

Master's Thesis

Design and commissioning of a vacuum compatible thrust measurement unit for nanosatellite thrusters

Topic

Water electrolysis propulsion (WEP) systems produce gaseous propellants in-orbit by decomposing stored water into hydrogen and oxygen by using an electrolysis unit. This enables the usage of water as a safe and green propellant while delivering higher performance capabilities compared to current hydrazine-based propellants. Furthermore, the propellants produced can be processed in a multi-mode setup, potentially including chemical (combustion and cold gas) and electrical means of propulsion.

When applying this novel technology to nanosatellite standards such as CubeSats, the favourable thrust ranges lie around $\sim 1\text{N}$ for a hot gas thruster and as low as few mN for an attitude control system. Measuring the thrust of those components is crucial to obtaining reliable performance metrics. However, the measurement can be challenging to conduct with a high level of accuracy and precision. This is due to the integration and interplay with the feeding system and other perturbing factors.

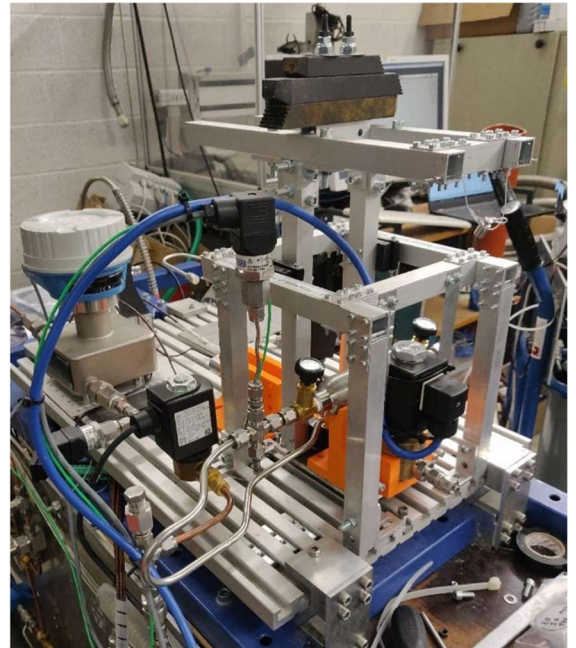


Figure 1 - Thrust measurement pendulum.

A thrust measurement unit is needed to conduct performance characterisations under vacuum conditions of WEP thrusters on EVE (WEP Test Bench), for two applications: a hot gas thruster and cold gas thrusters for an attitude control system. Within the scope of this work, such a measurement setup shall be designed, built and commissioned inside a vacuum chamber. Additionally, planned test campaigns shall be performed to obtain thrust measurement experimental data from the hot gas thruster and the cold gas.

Tasks

- Literature research on thrust measurement principles and concepts
- Design, construction and assembly of a test thrust measurement unit on EVE
- Commissioning in the context of a test campaign
- Analysis of the obtained experimental data
- Documentation and presentation of results

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