Thermo-Mechanical Impact of Thruster Plume Impingement on Space Debris

Company: Astroscale Ltd (https://astroscale.com/)

Project open to: 3rd/4th year undergraduate, Final year undergraduate, and Masters students

Application closing date: 30st September 2024

Expected duration of project: 5-8 months

Latest start date: End of October 2024

Application link:

Organisation description

Astroscale is the first private company with a vision to secure the safe and sustainable development of space for the benefit of future generations, and the only company dedicated to on-orbit servicing across all orbits.

Founded in 2013, Astroscale is developing innovative and scalable solutions across the spectrum of on-orbit servicing, including life extension, in situ space situational awareness, end of life, and active debris removal, to create sustainable space systems and mitigate the growing and hazardous buildup of debris in space. Astroscale is also defining business cases and working with government and commercial stakeholders to develop norms, regulations, and incentives for the responsible use of space.

Recently Astroscale has launched The End-of-Life Services (ELSA) program which is a spacecraft retrieval service for satellite operators. ELSA-d (demonstration) is the first mission to demonstrate the core technologies necessary for debris docking and removal which has already proven a success.

Project description

As part of its mission to ensure sustainable use of space, Astroscale is actively developing technologies to de-orbit defunct satellites and mitigate the growing problem of orbital debris. An important part of this active debris removal is the ability to de-tumble the client spacecraft to a sufficient level such that the servicing spacecraft can match the tumble rate and safely rendezvous. There are numerous strategies to achieve this, one of which is

thruster plume impingement. This strategy involves the deliberate interaction of the thruster plume from the servicing spacecraft's reaction control thrusters with the debris.

In order to improve mission safety, optimise debris removal strategies, and ensure compliance with international space sustainability regulations it is imperative to Astroscale that any actions taken by their spacecraft do not cause any further orbital debris to be generated. It is therefore desirable to understand potential consequences of plume impingement on debris.

The primary objective of this project is to assess the thermo-mechanical impacts of thruster plume impingement on typical low earth orbit space debris. This involves evaluating the heat transfer, mechanical forces, and potential erosion or damage to debris surfaces caused by the plume's interaction and will aid Astroscale in evaluating the risk and viability of this de-tumbling strategy.

The student will create a detailed report summarizing the findings, including computational models, and recommendations, as well as a potential presentation to Astroscale's technical team outlining key insights and proposed solutions. They will also make any supporting software or tools used in the simulation and analysis available to Astroscale.

Astroscale will provide technical specifications of the thrusters and information on target debris properties. The team will also guide students on modeling plume dynamics, support integration with mission requirements, and review project milestones to ensure alignment with Astroscale's goals.

Person specification

We are looking for students who are working towards an engineering degree with a background in aerospace and/or mechanical. Ideally the student would be looking at this opportunity for their final year project or post grad project and would have the knowledge to complete this to work to a high standard and set of requirements set by Astroscale.

We are looking for people who have a passion for space and wish to be involved in our companies' mission for pushing boundaries in the securing of a sustainable future.