

Studies on Space-Based Laser Targeting System for the Removal of Orbital Space Debris

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Abstract : Humans have been launching rockets since the beginning of the space age in the late 1950s. We have come a long way since then, and the success rate for the launch of rockets has increased considerably. With every successful launch, there is a large amount of junk or debris which is released into the upper layers of the atmosphere. Space debris has been a huge concern for a very long time now. This includes the rocket shells released from the launch and the parts of defunct satellites. Some of this junk will come to fall towards the Earth and burn in the atmosphere. But most of the junk goes into orbit around the Earth, and they remain in orbits for at least 100 years. This can cause a lot of problems to other functioning satellites and may affect the future manned missions to space. The main concern of the space-debris is the increase in space activities, which leads to risks of collisions if not taken care of soon. These collisions may result in what is known as Kessler Syndrome. This debris can be removed by a space-based laser targeting system. Hence, the matter is investigated and discussed. The first step in this involves launching a satellite with a high-power laser device into space, above the debris belt. Then the target material is ablated with a focussed laser beam. This step of the process is highly dependent on the attitude and orientation of the debris with respect to the Earth and the device. The laser beam will cause a jet of vapour and plasma to be expelled from the material. Hence, the force is applied in the opposite direction, and in accordance with Newton's third law of motion, this will cause the material to move towards the Earth and get pulled down due to gravity, where it will get disintegrated in the upper layers of the atmosphere. The larger pieces of the debris can be directed towards the oceans. This method of removal of the orbital debris will enable safer passage for future human-crewed missions into space.

Keywords : altitude, Kessler syndrome, laser ablation, Newton's third law of motion, satellites, Space debris

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