SYMPOSIUM ON STEPPING STONES TO THE FUTURE: STRATEGIES, ARCHITECTURES, CONCEPTS AND TECHNOLOGIES (D3)
Novel Concepts and Technologies for the Exploration and Utilization of Space (2)

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MOA2 – AN R&D PARADIGM BUSTER ENABLING SPACE PROPULSION BY COMMERCIAL APPLICATIONS

Abstract

More than 60 years after the late Nobel laureate Hannes Alfvén had published a letter stating that oscillating magnetic fields can accelerate ionised matter via magneto-hydrodynamic interactions in a wave like fashion, the technical implementation of Alfvén waves for propulsive purposes has been proposed, patented and examined for the first time by a group of inventors.

Consequently improved since then, the name of the latest concept, relying on magneto-acoustic waves to accelerate electric conductive matter, is MOA2 – Magnetic field Oscillating Amplified Accelerator. Based on computer simulations, which were undertaken to get a first estimate on the performance of the system, MOA2 is a corrosion free and highly flexible propulsion system, whose performance parameters might easily be adapted in operation, by changing the mass flow and/or the power level. As such the system is capable to deliver a maximum specific impulse of 13116 s (12.87 mN) at a power level of 11.16 kW, using Xe as propellant, but can also be attuned to provide a thrust of 236.5 mN (2411 s) at 6.15 kW of power. First tests – that are further described in this paper – have been conducted successfully with a 400 W prototype system at an ambient pressure of 0.20 Pa, delivered 9.24 mN of thrust at 1472 s ISP, thereby underlining the feasibility of the concept.

Based on these results, space propulsion is expected to be a prime application for MOA2 – a claim that is supported by numerous applications such as Solar and/or Nuclear Electric Propulsion or even as an 'afterburner system' for Nuclear Thermal Propulsion. However, MOA2 has so far seen most of its RD impetus from terrestrial applications, like coating, semiconductor implantation and manufacturing as well as steel cutting. Based on this observation, MOA2 resembles an RD paradigm buster, as it is the first space propulsion system, whose RD is driven primarily by its terrestrial applications. Different terrestrial applications exist, but the most successful scenarios so far revolve around MOA2's unique features with respect to high throughput/low target temperature coatings on sensitive materials. In combination with its intrinsic high flexibility, MOA2 is highly suited for a common space-terrestrial application research and utilisation strategy.

This paper presents the recent developments of the MOA2 R&D activities at Q2, the company in Vienna, Austria, which has been set up to further develop and test the magneto-acoustic wave technology and its applications.