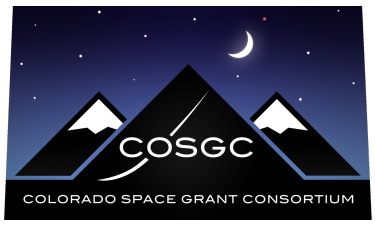

Colorado State University

Liquid Bi-Propellant Rocket for Payload Delivery

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Abstract

The Propulsion and Airframe Teams of Colorado State University's Competition Rocket Team are tasked with designing and building a launch vehicle to deliver a quadcopter payload that will collect surface soil data on the planet Mars. The purpose of the mission is to collect surface soil data of unexplored terrain inaccessible with current Mars rovers due to geographical discrepancies such as ravines or steep craters. To solve this issue, the team has designed and are building a liquid bi-propellant rocket engine and carbon fiber airframe to deliver the payload. The engine will feature ethanol as the fuel and nitrous oxide as the oxidizer, which will be mixed and delivered to the combustion chamber via a pintle injector. The combustion chamber is cooled by an ablative liner, and following combustion the hot gases exit through a graphite nozzle. The airframe will house both the engine and payload and will be constructed from carbon fiber. As of now, the propulsion system has been manufactured and is being tested, while the airframe is still in the manufacturing phase. Each subsystem will be tested, and the engine testing will culminate with a static hot fire. Once manufactured, the airframe will be tested for strength, and both the payload delivery and recovery systems will be tested for functionality. This project was chosen to be pursued since we believe drones are the future for planetary exploration as they provide greater capability of surveying. A bi-liquid engine was chosen because to deliver this payload in a real scenario, a liquid bi-propellant rocket would likely be used. The current industry is also looking towards colonization of Mars in the future, and this rocket and payload combination would facilitate part of the research required to get there.