Researchers set to put brakes on space junk problem

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(Phys.org)—Scientists at the University of Glasgow have developed a practical solution to the increasing problem of space debris.

Millions of pieces of 'space junk' are orbiting the Earth as a side-effect of human exploration and exploitation of space. The pieces range from tiny fragments of bigger objects such as rocket boosters to full-sized pieces of now-defunct equipment. Working satellites and spacecraft can be damaged by collisions with debris, which can travel at velocities of several kilometres per second.

The problem is compounded by every collision which creates more debris in turn; in 2009, the collision of a non-operational Russian communications satellite and a working US satellite created more than 700 pieces of debris.

Dr Patrick Harkness of the University's School of Engineering has led the development of the Aerodynamic End Of Life Deorbit System, or AEOLDOS, to help ensure that objects sent into space in future can be removed from orbit at the end of their operational cycle.

AEOLDOS is lightweight, foldable 'aerobrake' which can be added to small satellites known as CubeSats before they are launched into low Earth orbit. Once the satellite has reached the end of its operational life the lightweight aerobrake, made from a thin membrane supported by tape measure-like struts, springs open to generate aerodynamic drag against the extremely thin upper atmosphere that still exists in near-Earth

space. As the satellite falls out of orbit the aerodynamic effects increase, causing the satellite to harmlessly burn up during its descent. This ensures that it does not become another piece of potentially harmful space debris.

Glasgow-based SME Clyde Space, which builds small and micro spacecraft systems, is working with Dr Harkness to apply AEOLDOS technology to the CubeSats it provides to customers all over the world. CubeSats are used for space-related research projects and generally sent into space as secondary payloads on larger launch vehicles.

Dr Harkness said: "It's only been 55 years since Sputnik, the first man-made satellite, was sent into orbit, but since then we've managed to make made quite a mess of the space around our planet. The rate at which we're putting objects into orbit is accelerating each year, which is why it's vital for us to take more control over how they can be removed from orbit once they have served their purpose.

"CubeSats are currently aimed at lower orbits than is necessarily desired to ensure they will re-enter the Earth's atmosphere within 25 years in order to meet official recommendations set by the United Nations Office for Outer Space Affairs. This can curtail the full scientific potential of CubeSats, but AEOLDOS gives users much more control over the end of their project's life and could enable missions to take place at much higher altitudes because they know we can always produce the drag they will need to dispose of the spacecraft in time."

The tape measure deployment system has been developed by Malcolm McRobb, also from the School of Engineering. Coiling the tapes stores energy within them, which can be released years later to deploy the membrane. He believes that AEOLDOS has applications beyond space debris control.

He explained: "The technology could be used to enable solar sailing missions, where spacecraft can manoeuvre using the pressure of sunlight. Or it could form the basis of deployable antennae, increasing the sensitivity of small, low-powered spacecraft.

"We expect that another year to 18 months of development will see the AEOLDOS system available for commercial use through our licensing agreement with Clyde Space. After we have demonstrated that the technology can work in space, we are looking forward to designing these new and exciting applications for the device."

Craig Clark of Clyde Space said: "Clyde Space is widely recognised for developing key technologies and products that enable more advanced CubeSat missions, and AEOLDOS is another key innovation that will enable more spacecraft missions in the future.

"The team at the University of Glasgow have been able to solve critical problems relating to the drag sail deployment with effective, innovative solutions and it has been a pleasure working with them."

The development of the AEOLDOS project is part of the University of Glasgow's Space Glasgow Research Cluster, which draws together researchers from across the College of Science and Engineering to work on pioneering space-related projects.

Provided by University of Glasgow