Paper ID: 44135
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IAF SPACE PROPULSION SYMPOSIUM (C4)
Interactive Presentations - IAF SPACE PROPULSION SYMPOSIUM (IP)

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THE ZURQUI ENGINE: THE FIRST CENTRAL AMERICAN AND CARIBBEAN LIQUID ROCKET ENGINE

Abstract

This paper introduces the progress in the development of the first Central American and Caribbean liquid rocket engine: the Zurqui Engine. The main design stage was carried out with the help of an in-house software, the 'Rocket Engine Designer' (RED), which links with other programs to solve for the dimensions of the combustion chamber and nozzle. In this way a thrust of 700 N and chamber pressure of 450 psi were determined. Similarly, the optimal mixture ratio (O/F) for the chosen propellants, nitrous oxide and kerosene, was calculated to be 6.9 for a theoretical specific impulse of 245.5 s. To guarantee a stable mass flow rate of 0.291 kg/s, a pressure fed system was designed so that it provides enough propellants for a five second static fire test at NTP conditions. To increase efficiency, an 80% bell shaped nozzle was chosen, giving the Zurqui the final dimensions of 130 mm long by 52 mm of diameter, excluding the injection and cooling systems.

These preliminary results were used to produce a 3D model in Autodesk Inventor that was then used to perform a 2D axisymmetric heat transfer simulation under transient conditions in COMSOL Multiphysics. The engine is planned to be additive manufactured on stainless steel and make use of off-the-shelf components. The Zurqui Engine's design stage is nearly done, and once the heat transfer simulation and related areas are finished, the manufacturing process is esteemed to be relatively short, thus allowing the completion of the engine by early 2019.