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STUDENT BUILT CRYOGENIC LIQUID ROCKET ENGINE TECHNOLOGY DEMONSTRATOR: RESULTS AND LEARNING OUTCOMES

Abstract

Delft Aerospace Rocket Engineering (DARE) is a student rocketry society, affiliated with TU Delft, dedicated to developing and testing technologies across the space industry. Project Sparrow was one of those projects, with the goal to develop a technology demonstrator for an orbit capable liquid propellant rocket engine. Starting in 2020 this multi-year student-led project aimed to increase the technology readiness level (TRL) of several technologies identified as critical for launching an orbital rocket. The resultant DLX-150 "Firebolt" engine is a 10 kN liquid propellant rocket engine, using liquid oxygen and ethanol, capable of thrust vector control. This paper covers the initial development and testing of the rocket engine. Specifically, the design of thrust vector control (TVC), the thrust chamber and the pressurisation system were identified as the primary technical challenges. The constraints imposed by a very small budget, lack of readily available test facilities and the restrictions resulting from a global pandemic were overcome by focusing on critical design aspects and rapid testing. This resulted in a first successful engine test in August 2021, demonstrating stable combustion, an effective ignition system and safe control of the propellant flow.

The "Firebolt" engine has since been improved and successfully tested six more times during the academic year of 2021-2022 by a new team of DARE students.