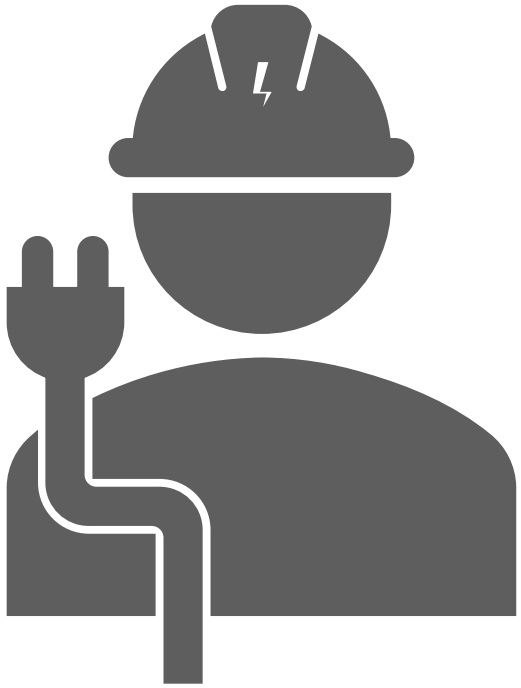
Solid Team Week 5 Progress Report

Created by

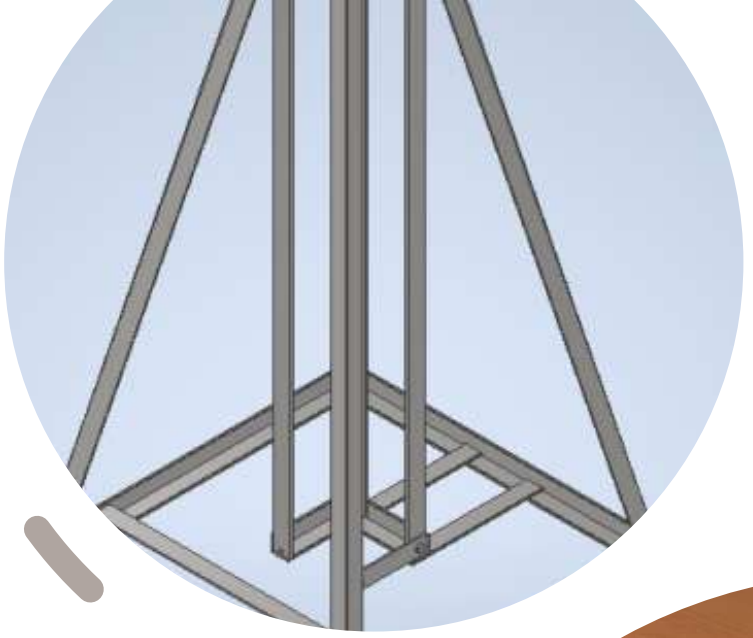
Benard Mburu



Objectives

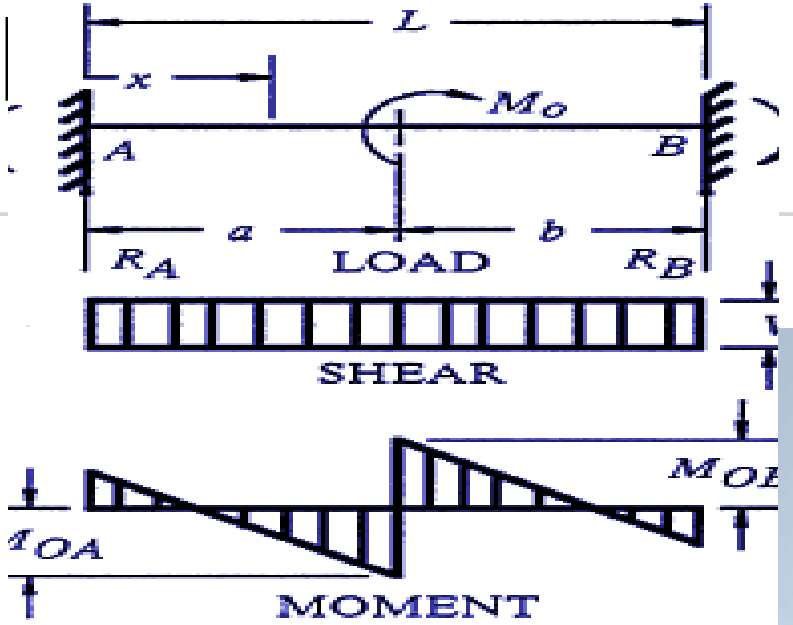
- Fabrication of nozzles and bulkheads
- Cooking of grains
- Procurement of test stand materials
- Desing and fabrication of test stand
- Continued printing of casting tools (5 copies needed)

