IAF ASTRODYNAMICS SYMPOSIUM (C1)
Mission Design, Operations & Optimization (1) (1)

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CONCEPTS AND APPLICATIONS OF AERODYNAMIC ATTITUDE AND ORBITAL CONTROL FOR SPACECRAFT IN VERY LOW EARTH ORBIT

Abstract

Spacecraft operations below 450km, namely Very Low Earth Orbit (VLEO), can offer significant advantages over traditional low Earth orbits, for example enhanced ground resolution for Earth observation, improved communications latency and link budget, or improved signal-to-noise ratio. Recently, these lower orbits have begun to be exploited as a result of technology development, particularly component miniaturisation and cost-reduction, and concerns over the increasing debris population in commercially exploited orbits. However, the high cost of orbital launch and challenges associated with atmospheric drag, causing orbital decay and eventually re-entry are still a key barrier to their wider use for large commercial and civil spacecraft. Efforts to address the impact of aerodynamic drag are being sought through the development of novel drag-compensation propulsion systems and identification of materials which can reduce aerodynamic drag by specularly reflecting the incident gas. However, the presence of aerodynamic forces can also be utilised to augment or improve spacecraft operations at these very low altitudes by providing the capability to perform coarse pointing control and trim, internal momentum management,

or secular control of inclination and RAAN for example. This paper presents concepts for the advantageous use of spacecraft aerodynamics developed as part of DISCOVERER, a Horizon 2020 funded project with the aim to revolutionise Earth observation satellite operations in VLEO. The combination of novel spacecraft geometries and use of aerodynamic control methods are explored, demonstrating the potential for a new generation of Earth observation satellites operating at lower altitudes.