PISTONLESS PUMP

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ABSTRACT

The application of a piston less pump to a launch vehicle or spacecraft can provide cost and reliability improvements over standard pressure fed or turbo-pump fed designs. Calculations show that in a first stage launch vehicle application, a system which uses the piston less pump has comparable performance to gas generator turbo-pump designs.

The performance can be improved by using low pressure liquid helium which is pumped using a piston less pump to high pressure and then heated at the engine. This allows for lower pressurant tankage weight. This system uses lessthan1%of the fuel mass in liquid helium, which offers a performance advantage over comparable gas generator turbo-pump powered rockets. A complete over all vehicle design is presented which shows how the various systems are integrated and how much each component weighs. The vehicle uses LOX/hydrocarbon propellants at moderate to high pressures to achieve high performance at low weight and low cost. The pump is also shown to have significant performance and flexibility increases for spacecraft when combined with high-pressure storable propellant engines. The proposed ump is also applicable to pumping gelled propellants.

KEYWORDS: Autogenous, Pressurization, CFD, Cryogenic Pumping, FMECA