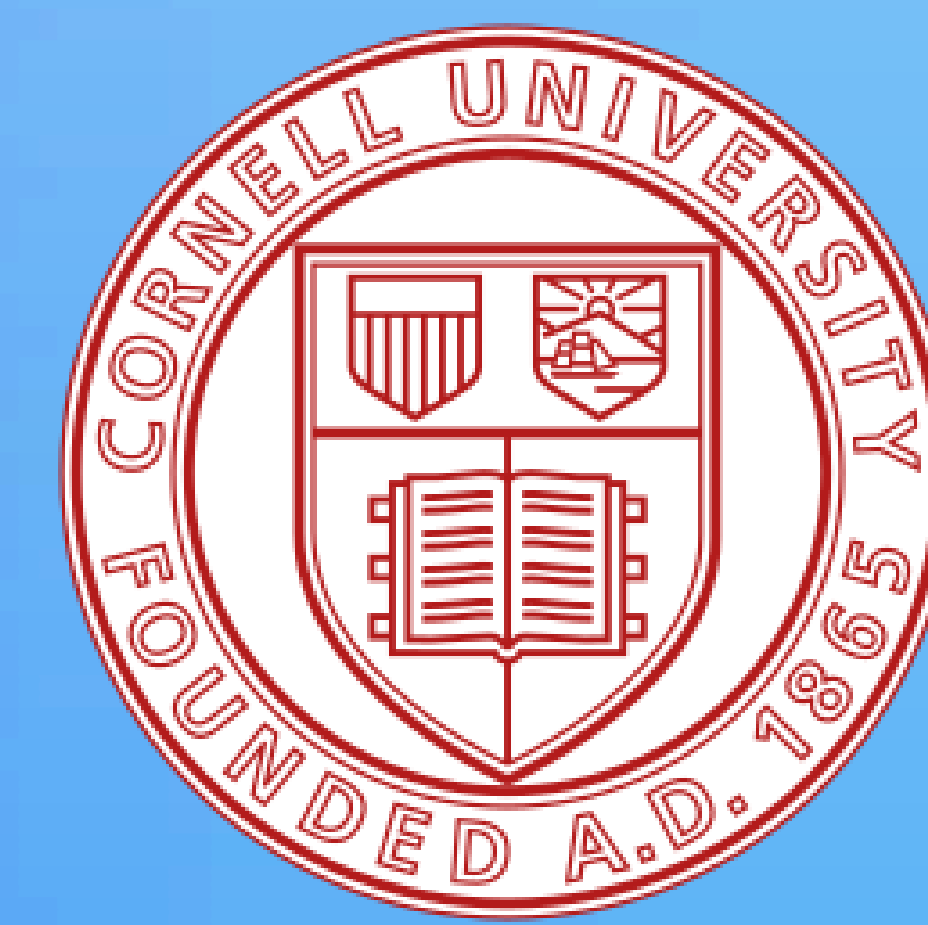


SLF AIR-POWERED REPELLER

Team M6 – Lanternfly Killers



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Introduction

Farmers are searching for ways of managing the SLF population without diminishing the potential crop yield in the grape industry. One way that the SLF population affects the crop yield is by entering the harvester during harvest. Finding a way to remove the flies from the vines as the harvester intakes the grapes is important to prevent them from tainting the crop.

Objective

Our repeller will be used to blow the SLF off the vine before it enters the harvester and taints the batch. Like any bug, the SLF is easily scared by sudden bursts of air. Our group uses this to cause them to fly off the vine before the grapes are harvested, ensuring a clean and safe harvest.

Methodology

1 A prototype was constructed using 3D-printed components, COTS hardware, and a motor.

2 Data was collected through various tests including but not limited to:

- An anemometer to measure wind speed
- Material bending test
- Fan pattern tests to determine lowing method

3 Multiple trials of each test were conducted to allow for the information to be validated.

4 The data was analyzed and aggregated to allow for easier analysis and viewing.

5 The aggregated data was analyzed to determine possible next steps and improvements.

Design Evolution

Multiple cone shapes changed based on exit and entrance air flow.

