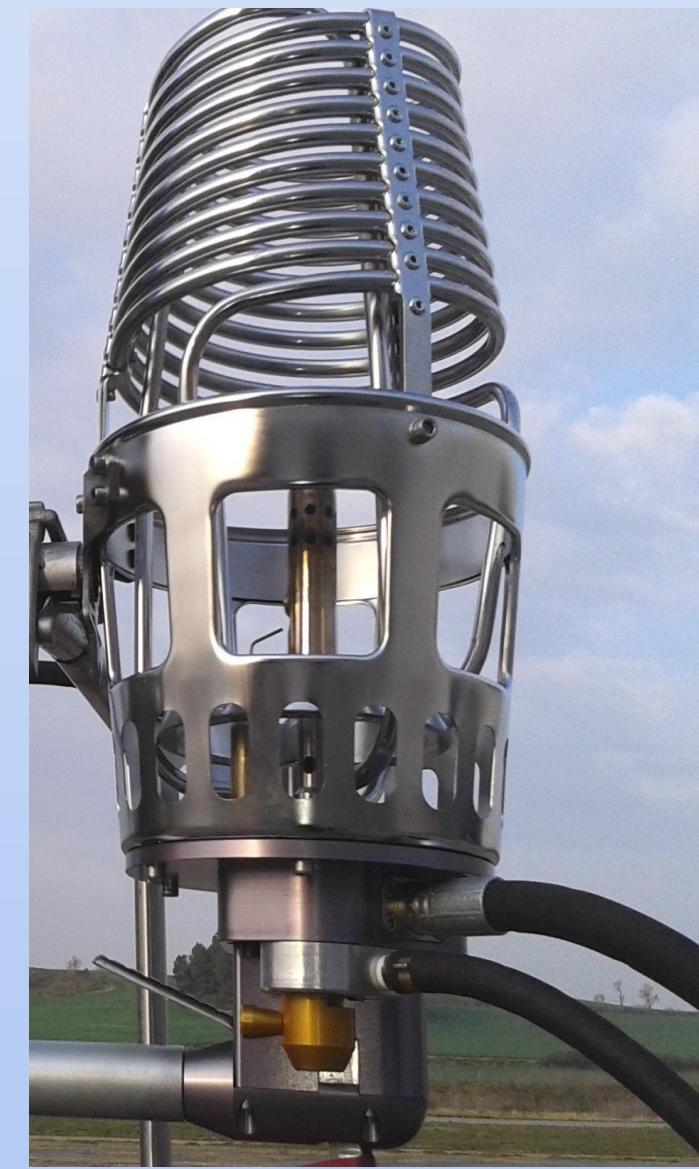
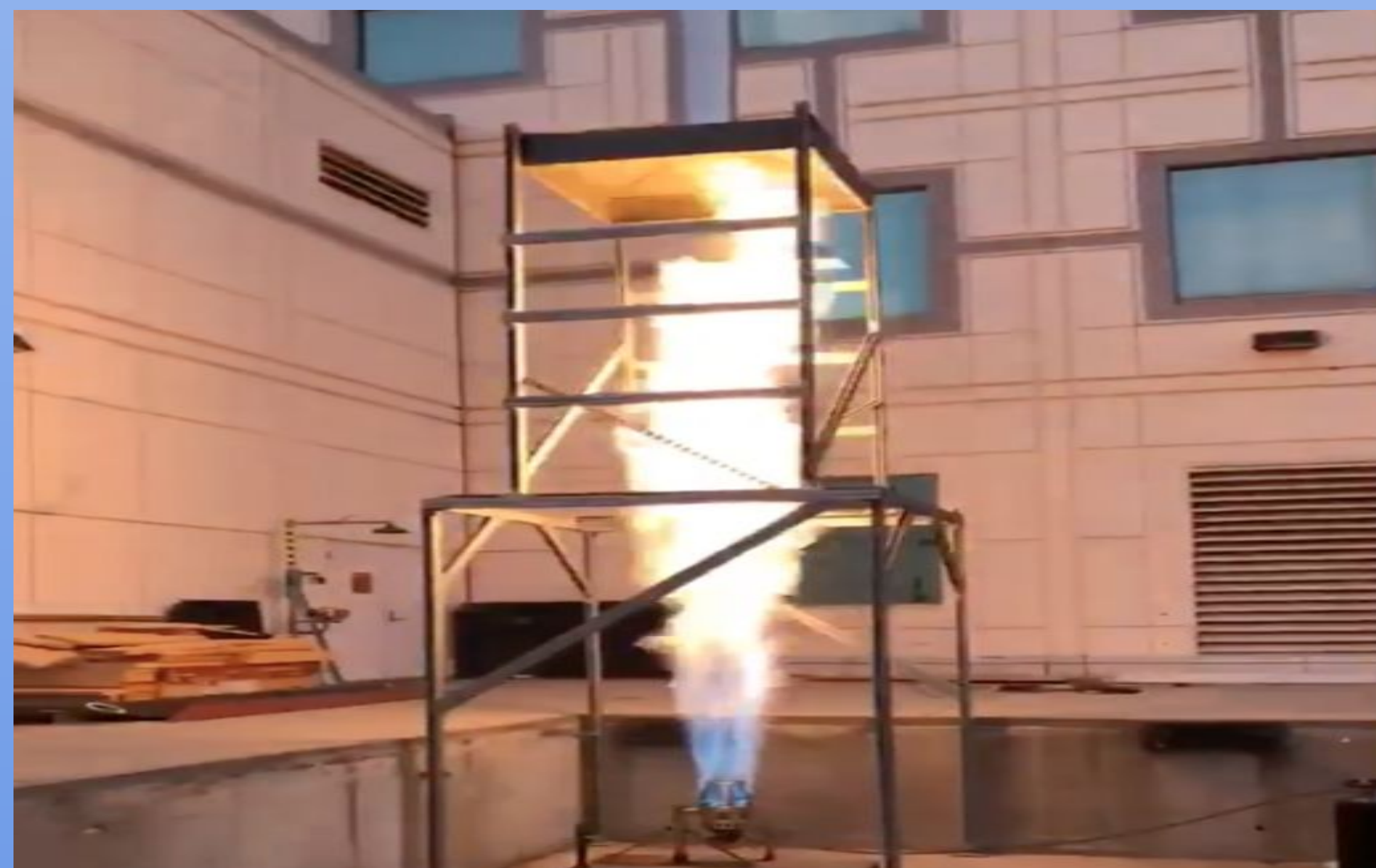


