Roaring Dutchmen Rocket Team

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Introduction

The Union College Rocket Team was preparing to compete at the Spaceport America Cup, hosted by the Experimental Sounding Rocket Association, in Truth or Consequences, NM. The SA Cup has multiple divisions of competition. The team wanted to participate in the 10,000ft commercial motor group. In this division, teams are required to send a rocket containing an 8.8lb scientific payload to an apogee of 10,000 feet using an off-the-shelf solid fuel motor. In addition they must recover the rocket.

Propulsion

The 2020 Roaring Dutchie was designed to reach an altitude of 10,000' by a Aerotech L-class 1325M solid-fuel engine. The decrease in weight and length of the new design allowed for a smaller and less powerful motor of 1325N average thrust compared to the previous 1456N. The motor would be mounted to the rocket using an Aerotech reloadable motor system aligned vertically inside the body using centering rings. The majority of the thrust would be transmitted through the body itself by fastening the RMS to the bottom face. Upon reaching 10,000', the Roaring Dutchman will deploy its 1' drogue chute to slow its descent before deploying its 5' main chute at 1,500' to ensure a safe landing.

Structures

The name 'Roaring Dutchie' was given after the following modifications to the previous year's rocket. To reduce packing size as a way to minimize transportation and material costs the body that houses the motor and parachutes has been decreased from 6in diameter to 4in. The section that houses the payload must have a 6in diameter to meet competition restraints on payload form factor. Therefore, a transition coupler of these two diameters is needed. As an initial choice the transition will be 3d printed out of ABS. Lastly the previous fins where attached to the body using 1/16th thick steel brackets these were too heavy therefore a 5/64th thick aluminum bracket design was made. The body is composed of a fiberglass reinforced phenolic tubing broken into 3 subassemblies as shown in figure 1 below. These are secured with nylon shear pins and detached from another upon ignition of ejection canisters.

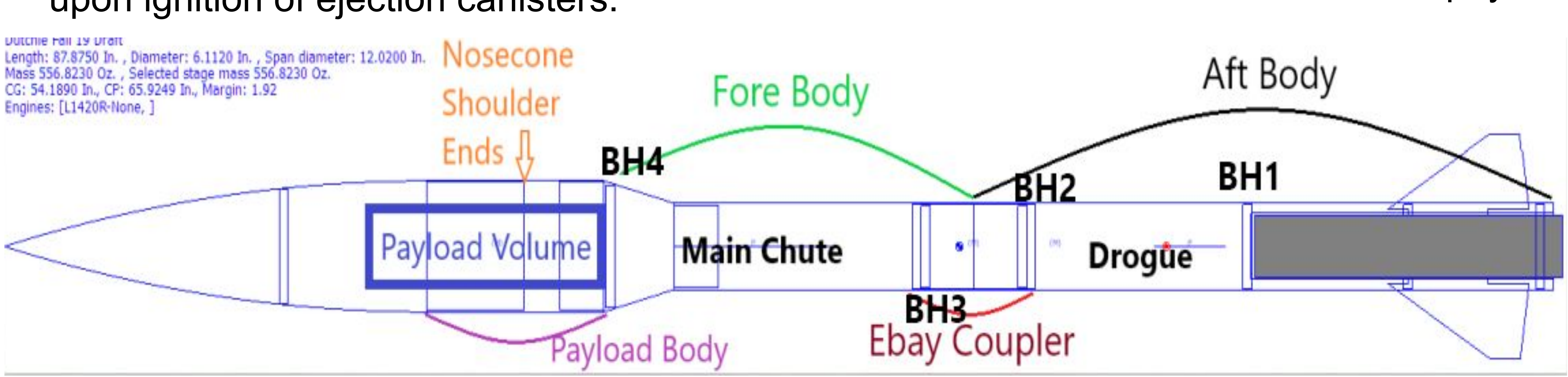

Figure 1. RockSim outline of Roaring Durchie

Telemetry

The data logging system on the rocket must be capable of recording altitude and location by GPS as defined by the rules for the SA Cup. The TeleMetrum v2 board is capable of the above and would run simultaneously with a backup board. The flight information would be transmitted as well as being stored in flash storage on the rocket. Pictured below is a color coded image of a test rocket flightpath.

