Engineers set their sights on asteroid deflection

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This is Dr. Massimiliano Vasile. Credit: Graeme Fleming@universityofstrathclyde

Pioneering engineers at the University of Strathclyde in Glasgow are developing an innovative technique based on lasers that could radically change asteroid deflection technology.

The research has unearthed the possibility of using a swarm of relatively small satellites flying in formation and cooperatively firing solar-powered lasers onto an asteroid – this would overcome the difficulties

associated with current methods that are focused on large unwieldy spacecraft.

Dr Massimiliano Vasile, of Strathclyde's Department of Mechanical and Aerospace Engineering, is leading the research. He said: "The approach we are developing would involve sending small satellites, capable of flying in formation with the asteroid and firing their lasers targeting the asteroid at close range.

"The use of high power lasers in space for civil and commercial applications is in its infancy and one of the main challenges is to have high power, high efficiency and high beam quality all at the same time.

"The additional problem with asteroid deflection is that when the laser begins to break down the surface of the object, the plume of gas and debris impinges the spacecraft and contaminates the laser. However, our laboratory tests have proven that the level of contamination is less than expected and the laser could continue to function for longer than anticipated."

Just over 100 years ago a 2000-kilometer area of vegetation was destroyed when an object believed to be 30-50 metres in diameter exploded in the skies above Tunguska, Siberia. While the likelihood of an immediate threat from a similar asteroid strike remains low, it is widely recognised that researching preventative measures is of significant importance.

Dr Vasile added: "The Tunguska class of events are expected to occur within a period of a few centuries. Smaller asteroids collide with Earth more frequently and generally burn in the atmosphere although some of them reach the ground or explode at low altitude potentially causing damage to buildings and people.

"We could reduce the threat posed by the potential collision with small to medium size objects using a flotilla of small agile spacecraft each equipped with a highly efficient laser which is much more feasible than a single large spacecraft carrying a multi mega watt. Our system is scalable, a larger asteroid would require adding one or more spacecraft to the flotilla, and intrinsically redundant - if one spacecraft fails the others can continue."

Dr. Vasile is now investigating the use of the same concept to remove space debris. The number of objects in orbit classified as debris is ever-increasing and with no widely accepted solution for their removal. Researchers at the University of Strathclyde believe the space-borne lasers could be used to lower the original orbit of the space debris and reduce the congestion.

Dr Vasile said: "The amount of debris in orbit is such that we might experience a so called Kessler syndrome – this is when the density becomes so high that collisions between objects could cause an exponentially increasing cascade of other collisions.

"While there is significant monitoring in place to keep track of these objects, there is no specific system in place to remove them and our research could be a possible solution.

"A major advantage of using our technique is that the laser does not have to be fired from the ground. Obviously there are severe restrictions with that process as it has to travel through the atmosphere, has a constrained range of action and can hit the debris only for short arcs."

Provided by University of Strathclyde