

DESIGN DEVELOPMENT

Booster Propellant

- Solid composite propellant.
- Addition of Red Iron Oxide to increase burn rate.
- Designed for high impulse, high thrust, and moderately short burn time.
- Accelerates the vehicle to optimize sustainer performance.

Sustainer Propellant

- Solid composite propellant
- Addition of oxamide to reduce burn rate
- Designed to have a high impulse, a low thrust, and a long burn time

Motor Casings

- Machined in-house from 6061-T6 aluminum tubing
- Snap-ring enclosures hold all pieces of the motor together

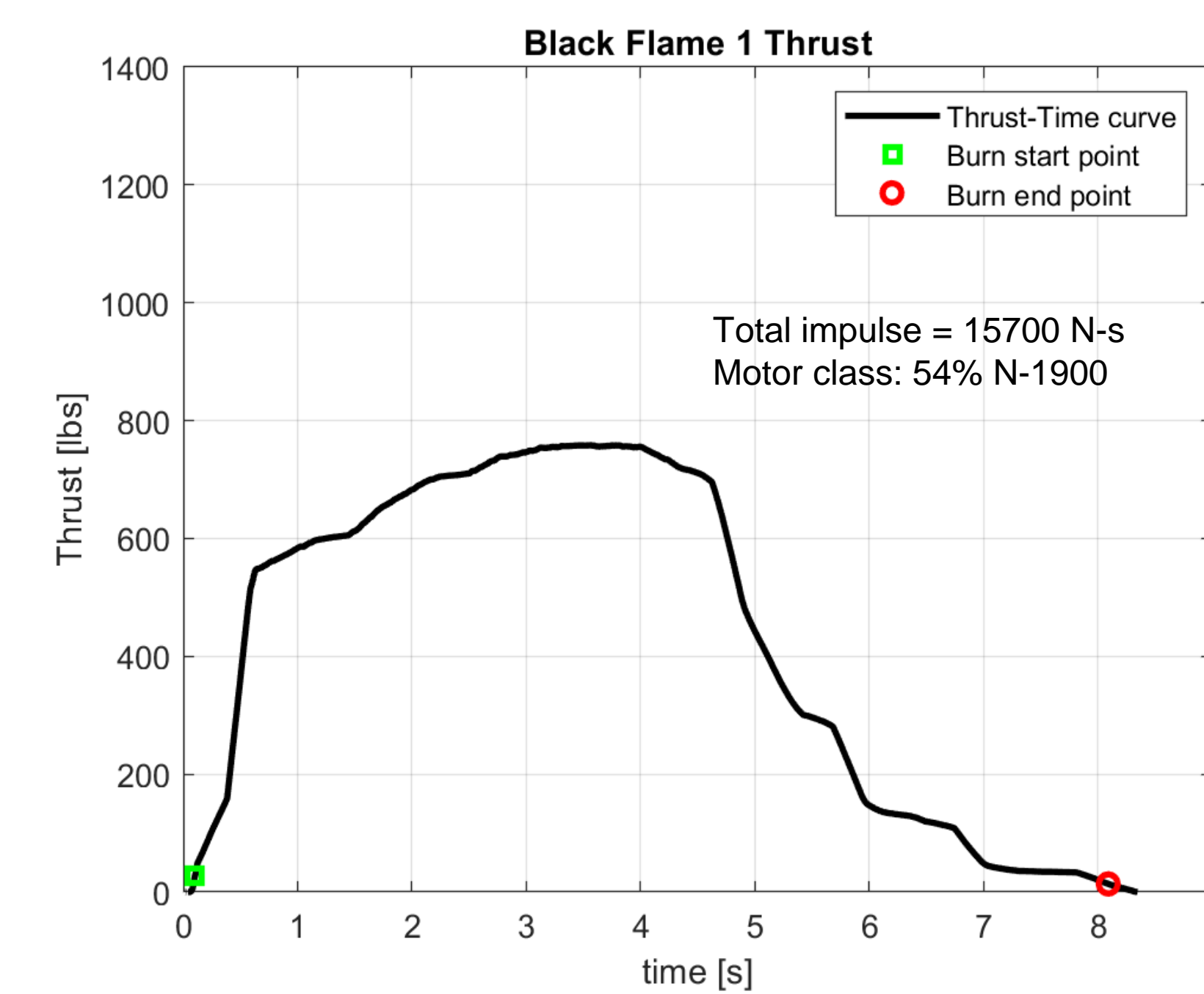
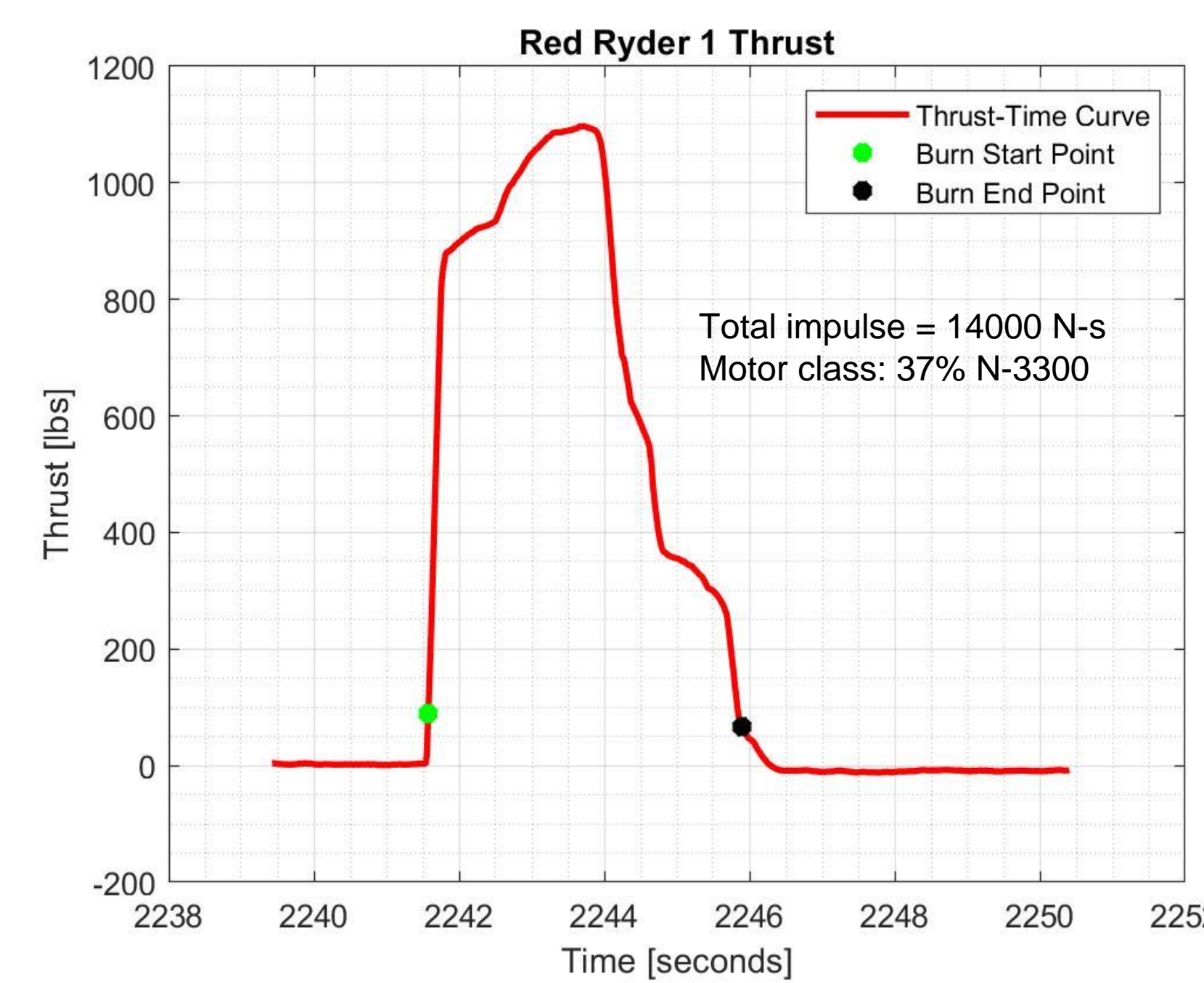
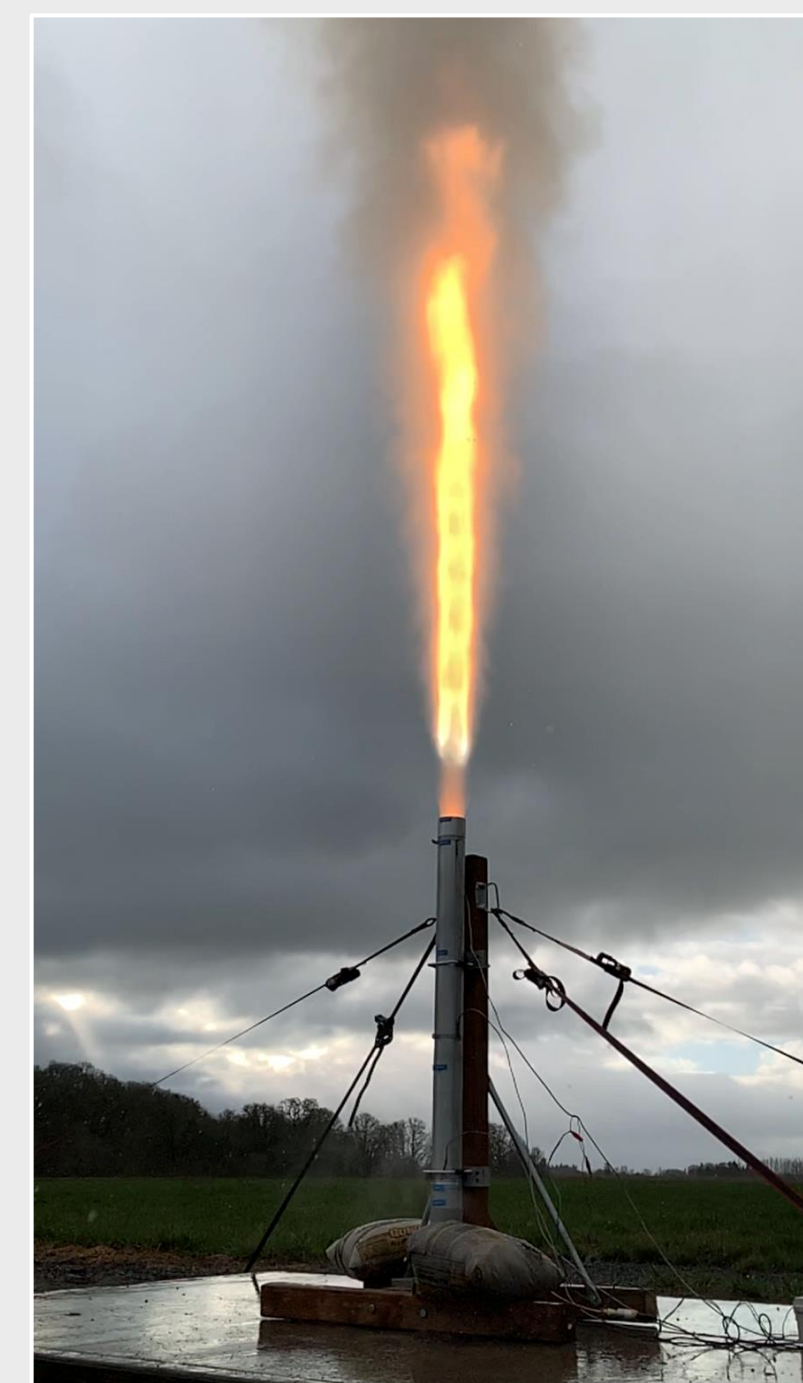
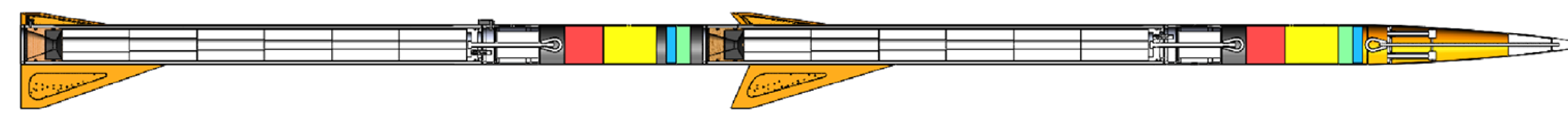
Nozzles

