Methane Hydrate Combustion

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INTRODUCTION

- Methane Hydrates are molecules of methane (CH4) bound within a crystal lattice of ice (H2O) created under high pressure & low temperature
- Little is known about Methane Hydrate's natural state including its properties combustion characteristics.
- Methane hydrates have been discovered in marine sediments and under shallow permafrost deposits in arctic regions where these conditions are ideal.
- University of Texas estimate total Methane Hydrate in the world would supply ~250 years worth of natural gas.
- Research Labs around the world are studying various methods of extraction.
- W.M. Keck Foundation Deep-Ocean Laboratory is studying Methane Hydrate combustion and burning characteristics but requires a facility with ideal conditions to obtain accurate results.

Methane Hydrate Combusting

Manuel Cardoso with Methane Hydrate

TEAM

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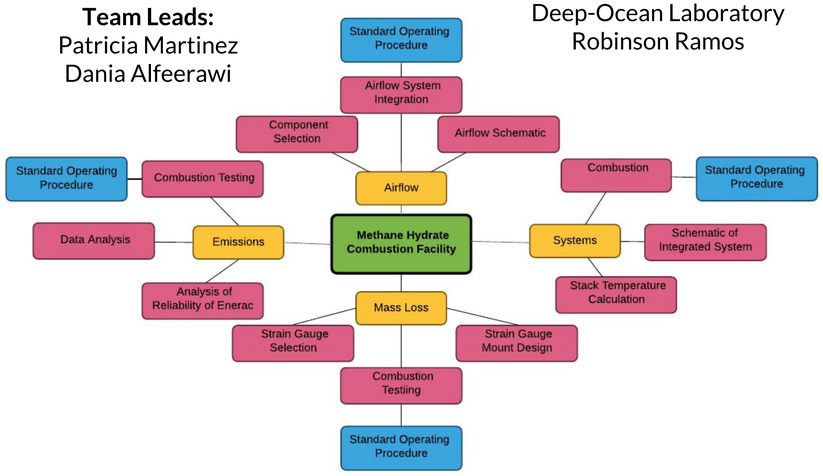
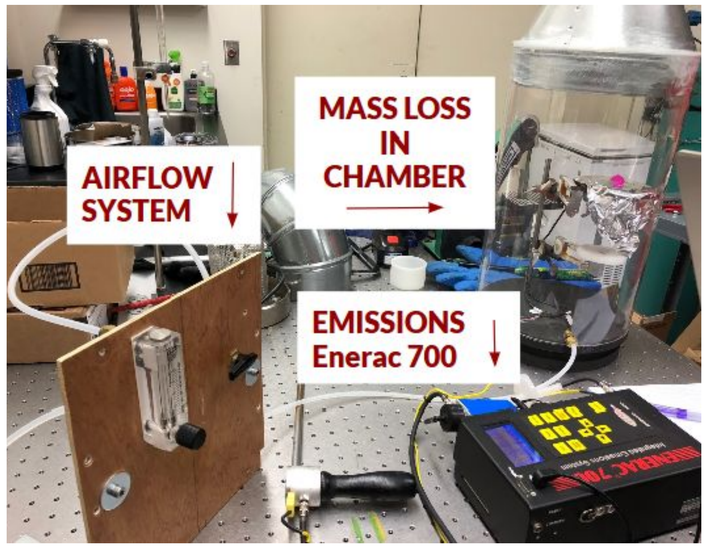


GOAL & REQUIREMENTS

The goal is to redesign, construct, and test an experimental system that allows for accurate emissions monitoring from a 50 cc methane hydrate sample. The combustion facility must measure total mass loss, water vapor, NOx, CO, and HC readings from a naturally burning methane hydrate sample.

- Design test chamber that has Laminar (Re < 2100) and Uniform Air Flow (Std. Deviation of air flow velocity < 1)
- Design weight measurement device that allows for data recording of 50 grams or less of Methane Hydrate weight loss and Liquid Water weight gain
- Provide varying air flow for Methane Hydrate and Gel Ethanol via airflow system
- Verify test chamber design facilitates accurate combustion emissions readings utilizing Enerac 700 probe



TIMELINE

Fall

- Design specifications and parameters determined
- Simulations made
- Materials and equipment selected

Winter

- Facility manufactured and fabricated by the end of winter quarter

Spring

- Testing of facility through Methane Hydrate Combustion
- Prototype ready to present

PROGRESS

Winter 2019 Progress

Complete

- Formal design with dimensioned Solidworks models
- Down selection of equipment needed to build entire combustion chamber.

Complete

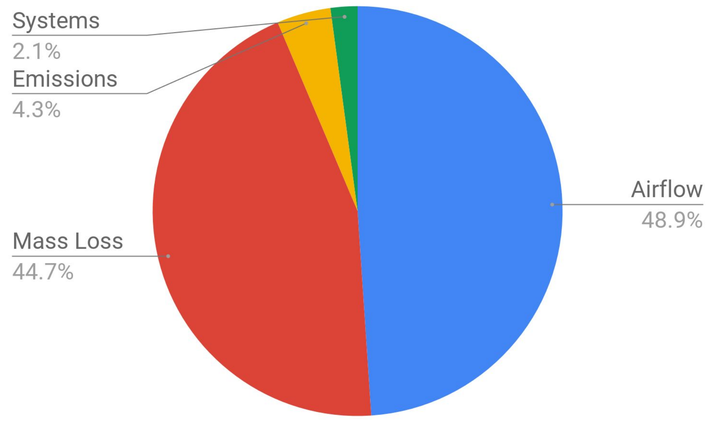
- Fabrication of combustion facility by combining and integrating airflow system, emissions system, and mass loss system

In Progress 75%

- Testing airflow in the combustion chamber to validate one air inlet as most optimal option for emissions readings
- Identifying design problems and initiating plan of action for design modification in spring 2019

BUDGET

Winter 2019 Budget



Note: Most of the necessary material can be found in the W.M Keck Foundation Deep Ocean Science Library, thus the budget is dedicated to replacements of existing instruments.