

50th Anniversary Celebrations of the First SLR Measurement

31 October 2014 marked the 50th anniversary of the first successful satellite laser ranging (SLR) measurement, and that was celebrated at the 19th International Workshop on Laser Ranging from 27-31 October in Annapolis, USA. The workshop, which was hosted by NASA Goddard Space Flight Center, attracted over 180 people from 23 countries.

The first session included a brief history of SLR through talks by six pioneers. Henry Plotkin, head of the GSFC 1964 SLR team, recalled the events that led to the first successful laser ranging measurement in 1964. Chuck Lundquist presented the early SAO programme that established the international network of Baker-Nunn cameras and laser ranging systems. George Veis discussed the early recognition of the need for an international reference frame and the improved accuracy that SLR could provide. Francois Barlier reviewed the history of the CNES laser ranging programme and its cooperation with SAO. John Bosworth reported on the contributions of the NASA Crustal Dynamics Project. The session concluded with a presentation on the early lunar laser ranging activities by Jim Faller.

Some further highlights of the meeting were:

- Successful two-way optical links to the Mercury Laser Altimeter and optical/radio two-way links that show the promise of interplanetary optical transponders.
- Time transfer by laser link to Jason-2 has demonstrated the way to synchronise laser-ranging observatories to the nanosecond level.
- The ILRS Analysis Centres have submitted their contributions for the ITRF2014 development.
- SLR remains a key contributor to precise orbit determination and validation of ocean-altimeter missions including ERS-2, GFO, Jason-1 and -2 and Envisat, the newer missions CryoSat-2, SARAL and HY-2a, and the upcoming Jason-3.
- SLR has played an important role in the validation of the GPS-derived orbits for ICESat-1 and would play such a role in future ice-altimeter missions.
- Lunar laser ranging currently provides many of the best tests of gravity that are available.
- A number of initiatives underway will address some of the large geographic gaps and technology voids in the ILRS network. The NASA Space Geodesy Program is planning up to ten CORE sites.
- Many groups are implementing the new-technology SLR hardware and software, enabling them to enhance data acquisition, pass interleaving, single photon operation and different levels of automation.
- While GRACE is providing an unprecedented insight into the time variations in the Earth's gravity field, the longest wavelength gravity field components and their time variations are provided by SLR.
- New-generation SLR system designs in both Russia and China offer promise of improved signal-to-noise performance and less susceptibility to range biases.
- Several stations have begun to include space debris tracking in their activities.
- A recent SLR tracking campaign demonstrated that some stations were able to track more than 30 GNSS satellites over the course of a week without significantly decreasing coverage of other satellites.
- Many new and creative ideas on satellite retroreflector array development are being explored.

At the Thursday evening banquet, Dr Piers Sellers, GSFC deputy director of the Sciences and Exploration Directorate and a NASA astronaut, related some of his humorous experiences from his three Shuttle journeys and six space walks. Furthermore, Pippo Bianco, chair of the ILRS Governing Board, presented the ILRS Pioneer Award to John Degnan and Michael Pearlman, citing their leadership and contributions to the field of SLR.