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Demonstration designs for the remediation of space debris from the International Space Station

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We present here designs for a staged implementation of an orbiting debris remediation system comprised of a super-wide field-of-view telescope (EUSO) and a novel high efficiency fibre-based laser system (CAN). Initial proof of concept stages will operate from the International Space Station (ISS) where the EUSO telescope has been designed for operation as a detector of ultra-high energy cosmic rays. Equipped with 2.5 m optics and a field of view of ±30 degrees, the EUSO telescope can also be utilized for the detection of high velocity fragmentation debris in orbit near the ISS. Further tracking, characterisation and remediation is to be performed by a CAN laser system operating in tandem with the EUSO telescope. For full scale versions of both instruments, the range of the detection/removal operation can be as large as 100 km. Utilising a step-by-step approach of increasing scale we present an analysis of implementation of:1) Proof of principle demonstration of the detection by a mini-EUSO and operation of 100-fibre CAN laser technology as an ISS based prototype, 2) Technical demonstrator of debris-removal that consists of the EUSO telescope for the detection and a 10000 fibre CAN laser for tracking and impulse delivery for debris re-entry, and 3) A free-flyer mission dedicated to debris remediation in a polar orbit with the altitude near 800 km. The integration of the two novel technologies aboard the ISS amounts to a novel approach as an immediate response to the serious space debris problem with the existing platform of ISS.

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