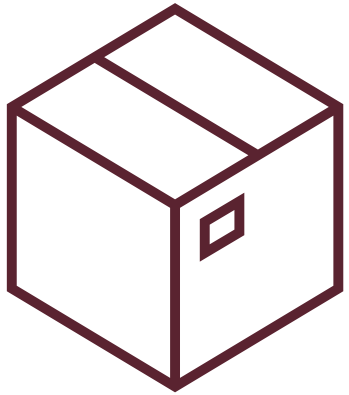
Remove



Move



Contain

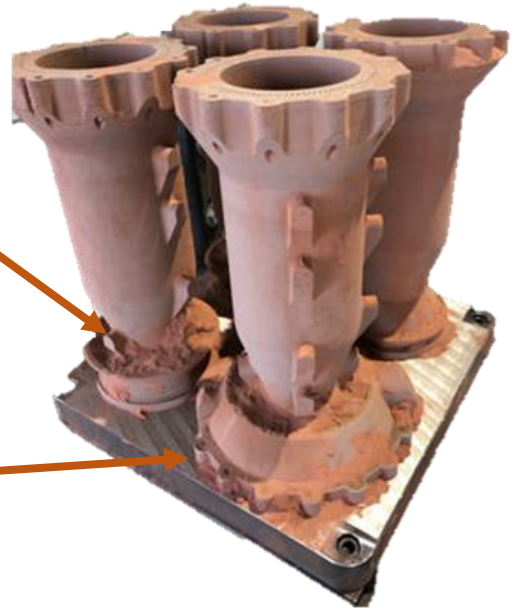


Project Background

Additive Manufacturing offers:
Rapid Prototyping
Reduced Production Time

Trapped powder inside parts

Hazardous particles in microgravity

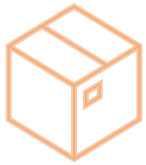


Goal: Portable cleaning device to bring to ISS

FAMU-FSU College of Engineering

Key Goals

Automatic Operation



Contain Dirty Solvent

Functions in Microgravity

Clean Internal Features

Durable

Targets and Metrics

Design will be able to clean 85-90% of debris

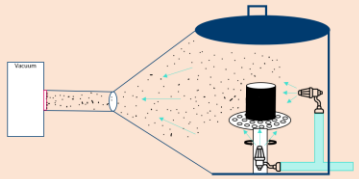
Cleaning

Particles are contained with no leaks in the device

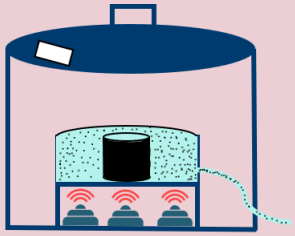
Containment/Safety

Concept Selection Overview

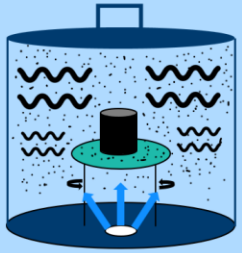
Liquid Nitrogen Spray



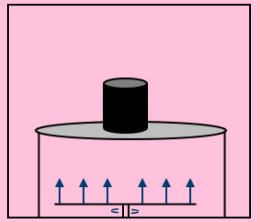
Sonic Wave Cleaner



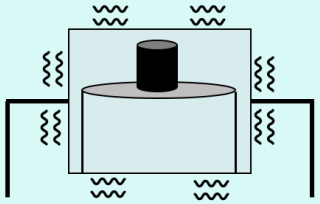
Vacuum Nucleation



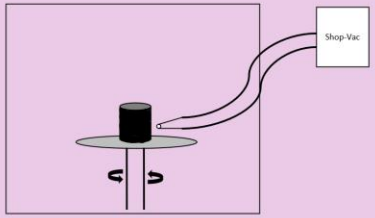
Dishwasher



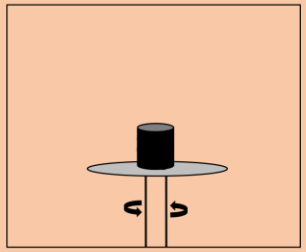
Momentum Shaker



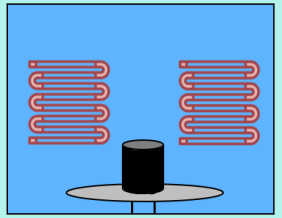
Shop-Vac Hose



Spinning Plate



Boiling Water



Sonic Wave Cleaner

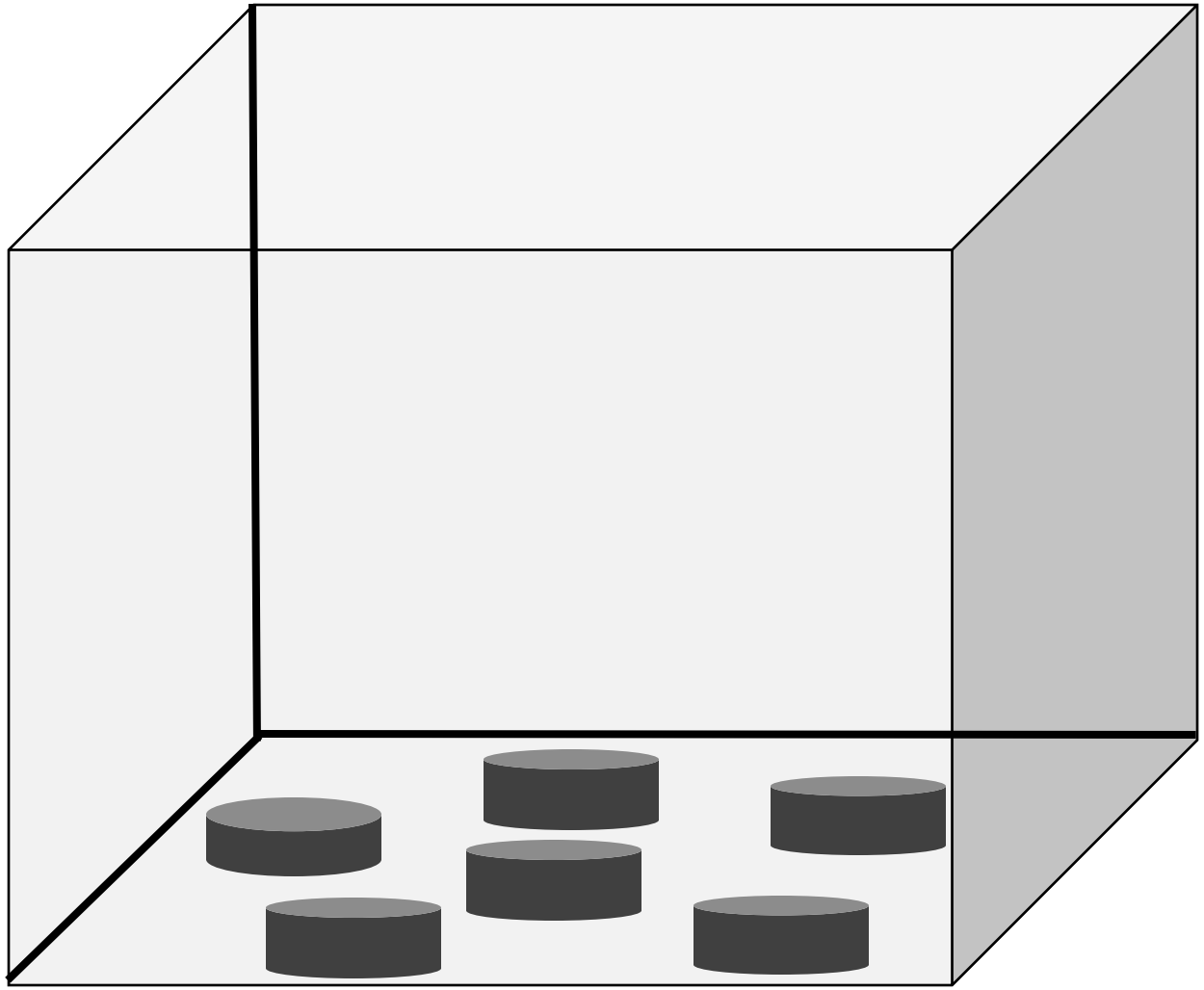
- Sonic waves pulsed underneath fluid
- Fluid is spun creating vortices
- Air will be pushed into the main body, while drain valve is opened

