



Advanced Combustion: Hot Air Balloon-Engineering

Background

This Advanced Combustion project stems from a graduate student's study of heat transfer that occurs inside a hot air balloon. However, little to no studies have been conducted to evaluate performance and efficiency of hot air balloon burners.

Project Goal

Design and construct a testing facility that mimics the conditions of a real hot air balloon, in which we are able to study the emissions and efficiency of an UltraMagic's 3.2MW MK-32 burner using a Enerac 700 gas analyzer.

Project Significance

- Provide a testing facility for hot air balloons outside the field.
- Increase combustion efficiency to reduce hot air balloon operation expenses & improve air quality by reducing emissions..
- Engage students in research and development topics that include combustion, thermodynamics, and fluid mechanics.



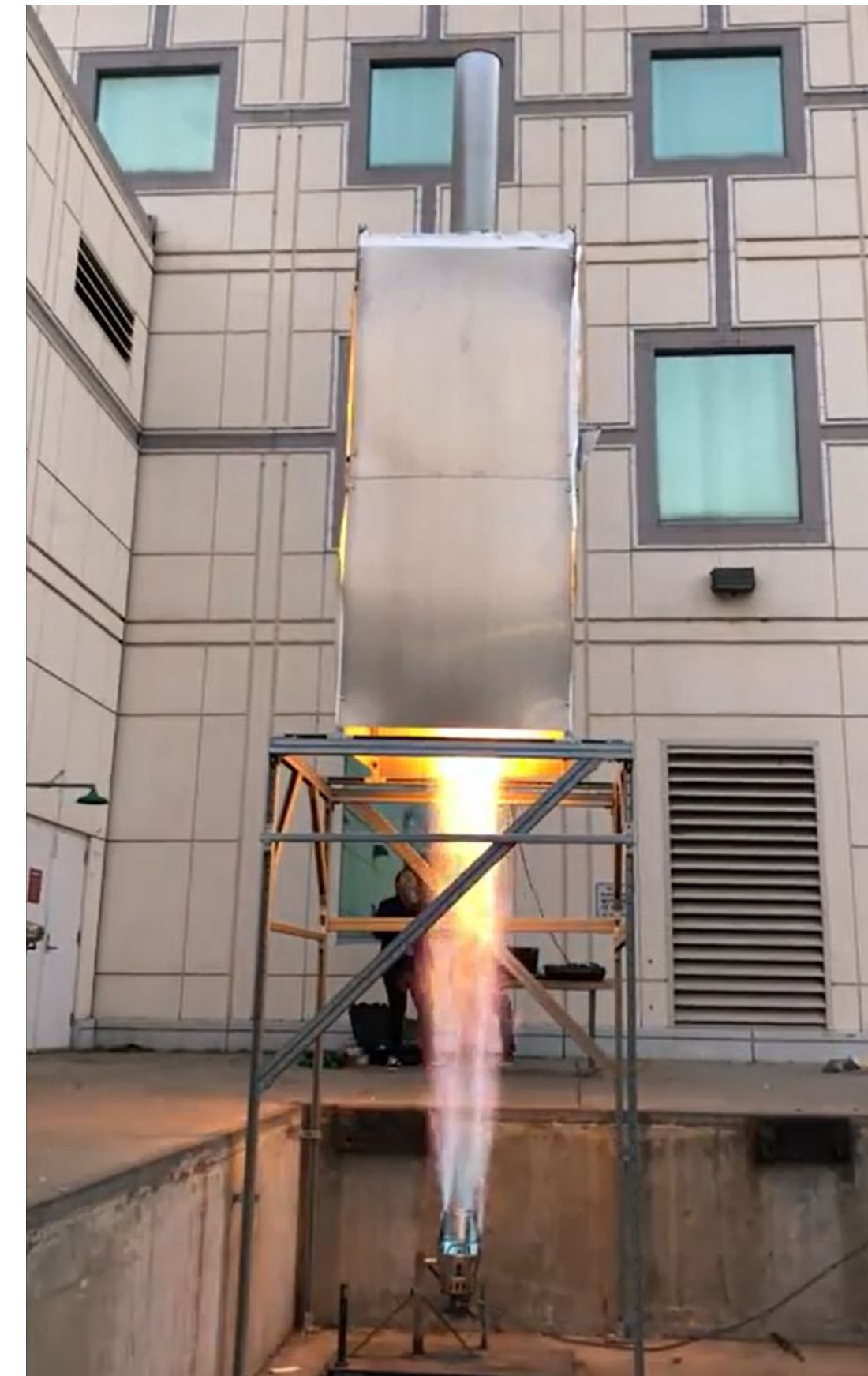
Enerac 700 Gas Analyzer



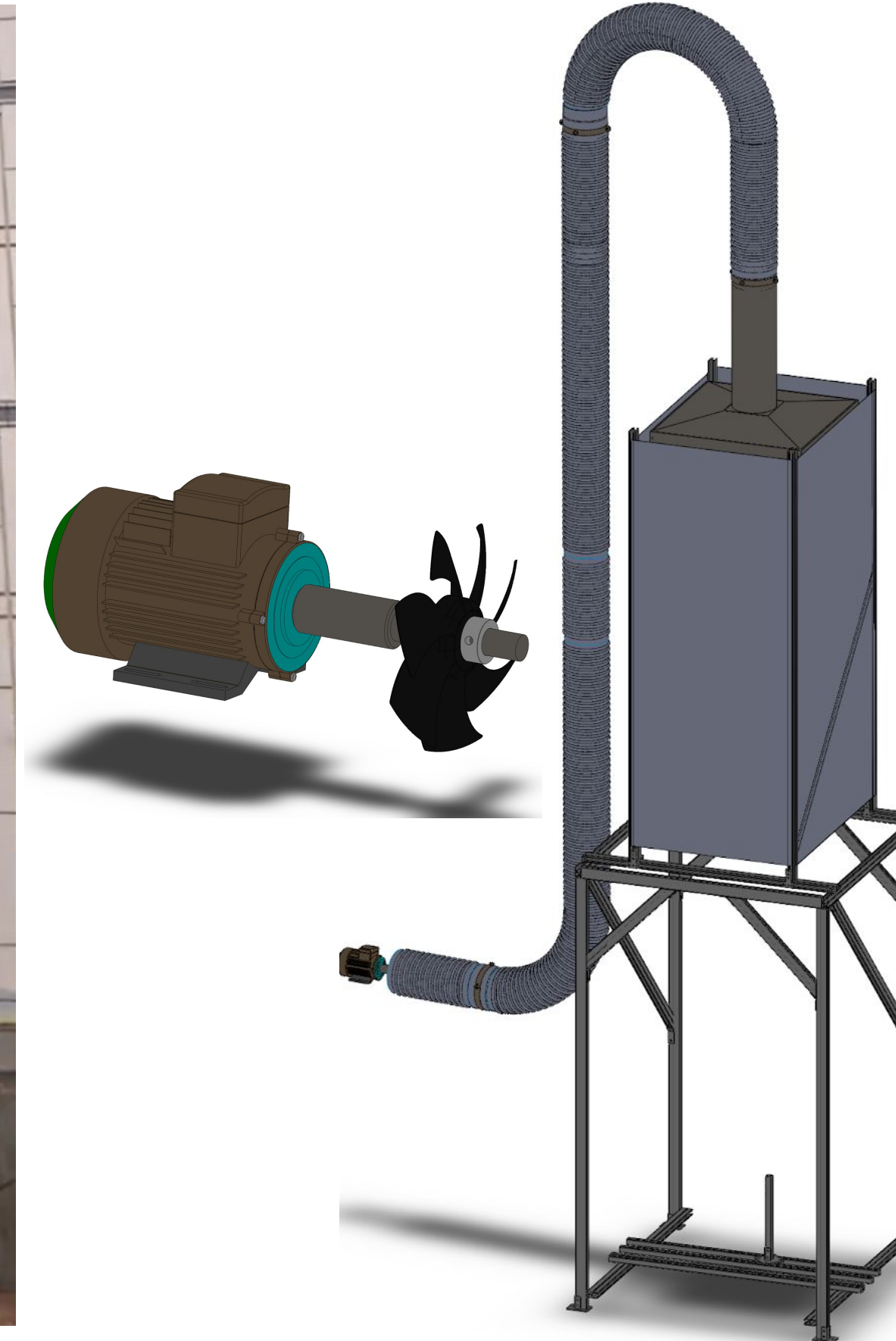
MK-32 Burner



Rig without duct/fan system



Modified rig with duct/fan



Accomplishments

- Development of a propane mass flow rate procedure.
- Creation of preliminary probe placement design.
- Design of a duct system to allow for optimal and safe sampling.
- Design of a fan system capable of supplying excess air to model conditions within a real hot air balloon.
- Design of a permanent mount for the burner onto the rig.