## Project Goals

The primary goal of this project is to research and design a functional adjustable testing method for finding the combustion efficiency and emissions of an MK-32 burner used in hot air balloons. The Enerac 700, a gas analyzer, was researched and tested for validation of accurate emissions concentrations of hydrocarbons, NO<sub>x</sub>, CO, and CO<sub>2</sub> to use for the burner's exhaust.

## Background

The MK-32 burner supplied by UltraMagic Ballooning has a maximum power output of 3.2 MW at a nominal pressure of 6 bar. The fuel utilized by this burner is liquid propane. Flame heights are approximately 20 ft high, and tests are conducted in bursts of approximately 15 seconds, similar to the estimated maximum flame burst time used by hot air balloon operators for lift.



Enerac 700 Gas Analyzer:

## Enerac 700 Control Volume Test

	Enerac 700	Span Gas Data Sheet	Error
[CO]	294 ppm	302.5 ppm +/- 2%	2.8%
% O <sub>2</sub> Volume	14.1%	14% +/- 2%	0.7%
% CO <sub>2</sub> Volume	4.2%	4% +/- 2%	5%

## Project Significance

- Reduce fuel costs for hot air balloon operators
- Quantifies emissions for improvement of air quality from operation
  - NO<sub>x</sub> forms smog and acid rain
  - CO is harmful for human health, reduces the amount of oxygen delivered to organs.



Horiba PG-350 Gas Analyzer:



## Gas Analyzer Comparison - Open System

	Enerac 700	Horiba PG-350
[NO <sub>x</sub> ]	10.2 ppm	9.14 ppm
% O <sub>2</sub> Volume	19%	18.75%
% CO <sub>2</sub> Volume	1.3%	1.26%

## Preliminary Burner Testing