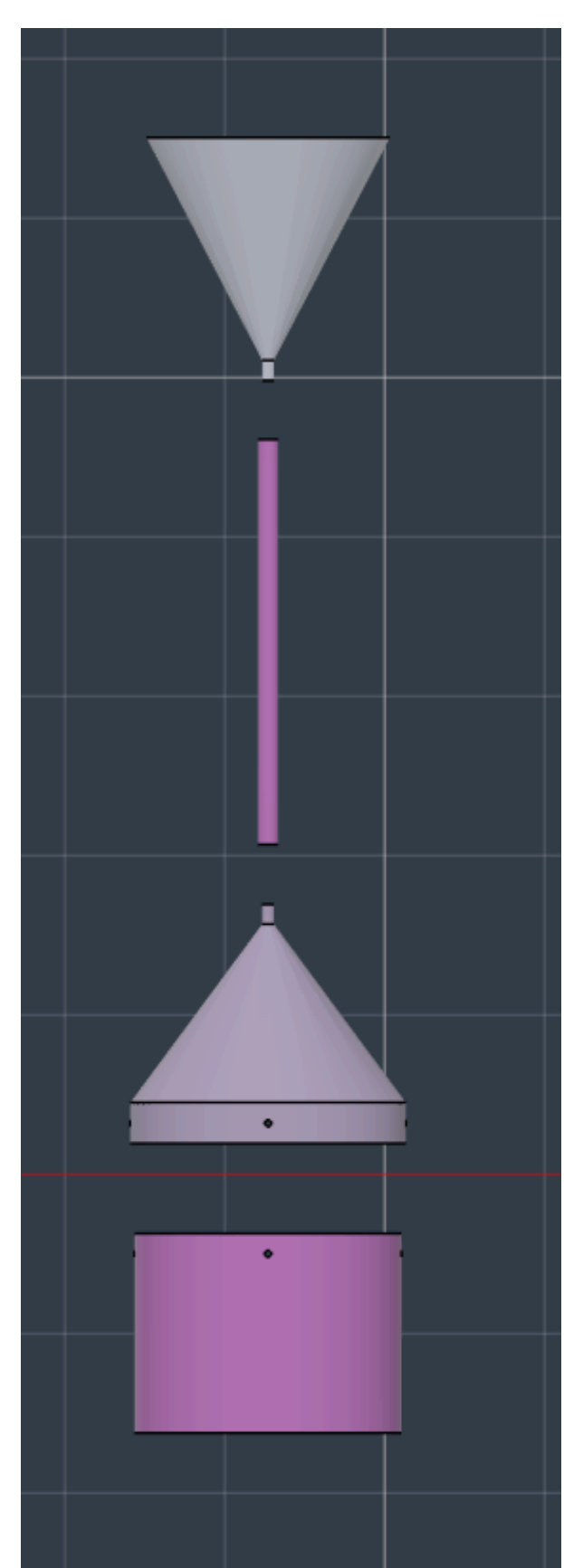


Figure 1: Initial Prototype

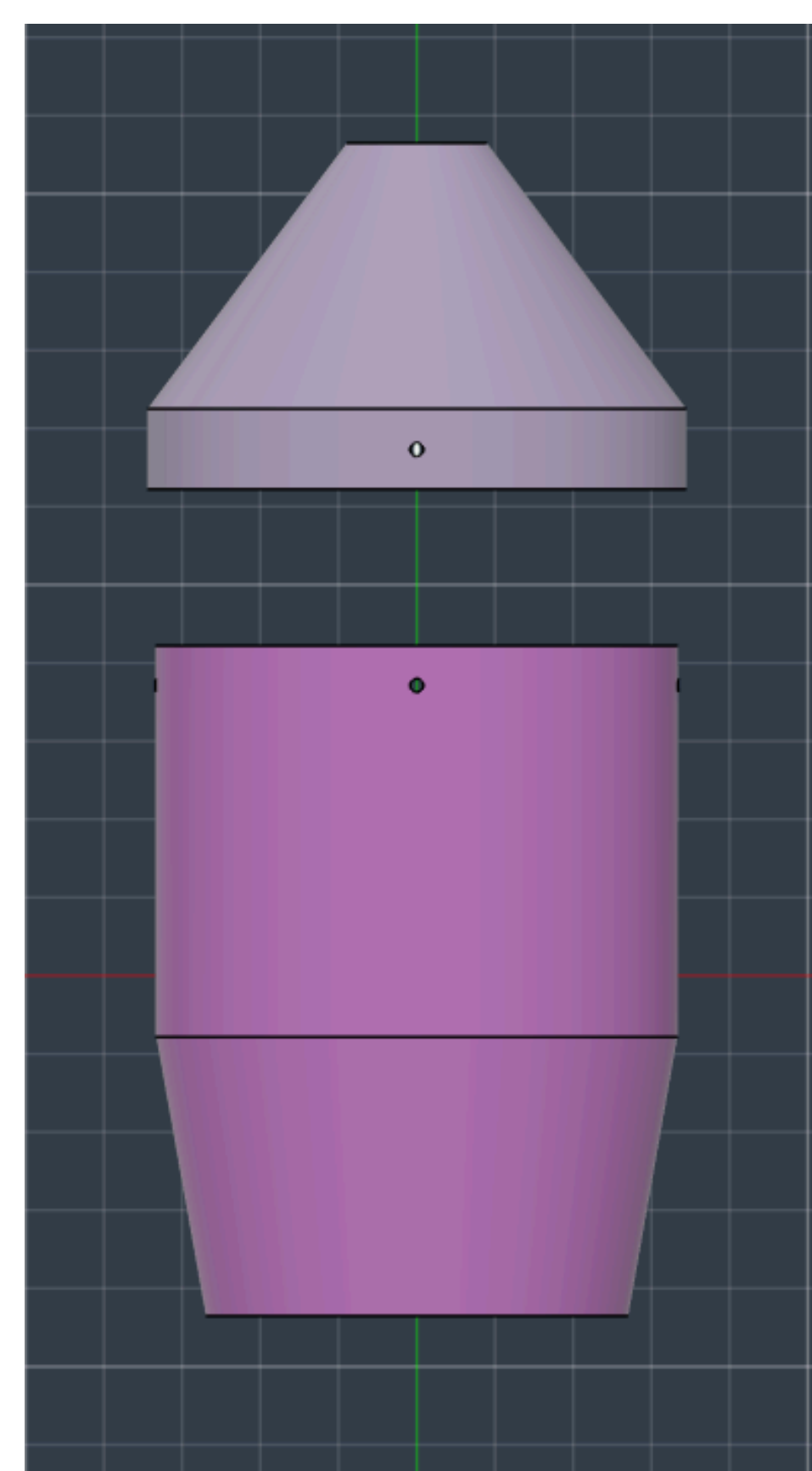


Figure 2: Final Prototype

Prototype

Our first prototype involved a dual-funnel design connected via tubing. Testing showed this design could not provide the needed thrust, so we modified the motor housing to have air holes to increase air flow and switched out our fan blades to provide directional flow.

