

SPACE PROPULSION SYMPOSIUM (C4)  
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PERFORMANCE ANALYSIS OF A HYBRID ROCKET FOR THE FIRST STAGE OF THE VEGA  
LAUNCHER

**Abstract**

The development of hybrid technology has led to the design of safe, efficient, economical and low cost engines. In this paper an analysis of a hybrid rocket performance for different propellant (HTPB and paraffine) and oxidizer (O<sub>2</sub>, H<sub>2</sub>O<sub>2</sub> and N<sub>2</sub>O) combinations has been done. Also the effect of different additives (Al, AlH<sub>3</sub>, Li, LIH) has been investigated. This analysis has shown competitive performance with respect to those of solid rockets. In particular, the comparison of the specific impulse between the P80 first stage of the VEGA launcher and a paraffine/aluminum hydride hybrid engine when combined with O<sub>2</sub>, H<sub>2</sub>O<sub>2</sub> and N<sub>2</sub>O showed an increase of respectively 19.2

The analysis was performed using the software Rocket Propulsion Analysis.

This work aims to confirm the feasibility of high-performance engines for small carriers suitable for launching nano-satellites or for the growing market of space tourism.