Aqua Scooter

Progress Report

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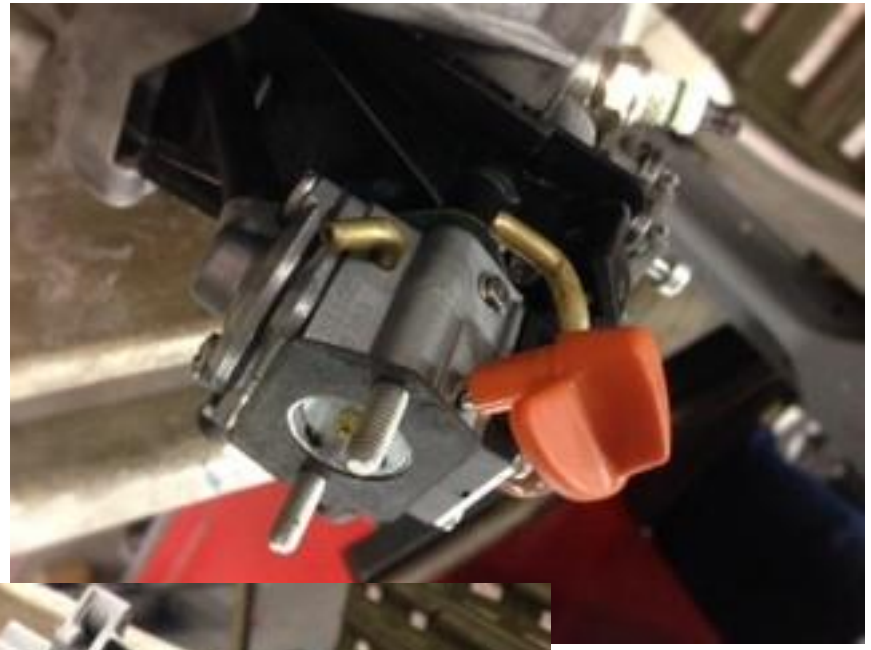
aqua SCOOTER

Overview

- Client Introduction
- Problem Definition
- Project Goal
- Objectives
- Tasks
- Constraints
- Final Considerations
- Analysis
- Current Status
- Conclusion
- References



Client Introduction

Aqua Scooter is a portable, gasoline powered water craft for individual use.

The client for this project, R.S.W. /D.I. Inc. is the owner and CEO of Aqua Scooter.

Problem Definition

Design a hydrodynamic, inexpensive, aesthetically pleasing Aqua Scooter, with a marine engine that complies with EPA regulations.

www.cnet.com

Project Goal

Need

- Current Aqua Scooter model does not meet EPA regulations

Goal

- Design an improved Aqua Scooter that exceeds EPA regulations

Objectives

- Design an aesthetically pleasing Aqua Scooter, that complies with EPA regulations
- The new design should be lightweight and provide similar thrust
- The system must be buoyant and relatively cheap to manufacture
- Must be safe for a child to use

Tasks

- Analyze and compare gasoline, propane, and butane 4-stroke engine concepts
- Quantify the ability for each fuel source to meet EPA regulations
- Calculate the drag coefficients for the two final outer shell designs
- Calculate thrust assuming a propeller that will generate a 5mph velocity

Constraints

- ½ gallon, plastic fuel tank
- Internal combustion powered
- Metal engine and muffler housing
- Starter assembly is plastic and metal
- Plastic prop protection
- Control handle included
- Throttle control
- Exhaust valve
- Must be 18 pounds or less
- Must provide at least 50 pounds thrust

