

Rocket Engine Development

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Background:

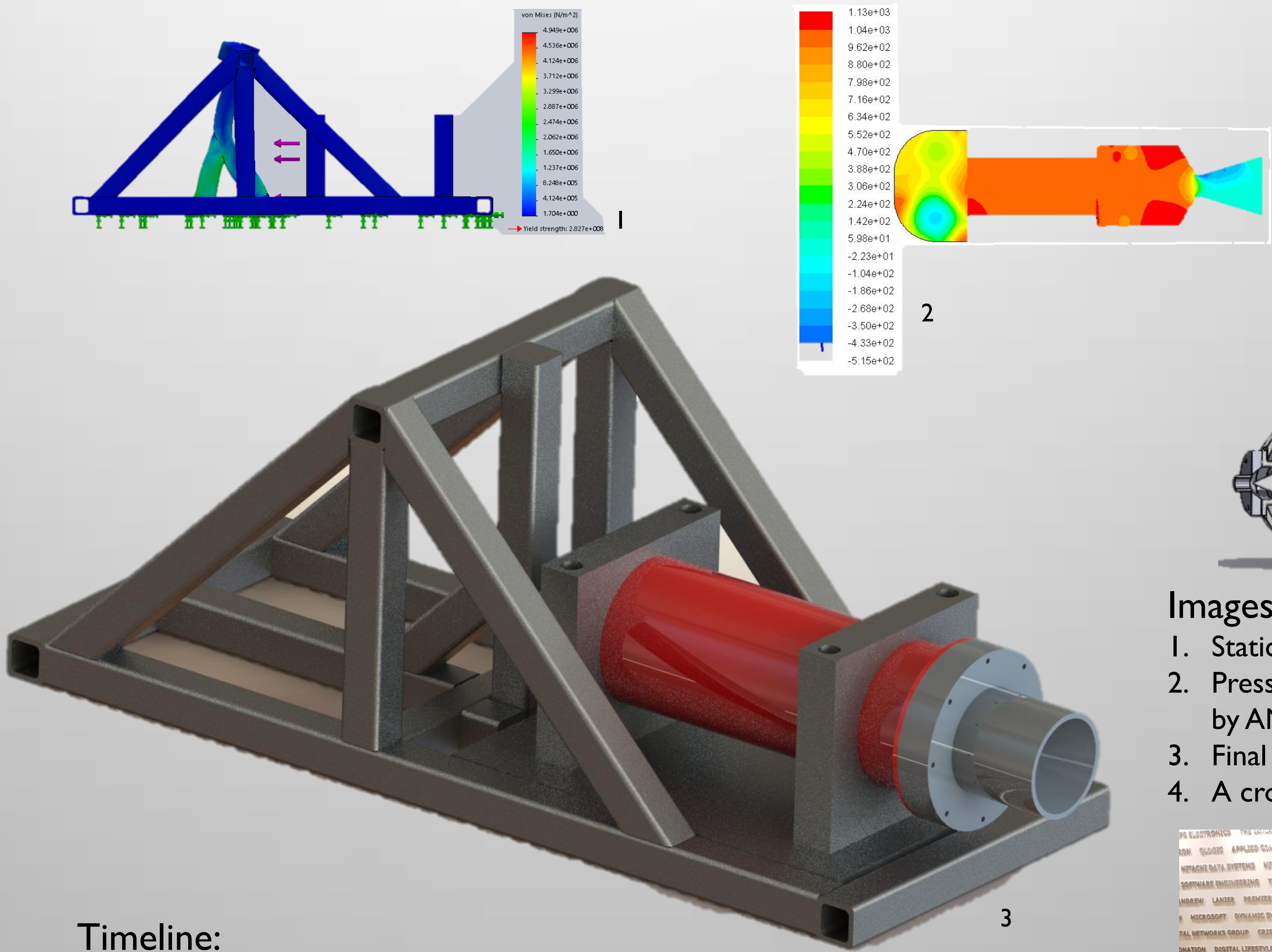
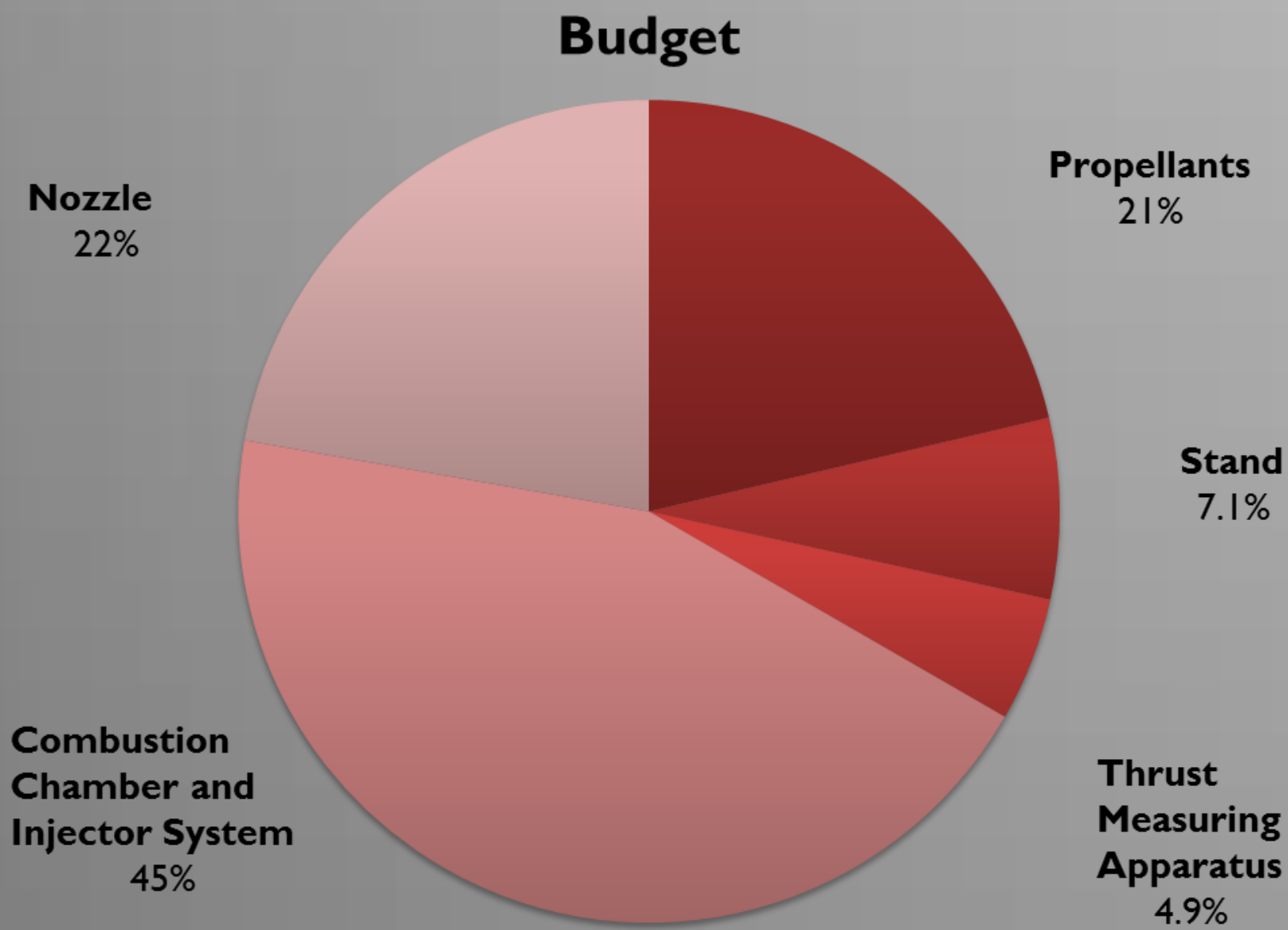
Traditional rocket engines use liquid propellants and have stayed conservative for some time. However, new hybrid rocket engines have been making more advancements, considering they have more advantages than liquid rocket engines. With the ability to mix between liquid, solid, and gas propellants, they can achieve higher thrust and efficiency. Getting inspiration from Stanford’s Advanced Rocket Propulsion class, our team set goals to build a hybrid rocket engine that can achieve higher thrust for a longer duration.

