
Korean Plan for SLR System Development

Hyung-Chul Lim^{1,2}, Jong-Uk Park¹, Sang-Ki Jeong², Byung-Su Kim²

1. Korea Astronomy and Space Science Institute, Daejeon, Korea
2. Korea Institute of Science and Technology Evaluation and Planning, Seoul, Korea

Contact: hclim@kasi.re.kr

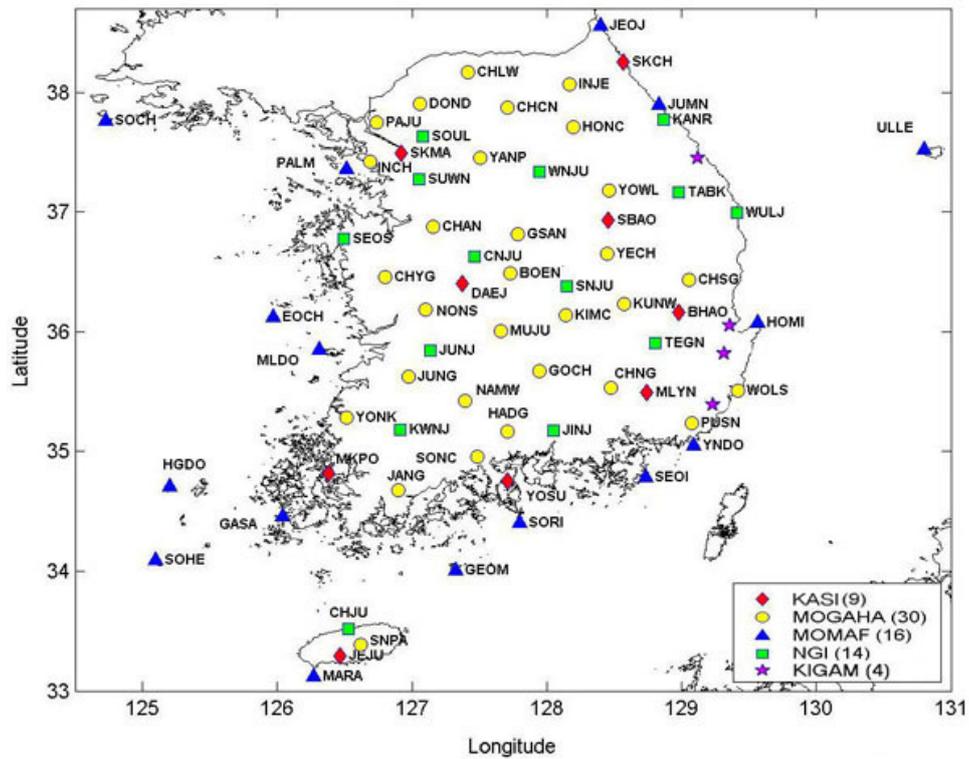
Abstract

There are about 70 GNSS stations in Korea for GNSS applications including space geodesy, and 3 VLBI stations will be constructed by 2007 for astronomical and geodetic research. In addition, two Korean satellites with a laser retro-reflector array, STSAT-2 and KOMPSAT-5, will be launched in 2008 and 2010, respectively. Thus, SLR system is considered to be necessary in Korea for constructed for satellite laser tracking and space geodesy research. KASI has a plan to develop a fixed SLR station and a mobile SLR station in the near future. In this study, future Korean plans of SLR system development will be presented.

Introduction

More than 70 GNSS (Global Navigation Satellite System) stations have been operated by several institutes, including KASI (Korea Astronomy and Space Science Institute), for accomplishing missions of navigation, space geodesy, and so on. From 1995, KASI has been playing an important role in IGS (International GNSS Service) and IERS (International Earth Rotation and Reference Systems Service) as global GNSS station, and operating an IGS global data center from 1996. Except GPS applications, KASI has a wide variety of research areas like optical, radio, theoretical and observational astronomy research, and is expanding its area through astronomical research in space. So, KASI has been constructing 3 VLBI (Very Long Baseline Interferometry) stations with receivers working in the frequencies 2/8, 22 and 43GHz bands which will be completed by 2007 for radio astronomy research including space geodesy. Fundamental stations for geodesy operate three geodetic space techniques at one location: VLBI, GNSS and SLR (Satellite Laser Ranging), which can give a powerful tool for space geodesy such as global reference frame. KASI has a plan of operating a fundamental station in Jeju island in which a GNSS station is already operated and a VLBI station will be completed in 2007. So, KASI wants to develop a SLR system for constructing a fundamental station, and it has tried to raise funds for SLR system development from Korean government.

After KITSAT-1 was launched in 1992, which was the first Korean satellite, Korea launched 6 LEO (Low Earth Orbit) satellites made by Korean technology. They are not all equipped with LRA (Laser Retro-reflector Array) because precise orbit determination is not required in their missions. However, two Korean satellites with LRA will be launched in 2008 and 2010, respectively: Science Technology SATellite-2 (STSAT-2) with a Lyman-alpha imaging solar telescope and Korea Multi-Purpose SATellite-5 (KOMPSAT-5) with a Synthetic Aperture Radar (SAR). STSAT-2 LRA was developed through international collaboration between SaTReC (Satellite Technology Research Center), Korea and Shanghai Astronomical Observatory, China. But KOMPSAT-5 will have the same LRA as Champ, Grace and TerraSAR-X satellites, whose LRA will be made by GFZ (GeoForschungsZentrum Potsdam), Germany.