Project Overview/Updates

How will our prototype function:

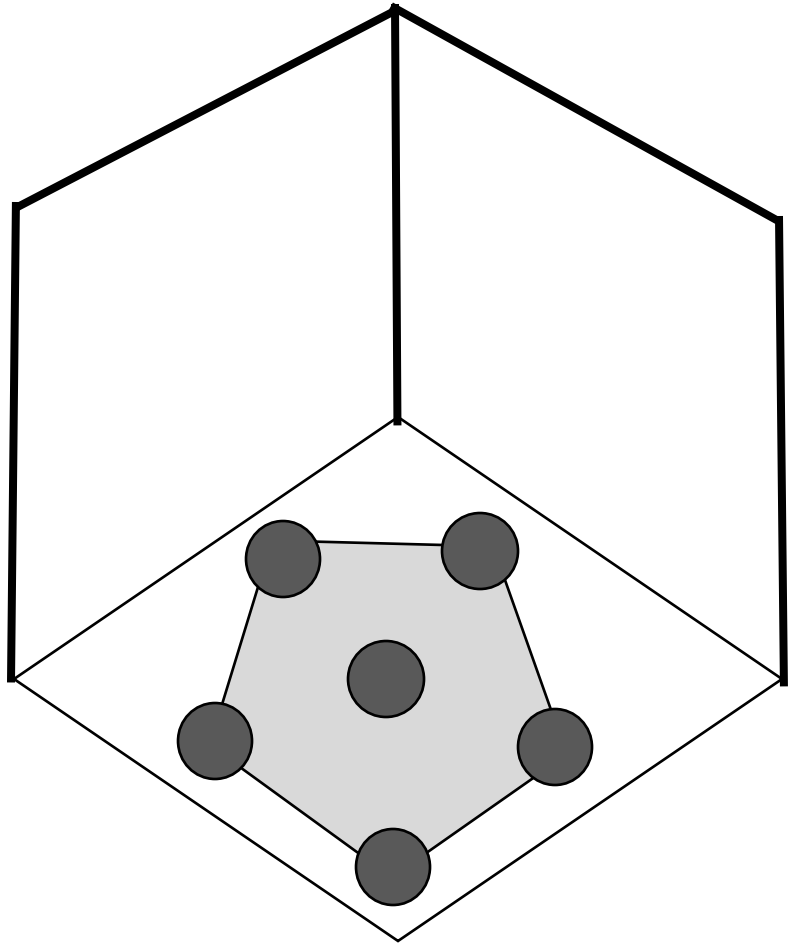
- Sensors, sit flush against the bottom of the main body

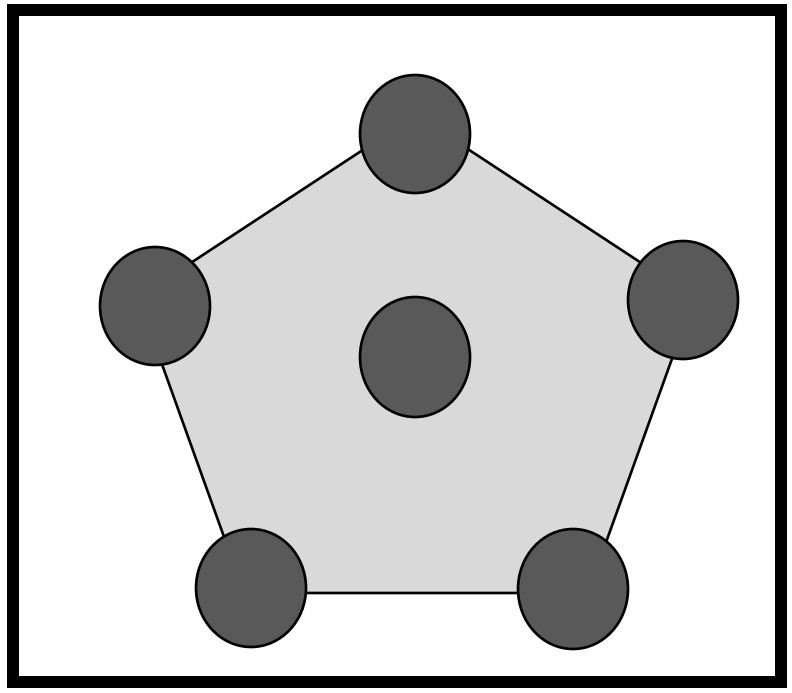
- Sensors produce a cone of frequency; this cone will ensure the part area is covered



