SPACE PROPULSION SYMPOSIUM (C4)
Propulsion Technology (2) (5)

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DESIGN BOUNDARIES OF A LIQUID-FUELLED PROPULSION SYSTEM FOR A 500N SOUNDING ROCKET

Abstract

SMART Rockets project is an education project primarily for undergraduate students. In the frame of the programme STERN (Studentische Experimental-Raketen), which is managed by the German Space Agency (DLR), they have the opportunity to design, develop and launch a sounding rocket. The programme was initiated in 2012 and 2 launch campaigns with 6 rockets in total have been conducted until now. The results of the rocket flights will be presented in this paper with regard to the various propuslion systems like solid propellants and different propellant combinations for hybrid rocket engines. Furthermore the results and conclusions regarding the educational objectives will be presented. However the main focus of this contribution lies on the design challenges that come along with the development of the liquid-fuelled propulsion system within the SMART Rockets project. The utilised propellants are ethanol and liquid oxygen (LOX) and especially the cryogenic nature of LOX sets design boundaries regarding the miniaturisation of such a rocket system for educational and research purposes. With a nominal thrust of 500N extensive lightweight optimisation is necessary to integrate the pressure-fed propulsion system. Flight trajectory simulation data is used to discuss the influence of a low thrust to weight ratio. Final solutions for a reliable flight of the aerodynamically stabilised rocket will be drawn.