Effect of Geometric Manipulation on the Main Combustion Chamber of a Full- Flow Staged Rocket Engine

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Purpose: Colonization of Mars is one potential solution to Earth's rising temperatures, which requires efficient propulsion. The purpose of this investigation is to determine the effects of varied geometric paneling within the combustion chamber of a methane-oxygen full-flow staged rocket engine in an effort to increase the power and efficiency of modern liquid rocket propulsion. Hypothesis: With more chaotic particle motion inside the main combustion chamber, particle-particle collisions and thus particle-wall collisions. By definition, the more particle-wall collisions that occur within an enclosed space, the higher the pressure experienced within that space. An increase in thrust force under a constant quantity of fuel & oxidizer makes for a greater reaction efficiency. If the spherical polyhedron combustion chamber paneling of a methane-oxygen full-flow staged rocket engine increases in frequency, then the maximum thrust and reactant efficiency of that rocket will also increase. Procedure: Stage 1: Create a new model engine and spherical chamber. Input Young’s modulus and Poisson’s ratio. Seed the sphere and the edges by the frequency of the spherical polyhedron. Mesh model. Repeat this process for all chambers with the according frequencies. Stage 2: Conjoin a new model cone and combustion chamber instances for each trial. Stage 3: Select shell edged pressure and apply to seeds of combustion chamber. Record results for analysis. Repeat this using the corresponding combustion chambers for each trial. Conclusion: The results did match the hypothesis. An established correlation between the shape of a combustion chamber and it’s maximum pressure and thrust has great potential to influence the world of both liquid rocket propulsion power and efficiency.

Awards Won:

Aerojet Rocketdyne Foundation: First Award of $1500.00