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Space Debris Detection, Tracking and Characterization - SST (1)

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A NEW GLOBAL LASER RANGING NETWORK FOR SATELLITE AND DEBRIS TRACKING

Abstract

Satellite laser ranging (SLR) provides the most accurate orbit determination information for Space Surveillance and Tracking (SST) of satellites and space debris. Currently, SLR is limited to geodetic and Global Navigation Satellite System (GNSS) satellites. Lumi Space is developing a network of SLR stations to provide SLR information for enhanced, efficient Space Traffic Management (STM) by tracking both satellites and debris.

With the proliferation of satellites in Low Earth Orbit (LEO), STM is becoming more difficult and risky. Conjunction warnings are routinely ignored, even though the number increases with the square of the number of satellites and debris in orbit. Collision avoidance manoeuvres are expensive; another disincentive to sustainable STM. A network of 12 globally distributed stations has the capability to improve STM for 10,000 satellites.

Furthermore, compared to current tracking methods (radar and optical sensors), the accuracy of SLR enables novel applications and an increase in the orbit-carrying capacity of each orbital regime. The increase offered by more accurate SST is explored, with an overview of novel technologies that are enabled including close-proximity operations, rendezvous and docking, which have implications for in-orbit servicing, manufacturing and debris removal.

This paper is broadly divided into two parts; the first explains in detail the benefits and opportunities afforded to the space industry by a global SLR network dedicated to satellite and debris tracking thus easing access to precision SST. The second, describes a proposed network and shows a range of network configurations to increase coverage with reference to technical and practical issues with regards to global station locations.