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STARC: TOWARDS A TRANSPORTABLE LASER RANGING STATION

Abstract

The increasing number of active satellites leads to an expected growth of the space debris population. Even today space debris is one of the major threats for active satellites and manned space missions. Therefore the low Earth orbit (LEO) population has to be monitored closely in order to avoid collisions. Precise measurements of the slant range, which can improve the orbit determination, can be performed by satellite- and space debris laser ranging.

At the Institute of Technical Physics at the German Aerospace Center new technologies are developed and investigated for the detection, determination and ranging of space debris based on optical systems. At our fiber based laser ranging station Uhlandshöhe-Forschungsobservatorium (UFO) we successfully demonstrated time of flight measurements to cooperative objects in LEO with low pulse energies but high repetition rates. Based on these experiences we are setting up a transportable laser ranging station STARC (Surveillance, Tracking And Ranging Container) for laser ranging of space debris in LEO. A standard 20ft ISO container, which can be operated autonomously with a 14kVA generator, contains all the scientific equipment and work places. The implemented laser ranging system raises above the roof of the container within less than 1min by a lifting platform. A transmitter- and a 17" receiver telescope are mounted on an agile alt-azimuth mount with an encoder resolution of 26-bit which gives an angular resolution of 1/50arcsec. In order to use the needed higher pulse energies for a ranging to space debris the D-STAR system guides laser pulses through a Coudé train from the space debris laser to the transmitter telescope. A Nd:YAG system at a wavelength of 1064nm will be used as a laser pulse source. At repetition rates of few 100Hz the pulse energy shall be higher than 100mJ for pulse durations (FWHM) smaller than 10ns.

This work reports on the progress of the transportable laser ranging station D-ConSTAR. In addition to the first passive optical tracking of an orbiting object in LEO, a comprehensive pointing model that compensates the deterministic tilt of the platform as well as the deployment at arbitrary sites will be discussed in this work.