

17th IAA SYMPOSIUM ON SPACE DEBRIS (A6)  
Post Mission Disposal and Space Debris Removal (2) (6)

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## IN-ORBIT PERFORMANCE OF DEORBITING SAILS

### Abstract

The Surrey Space Centre (SSC) has performed several TRL raising projects for maturing deorbiting technology. Since 2017, the SSC has launched four deorbit sail systems hosted on a range of platforms. The InflateSail CubeSat demonstrated deployment of a dragsail and a novel inflatable boom system to provide passive spacecraft stability. The debris removal demonstration payload deployed a 10m<sup>2</sup> transparent polymer drag sail, supported by four carbon fibre reinforced polymer (CFRP) booms. Launched on 23rd June 2017, the mission achieved rapid success through a successful deorbit from a 500km altitude orbit in only 72 days. InflateSail was the first successfully deployed Sail from a European spacecraft and the first successful use of inflatable structures on a CubeSat. The same sail deployment mechanism has been implemented on the 100kg class microsat for the RemoveDebris mission, which has successfully demonstrated Active Debris Removal with the sail deployment planned for March 2019 with re-entry expected by August 2019.

Building on the experience from these missions, the Surrey Space Centre is developing a range of large area deployable sails for application to a variety of mission profiles, platform masses and orbits in order to deorbit satellites quickly and thus reduce collision risks. The SSC has delivered two such systems, designed as a self-powered 16m<sup>2</sup> deorbiting sail installed on 250kg and 1,000kg class deployment structures. The sails were set deploy on 4th December 2018 with confirmation pending from optical observations.

This paper will report the flight performance for the four recently flown sails before addressing drivers for appropriate dragsail design and operations. The paper will present a comparative study of the flight

results of the sail systems utilising drag measurements, optical measurements and in-situ attitude measurements.