Overview

The "Blue Jay" is a 12 ft., LOX and paraffin hybrid rocket with a designed total impulse of 20,330 Ns. The rocket will have its maiden flight summer 2022 at the Friends of Amateur Rocketry with a target altitude of 10,000 ft. above ground level. The rocket is expected to weigh around 100 lbs. dry. This is BYU's first hybrid rocket, and one of the first LOX paraffin hybrids to be flown. The rocket is divided into four subsystems: structures and recovery, electronics and controls, plumbing, and propulsion.

Subsystem Designs

Electronics and Controls

The electronics are composed of two redundant systems, a Teensy 4.1 and an Arduino Due, that control the launch sequence and valves as well as logging and transmitting flight performance data. Additional pressure data from the plumbing system is also recorded and monitored.

Propulsion System

NASA CEA was used to predict the thermochemistry of liquid oxygen combusting with paraffin wax. The team also decided to keep the total empty weight of the rocket to around 100 lbs., and the thrust to weight ratio was chosen to be 6.5. The burn time was also not to exceed 6 seconds. These requirements, in addition to the objective altitude of 10,000 ft., enabled Python code developed in house to iteratively solve the equations of motion for this rocket and determine the thrust required to reach to target altitude. Code was also developed to employ the method of characteristics in designing the contour for the nozzle.

Next Steps

As parts are coming in, the rocket is nearing its completion. A series of tests are planned to check the integrity of the rocket, the impulse of the motor, and the control of the valves. "Blue Jay" is only the beginning for hybrid and eventually liquid rocket engine development at BYU.

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