# Group 13 – Space Sweeper

*June 23, 2022*

With "*the continuous use of the orbital region up to 1,000 km altitude must be protected from the threat of space debris*" as our mission need statement, we aim to design a modular spacecraft that can be deployed within five days of any breakup event, and clean over 50% of the one-to-ten-centimeter space debris pieces generated by it, with an orbital altitude between 350 and 1000 km. This will be accomplished using the principle of ablative laser propulsion, where a laser pulse is used to burn off pieces of the debris objects, creating a plasma plume that acts as a thruster, decelerating the object enough to lower its perigee to 340 km, where the atmosphere is dense enough to deorbit the object within one year. For this goal, a completely novel, state-of-the-art payload was designed by the group, consisting of a LiDAR system with a range of 300 km to detect the debris pieces, and an Nd-YAG laser of around 20 kW to ablate them.

At this stage of the project, the team is well on track with the detailed design of all the subsystems involved in the design, whereas only the most important ones are discussed here. The GNC engineers have concluded that the spacecraft will enter an orbit that is coplanar to the one where the event has occurred, 30 km above it, moving in the same direction as the debris. The launcher selection concluded with ESA's new Ariane 6 emerging as the winner, a launch vehicle with unproven reliability as of now, but with the highest amount of flexibility in terms of orbit injection, and a market competitive launch cost. The high power usage of the payload subsystem leads to a criticality in the EPS subsystem, where a preliminary estimate of the solar array area of around 60 $m^2$.

During the last two weeks the team will create the CAD models of the system, and shift its focus to the more administrative tasks required by the project organisers. After the draft version of the Final Report is delivered, the team will create the presentations for both the Final Review and the Symposium, and thoroughly practice them, while waiting for the feedback from the Tutor and Coaches. This feedback will then be applied to deliver a well written, professional scientific report.

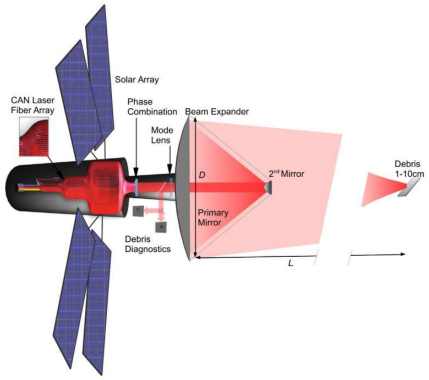


**Figure 1 – Example layout for the space-based laser[1] system.**

[1]Soulard, R., N.Quinn, M., Tajima, T. & Mourou, G. ICAN: A Novel Laser Architecture for Space Debris Removal. Acta Astronautica 105,
192–200 (2014)