29th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Interactive Presentations - 29th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (IP)

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A THRUSTED SMALL SATELLITE USING HALL-EFFECT FOR SMART DEPLOYMENT OF CUBESAT CONSTELLATIONS

Abstract

A swift and complete deployment of a multi-orbit nano-satellites constellation can presently take months. This forced deferral in the implementation of the complete satellites' distribution can expose the overall mission, and companies behind it, to risks of profitability, since the nominal service cannot be activated, and part of the fleet will consume valuable life-time while not being fully exploited. GAUSS has a long-lasting tradition in the research, design, development and launch of Small Satellites, since early 2000. With more than ten satellites launched so far, ranging from 1U CubeSats to 35kg Micro-satellites, the Company has pioneered the idea of using small satellites for educational and industry purposes. In 2013 the Company developed and launched UNISAT-5, a micro-satellite whose main mission was the release in orbit of four CubeSats and four PocketQubes, using proprietary and third-party deployment technologies, as well as custom-made electronics. UNISAT-6 successfully repeated the mission less than one year later by releasing four additional CubeSats in space while imaging the event. On March 22nd, 2021, UNISAT-7 was launched, and it successfully released two CubeSats and three PocketQubes, using only GAUSS' deployment technology. It then started its secondary IOD mission, to test original and third-parties' space technologies, among which was a low-thrust engine, paired with a precise ADCS solution, to control the thrust vector. The demand for a precise orbit insertion of several CubeSats at once is significantly increasing, given the number of LEO constellations proposed for the next five years. GAUSS, based on the heritage gained by past missions and specifically with UNISAT-7, is designing a new micro-platform with a wet mass of about 50kg that will integrate a flight-proven, miniaturized Hall-effect propulsion system. This Hall-effect engine generates thrust by creating and accelerating ionized Xenon gas over magnetic and electrostatic fields. This thruster has already been independently commissioned in space, its maximum thrust is 5mN, about 10x the maximum thrust of the propulsion system utilized in UNISAT-7. The specific impulse is about 950s, almost double the Isp of the propulsion in UNISAT-7. The power requirement is about 100W, therefore the new platform will adopt deployable solar panels and a dedicated EPS subsystem with several Li-Ion battery packs in parallel, following the experience of UNISAT-7 in this regard, where the power requirement was 50W. The expected life-time of the thruster is 2500h that, combined with a duty cycle of about 30