Creating a High Velocity Two Staged Deployment Rocket

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Abstract

The purpose of this project is to build and test new and innovative systems for the Idaho State University (ISU) Spaceport Cup competition rocket. Designs were simulated with the Open Rocket Simulation software. Elements such as size, weight distribution, and aerodynamic flow were considered. For the first design, a carbon fiber first stage is utilized to house the engine casing. Fiberglass fins are attached to a six inch diameter carbon fiber tube which makes up the first stage. A fiberglass coupler then connects the carbon fiber tube to a fiberglass tube that's part of the second stage. The fiberglass coupler is utilized as the electronics bay. Deployment of the drogue chute and full chute is done during separation through the use of a three gram and three and half gram charges respectively. The deployment of the four-foot drogue chute at apogee orients the vehicle to allow the deployment of the ten-foot main chute. Both rockets will have a GPS unit that communicates with the onboard altimeter enabling a more accurate flight path that corresponds with the data packets sent by the GPS unit. Being able to have full reusability of the vehicle for future flights is the objective. For the current launch of the rocket, the payload includes a 1080p camera attached to the fuselage side as well as an eight-pound weight contained in the nose cone. As well as the competition team, a senior design team also created a test rocket that is exploring experimental and innovative ways to deploy the parachute system.

The additional rocket utilizes a new way to deploy parachutes for the recovery of the high-powered rocket model. Through the use of three separate, three quarter inch tubes made of carbon fiber that run down the length of the main rocket body which houses shock cords and parachutes. The parachute will be deployed by three separate one-gram black powder charges allowing the body of the rocket to remain intact instead of breaking apart like most traditional high power rocket models. The rocket will be approximately five feet tall and have a full electronics bay that includes two altimeters and a GPS unit. The project will provide the future teams at ISU to build and complete more reliable and accurate rockets for the annually held Spaceport Cup Competition.

Introduction

The creation of the rocket started as a senior design project to design and create a level 3, two stage deployment, high powered rocket that will go and compete in the 10,000 feet category in the Spaceport Cup Competition. This has since been expanded upon to be used as an opportunity for students to explore and learn about the aerospace engineering field at Idaho State University and has led to the creation of another rocket by a senior design team. This rocket is a stage 2, high powered rocket, using an experimental way of parachute deployment for potential use in future missions, and the rocket will reach 2,000 feet above ground level.

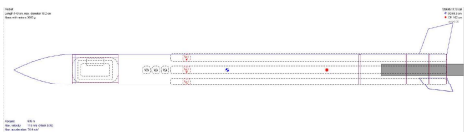

Figure 1. Design of Senior Design Rocket

Figure 2. Senior Design Rocket

Figure 3. Spaceport Cup Rocket

Results

The launch of the High Velocity rockets will be the first of its kind for Idaho State University Students. The design, fabrication, and testing provided valuable experience for every student involved.

The success of the High Velocity Rocket will allow future students to conduct experiments placed inside of the payload area inside the nose cone.

Future Objectives

Future objectives with the project will be to continue improving on the design of the mark 1 rocket and with the improvement increase the score and placement achieved at the annual Spaceport Cup Competition. Ideas that will be looked into improving include; improvements to the nose cone design and how the removable payload will be situated within it, a redesign of the electronics bay to improve ease of use and assembly of the rocket, creating a new camera system and mount to provide clearer video and pictures of the rocket's flight, a overhaul of the main chute deployment system to improve on ease of use, and to correct any problems that occurred during the creation of the mark 1 rocket.

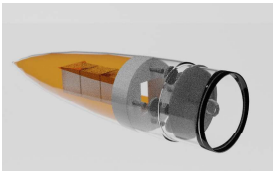

Figure 4. Redesign of nose cone to have a removable payload

Conclusion

1. Design, create, and compete in the Spaceport Cup Competition with a high speed, two stage deployment rocket.
2. Create a rocket that utilizes a new way to deploy parachutes for the recovery of the high-powered rocket model.
3. Have successful rocket launches and retrievals.
4. To improve on the mark 1 designs of the rocket to further improve score and placement at the Spaceport Cup Competition.

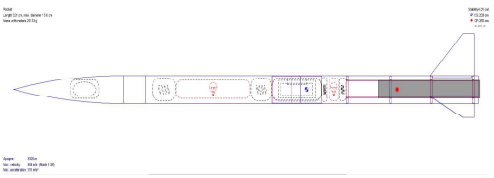

Figure 5. Design of Spaceport Cup Rocket