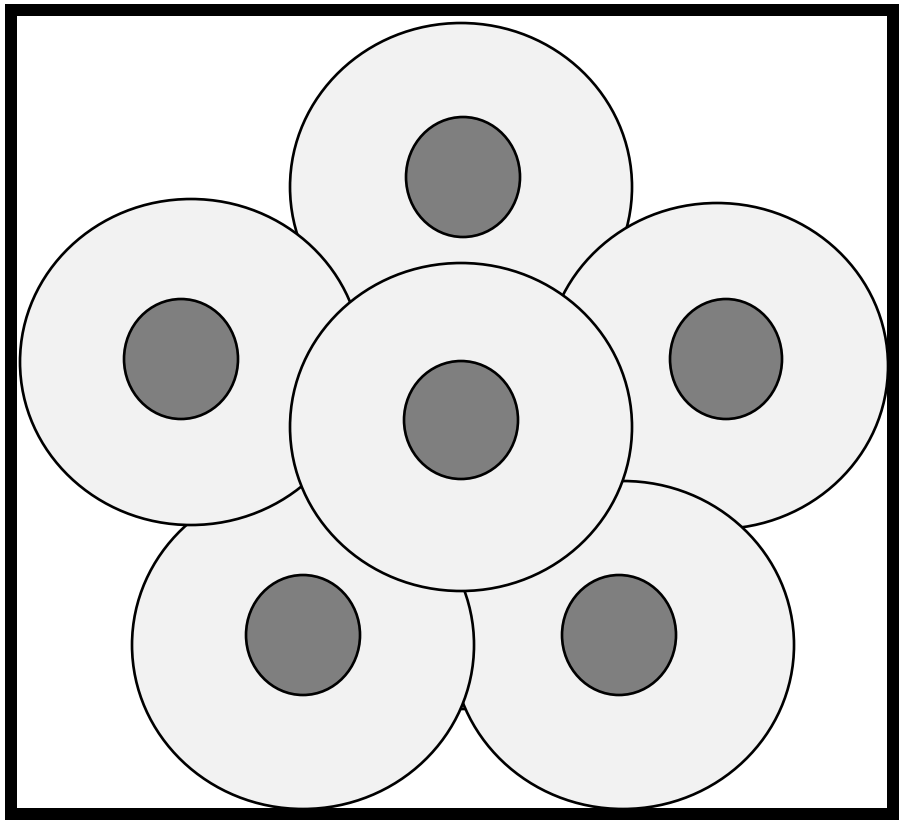
FAMU-FSU College of Engineering

Project Overview/Updates





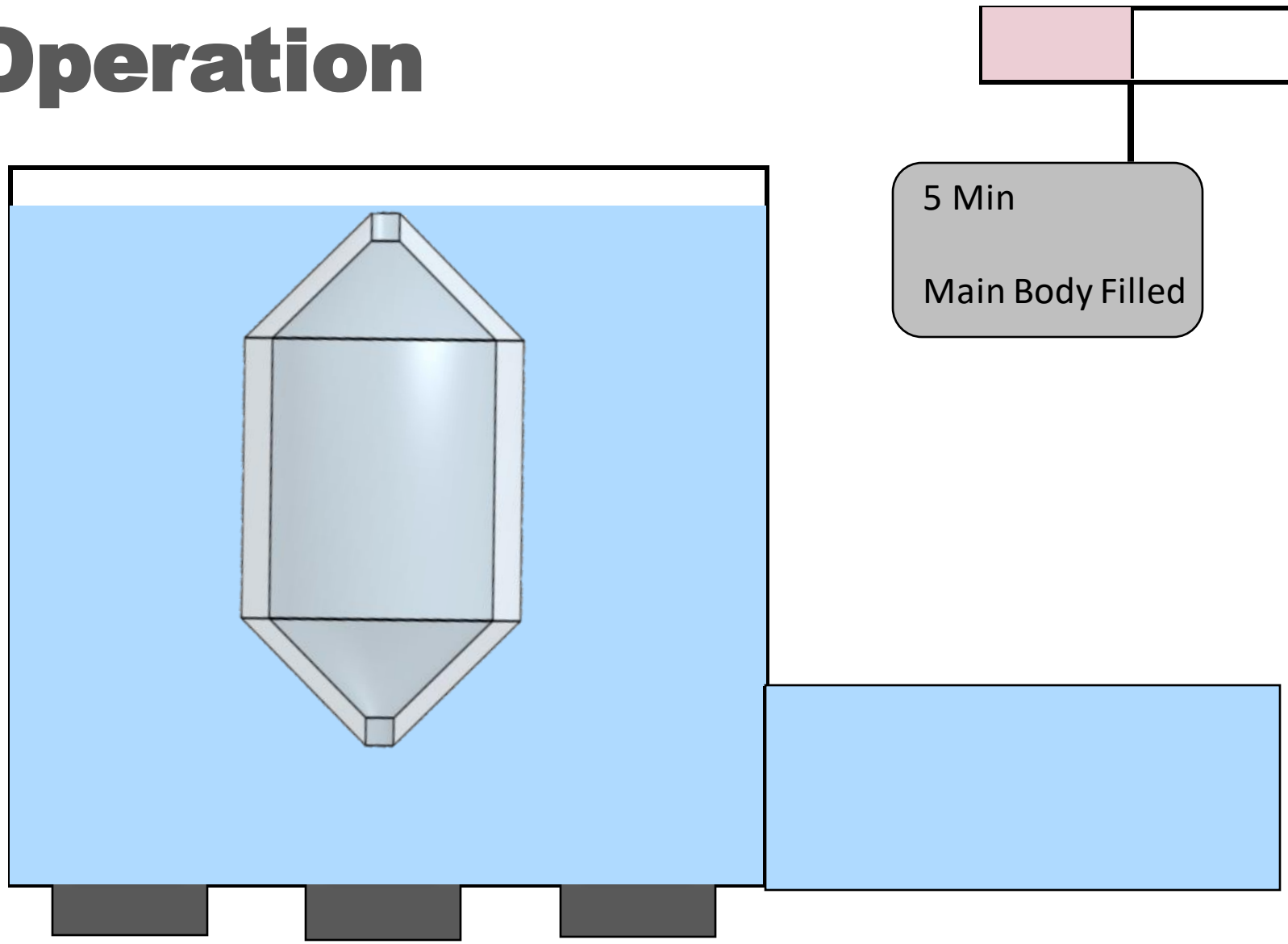
Project Overview/Updates



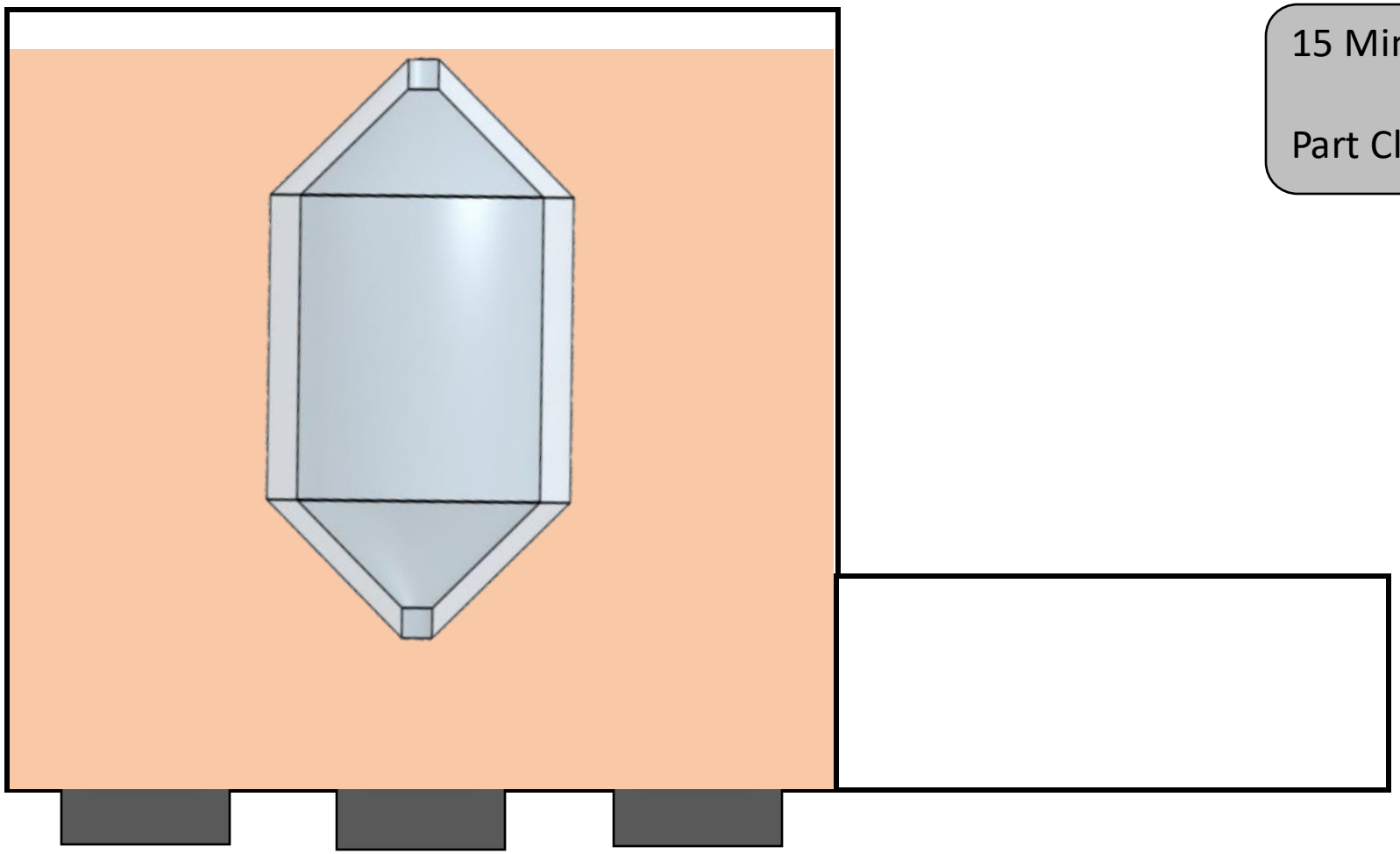
Why:

- Rectangular mesh basket is covered by all the sensors
- The location of the stands holding the box off the ground are located on the corners

