» BIOINSPACED | Bioinspired Solutions for Space Debris Removal «

The problem of space debris

Space debris is already known as a significant problem which grows with the increasing use of space. Debris colliding with satellites poses a threat to the success of satellite missions.

Small debris (which can be the result of earlier collisions), have such high relative kinetic energies that a collision can even have explosive effects. The US Space Surveillance Network has tracked 16.000 unused objects weighing up to 6000 tonnes of active hardware. The total amount of material, which mainly consists of the remains of satellites and rockets, adds up to approximately 9000 tons, where almost 2900 tons is located in Low Earth Orbit. Because of the rising number of space debris on the one hand and space technology (e.g. Starlink) on the other hand there is an increasing risk of initiating an unstoppable cascading effect (Kessler syndrome). To avoid this, five to ten objects with high mass should be removed annually from LEO.

Space Debris Removal

The removal of these objects can be accomplished by Active Debris Removal (ADR) where the deorbiting of the risk object is actively accelerated. For that, a spacecraft, which is called “chaser”, is launched into an orbit where it performs a rendezvous manoeuvre with the desired space debris object which is called “target”. Although rendezvous missions can be considered as routine operations nowadays (e.g. ISS mission supply), rendezvous with space debris are highly complex since the target object is considered as non-cooperative (no docking mechanism, tumbling behaviour). Hence, such removal missions are very difficult to perform which makes them also cost-intensive. To this date, no ADR mission has been successfully accomplished and the need for novel efficient space debris technologies is large.

About BIOINSPACED

The BIOINSPACED projects intends to assess biomimetic solutions for space debris technologies. Fraunhofer CML will apply their expertise in conceptualising bio-inspired technologies to develop a catalogue of possible solution scenarios. This will be done by analysing existing biomimetic examples and screening nature’s idea pool to define new bio-inspired solution that fulfil the defined requirements. The most promising of the scenarios will be selected and a proof-of-concept breadboard will be developed in order to demonstrate the feasibility of the solution as a future space debris removal technology.