Gantt Chart

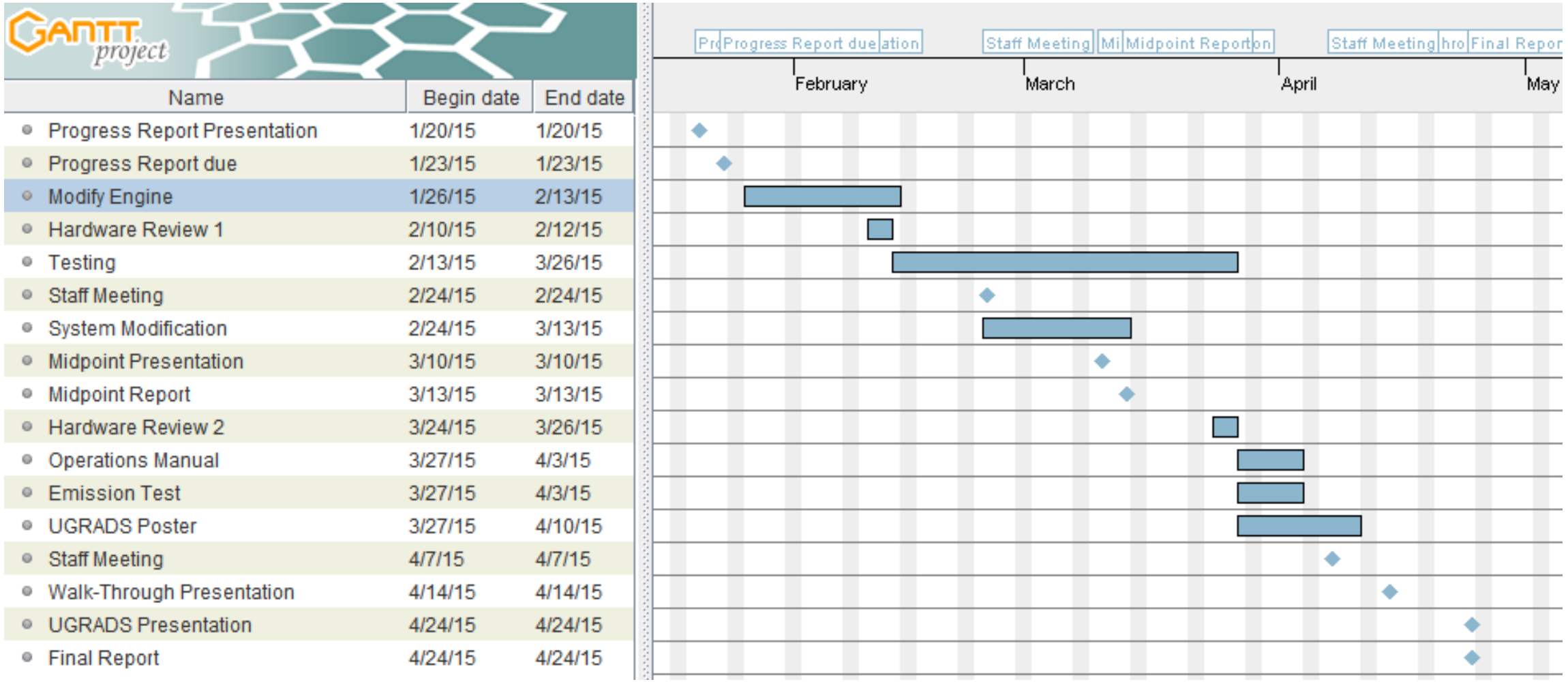


Table 1: Gantt Chart and Deliverable schedule.

Concept Analysis

- Alternate Fuel Analysis

- Shell Analysis

www.calor.co.uk

Propane and Butane Analysis

- Assumptions
  - Calculated using Honda GX25 converted to propane or butane
  - Manufacturer rated @ 1 HP
  - Running time of 3 hours
  - Not Adjusted for Efficiency

- Results
  - Calculated weight of propane is 12.52 ounces
  - Calculated weight of butane is 12.50 ounces

Shell Analysis

Drag Force

$F = 0.5\rho V^2 C_d A$

Where:

