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DEVELOPMENT PROGRESS OF THE MAS-10K REGENERATIVELY COOLED SUB-SCALE PROPULSION TECHNOLOGY DEMONSTRATOR

Abstract

The MAS-10K is a 10kN, regeneratively cooled, pressure fed, Lox / Ethanol rocket engine currently in development and testing by MARCOM Aeronautics & Space (Pty) Limited. The engine is designed to serve as a preliminary sub-scale prototype development engine in support of the CHEETAH-1 Commercial Satellite Launch Vehicle, a two stage expendable vehicle designed to carry upwards of 1000kg to low-Earth orbit.

The primary objectives of the project are to, 1) isolate and develop key, innovative and cost-effective manufacturing techniques in respect of regeneratively cooled combustion chambers, 2) calibrate and conduct performance testing on an unlike-on-unlike impinging injector arrangement, 3) evaluate chamber heat transfer and cooling characteristics and establish the necessity for additional film cooling of the chamber wall, 4) demonstrate successful ignition (via spark torch ignition), extended operation and safe shut-down of the engine and, 5) establish life-cycle and durability criteria with respect to repeated ignition sequences. Further, the development program is also expected to provide key cost information with respect to the development and manufacture of more substantial engines.

The MAS-10K is designed to operate at a chamber pressure of 20 Bar and is currently limited to an expansion ratio of 5.4:1 however, with the addition of an appropriate radiation cooled nozzle extension for improved performance, the engine could be suitable for use as an upper-stage kick motor for orbital transfer trajectories of larger payloads.

This paper provides an overview of the engine itself, highlighting specific results and lessons learned during the design, development, manufacturing and testing cycle of the program.