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Title

MOTUS - motorized dispenser for the nanosatellite constellation deployment

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Abstract

In-space logistics and, by extension, in-orbit servicing markets have high long-term potential, with currently several segments identified that have different maturity levels in terms of customer and technology readiness, and these include: a) constellation deployment (mostly SSO and LEO), b) deployment of smallsats to uncommon orbits (e.g. MEO / GEO / LLO), and c) in-orbit servicing, refueling, life extension and active debris removal (mostly on GEO, but also other orbits). The constellation deployment segment is the most mature and presents a near-term opportunity with high revenue potential. Currently, it is also the highest volume in terms of customers or satellites to be launched. Last-mile logistics services using an orbital transfer vehicle are enabling technology for this segment by lowering prices, improving access to different orbital planes, and accelerating time to deploy constellation satellites on their proper slots.

This paper presents the design and analysis of the small orbital transfer vehicle called Motus, which is dedicated to the nanosatellites, particularly in the CubeSat and PocketQube form factors. Motus comprises a spacecraft bus, propulsion system, and modular deployers. It is launched in a rideshare or piggyback mission with customer satellites onboard, separates from the launcher, and performs consecutive maneuvers and satellite deployments. Thanks to its chemical propulsion system, it has significant delta-V available combined with high thrust. Motus can perform any combination of maneuvers required by customers, especially for constellation satellites, including phasing, LTAN, altitude, or inclination change. It can deploy multiple satellites in different orbital slots or provide large orbit changes for a single satellite.

Thanks to the focus on the single satellite segment, Motus is highly tailored, being the smallest OTV in the development (50 – 100 kg total mass). Compared to other solutions, it is designed to deploy small batches of CubeSats rather than take onboard multiple different-sized satellites with different needs. Additionally, it is equipped with green propulsion combining high thrust, system simplicity, low cost, and high volumetric efficiency. The paper summarizes the preliminary design and analysis for the nanosatellite deployment use case.

References