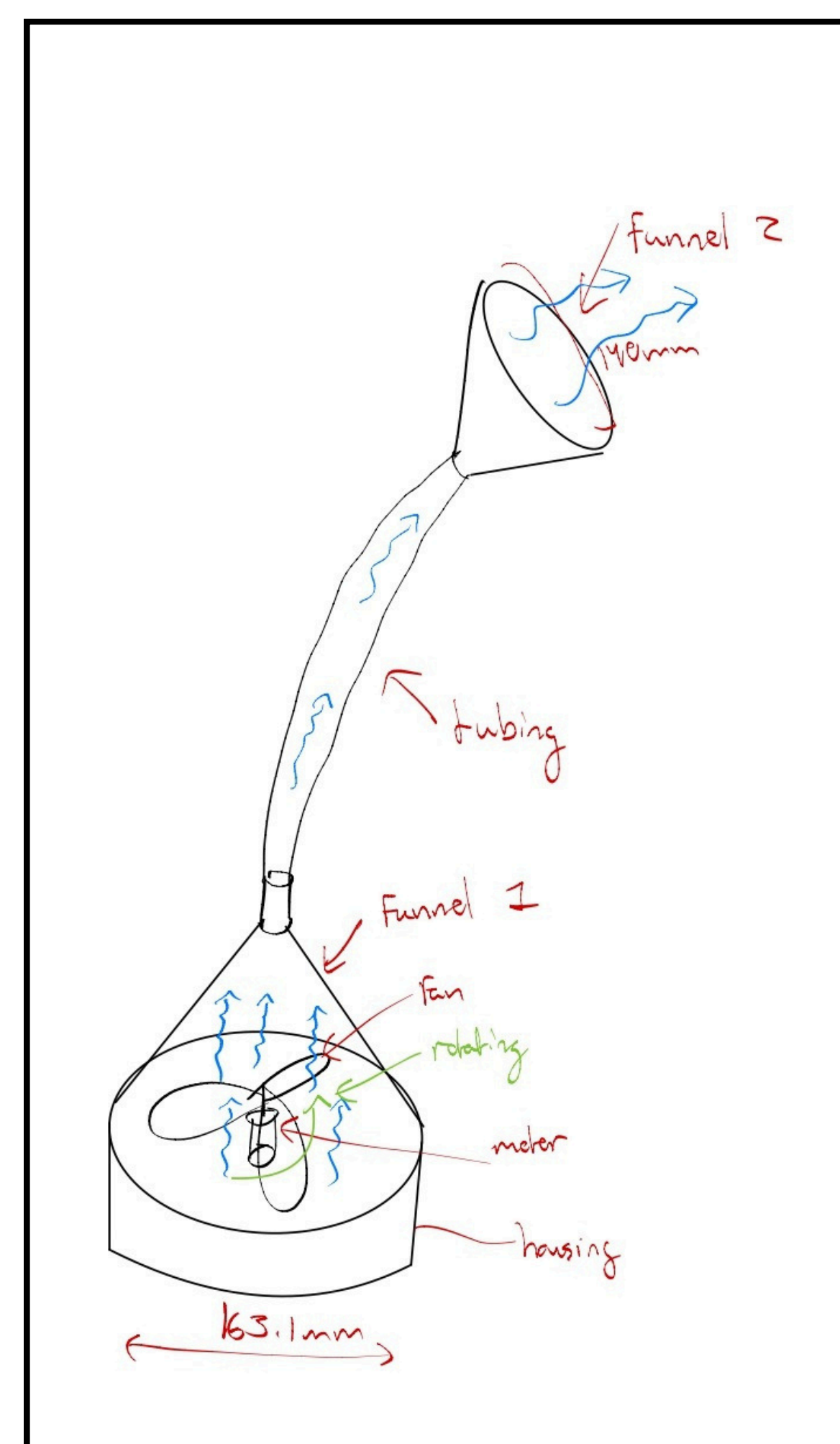


Figure 4: Initial Sketch

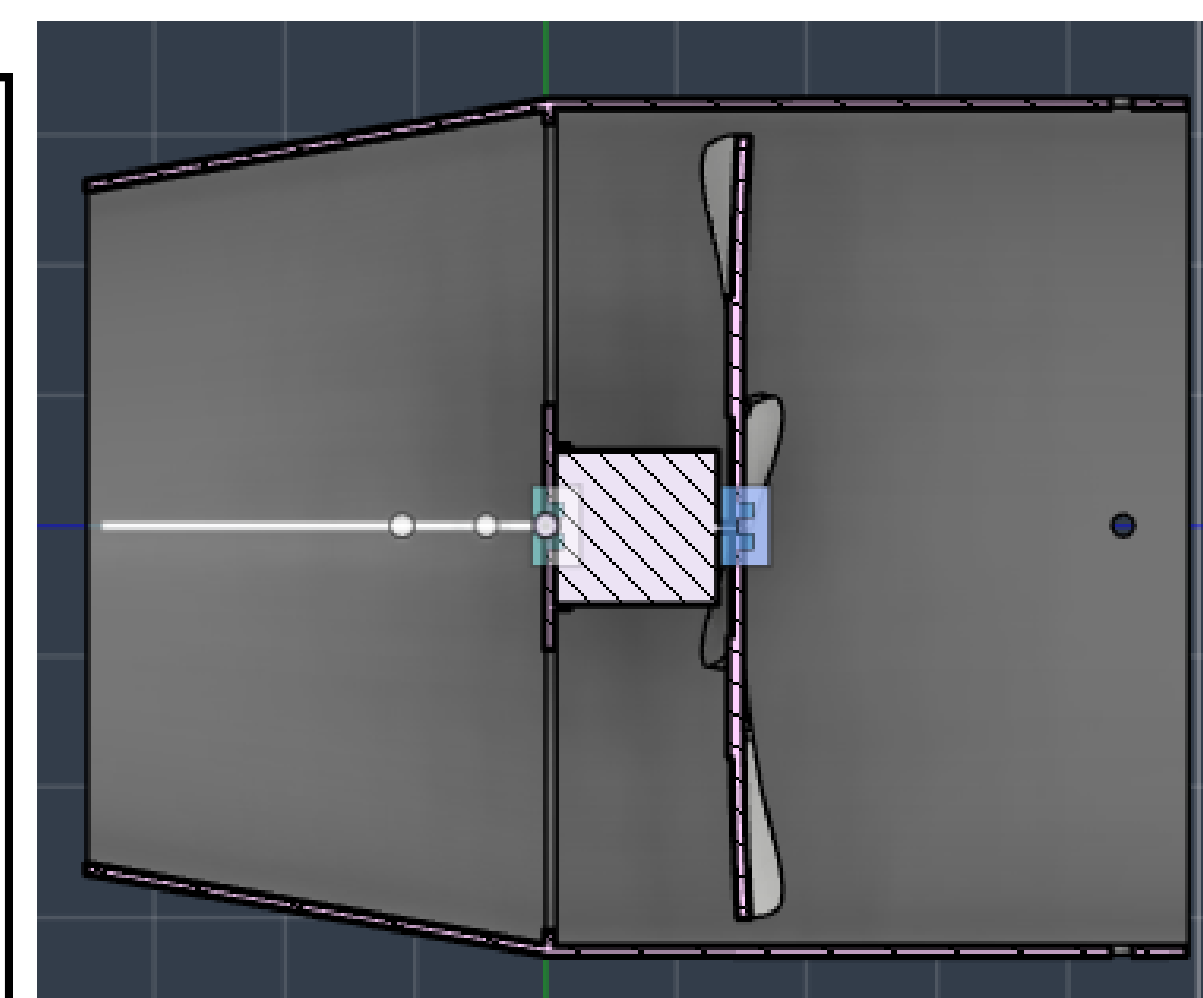


Figure 5: Cross-Section of Finished Housing