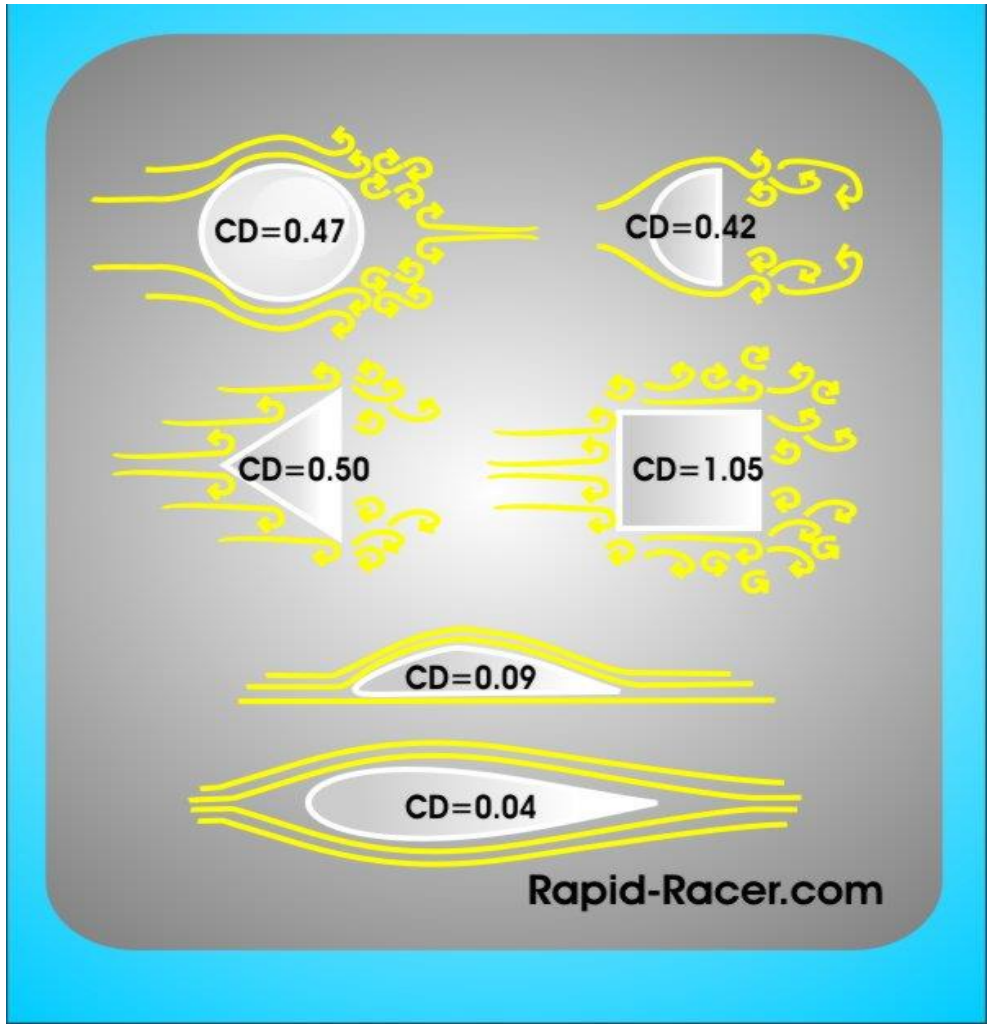
$F = Drag\ force\ [N]$

$\rho = Density\ \left[\frac{kg}{m^3}\right]$

$V = Velocity\ \left[\frac{m}{s}\right]$

$C_d = Drag\ Coefficient$ [unitless]

