The NASA Satellite Laser Ranging Network: Current Status and Future Plans

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Abstract

Over the past few years, the NASA Satellite Laser Ranging (SLR) Program has experience a resurgence of energy. In preparation for the completion and deployment of the SLR 2000 Replacement Systems, the NASA heritage SLR network continues to provide quality SLR data products to the International Laser Ranging Service (ILRS). Recently, NASA made the decision to return two critical stations in Maui, Hawaii and Arequipa, Peru back to operational status. NASA has been working hard to bring these two stations back on-line with the replacement of the HOLLAS station with the TLRS-4 system and the re-start of the TLRS-3 system. Other highlights have occurred throughout the NASA SLR network. The current status and the future plans of the NASA SLR Network will be discussed in this paper.

Background

The NASA SLR network consists of eight stations. NASA built five trailer-based Mobile Laser Ranging Stations (MOBLAS) and two highly compact Transportable Laser Ranging Systems (TLRS). The University of Hawaii and the University of Texas have operated two high performing Observatory SLR systems at their respective Universities. The University of Texas system has Lunar Laser Ranging (LLR) capability. NASA also has partnerships with foreign Government agencies and Universities for the operations and maintenance of MOBLAS systems. Under these partnerships, NASA continues to provide the SLR system, training, engineering support, and spare parts to maintain operations. The host country provides the site, local infrastructure, and the operating crew.

In February 2004, a forty percent decrease in the NASA SLR budget caused major reductions to the NASA SLR Network. The reductions included reduced network infrastructure, operational coverage at the stations, sustaining engineering staff, and data operational support. The MOBLAS-7 (Greenbelt, Maryland), McDonald Laser Ranging System (MLRS) (Fort Davis, Texas), and HOLLAS (Maui, Hawaii) stations were reduced to one shift operations. The NASA operator was removed from MOBLAS-8 site in Tahiti. In addition, the TLRS-3 site in Arequipa, Peru closed in February 2004, and the HOLLAS site in Maui, Hawaii closed in June 2004.

Resurgence of NASA SLR Network

In October 2004, the NASA SLR program experienced a resurgence of energy. Additional funding was provided by NASA Headquarters to re-open the TLRS-3 system in Arequipa, Peru. The TLRS-4 system, which was in caretaker status at Goddard Space Flight Center, was returned to operational status and shipped to Maui to replace the HOLLAS station. Another operational shift was added to the MLRS in Fort Davis, Texas. Additional highlights occurred throughout the NASA SLR network which are listed below.

MOBLAS-4 (Monument Peak, California):

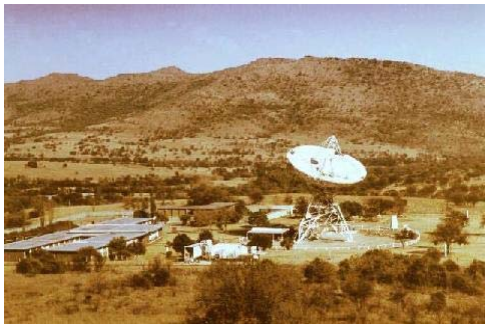
NASA continued its collaboration with HTSI for the operations and maintenance of the MOBLAS-4 system. The site installed new Geoscience equipment. A Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS) instrument and a seismic instrument were installed at the SLR site. The DORIS instrument is from the Institut Geographique National (IGN) in France and the seismic instrument is from SCRIPPS Institution of Oceanography in San Diego, California. The site also installed a newly High Performance forWireless Research and Education Network (HPWREN) high speed internet access. The station is continuing three shift operations, five days per week, twenty-four hours per day.

MOBLAS-5 (Yarragadee, Australia):

NASA continued its collaboration with Geoscience Australia (GA) for operations and maintenance of the MOBLAS-5 system. The MOBLAS-5 crew continues to be one of the top data producing station in the ILRS. The station is continuing three shift operations, seven days per week, twenty-four hours per day.