Operation



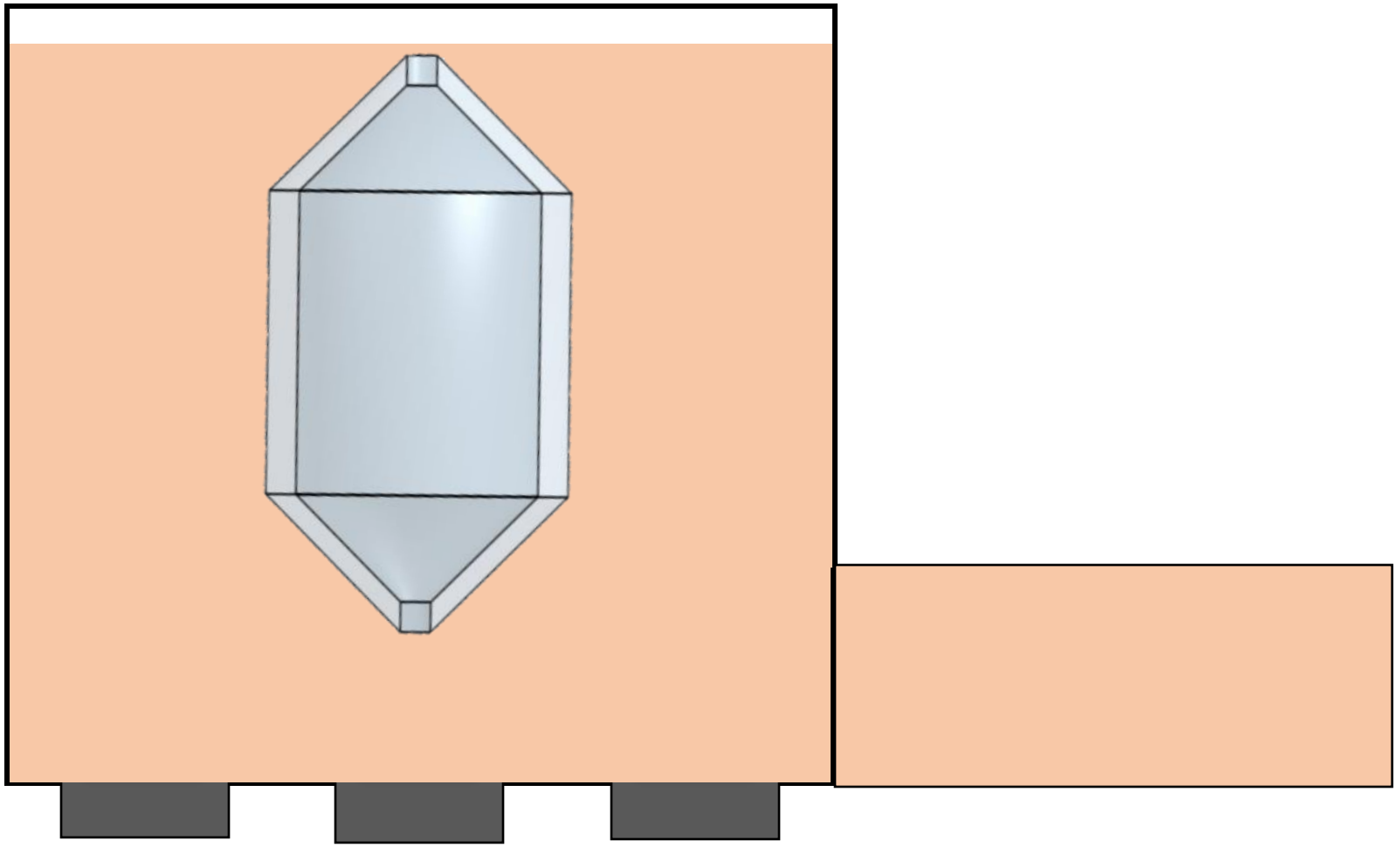
Operation

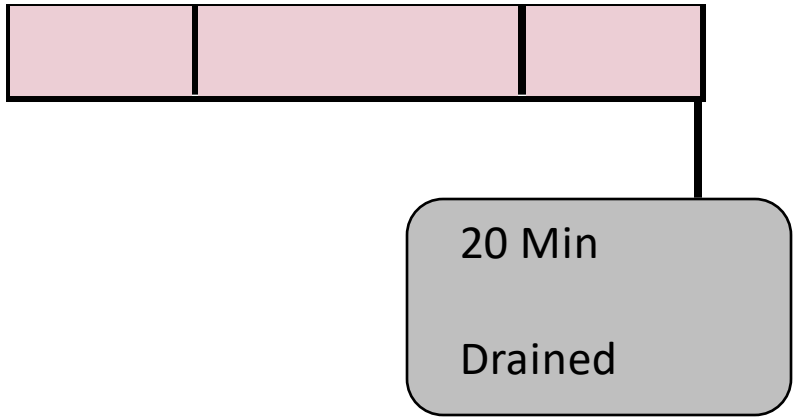


15 Min

Part Cleaned

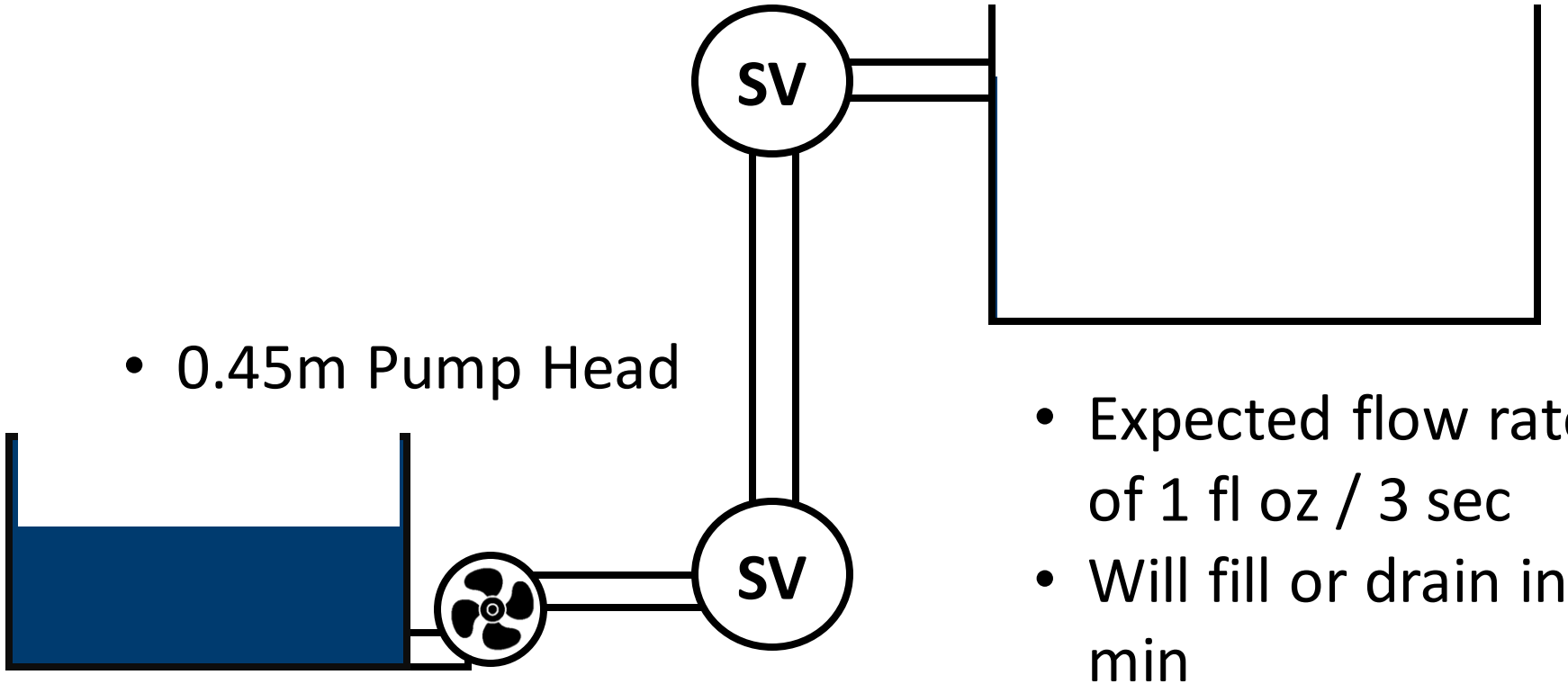
Operation





Flow Analysis

1

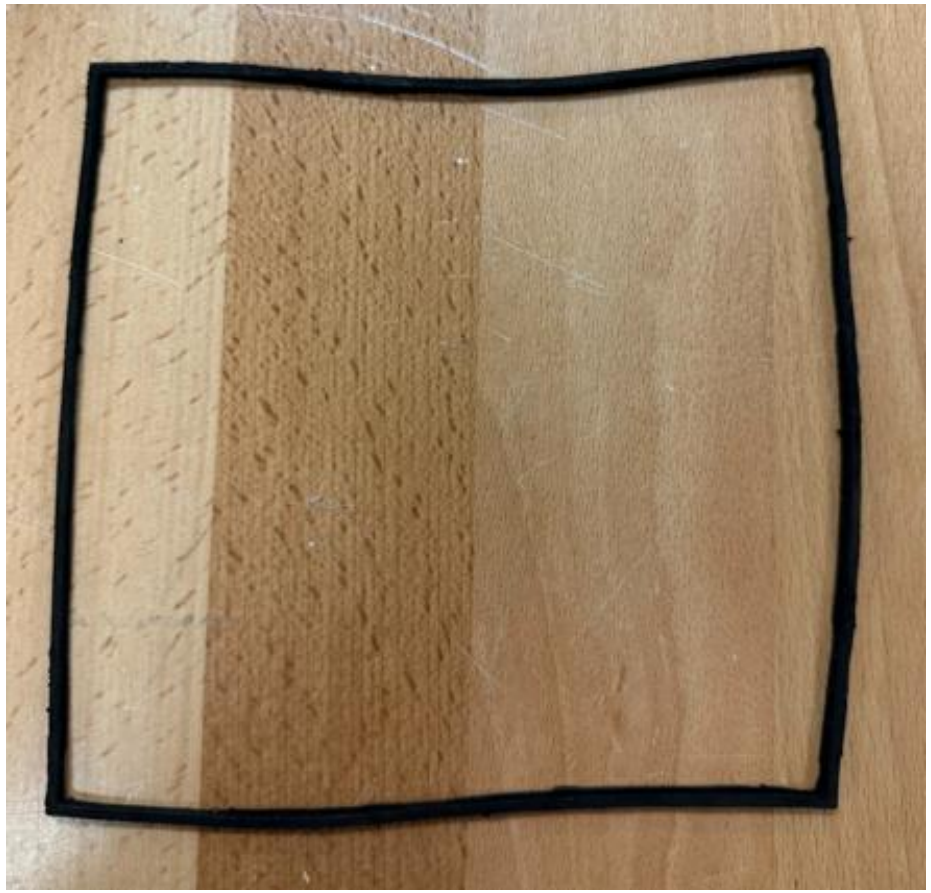


- 0.45m Pump Head

- Expected flow rate of 1 fl oz / 3 sec
- Will fill or drain in 5 min

Gasket for Sealing the Lid

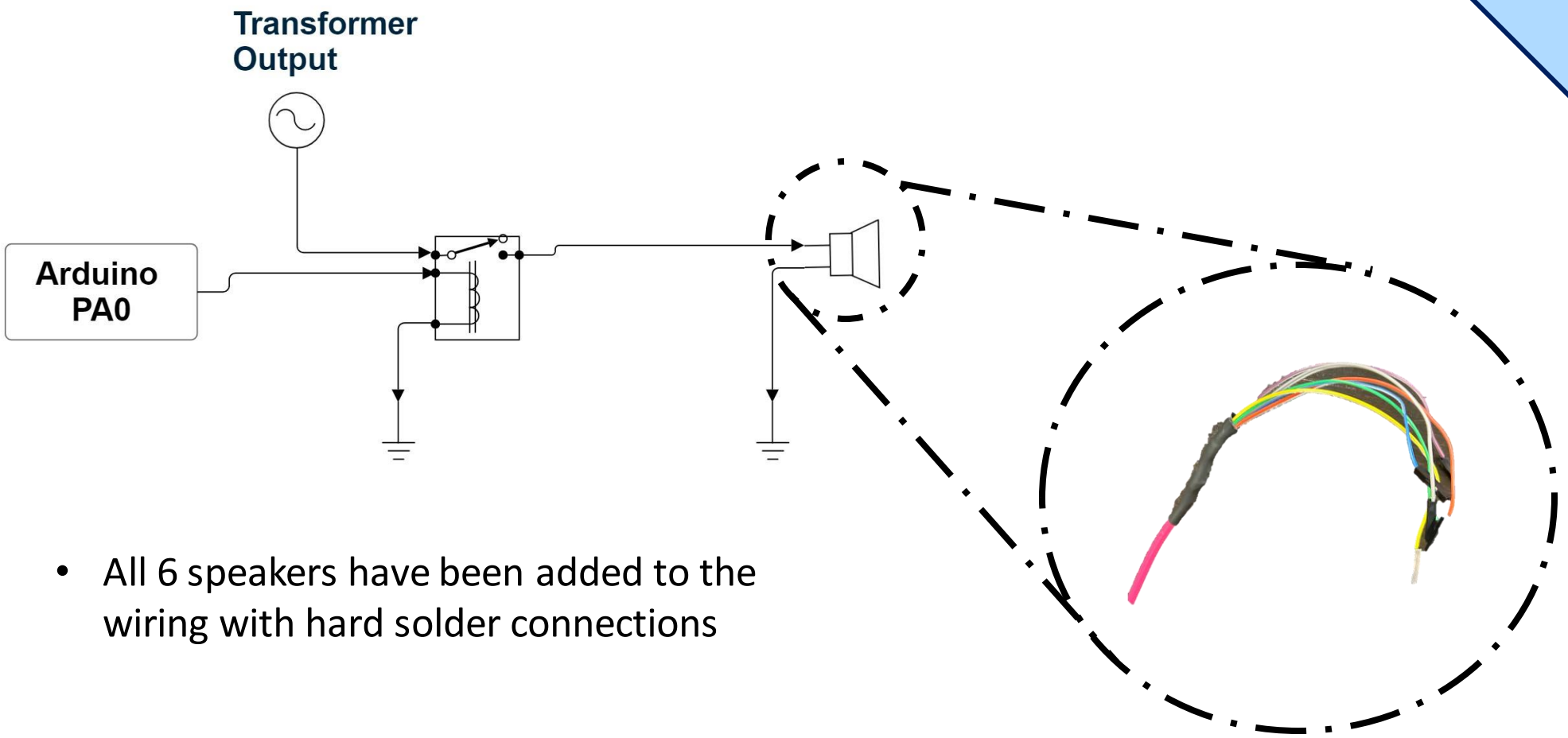
