IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Environmental Effects and Spacecraft Protection (6)

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DISCOVERER - DEVELOPING TECHNOLOGIES TO ENABLE COMMERCIAL SATELLITE OPERATIONS IN VERY LOW EARTH ORBITS

Abstract

The DISCOVERER project is developing technologies to enable the sustained-operation of satellites in very low Earth orbits (VLEO) for communications and remote sensing applications. Operating closer to the surface of the Earth significantly reduces latency for communications applications and improves link budgets, whilst remote sensing also benefits from improved link budgets, the ability to have higher resolution or smaller instruments, all of which provide cost benefits. In addition, all applications benefit from increased launch mass to lower altitudes, whilst end-of-life removal is ensured due to the increased atmospheric drag. However, this drag must also be minimised and compensated for.

DISCOVERER is developing several critical technologies to enable commercially viable operations in at these lower altitudes:

- materials that encourage specular reflections of the residual atmosphere in free molecular flows, which can be used in concert with the design of external satellite geometries to minimise drag, and generate lift for aerodynamic attitude and orbit control
- aerodynamic attitude and orbit control methods, which are essential at lower altitudes to complement traditional attitude control actuators.
- atmosphere breathing electric propulsion (ABEP), combining an optimised atmospheric intake with a inductive plasma thruster (IPT), to effectively remove the lifetime limits resulting from finite propellant for drag compensation.
- environment monitoring payloads with the potential to provide active feedback for aerodynamic attitude and orbit control.

2020 is an exciting year for DISCOVERER. Highlights include:

- the commissioning of our Rarefied Orbital Aerodynamics Research facility (ROAR) which can characterise the reemission characteristics of a beam of atomic oxygen (the predominant gas species in VLEO) at orbital velocities with material samples, and thereby determine their reflection properties.

- the first ignition of our ABEP prototype IPT and test of sub-scaled intakes in ROAR.
- the launch of our Satellite for Orbital Aerodynamics Research (SOAR) which will validate the aerodynamic performance of materials and demonstrate aerodynamic manoeuvres.
- the return of materials samples from the MISSE exposure facility on the International Space Station demonstrating the survivability of candidate novel materials.

This paper will provide highlights from the developments, and demonstrate the potential for a new class of aerodynamic commercial satellites operating at altitudes below the International Space Station.

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