Purpose:

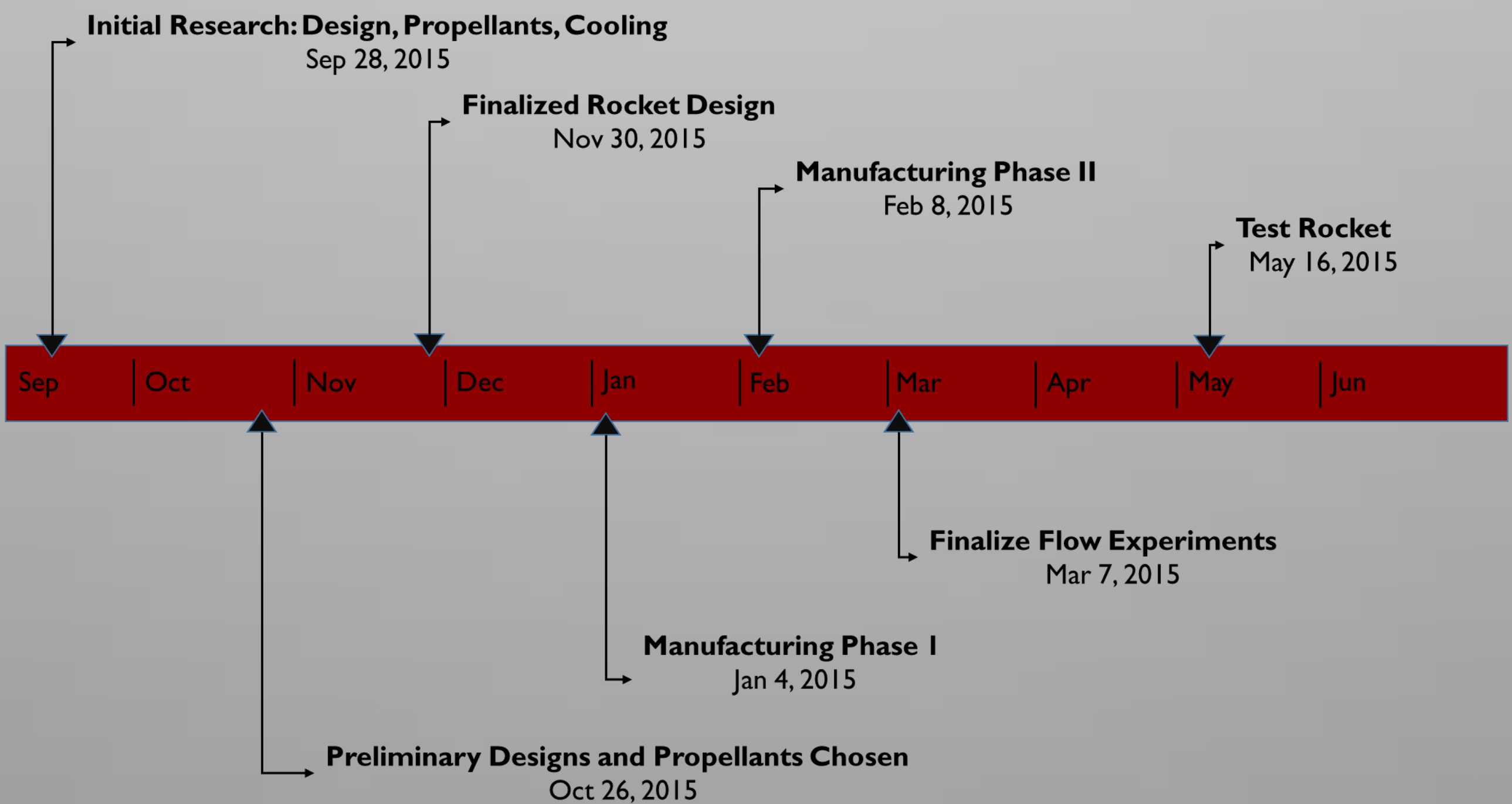
To design and build a hybrid rocket engine, using a mix of solid with liquid or gas propellant.