1



- Buna-n gasket selected
- Excellent resistance to oils and grease
- Laser cut for precise shape
- Multiple passes at low power done to avoid embrittlement

Electrical Progress

1



- All 6 speakers have been added to the wiring with hard solder connections

Inner Components

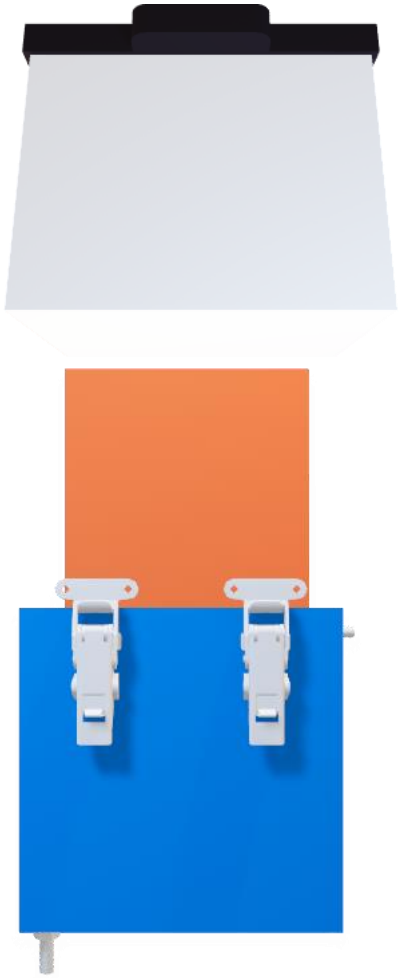
- The mesh basket will be secured to the sides of the main body
