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DEMONSTRATION OF SPACE DEBRIS OBSERVATION CAPABILITIES OF THE ESA IZN-1  
ROBOTIC OPTICAL GROUND STATION

**Abstract**

To successfully deal with space debris objects, being now to avoid collisions or in the near future to remove them, it is fundamental to accurately know their state in terms of trajectory and attitude.

The accurate knowledge of the objects position and trajectory is fundamental in the space traffic management as discriminator in the manoeuvre decision making process which becomes even more important with the increasing number of objects in space.

In addition to this aspect, for future debris removal missions, it is fundamental to accurately know the attitude of the target object. In particular, the a priori attitude state might be used both in the satellite design phase, and in defining the optimal capturing strategy. The accuracy of an orbit or an attitude determination process is strictly dependent on the accuracy of the measurements used within these processes.

The laser ranging technique is a well-established technology constituting a highly accurate alternative to radars tracking measurements which has been successfully applied both for orbit and attitude determination purposes.

ESA is actively contributing to the collection of high accurate measurements with the recent deployment, of ESA's IZN-1 (speak: Izaña One) optical ground station in the Teide Observatory. The station has been designed as a multipurpose test-bed for satellite laser ranging (SLR), on-demand support for ESA missions, optical communications and SST, in fact it has been also integrated with the ESA Expert Centre.

In this paper, we will describe the capabilities of the IZN-1 station in the field of tracking space debris. The IZN-1 station is equipped with a 400 Hz satellite laser ranging system, which is operating both at 532 and 1064 nm, allowing ranging to cooperative space debris. Additionally, the IZN-1 station is also equipped with a space debris camera system allowing not only classical astrometric observations but also the collection of measurements for the characterization of space debris. We will also introduce how the measurements gathered through the IZN-1 station can be used for space debris orbit and attitude determination and in contingency support.