

Space Debris - How can laser technology contribute to a sustainable solution for the further exploitation of space as a resource?

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From more than 6,250 launches about 8,800 satellites remained in space today; out of which 6,500 are operational. These are accompanied by almost 2,500 spent orbital rocket-bodies and a large number of fragmentation debris and mission related objects. This large amount of space hardware has a total mass of more than 10,000 tonnes. More than 630 fragmentation events occurred meanwhile. All non-functional, human-made objects are considered space debris. Low Earth orbit (LEO) has become the most congested region in near-Earth space, containing approximately 75% of all known objects. At typical collision speeds of 10 km/s in LEO, impacts by debris larger than about 10 cm are assumed to cause catastrophic break-ups – the destruction of the spacecraft. Collisions with debris larger than 1 cm could disable an operational satellite or could cause the break-up of a satellite or rocket body. Impacts by millimetre-sized objects could cause local damage or disable a subsystem of an operating satellite. Today's evolution of the space debris environment raises concerns on the long-term sustainability, and is a safety issue for operational spacecraft and to persons and property on Earth in cases of uncontrolled re-entry events. Protecting our space-based infrastructure is at the focus of ESA's Space Safety Programme in recognising the safety aspects of missions and the importance of sustainable utilisation of space as an integral part of society and economic growth.

In the talk we will introduce ESA's Space Safety Programme, with focus on current technology needs to track and catalogue objects. We show how such data is used for modelling the environment and also in daily operations, i.e. to detect critical conjunction events, upcoming uncontrolled re-entry events or other major space events like break-ups. The rapid progress in developing satellite laser ranging to space debris brings many new opportunities and several challenges. We will present recent achievements and ESA's perspectives for further steps. A brief look at the internationally agreed efforts to mitigate space debris, and how ESA implements these, completes the presentation.