Tasks Completed



1. Completed 3D printing of 1 casting tool.
2. Test stand re-designed to trapezoidal shape to improve stability. Bolted joints allow assembly/ disassembly. Rocket motor is also easily mounted and accessible from one side

TEST STAND LOADI



Angle beam – 1.25 * 1.25 * 3/16 in

L = 600mm

Max thrust = 2500N --> Safety of 2 : 5000N

Torque = 750Nm

I = 2.56488*10^-8 m^4

Ra = 1875N

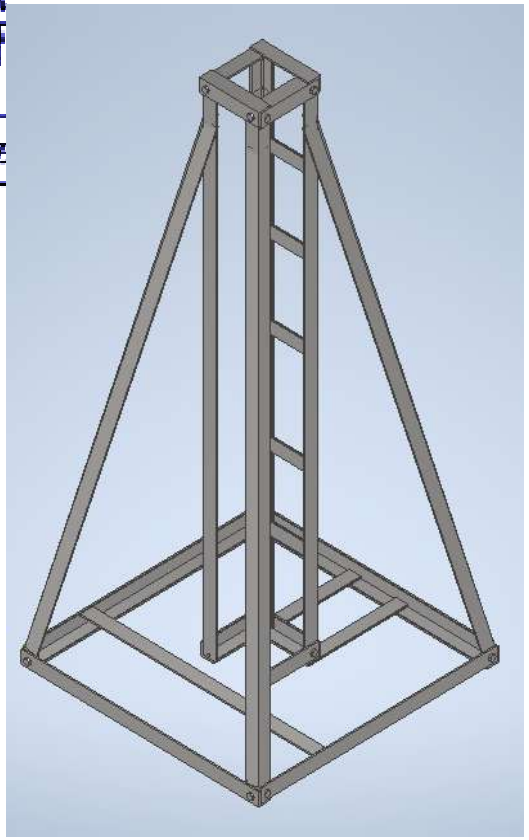
Ma = 187.5Nm

Max deflection = 1.5mm

$$R_A = \frac{-6M_o ab}{L^3} = -R_B$$

$$M_A = -\frac{M_o b}{L^2}(2a - b)$$

$$y_x = \frac{-x^2}{6EI}(3M_A - R_A x) \quad @ \quad x \le a$$



3. Material Procurement

The procurement of various materials as listed in the Bill of Materials (BOM) was successfully completed.

4. Updating Inventory

Item name	Quantity	Location		Status
Cable Ties	100	Rapid Prototyping Room	Solid	In Stock
Epoxy Resin	750ml	Rapid Prototyping Room	Solid	In Stock
Epoxy Hardener	250ml	Rapid Prototyping Room	Solid	In Stock
Speaker	1	Rapid Prototyping Room	Solid	In Stock
Key switches	2	Rapid Prototyping Room	Solid	In stock
Strobe Lights	4	Rapid Prototyping Room	Solid	In stock
M8 Bolts	160	Rapid Prototyping Room	Solid	In stock
M8 Nuts	60	Rapid Prototyping Room	Solid	In stock
Washers	60	Rapid Prototyping Room	Solid	In stock
Center Drill	1	Machine Shop	Solid	In use
Cutting tools	2	Machine Shop	Solid	In use
Drill b*it*	1	Machine Shop	Solid	In use
H/R angle line, Mild Steel, 50x50x6, 6mtr	1	Rapid Prototyping Room	Liquid	In Use
Drill bit 8mm	2	Rapid Prototyping Room	Liquid	In Use
Hydrogen Peroxide	600ml	Rapid Prototyping Room	Solid	In Use
HCL	1	Rapid Prototyping Room	Solid	In Use
Acetone	500ml	Rapid Prototyping Room	Solid	In Use