- It will hold contaminated part to avoid damage
- Size is 5" x 5" x 4.5"

1

2

Current Work

Preliminary Creo Design



- The mesh will go into the machine fitted with the black lid on top
- Sealed with two latches

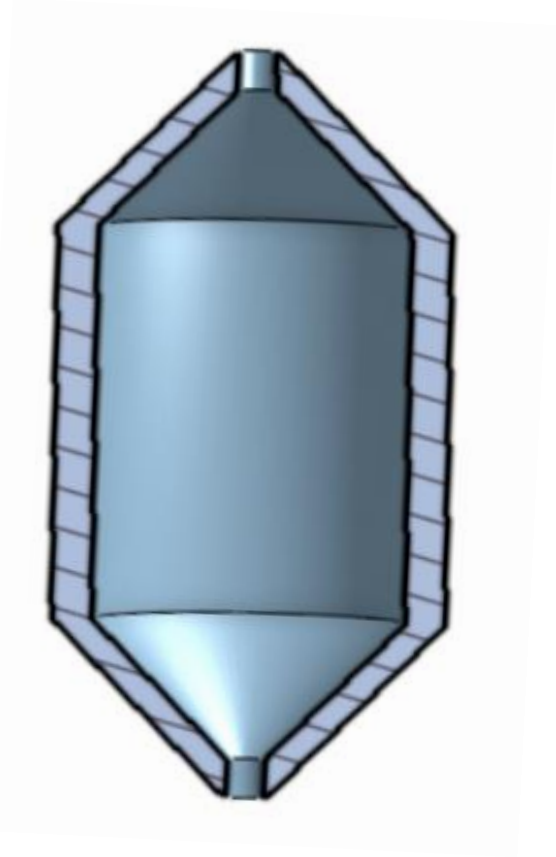
1

2

Current Work

Test Part

- Height of part is 1in
- 1/20'' hole
- Hollow
- SLS Nylon 12 (Particle Size$\approx 40\ \mu m$)



