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DEVELOPMENT OF A 25KN HYBRID ROCKET ENGINE FOR THE STRATOS III SOUNDING
ROCKET

Abstract

In 2015 Delft Aerospace Rocket Engineering (DARE) broke the European altitude record for amateur rockets by reaching an altitude of 21.5 km with their Stratos II+ rocket. Since then this record has been broken by a team of students from the university of Stuttgart and the record currently stands at 32 km. Because of this DARE has started the development of the Stratos III rocket, with which it aims to break the European altitude record for amateur rockets once again. In order to break the record DARE is developing a new 25kN hybrid rocket engine to power the Stratos III rocket named the "DHX-400 Nimbus". The design of the engine is mostly based on the lessons learnt from Stratos II+ and the engine will use a similar oxidizer and fuel combination consisting of nitrous oxide and a combination of Sorbitol, Paraffin Wax and Aluminium micro particles. Furthermore a small scale test campaign was performed to test out different concepts which could potentially be used in the full scale version of the engine. Furthermore two different versions of the engine were developed: a "heavy" version, which features an aluminium shell and a graphite nozzle. This version is more robust and was used for testing the internal ballistics of the engine. The second version is a "lightweight" version, which features a 3D printed titanium nozzle and a composite combustion chamber. This second version is intended to be used for the Stratos III rocket. It should be noted that the "DHX-400 Nimbus" is more than twice as powerful as its predecessor, which lead to several complications during the design and production process. This paper aims to describe the development process of the "DHX-400 Nimbus", including the complications that were found during the scaling up of the engine and how these complications were eventually resolved. This paper shall discuss the design and production of the "DHX-400 Nimbus", along with relevant data from several static hot fire tests and a comparison to previous DARE hybrid rocket engines. Finally, recommendations for future improvements shall be given. Keywords: hybrid, rocket, nitrous, Nimbus, DARE, student