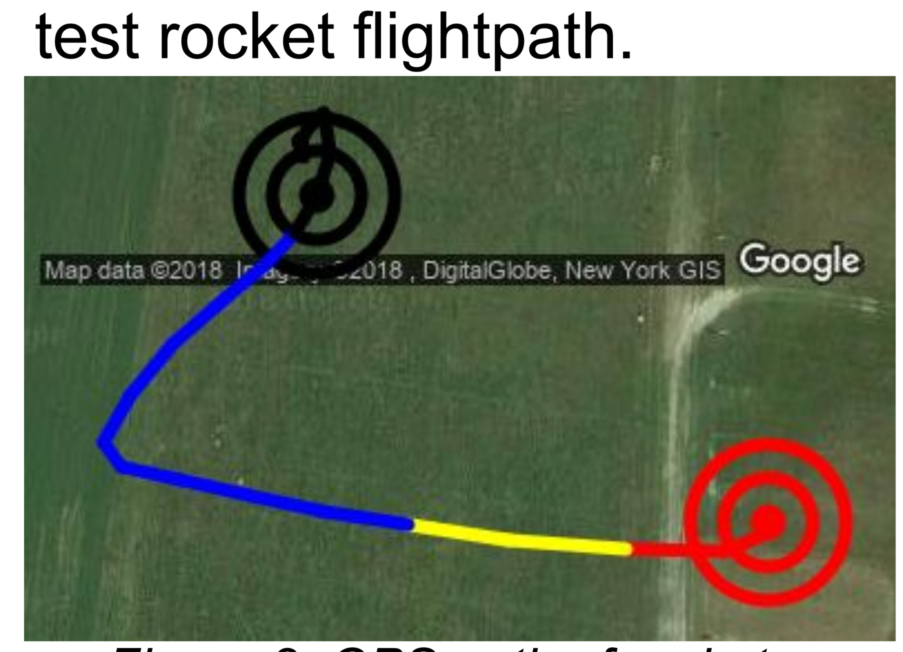

Figure 2. GPS path of rocket recorded by flight computer.

The path represented in in red is the boost phase of the rocket, yellow shows the coast phase, blue indicates descent under the drogue parachute, and black is descent under the main parachute.

Payload

The proposed payload will focus on monitoring atmospheric conditions as a way to track effects of climate change. It will be deployed from under the nose cone right after the main parachute has been deployed.

Inside the walls of a 3D printed polymer lattice figured, a Raspberry Pi Zero micro-computer will be connected to a SparkFun CCS811/BME280 Environmental Combo Breakout sensor. This sensor will read and log measurements of temperature, barometric pressure, humidity, TVOC and CO2 levels from the altitude that the payload is deployed to when it has reached the ground. The Raspberry Pi Zero will be powered by a 5 volt lithium battery. As an all-in-one solution for data recovery, a Apogee Rockets, Simple GPS tracker, freq: 902-928 MHz, 17 dbm Spread Spectrum will be used to track the payload.

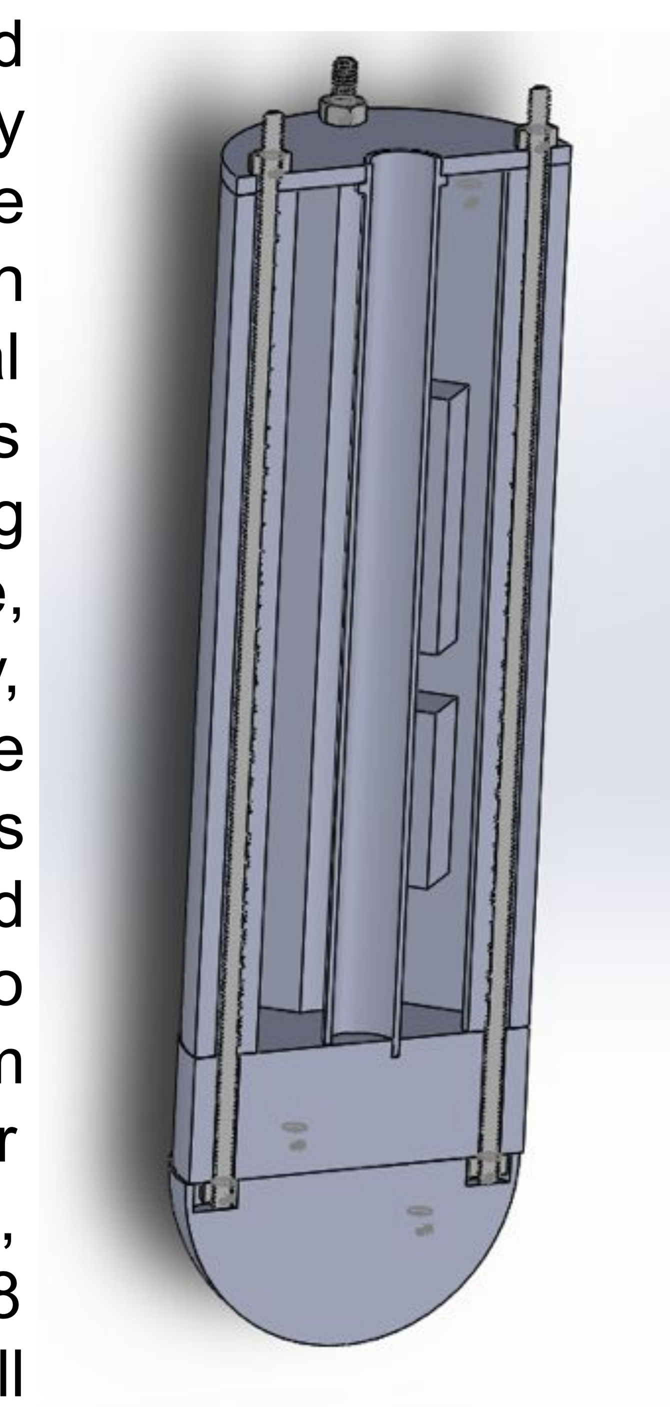

Figure 3. SolidWorks model of scientific payload deployable

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