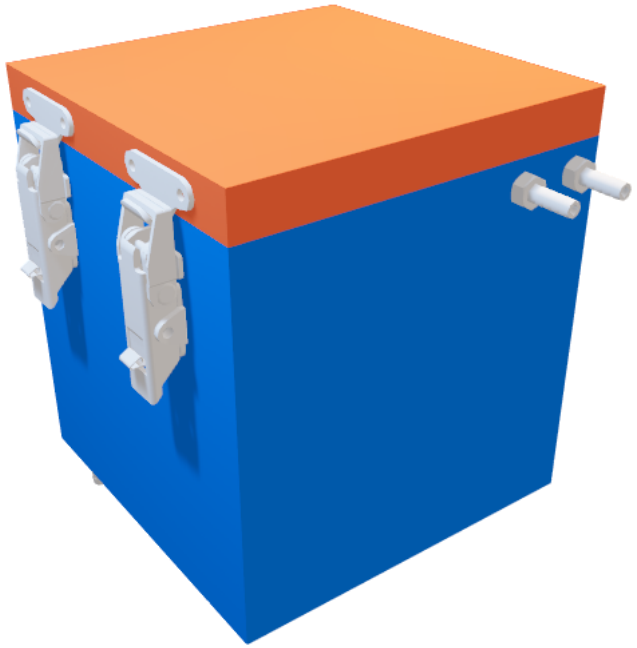
1

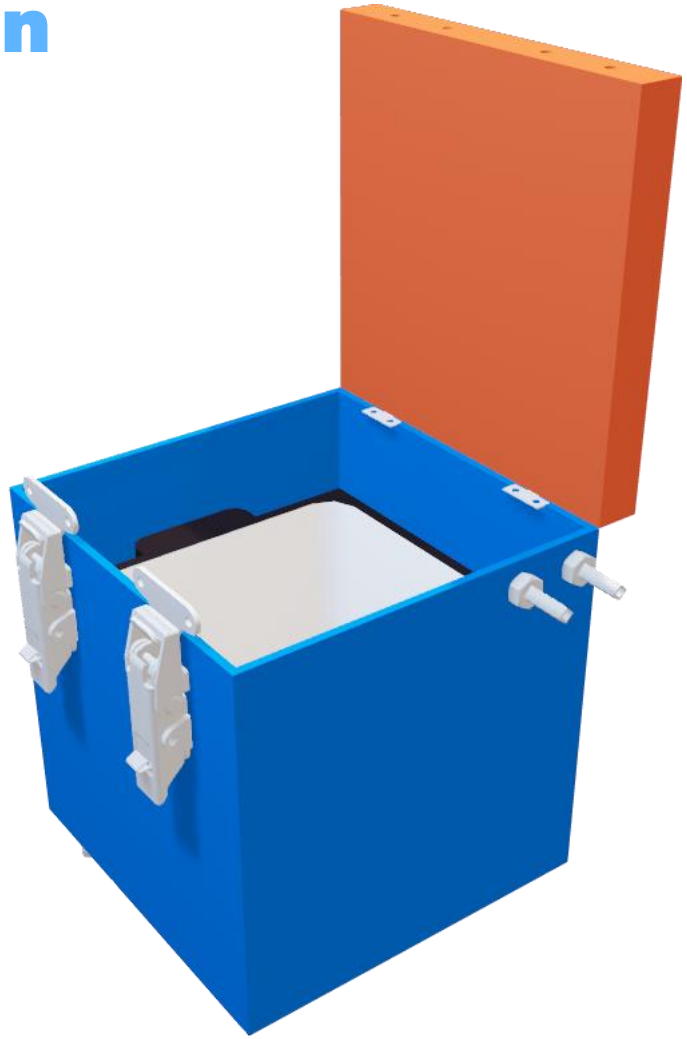
2

3

Current Work

Preliminary Creo Design



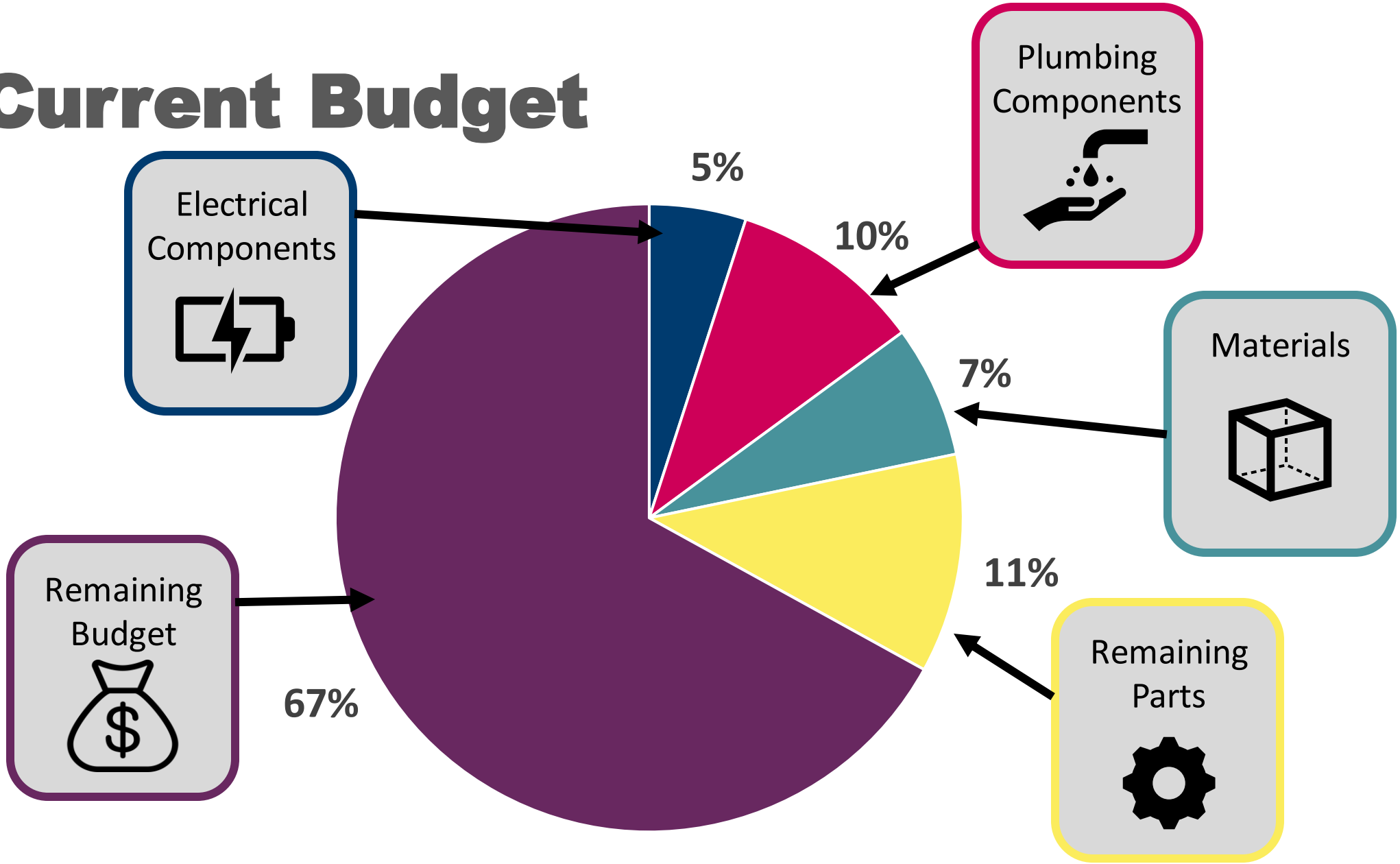


1

2

3

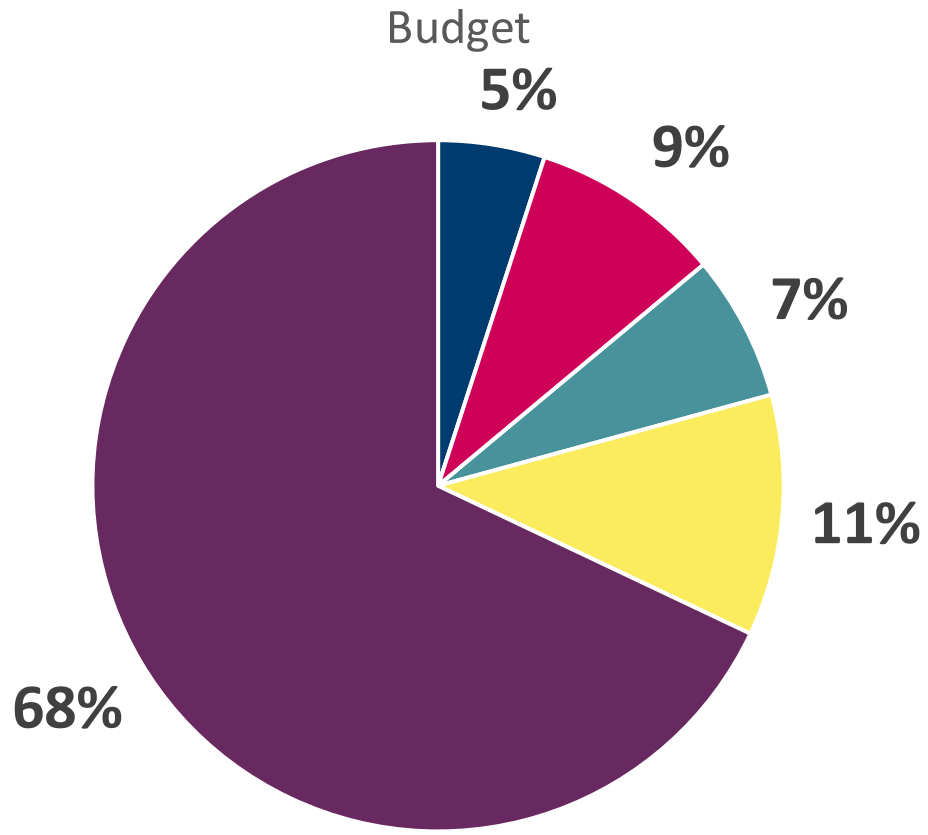
Current Budget



Current Budget

