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MAGDRIVE: DEVELOPING NEXT GENERATION ELECTRIC PROPULSION FOR EVOLVING SPACE ENVIRONMENTS AND MARKETS

Abstract

The Magdrive thruster is a novel electric propulsion system designed for the next generation of spacecraft. This easy to integrate system offers increased lifespans and manoeuvrability for the rapidly changing space environment and market. In this paper, results of ground based tests will be shared, along with future development plans and route to market. Magdrive propulsion systems target the gap between high thrust chemical rockets and high specific impulse (Isp) electric thrusters for in-space propulsion. The technology offers variable Isp, and a significant improvement in thrust to weight ratio to other small electric propulsion technologies. The thruster is a novel variant of a pulsed plasma thruster, utilizing solid inert metal propellants – this makes the 'wet' system shelf-stable and easier to integrate, without needing launch-site fueling. An internal energy storage is charged up slowly (on the scale of minutes) and discharged rapidly (over several seconds), providing higher power for a rapid and versatile impulsive burn. This continually charges a high voltage pulsed power system, which discharges at up on ¡1ms timescales to deliver multi-kiloamp pulses at up to 1 kHz, vaporising small amounts of the metal propellant into plasma, which is then accelerated out of the thruster to impart momentum onto the spacecraft. The Magdrive thruster will enable spacecraft to operate in an increasingly crowded sky, by performing high-cadence avoidance manoeuvres and controlled deorbiting for disposal. This will play a key role in enabling the continued, sustainable use of space, particularly as spacecraft numbers skyrocket with mega-constellations. The unique characteristics of the thruster also facilitate new business models for active debris removal and in-orbit servicing and manufacturing. These activities are dependent on repeated interception and close proximity operations, which this new technology makes achievable with a single type of propulsion system. Magdrive are targeting a 1U, ¡1.5 kg dry mass for initial products, targeting an in orbit demonstration in 2025. Results of ground based test of the engineering model will be shared, along with future development plans and route to market. This CubeSat scale propulsion system is designed for spacecraft from 10 kg (e.g. 6 U) up to 200 kg (where arrays of thrusters are to be used). This paper will summarize progress to date, including our spaceflight test and plans for 2025, and provide some insight into the challenges of the technology and how our 'Sprint' development program is addressing technical risks.