Designing and Fabricating a Vortex Aerospike Rocket Engine

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On average, 51% of a rocket engine’s weight is in the cooling system, so finding an engine design that would drastically reduce the engine's weight, complexity, and production cost would be extremely beneficial. I believe that small one-stage rockets will be the main method for smaller organizations to reach orbit shortly. The engine must be efficient at both sea level and in space to achieve this. Since the start of spaceflight in the 1960s, many innovations on the typical rocket engine have been theorized, but few have been adopted. This project takes two innovations previously theorized and tested, vortex cooling and aerospike nozzle, and combines them in a proof of concept prototype. First, the prototype was designed in Computer-Aided-Design and then validated in a Compusonal-Fluid-Dynamic simulation. Next, the design was fabricated out of mostly hardware store materials. The custom nozzle design was made through lost-PLA-casting. Then many tests were conducted with this prototype, and 4 data points were collected: nozzle temperature, combustion chamber temperature, chamber pressure, and thrust. The data collected showed the success of the vortex cooling method as the chamber temperature was much cooler than the nozzle temperature, and the success of the engine as a whole was validated by the thrust data. This project shows that a vortex aerospike design is a viable and useful idea, that a functioning rocket engine can be created relatively inexpensively and with widely available parts, and proves the idea that departing from typical rocket engine design can lead to beneficial findings.

Awards Won:

Office of Naval Research on behalf of the United States Navy and Marine Corps: The Chief of Naval Research Scholarship Award of $15,000

Second Award of $2,000