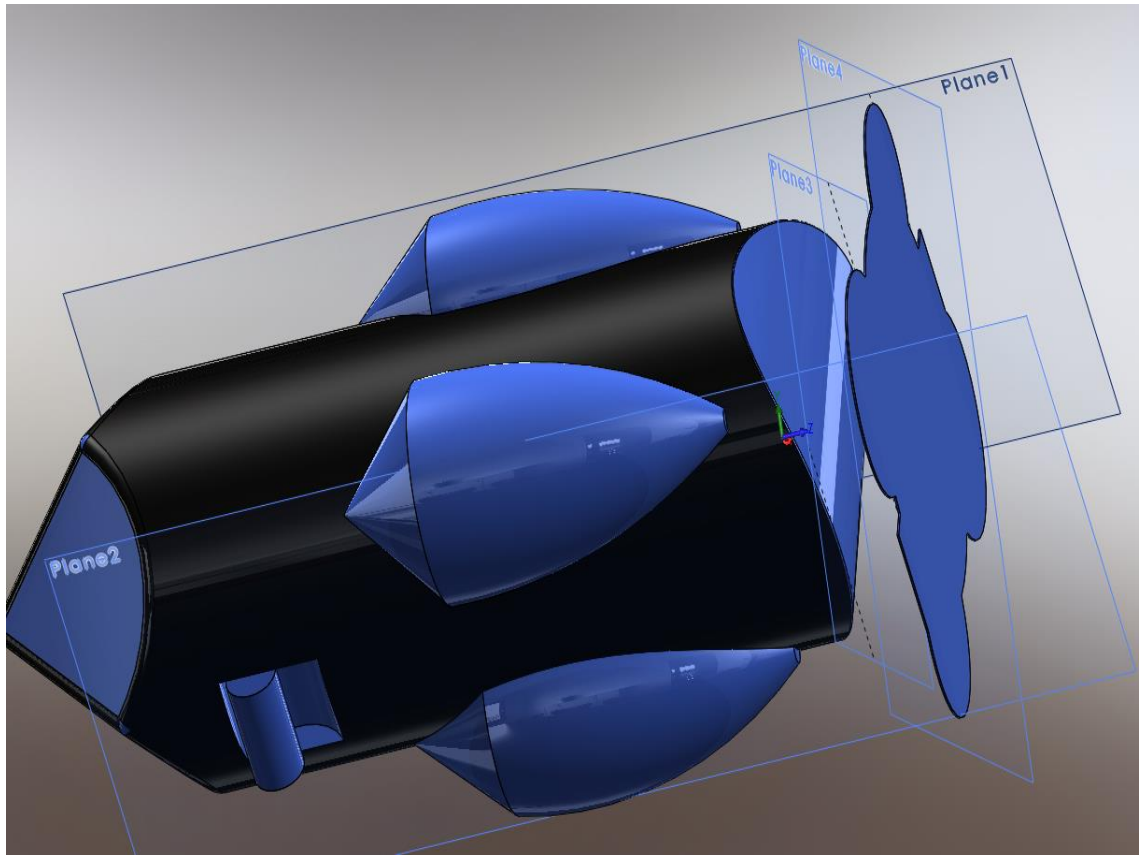
$A = Area\ orthogonal\ to\ flow\ [m^2]$



www.rapid-racer.com

Shell Analysis- Triton

- **Assumptions**
- $C_d = 0.10$
- $A = 513.20in^2 = 0.3311m^2$
- $\rho = 999\frac{kg}{m^3}$
- $V_e = 2.235\ \left[\frac{m}{s}\right]$
- **Drag Force**
- $F = 0.5\rho V^2 C_d A$
- $F = 0.5(999)(2.235^2)(.1)(0.3311)$
- $F = 82.6N$



Current Status on Shell Design

- 3-D Printing: Points to Consider
  - Where engine will be mounted
  - Shelled cut into halves
  - Lip added to attach halves
  - Scaled down for prototype

www.plastic-mart.com

Current Status Engine

- Conversion Kits
- 4-Stroke Engines
- 2-Stroke Engines
- Emission Testing
  - On-Site Testing
- Testing Environment
- Cost of Materials

Conversion Kits: Propane

- Alt Fuel
  - Intake Adaptor
  - Bracket For Tank
  - Regulator
  - Attachment Line
  - Fuel Line