Budget

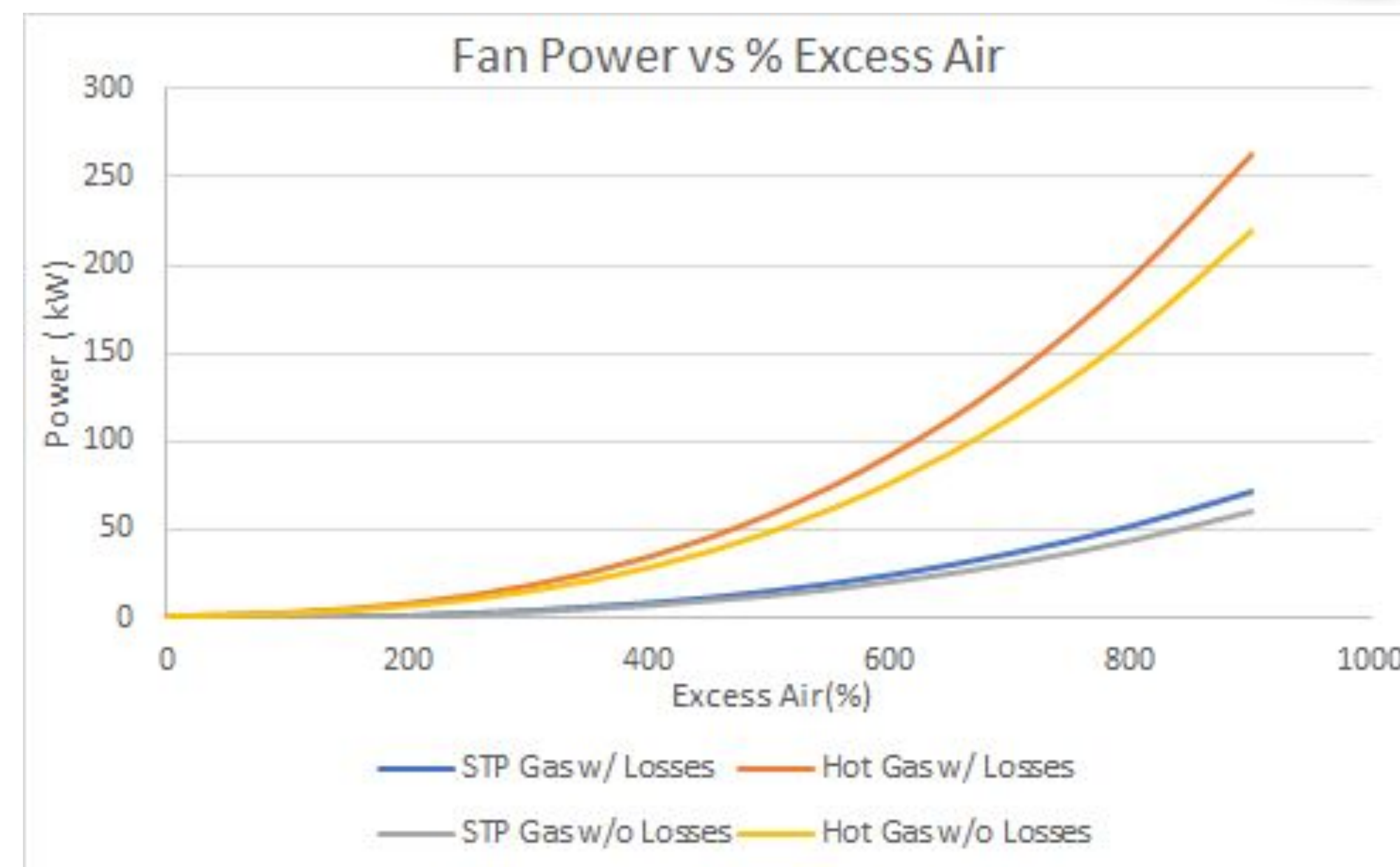
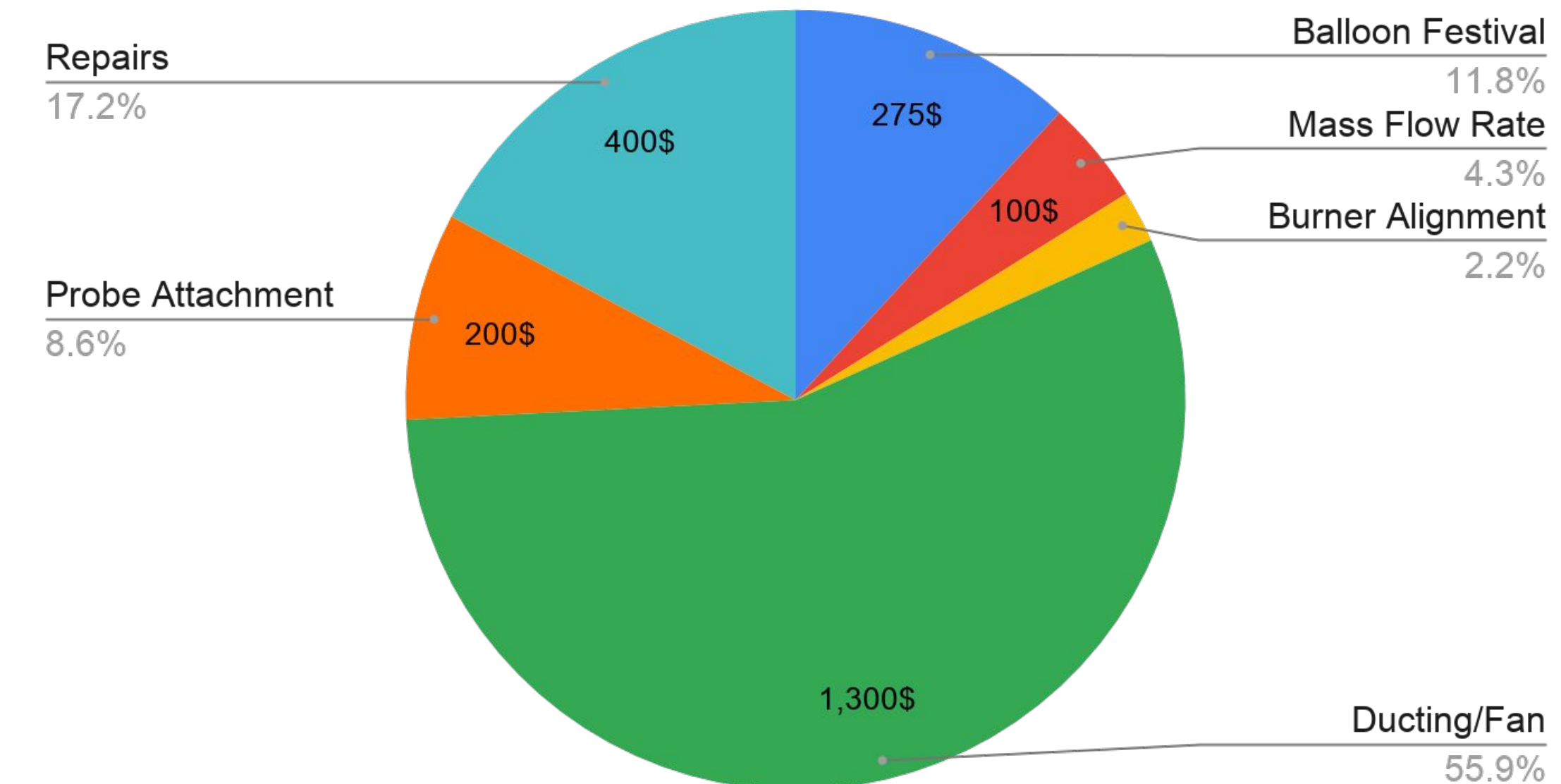


Figure 1: Fan power required as a function of excess air entrained.

Future Plans

- Manufacture a fan-ducting system that would mimic the air entrainment of a real hot air balloon.
- Investigate methods of improving efficiency and reducing emissions.
- Finalize the design for a probe mounting device that would allow in-field testing.