Project Name
Student Space Systems Liquid v1 Rocket Engine

Date of Report Submission
8/25/2017

Project Purpose
The goal of this project is to design, build, and test a prototype liquid engine. The engine is intended to burn propellants whose exhaust products are one of the cleanest of any propellant combination. The manufacturing of this engine will utilize Direct Metal Laser Sintering techniques, an additive process that dramatically reduces the waste in conventional machining. It also allows the use of Inconel superalloy, which will afford the strength and heat resistance to the engine components; these benefits will allow it to fire multiple times without sustaining significant damage. Following build and testing, this engine will power a student-built rocket to 30,000ft. This engine will produce 1000lbf of thrust on average and incorporate several first iteration technologies such as film cooling and motor control; it will serve as a testbed to practice operating high pressure fluid systems and monitoring engine health. Its operation will also inform our design of future engines.

Detailed Account of Expenditures To Date
No funds have been spent on this project to date.

Project Progress to Date
Our initial aim was to design the engine to use kerosene and liquid oxygen. After progressing in that design, we were met with several logistical challenges regarding the purchase and handling of cryogenic substances; this inclined us to redesign the engine to burn ethanol and nitrous oxide. This propellant combination is clean burning, with the main byproducts including water, nitrogen, and carbon dioxide. All of these gases occur naturally in the atmosphere. The engine will match the instantaneous thrust of the original engine design.

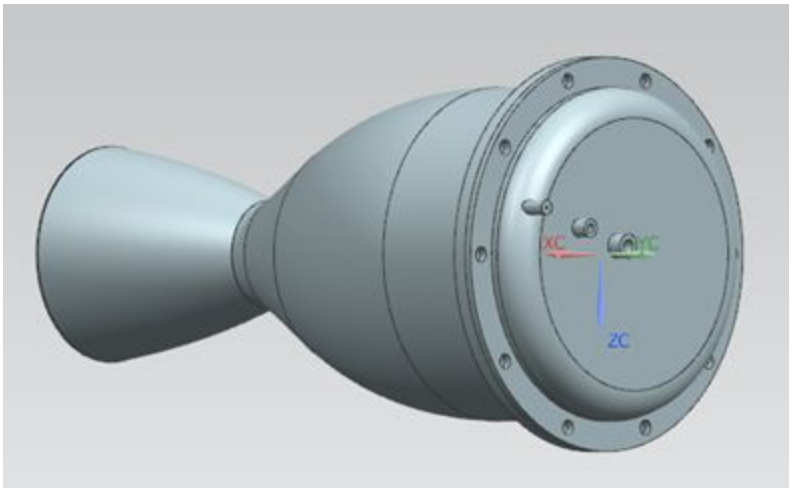
Now our teams are finishing the design and analysis of both the injector plate and plumbing systems as well as procedures for operating the engine. Final CFD simulations are underway for the injector plate. Both these subsystems will go through Critical Design Review before the end of September and Final Design Reviews will follow shortly after. Once the subsystems pass the design reviews, all of the engine components will enter the manufacturing process. We aim to complete manufacture of all the parts by December 2017.

Student Involvement and Outreach to Date
The students are the ones carrying out the entire design and analysis process. Some outreach has been done to obtain quotes from vendors and determine lead times and costs for manufacturing the engine components.

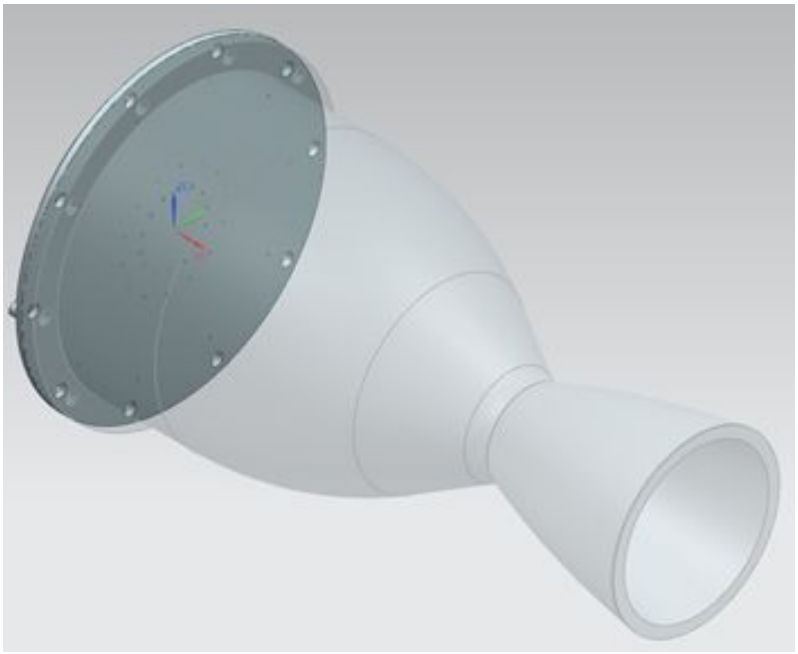
Marketing and Promotional Efforts to Date

No marketing centered around the liquid engine project has taken place.

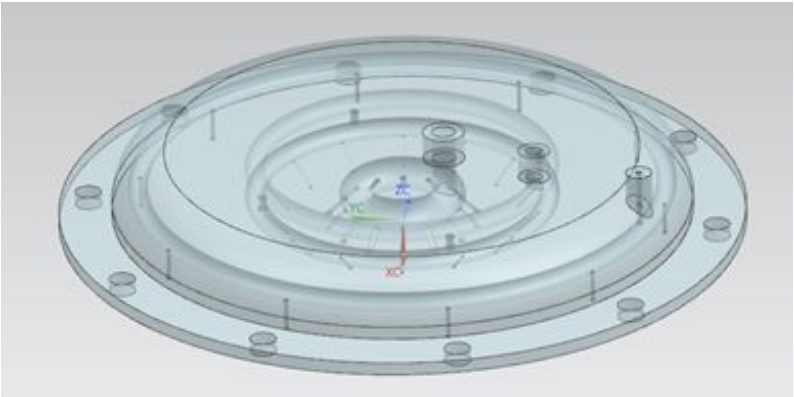
Additional Comments



CAD assembly of combustion chamber, injector plate



Injector Plate (opaque)



The injector plate has ten orifices for spraying a thin film of propellant into the combustion chamber to act as a coolant for the wall.