propanepowerkits.com

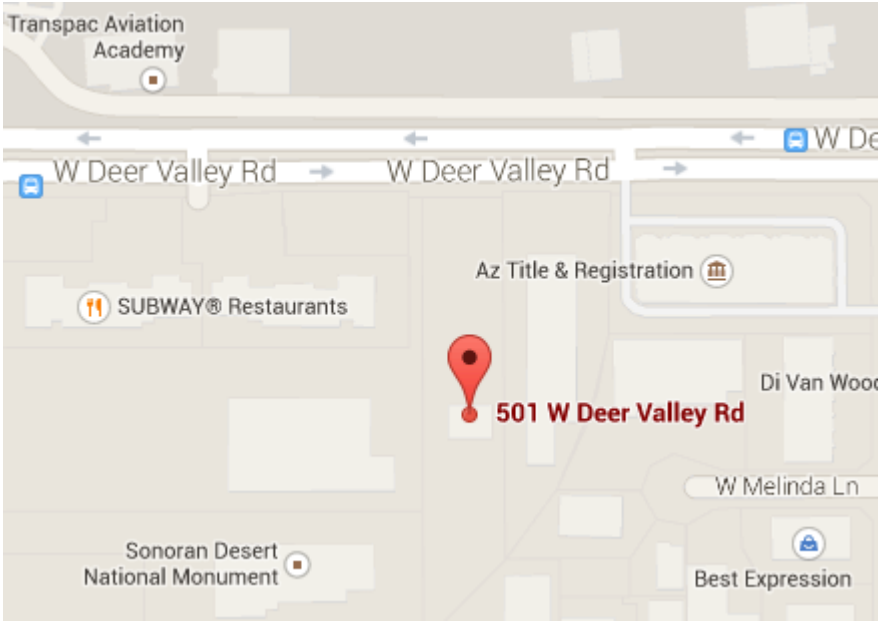
Honda GX-25 4-Stroke Engine

- 1-HP
- 25cc Displacement
- 6.8lbs Dry Weight
- $265.00

engines.honda.com

Emissions Testing

- On Location Testing
  - Deer Valley Emissions Test
    - 501West Deer Valley Road, Phoenix, AZ 85027
- Portable Testing
  - Nova
    - Quote: $9,150



Campus Testing Environment

- 150 Gallon Tank
  - $175.00
  - Check with Biology
    (waiting for response)

www.homemodish.com

- Trough Pool
  - $104.00
  - Used stores
  - Craigslist

www.plastic-mart.com

Load Efficiency Experiment

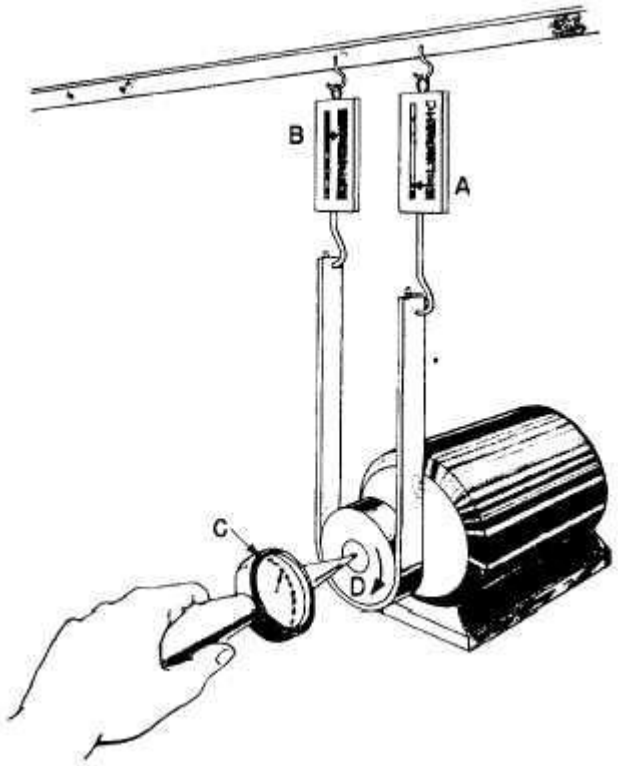
- Prony Brake Test
  - Requires:
    - 2 Force Scales (A & B)
    - Tachometer (C)
    - Pulley (D)
    - Belt
  - $P = \frac{(F_A - F_B) * D}{t}$

