**Supported by: Laser Ranging Facility**, **White Sands MDL**, **USGS**

**Background**

- The International Laser Ranging Service (ILRS) provides global satellite and laser ranging (SLR and LLR) data and their related products to support geodetic and geophysical research and other applications.
- SLR data fundamentally contribute to the realization of the International Terrestrial Reference Frame (ITRF), uniquely defining its origin-geocenter, and, in combination with VLBI, its scale.
- An accurate ITRF provides essential underpinning for robust determination of sea level rise, post-glacial rebound, loading response to ice sheet melt, mountain uplift, etc.
- The ILRS is one of the space geodetic services of the International Association of Geodesy (IAG). The ILRS is a cooperative federation supported by global institutions providing their own funding for their respective activities.
- The ILRS became a network member of the WDS in early 2013.
- All data and derived products are freely available to a global research community within hours through ILRS data centers:
  - Crustal Dynamics Data Information System (CDDIS), NASA GSFC (USA)
  - EuroLas Data Center (EDC), Deutsches Geodätsches Forschungsinstitut, Technische Universität München (Germany)
- Data: SLR data consist of a distance or range (measured as round-trip laser time of flight, station to satellite and back) and, time, together with data correction information such as atmospheric effects, which are to be applied to the data.
- Products: SLR and LLR data sets used by ILRS to generate a number of scientific and operational data products including:
  - Earth orientation parameters (polar motion and length of day)
  - Station coordinates and velocities of the ILRS tracking stations for the ITRF
  - Time-varying geocenter coordinates
  - Static and time-varying coefficients of the Earth’s gravity field
  - Centimeter accuracy satellite ephemerides
  - Fundamental physical constants
  - Lunar ephemerides and librations and orientation parameters
- **Applications:** Accuracy of SLR/LLR data products is sufficient to support a variety of scientific and operational applications:
  - Realization of global accessibility to and improvement of the ITRF and monitoring three-dimensional deformations of the solid Earth
  - Monitoring Earth rotation and polar motion
  - Support the monitoring of variations in the topography and volume of the liquid Earth
  - Tidally generated variations in atmospheric mass distribution
  - Calibration of microwave tracking techniques
  - Picosatcom global time transfer experiments
  - Astrometric observations including determination of dynamic equinox, obliquity of the ecliptic, and precession constant
  - General relativistic, gravitational, and lunar physics studies
  - Solar System tie to the International Celestial Reference Frame (ICRF)

**Successes**

- ILRS develops the necessary global standards/specifications and encourages international adherence to its conventions
- Update of ITRS Terms of Reference now underway
- Network of tracking stations expanding and upgrading
- NASA’s Space Geodesy Project upgrading current stations and adding new stations to enhance global network
- New Russian overseas stations enhancing spatial and temporal coverage
- List of target satellites continues to expand as new missions utilize SLR for orbit determination and other applications; recent growth of GNSS tracking
- Official orbital data product on LAGEOS and Etonal satellites now operational
- New Data Quality Control Board established to address laser ranging data quality issues
- Early use of optical receivers in space as a step toward optical transponders for extended range

**Challenges**

- Increasing global coverage of laser ranging stations; many geographic gaps still exist
- Implementing new systems and upgrades to overcome the present anachronistic mix of new and old technologies
- Improving data quality as the ILRS strives for mm accuracy
- Supporting an ever increasing list of targets, many now at GNSS and synchronous altitudes
- Supporting new missions in order to contribute to a broader range of scientific and operational applications
- Developing new retroreflector designs to increase range accuracy and signal link

**Best Practices**

- ILRS develops the necessary global standards/specifications and encourages international adherence to its conventions
- Multiple Data Centers for reliability and redundancy
- Metadata made available by Data Centers for SLR data and products to enable data discovery
- Website provides information for all components, users, and server operators
- Links are provided to extensive information on the ILRS network including performance assessments and data quality evaluations
- Descriptions of supported satellite missions (current, future, and past) are provided to aid in station acquisition and data analysis
- Central Bureau coordinates activities within the service
- Frequent workshops held to exchange information on science, technology, operations, and upcoming activities
- Standing Committees and Study Groups to focus on specific technical and operational areas

**More Information/Feedback**

- The ILRS welcomes feedback on the service and the material presented in this poster. For more information about the ILRS, contact the ILRS Central Bureau at: ilrs-cb@lists.nasa.gov
- More information about the ILRS is available from the ILRS website at: http://ilrs.gsfc.nasa.gov