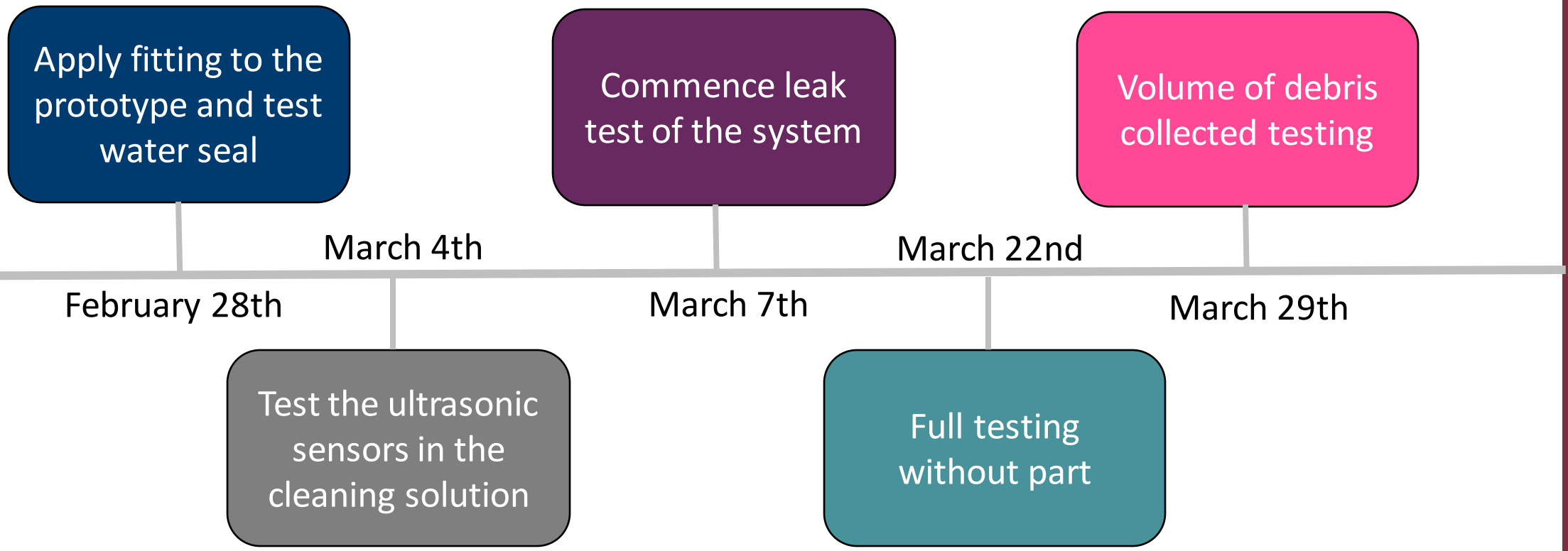
- Electrical Components - $99.73
- Plumbing Components - $198.75
- Materials - $136.19
- Remaining Parts - $225.75

- Remaining Budget - $1339.58



FAMU-FSU College of Engineering

Future Work



Questions

FAMU-FSU College of Engineering