    $P = Power$

    $F_i = Force\ measured\ from\ spring$

    $D = Distance\ Pulley\ Traveled$

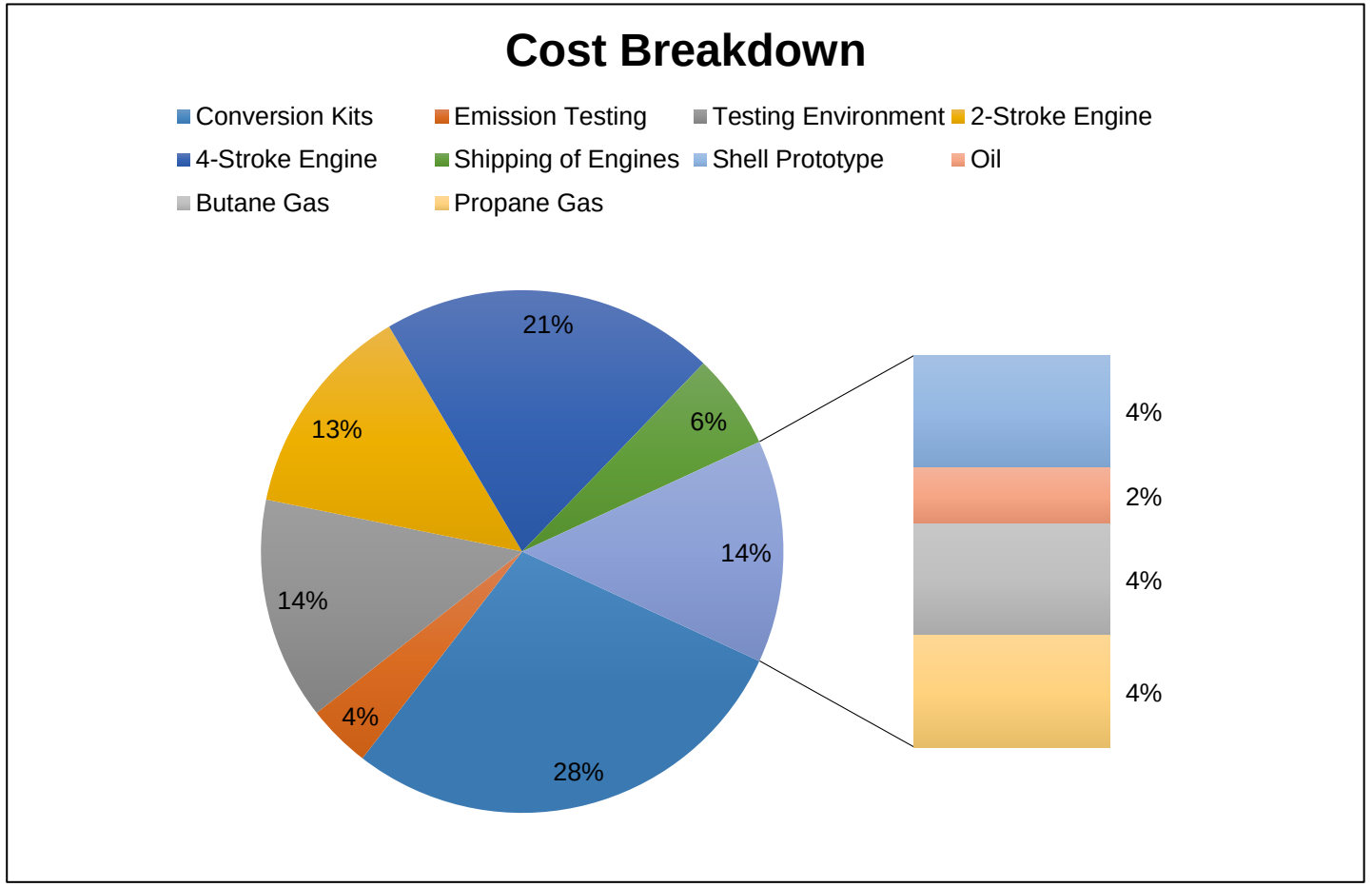
    $t = time$



enginemechanics.tpub.com

Cost of Materials

Item	Budget Costs	Actual Costs	% of Total	% of Total
Conversion Kits	$200.00	$363.00	9.69%	28.58%
Emission Testing	$1,000.00	$50.00	48.43%	3.94%
Testing Environment	$175.00	$175.00	8.47%	13.78%
2-Stroke Engine	$200.00	$169.00	9.69%	13.31%
4-Stroke Engine	$240.00	$263.00	11.62%	20.71%
Shipping of Engines	$75.00	$75.00	3.63%	5.91%
Shell Prototype	$50.00	$50.00	2.42%	3.94%
Oil	$25.00	$25.00	1.21%	1.97%
Butane Gas	$50.00	$50.00	2.42%	3.94%
Propane Gas	$50.00	$50.00	2.42%	3.94%
	$2,065.00	$1,270.00		



