



## The International Laser Ranging Service (ILRS)

web: [ilrs.gsfc.nasa.gov](http://ilrs.gsfc.nasa.gov)

Chairman of the Governing Board: **Werner Gurtner** (Switzerland)

Director of the Central Bureau: **Michael Pearlman** (USA)

Secretary: **Carey Noll** (USA)

### Development

For many years, international SLR activities had been organized under the Satellite and Lunar Laser Ranging (SLR/LLR) Subcommittee of the CSTG. The Subcommittee provided a venue for organizing tracking campaigns, adopting data formats, reporting on network status, and sharing technology. However, membership and commitment to the Subcommittee were informal, and the main focus was on systems and data acquisition rather than on the production of the most meaningful data products for end users. With strong encouragement from the President of the CSTG, the CSTG SLR/LLR Subcommittee Steering Committee undertook the formation of the ILRS. A draft Terms of Reference, detailing the mission and the organization of the new service was written and accepted by the CSTG Executive Board in May 1997. A joint CSTG/IERS Call for Participation in the new ILRS was issued on 24 January 1998. Institution proposals in response to the Call were evaluated at a special meeting of the CSTG SLR/LLR Subcommittee Steering Committee and subsequently approved by both the CSTG Executive Board and the IERS Directing Board on 18 April 1998. ILRS approval was granted to 46 tracking stations, 4 Operations Centers, 3 Analysis Centers, 4 Lunar Analysis Centers, 18 Associate Analysis Centers, 2 Global Data Centers and 1 Regional Data Center. The Central Bureau was established at the NASA Goddard Space Flight Center. Appointments and elections of Governing Board members were carried out during the summer of 1998. On 22 September 1998, the CSTG SLR/LLR Subcommittee was officially disbanded, and replaced by the First ILRS General Assembly, held in conjunction with the 11th International Workshop on Laser Ranging in Deggendorf, Germany. The first ILRS Governing Board meeting was held on 25 September 1998.

### Mission

The ILRS collects, merges, analyzes, archives and distributes Satellite Laser Ranging (SLR) and Lunar Laser Ranging (LLR) observation data sets of sufficient accuracy

to satisfy the objectives of a wide range of scientific, engineering, and operational applications and experimentation. The basic observable is the precise time-of-flight of an ultrashort laser pulse to and from a retroreflector-equipped satellite, corrected for atmospheric delays and satellite center of mass. These data sets are used by the ILRS to generate a number of fundamental data products, including but not limited to:

- Centimeter accuracy satellite ephemerides
- Earth orientation parameters (polar motion and length of day)
- Three-dimensional coordinates and velocities of the ILRS tracking stations
- Time-varying geocenter coordinates
- Static and time-varying coefficients of the Earth's gravity field
- Fundamental physical constants
- Lunar ephemerides and librations
- Lunar orientation parameters

### Structure

The ILRS accomplishes its mission through the following permanent components:

- Tracking Stations and Subnetworks
- Operations Centers
- Global and Regional Data Centers
- Analysis, Lunar Analysis, and Associate Analysis Centers
- Central Bureau
- Governing Board and Working Groups

Information on these permanent components can be found in the ILRS website.

### ILRS Governing Board 2002

Michael Pearlman, Ex-Officio, Director, Central Bureau

Carey Noll, Ex-Officio, Secretary, Central Bureau

Hermann Drewes, Ex-Officio, CSTG President

Bob Schutz, Appointed, IERS representative to ILRS

Werner Gurtner, Appointed, Eurolas Network Representative  
 Pippo Bianco, Appointed, Eurolas Network Representative  
 Hiroo Kunimori, Appointed, WPLTN Network Representative  
 Ben Greene, Appointed, WPLTN Network Representative  
 David Carter, Appointed, NASA Network Representative  
 Jan McGarry, Appointed, NASA Network Representative  
 Ron Noomen, Elected, Analysis Center Representative  
 Graham Appleby, Elected, Analysis Center Representative  
 Wolfgang Seemueller, Elected, Data Center Representative  
 Peter Shelus, Elected, LLR Representative  
 Ulrich Schreiber, Elected, at Large Representative  
 Georg Kirchner, Elected, at Large Representative

## Products

The products of the Analysis, Lunar Analysis, and Associate Analysis Centers are made available to the scientific community through the two Global Data Centers:

- Crustal Dynamics Data Information System (CDDIS) at the NASA Goddard Space Flight Center, Greenbelt, MD, USA,
- European Data Center (EDC), Munich, Germany, and one Regional Data Center
- Shanghai Observatory, Shanghai, PRC.

The accuracy of SLR/LLR data products is sufficient to support a variety of scientific, engineering, and operational applications including:

- Realization of global accessibility to and the improvement of the International Terrestrial Reference Frame (ITRF)
- Determining the precise location of the geocenter relative to the global network and its time variations
- Monitoring three-dimensional deformations of the solid Earth
- Monitoring Earth rotation and polar motion
- Monitoring the static and dynamic components of the Earth's gravity field and geoid.
- Supporting, via precise ranging to altimetric satellites, the monitoring of variations in the topography of the liquid and solid Earth (ocean circulation, mean sea level, ice sheet thickness, wave heights, vegetation canopies, etc.)
- Tidally generated variations in atmospheric mass distribution
- Calibration and validation of microwave tracking techniques (e.g., GPS, GLONASS, DORIS, and PRARE)
- Picosecond global time transfer experiments
- Determination of non-conservative forces acting on the satellite

- Astrometric observations including determination of the dynamic equinox, obliquity of the ecliptic, and the precession constant
- Gravitational and general relativistic studies including Einstein's Equivalence Principle, the Robertson-Walker  $b$  parameter, and time rate of change of the gravitational constant,  $G$
- Lunar physics including the dissipation of rotational energy, shape of the core-mantle boundary (Love Number  $k_2$ ), and free librations and stimulating mechanisms
- Solar System ties to the International Celestial Reference Frame (ICRF)

## Publications

The ILRS Central Bureau maintains a comprehensive website as the primary vehicle for the distribution of information within the ILRS community. This site can be accessed at <http://ilrs.gsfc.nasa.gov>. Many ILRS and related publications and reports can now be accessed online through the ILRS website including:

- ILRS Terms of Reference and Working Group Charters
- ILRS Annual Reports (first volume published covers year 1999)
- ILRS General Assembly Minutes and Reports
- ILRS Governing Board Minutes
- ILRS Working Group Minutes and Reports
- ILRS Associates Telephone and Email Directory
- ILRS Organizations and Technical Contacts
- Science and Engineering References and Reports