- Machined in-house using combination of canvas phenolic and graphite
- Designed to increase efficiency compared to full graphite nozzle
- Reduces heat transfer to motor casing



# HIGH ALTITUDE ROCKET TEAM: PROPULSION

OSU High Altitude Rocket Team, HART, is responsible for designing a two-stage demonstration rocket capable of setting a university altitude record. The **Propulsion** sub-team is responsible for designing and validating the propulsion components of the rocket. The 2019-2020 HART team members have made significant strides towards optimizing the rocket's performance and integration time.



## DESIGN VALIDATION

Static Test Fires:

- Used to collect performance data from the motor (**Pressure, Thrust, Temperature**)
- Test the **performance** of the **motor casing**, the **nozzle**, and **both propellant formulations**

## DESIGN INNOVATION

- The 2019-2020 High Altitude Rocket Team has introduced unique design changes with hopes to optimize the rocket. **Phenolic nozzles** have both reduced the overall weight of the motor assembly and improved nozzle efficiency, leading to improved thrust values. **Snap-ring enclosures** have improved the rocket integration time and difficulty while also reducing weight and drag from the rocket by removing the need for radial bolts. **Simplified propellant formulations** ensure consistent characteristics and performance.



TEAM MEMBERS

- Ammar Alkhalifa
- Connor Anchick
- Colton Buchanan
- Kenny Fisher

TECHNICAL ADVISOR

Dr. Nancy Squires

PROJECT SPONSOR



Project Status

- Finalized designs.
- Manufacturing for testing done.
- Three full-scale booster tests.
- One full-scale sustainer test.
- Upon successful testing, design optimization will begin.