

NAKUJA 4 Solid Propulsion Team

WEEK 4 PROGRESS REPORT



WEEK'S OBJECTIVES

- Preparation of the Bill of Materials #1
- Procurement of Materials #1
- 3D Printing of the Casting Tools #2
- Research on Test Stand Design #5
- Research on Motor Inhibitor #6



PREPARATION OF BILL OF MATERIALS

We prepared the bill of materials which included;

- materials needed for fabrication of the motor and nozzle and casing
- ignition circuit components
- chemicals required for grain preparation and storage

The following is the link for the Bill of Materials

<https://docs.google.com/spreadsheets/d/1FbWmaaT0nI9665jFh08SqWUDMGrxwWAYC85VwriNi-A/edit?usp=sharing>

3D PRINTING OF THE CASTING TOOLS

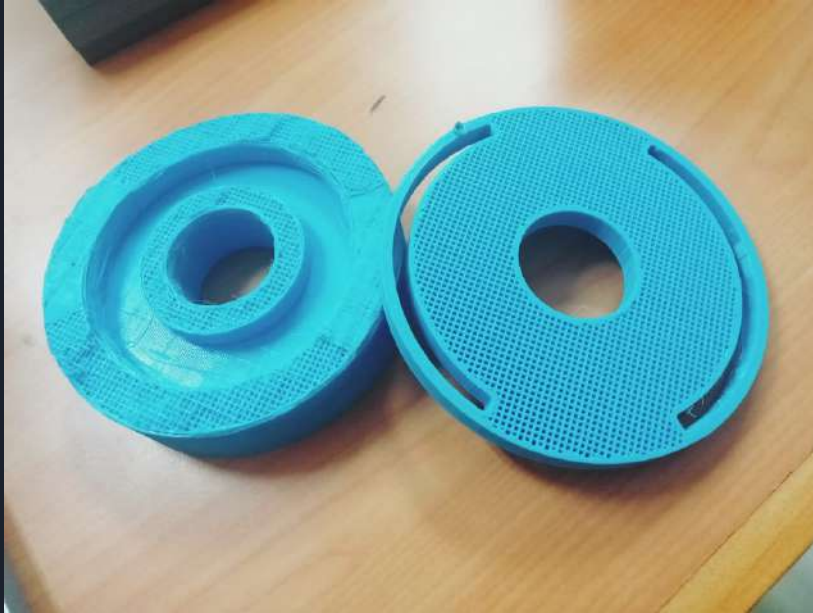


We modified the **infill** and design of the casting tools to **70%**.

This was to make them strong enough to handle the weight and temperature of the grains.

The weight of a single grain being about **1.26 kg**.

CHALLENGES ENCOUNTERED DURING 3D PRINTING



During printing of the base, the 3D printer failed a few times.

This was due to;

- Use of a newer Prusa Slicing Software that wasn't exactly compatible with the Prusa i3 3D Printer
- Not including supports during printing

There was an issue with transfer of the sliced files to the Ultimaker Cura S3 printer

We were able to diagnose and rectify the above issues.



THERMAL INSULATION OF ALUMINIUM CASING

. During combustion, the propellant generates intense heat (approx. 1600K)

. Without insulation, this heat would cause structural failure.

Factors to consider: Material Selection, Thickness Optimization, Adhesion and Bonding

Challenge: Thickness Optimization

Material used

Ceramic Cloth: a high-temperature ceramic cloth 1260°C. Serves as the ablative layer, shielding the motor case from direct heat transfer.

Epoxy Resin Sealing: To secure the ceramic cloth, we use thermosetting epoxy resin. This prevents leakage.

INSULATION CONT.

Critical Sealing:—the bulkhead and nozzle—we rely on heat-resistant silicon (ceramic silicon).

Rating: 1500°C

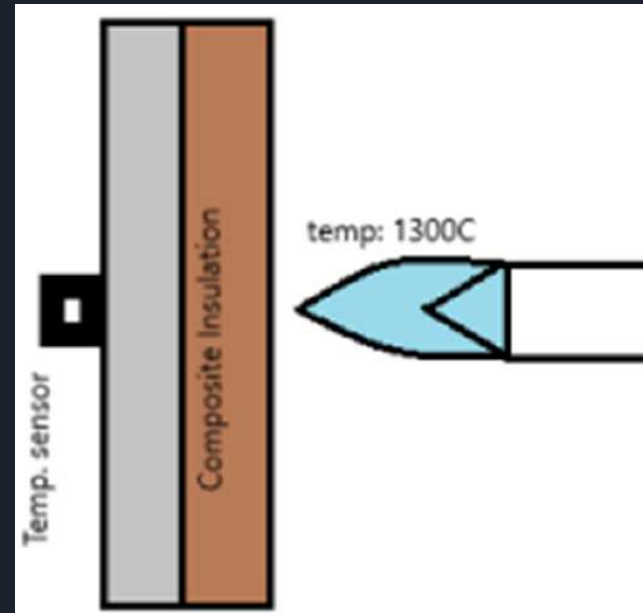
Optimization and Practical Factors

Insulation Thickness: By experimental means

Use of oxy-acetylene neutral flame

To investigate ablation rate and casing temp

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NEXT WEEK'S OBJECTIVES

- Fabrication of Casing and Bulkhead
- Cooking of Grains Continuation
- Test Stand Fabrication
- Ignition Circuit Fabrication

THANK YOU