MOBLAS-6 (Hartebeesthoek, South Africa)

NASA continued its collaboration with the South African National Research Foundation and the Hartebeesthoek Radio Astronomical Observatory (HRAO) for operations and maintenance of the MOBLAS-6 system. The system was originally installed in HRAO in June 2000. The MOBLAS-6 operations began in August 2000. The site dedication ceremony occurred in November 2000. The HRAO site is collocated with Very Long Baseline Interferometry (VLBI), Global Positioning System (GPS), and DORIS. The station is continuing three shift operations, five days per week, twenty-four hours per day.



MOBLAS-7 (Greenbelt, Maryland)

NASA continued its collaboration with HTSI for the operations and maintenance of the MOBLAS-7 system. MOBLAS-7 continues to perform outstandingly despite the reduction in operational shifts. The system is used by NASA to test all upgrades and modifications to the NASA network prior to being installed in the field sites. The station is continuing one shift operations, five days per week.

MOBLAS-8 (Tahiti, French Polynesia)

NASA continued its collaboration with Centre National d'Etudes Spatiales (CNES) and the University of French Polynesia (UFP) for the operations and maintenance of the MOBLAS-8 system in Tahiti, French Polynesia. The Tahiti Geodetic Observatory recently named Dr. Jean Pierre Barriot as its new Director. The station was affected by the removal of a NASA operator and trainer due to budget reduction in 2004. The staff has done an excellent job operating and maintaining the station despite poor weather conditions at times. The MOBLAS-8 system was originally shipped to Tahiti in August 1997. The site dedication ceremony occurred in May 1998. The system is collocated with a GPS and DORIS system. The station will be providing two shift operations, five days per week.

TLRS-3 (Arequipa, Peru)

NASA re-newed its collaboration with the Universidad Nacional de San Agustin (UNSA) for the operations and maintenance of the TLRS-3 system in October 2005. The TLRS-3 crew working with Honeywell Technical Solutions Incorporated (HTSI) engineers began restoring the site to full operations. The restoration of the site included repairs to the laser, controller computer, HP5370, gimbal, dome controller, and telescope. The system's first light was September 23, 2006. As of the October 16, 2006, 90 pass segments had been acquired with a data quality of < 10 mm RMS on Lageos. The average ground calibration was at the 5.4 mm level. The station is providing two shift operations, day and night, five days per week.

TLRS-4 (Maui, Hawaii)

NASA renewed its collaboration with the University of Hawaii, Institute for Astronomy (IfA). After the HOLLAS system was decommissioned in June 2004, the site was converted to the new PanStarrs Observatory. NASA decided to bring the TLRS-4 system to operational status and ship it to the Haleakala Observatory in Maui, Hawaii. The TLRS-4 system had a highly successful inter-comparison test with MOBLAS-7. The system passed an Operational Readiness Review in September 2005. After 10 years on non-operations, TLRS-4 was shipped to Maui in April 2006. HTSI working with the University of Hawaii IfA personnel, prepared the site and installed the system on new pad on top of Mount Haleakala. The system's first light was in October 2006. The station will be providing two shift operations, day and night, seven days per week.

MLRS (Fort Davis, Texas)

NASA continued its collaboration with the University of Texas and the Center for Space Research (CSR) for operations and maintenance of the MLRS system in Fort Davis, Texas. MLRS provided SLR and LLR tracking data. CSR continued its data analysis support for the ILRS network. The station will be providing operations seven days per week, twelve hours per day.

Conclusion

The future of the NASA SLR Program is exciting. The resurgence of energy can be seen by the recent accomplishments of the various stations. NASA is increasing its infrastructure as well as plans are in place to increase stations operational shifts. The TLRS-3 system in Arequipa and the TLRS-4 system in Maui will be fully operational in December 2006. Dedication ceremonies for re-opening both sites are being organized for January/February 2007 timeframe. In addition, significant progress continues on the SLR2000 prototype development. We would like acknowledge the extraordinary efforts and dedication of the team supporting the NASA SLR network which includes NASA personnel, contractors, universities, and our foreign partners.