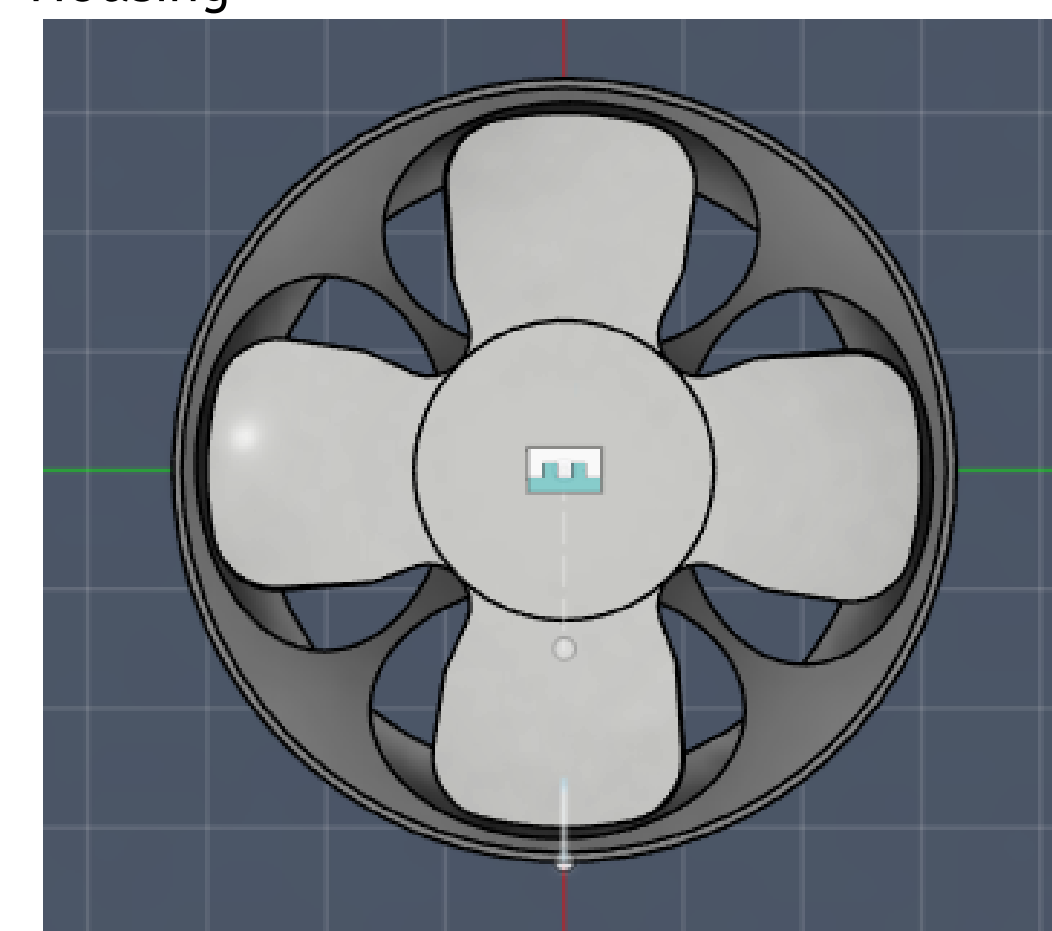


Figure 6: Upper Cross Section of Finished Housing

Data

We were able to successfully meet our three criteria for success:

- **Wind speed:** We used an anemometer to find the speed of airflow output from our device. We set up two fixed sensors at the outlet and take the average of the measured wind velocity. We also ran wind tunnel simulation via Simscale on the funnel to estimate the aerodynamic properties.
- **Material Strength:** Motor housing integrity was testing using force gauges, showing completely elastic deformation after 177 Newtons of force was applied. Due to lab limitations, we were not able to reach the breaking point of material. Further research showed that PLA has a tensile strength of 40-60 MPa.



Figure 3: Material Deformation Test

- **Knocking Flies off:** We fabricated a mock grape vine and lanternfly setup, testing the effectiveness of the nozzle shape. It took ~1-2 sec. of blowing air to knock off the lanternflies.

Results

Inlet Velocity:	3.1 m/s
Max Speed:	10.28m/s
Max Pressure:	191.18 Pa
Dynamic Pressure:	183.75 Pa

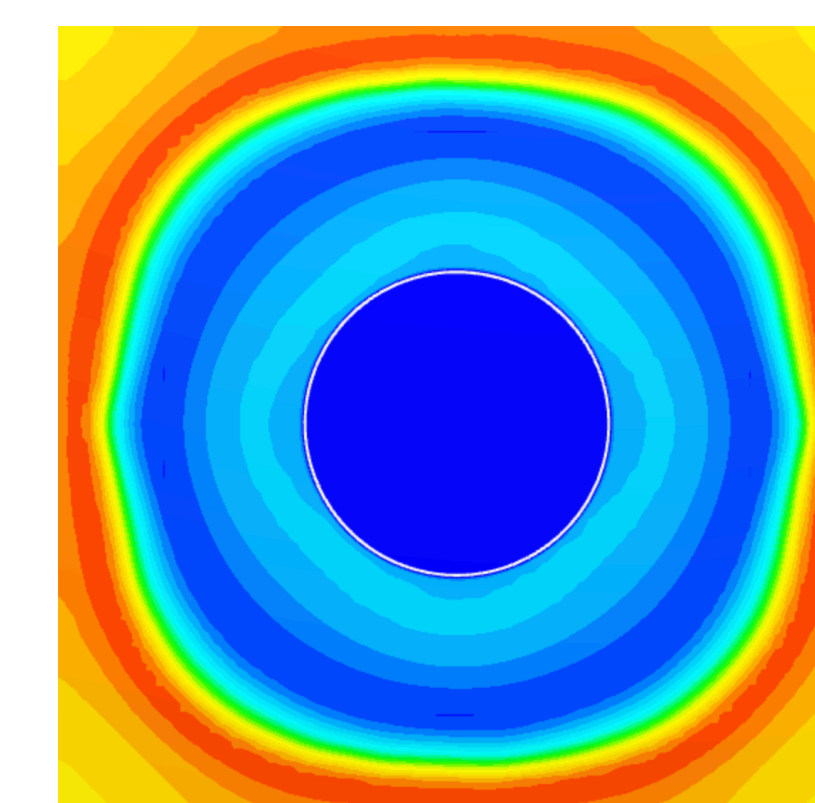
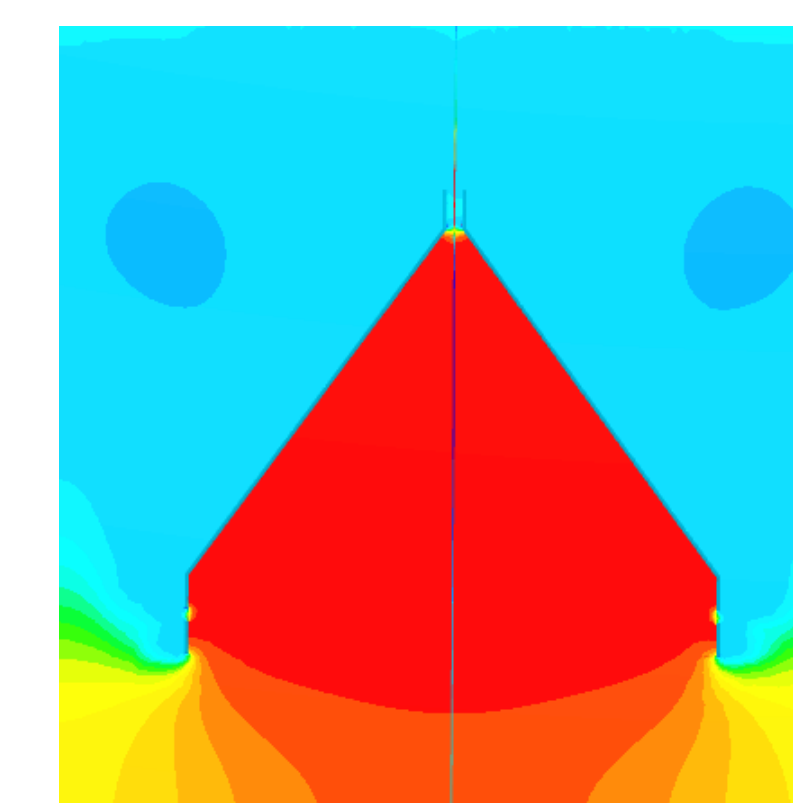
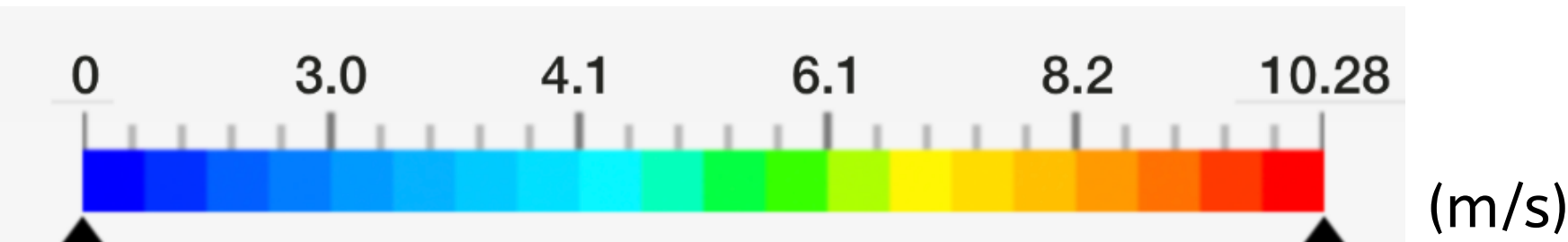