Korea Astronomy and Space Science Institute (KASI)
 Ministry of Government Administration and Home Affairs (MOGAHA)
 Ministry of Maritime Affairs and Fisheries (MOMAF)
 National Geographic Information Institute (NGI)
 Korea Institute of Geoscience and Mineral Resources (KIGAM)

Figure 1. Korean GNSS Network

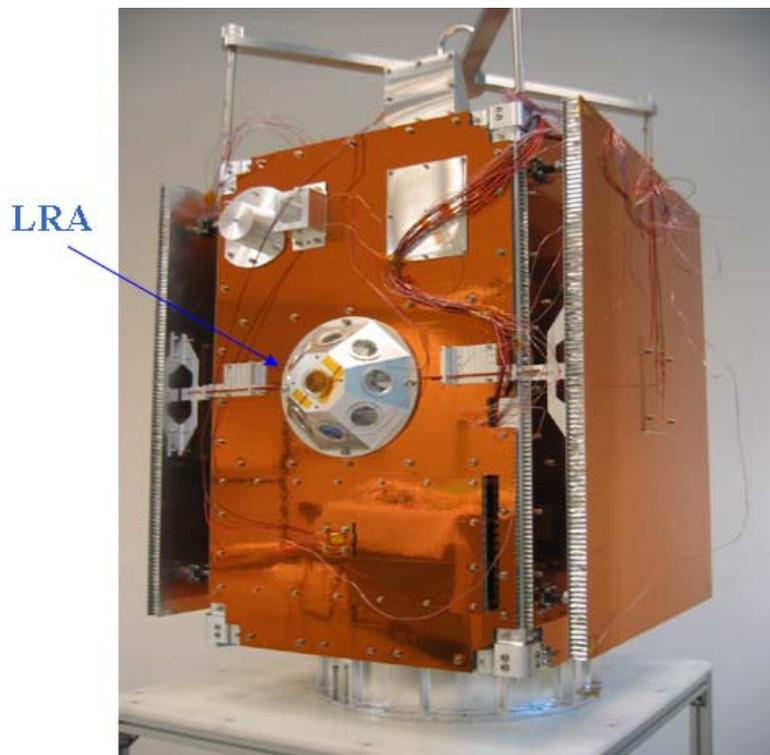


Figure 2. STSAT-2(first Korean satellite with LRA)

Future Plan for SLR system development

KASI conducted the preliminary study for SLR system development from December 2004 to November 2005 with KAERI (Korea Atomic Energy Research Institute), KIMM (Korea Institute of Machinery and Materials) and SaTReC (Satellite Technology Research Center). In the preliminary study, KASI carried out a feasibility study on SLR system development and made the conceptual design of Tx/Rx telescope and Control & Operating System. The conceptual design of the laser generator was done by KAERI, the tracking mount by KIMM, and the Tx/Rx electric system by SaTReC. KASI has tried to obtain the financial support of the Korean government for SLR system development (KSLR project) since this preliminary study, and wants to start the KSLR project in 2008 with KAERI, KIMM and SaTReC. In this project, one fixed system with a 1m Rx telescope and one mobile system with 40cm Rx telescope will be developed for 5 years. The detailed requirements of a fixed system are shown in Table 1. The mobile system will be integrated by introducing the core subsystems from abroad, and the fixed system will be developed through the international and domestic collaboration. So, it will take about 3 years to develop a mobile system but 5 years (subsystem development: 3.5yr, system integration: 0.5yr, test operation: 1yr) to develop a fixed system. After a fixed SLR system is constructed, KASI will join to ILRS (International Laser Ranging Service) for the contribution of the international SLR society.

As mentioned in the previous section, STSAT-2 will be launched in 2008 when Korea will not be capable of tracking it. So a mobile system (TROS, Transportable Ranging Observation System) will be introduced in China this June for laser tracking of STSAT-2 but the detailed schedule is not fixed

Table 1. Requirements of the future Korean SLR system

| Items | Requirements |
|---------------------|---|
| Tracking Coverage | <ul style="list-style-type: none">• Possible to track satellites in the altitude of 25,000km• STSAT-2, KOMPSAT-5, GPS, Galileo Satellites and so on. |
| Ranging Accuracy | <ul style="list-style-type: none">• Lageos : 10mm(SS), 1-2mm(NP)• GPS and Galileo : 20mm(SS), 3-5mm(NP)• Ground Target : 3mm(SS), 1mm(NP) |
| Automatic Operation | <ul style="list-style-type: none">• Remote control from the remote site via internet or dedicated line.• Aircraft detection using radar and automatic observation according to the schedule. |
| Etc | <ul style="list-style-type: none">• Daylight tracking.• Optical tracking of the space launch vehicle (if possible). |

Summary

Two Korean satellites with LRA, STSAT-2 and KOMPSAT-5 will be launched in 2007 and 2009, respectively. Therefore, SLR system is steadily required to be established in Korea not only for satellite tracking, but also for space geodesy research by using GNSS and VLBI. In response to this demand, KASI have prepared for development of SLR system for several years, and expect to launch the project for the development of SLR system from 2008. KASI has a plan to develop one mobile and one fixed SLR systems for 5 years. After a fixed SLR system is constructed, KASI will join ILRS and participate in the international tracking campaign.

References

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