Objective:

- To achieve 1000 lbs of thrust for a burn time of 20 seconds.
- To choose types of propellant.
- Research on the correct mixing ratio that will deliver the required thrust.
- Design combustion chamber with nozzle to withstand forces to a safety factor of 2.5 with the available budget.
- Design stand that can house the rocket engine and the propellant tanks.
- Design thrust measuring system.
- Run thermal and flow simulations to accurately get temperature values.

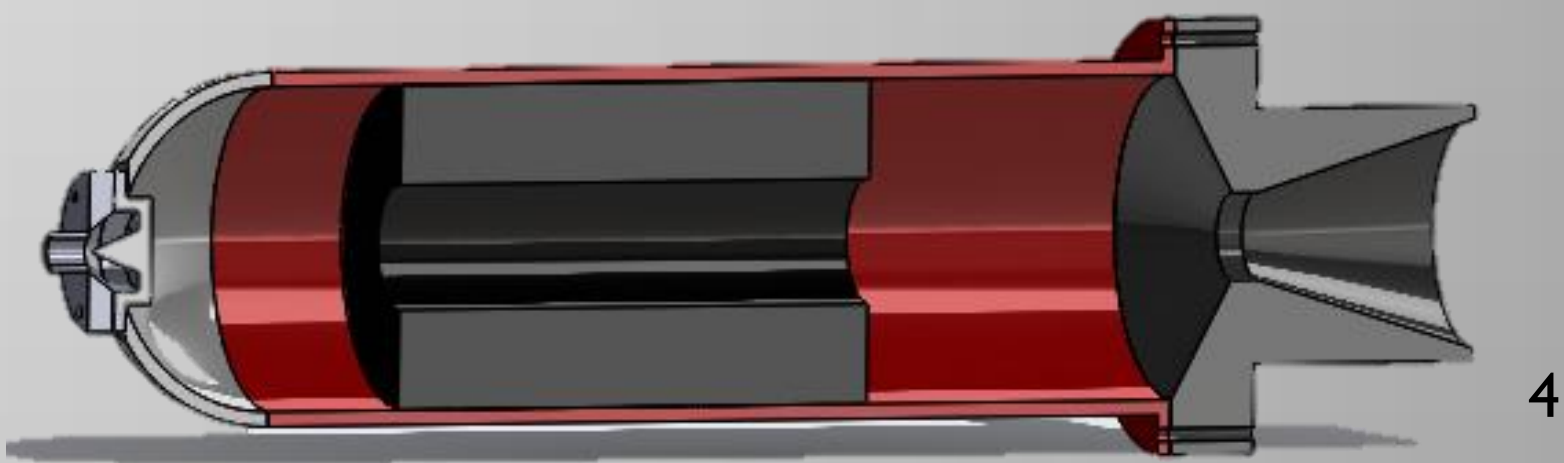


Timeline:



Achievements:

- Finalize propellants to paraffin wax with 40% aluminum and N_2O gas.
- Use of COMSOL and ANSYS Fluent to run flow simulations and get thermal and pressure distributions along engine.
- Stand is designed and ready to build.
- Thrust measuring apparatus designed using load cells and Arduino to collect accurate data.



Images:

- Static stress simulation run on the stand using SOLIDWORKS.
- Pressure distribution along the combustion chamber achieved by ANSYS Fluent flow simulation.
- Final rendering of the rocket engine.
- A cross sectional view of the combustion chamber.



Team Members:

From top to bottom: Edgar Delgado, Paul De Mesa, Danny Zarour, Anthony Long, Francisco Mendoza, Jianan Qu, John Huynh, Jim Faber, Lakshan Peiris, Conner Farrell, Jolie Belegarde, Bryan Orozco, Joshua Yang, Walter Hsieh, Daniel Cho, Tiffany Quach, Jodie Loo, Wendy Liu, Maria Barajas, Nathan Sharifrazi, Alex LaVelle, Jose Montenegro, Victor Chen, Vishnu Maharaj.

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