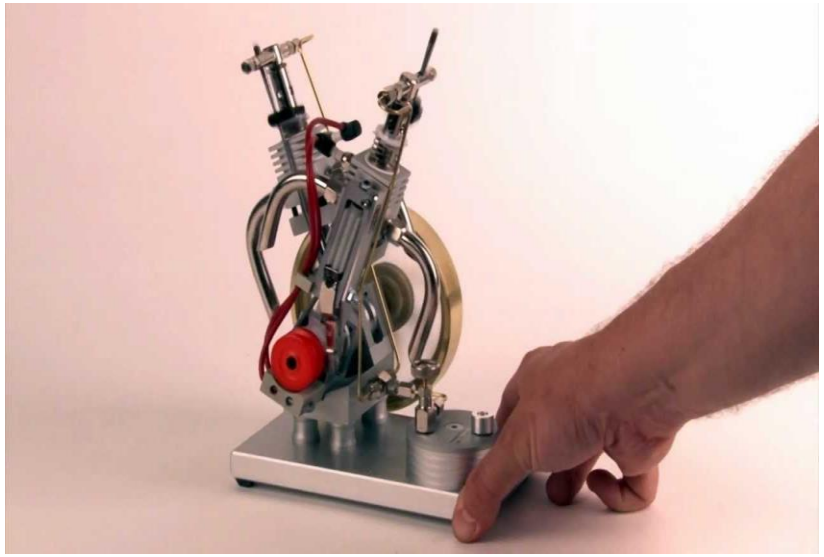
Conclusion

The engine should be delivered within 2 weeks.

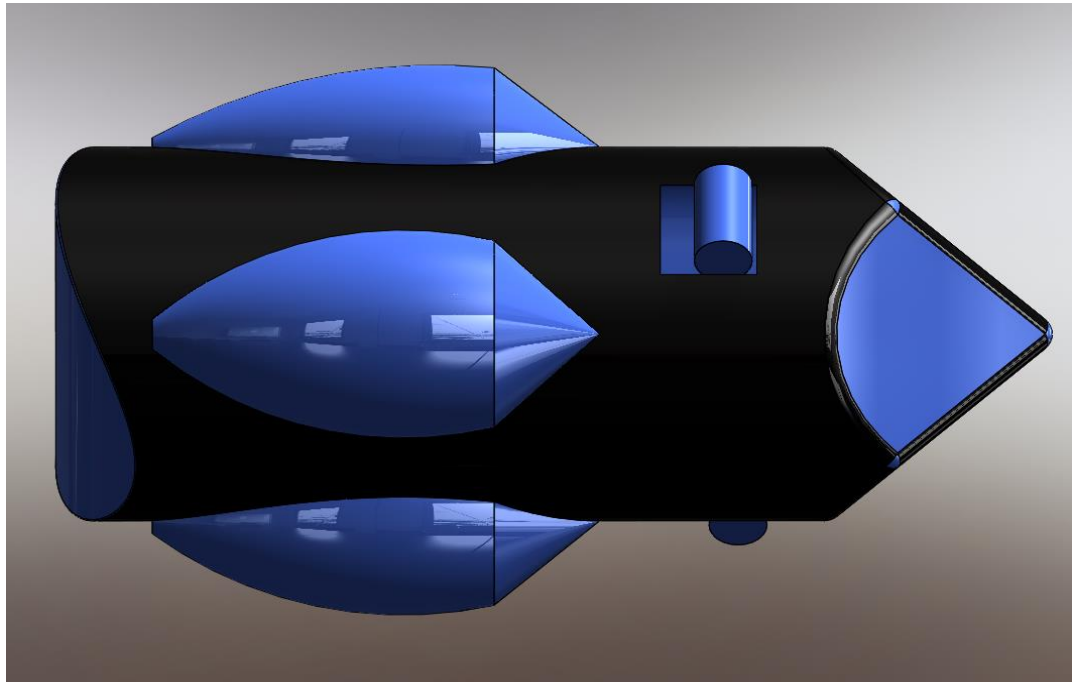
The team will create testing scenarios to establish the power and efficiency of the engine.

The conversion kit will be installed and a comparison between the power and efficiencies of the alternate fuels can be established.

The emissions from each fuel will be measured.



www.youtube.com/watch?v=QvUih9Y2Nmw



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Any Questions?