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INVITED TALK: Current Trends and Challenges in Satellite Laser Ranging

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Satellite Laser Ranging (SLR) is used to measure accurately the distance from ground stations to retro-reflectors on satellites and on the Moon. SLR is one of the fundamental space geodetic techniques that define the International Terrestrial Reference Frame (ITRF), which is the basis upon which many aspects of global change over space, time, and evolving technology are measured; with VLBI the two techniques define the scale of the ITRF; alone the SLR technique defines its origin (geocentre). The importance of the reference frame has recently been recognized at inter-governmental level through the United Nations, which adopted in February 2015 the Resolution 'Global Geodetic Reference Frame for Sustainable Development.'

Laser Ranging provides precision orbit determination and instrument calibration/validation for satellite-borne altimeters for the better understanding of sea level change, ocean dynamics, ice mass-balance, and terrestrial topography. It is also a tool to study the dynamics of the Moon and fundamental constants and theories. With the exception of the currently in-orbit GPS constellation, all GNSS satellites now carry retro-reflectors for improved orbit determination, harmonization of reference frames, and in-orbit co-location and system performance validation; the next generation of GPS satellites due for launch from 2019 onwards will also carry retro-reflectors. The ILRS delivers weekly realizations that are accumulated sequentially to extend the ITRF and the Earth Orientation Parameter series with a daily resolution. SLR technology continues to evolve toward the next generation laser ranging systems and it is expected to successfully meet the challenges of the GGOS2020 program for a future Global Space Geodetic Network. Ranging precision is improving as higher repetition rate, narrower pulse lasers and faster detectors are implemented within the network. Automation and pass interleaving at some stations is expanding temporal coverage and greatly enhancing efficiency. Discussions are ongoing with some missions that will allow the SLR network stations to provide crucial, but energy-safe, range measurements to optically vulnerable satellites. New retroreflector designs are improving the signal link and enable daylight ranging that is now the norm for many stations. We will discuss many of these laser ranging activities and some of the tough challenges that the SLR network currently faces.

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