

SPACE PROPULSION SYMPOSIUM (C4)  
New Missions Enabled by New Propulsion Technology and Systems (6)

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5 KW HALL EFFECT THRUSTER(S) TO IMPROVE VEGA LAUNCHER CAPABILITIES

**Abstract**

To enhance the capabilities of small launchers, such as Vega, an upper stage propelled with one or more high power Hall Effect Thrusters has been identified as a winning solution. Among electric thrusters, Hall Effect thrusters (HET) are the best compromise between thrust provided and specific impulse. High power HETs have a very good efficiency, exceeding 55 percent, and their fairly high specific impulse brings important savings in terms of propellant mass for a given mission Delta-V. Besides their thrust is significantly higher with respect to the one obtainable with other electric devices (i.e. Gridded Ion Engines), allowing for faster orbit transfers and making HET especially suitable for orbit raising tasks. With a 5 kW HET, thrust levels up to 0.3 N are easily achievable; with a cluster of four thrusters, 1 N can be obtained. Specific impulse is close to two thousand seconds in the high-thrust mode (it can be raised up to 2500s at the expense of the total thrust provided). With such performance it is possible to lift a mid-size spacecraft from LEO to GEO in about three months and from LEO to MEO in less than two months, with consistent mass savings w.r.t. traditional chemical propulsion systems. Several mission profiles have been here analyzed, taking Vega as baseline launcher and showing the benefits of adopting electric propulsion to enhance its present capabilities. Different spacecraft configurations have been considered, with initial dry masses in the range 800-2000 kg (which are in line with Vega allowable payload). The thruster unit considered for this analysis is Alta's 5 kW HET, which is presently under development and whose performance are briefly described in the present work.