Figure 7: Vertical Velocity Pressure Analysis Figure 8: Horizontal Velocity Pressure Analysis



Analysis

We were able to successfully meet our three criteria for success:

- **Wind speed:** The wind speed was 10.28 m/s which was able to displace 23,743 cm³/s which is more than our value of 1,000 cm³/s
- **Material Strength:** Our PLA motor setup is able to handle the estimated vibration force of 150 Newtons
- **Knocking Flies off:** We were successfully able to knock flies off our mock vine setup

Success Criteria

1. The blower will be simplified to 1 unit to attach to the harvester.
 2. The blower can stop and start in less than 1 second to deliver a quick burst of air, causing the SLF to fly away.
 3. Must be able to blow off adult spotted lanternflies (average weight of .331g)
- Cost Breakdown: Our total was \$43.25. We spent \$4.58 on 3D printing, \$23.24 on electronics, and \$15.43 on other hardware. This was well within our \$350 budget for this project.

Conclusion

Our prototype successfully removed the mock SLFs from the vine. The wind speed and funnel shape were effective in achieving the original problem. The design would be simple to integrate onto an existing harvester without damaging the grapes. In the future, this design could be integrated with a compressed-air system to eliminate the need for a motor. Our final cost was \$43.25, which is reasonable for our product since it can be used long-term.

References

- Parra, Gregory, et al. 2024 Spotted Lanternfly Research & Technology Development Meeting. Apr. 2025.
- PLA66. "What Are the Properties of Polylactic Acid?" Professional PLA Manufacturer, 3 June 2023, plamfg.com/blog/properties-of-polylactic-acid/.