Paper ID: 86960
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IAF SPACE PROPULSION SYMPOSIUM (C4)
Solid and Hybrid Propulsion (1) (3)

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MECHANICAL DEVELOPMENT AND STATIC-FIRE TESTING OF AN ORBITAL-SCALE HYBRID PROPULSION ENGINE

Abstract

HyPrSpace has developed a novel orbit-capable hybrid propulsion system with a simplified and compact design, delivering versatile engines that can complete an array of objectives. The company's first full scale demonstrator called Terminator, is a 100kN-class engine (Φ1m x 6m) and serves as a stepping stone for the development of our orbital rocket engines. This work presents the global engine development and testing methodology adopted at HyPrSpace for guiding the Terminator engine sizing and subsequent engine developments.

The development of the Terminator engine was shaped by a process consisting of testing the assumptions and iterating on engine designs using a scaled down 1:20 twin called Joker 3. The delivery and testing of the engines were carried out according to these global steps: engine design, manufacturing of parts, reception and control, unit testing, assembly, instrumentation, and delivery to the test stand. Engine tests were conducted along two main axes. The first involved regular firings of the Joker 3 prototype. This enabled HyPrSpace's engineers to validate various solutions to be implemented on Terminator, regarding both the mechanical and electronic components developed in-house. The second axis involved the firing tests of Terminator, which served as validation for our hybrid propulsion technology and enabled a verification of our numerical modeling capabilities. The Joker 3 and Terminator engines have enabled key solutions to be tested and validated, such as thrust modulation capability and thrust vectoring control technology. The challenges encountered have produced valuable lessons for the development of the company's future engines.

Key words : Static-fire testing, mechanical development, hybrid rocket engine, orbital launcher