5. Nozzle Fabrication

Turned from 100mm to 89mm

Drilled using 10mm, 12mm, 21mm, and 22mm bits

Commenced tapering at 30°

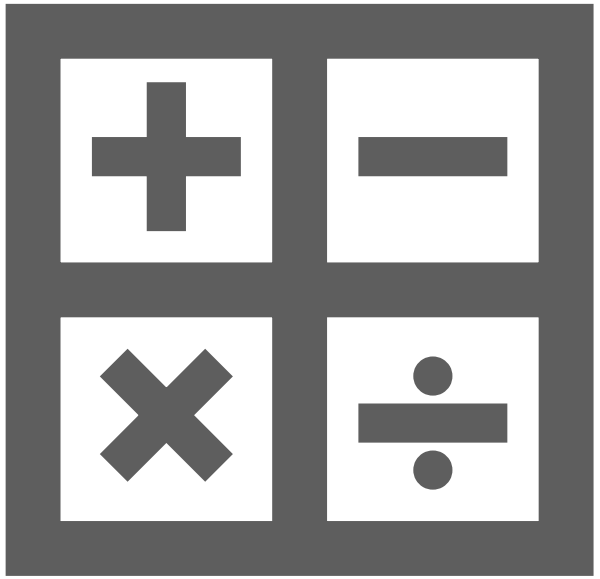
Photos provided by Unsplash



To be done on Monday:

1. Outside taper
2. Drilling and tapping
3. Purchase of thicker Orings

6. Fuel Grain Calculations



Simulated mass of 1 grain = 1264g

Using 15% allowance for waste, Total mass = 1.15 * 1264 = 1454g

Ratio of Potassium Nitrate: Sorbitol = 65:35

mass of KNO3 = 0.65 * 1454 = 945.1g

mass of solid Sorbitol = 0.35 * 1454 = 508.9g

Liquid sorbitol contains 70% Sorbitol;

mass of liquid Sorbitol required = (100*508.9)/70 = 727g

Mass of iron (III) oxide = 1% of total mass

=> 0.01 * 1454 = 14.54g

Grain Cooking Process

- Measured 727g liquid sorbitol, preheated to 240°C and stirred it continuously until it caramelized.
- Weighed and mixed 945.1g potassium nitrate and 14.54g iron(III) oxide

Stirred mixture for 20 minutes while adjusting temperature to get the preferred viscosity.

Poured mixture into casting tool, inserted center rod, and cooled.

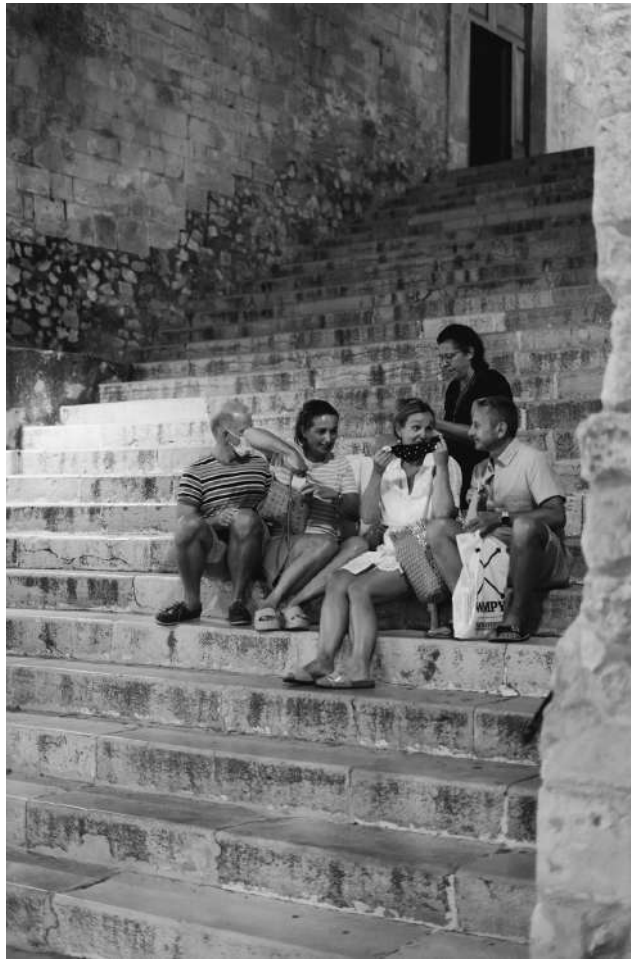
Challenges faced

1. **Broken boring tool**

The spindle accidentally reversed direction which took out the tip of the boring tool.

Next Steps

- **Finish Nozzle and Bulkhead Preparation**
- **Printing of Casting tools**
- **Purchase of Test stand Components and Orings for the nozzle**
- **Assemble and test the newly designed test stand**
- **First Static Test (Tuesday or Wednesday)**



Photos provided by Unsplash