Ground Support and operations for the VSOP-2 / ASTRO-G Project

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Abstract

We are now designing the operation of the VSOP-2 (the VLBI Space Observatory Programme-2), which was started as a second space VLBI project in Japan. VSOP-2, has now been approved by Japan's space agency, JAXA, as the ASTRO-G project. The apogee height of ASTRO-G satellite will be 25,000 km which gives the maximum baseline length of about 30,000 km between the space and ground radio telescopes. It will have a maximum angular resolution at 43 GHz (7 mm) of about 40 micro-arcseconds. ASTRO-G will be launched by Japanese HIIA rocket, in the Japanese financial year of 2012. We are now designing the basic system of the satellite with targeting the launch of 2012. We also design the operation of the VSOP-2 now. Most of the operation system will follow the way we succeeded in the VSOP-1 project (1997-2005) .

The operation of VSOP-1 has gone rather smoothly, despite being a huge project spanning 14 countries when including ground telescopes, correlaters, tracking stations, and the satellite and commanding station. We thank to international VLBI cooperative structures which precede VSOP-1, and to the individual efforts of many collaborators in many countries.

Operation elements of the space VLBI is as follows. Commanding and telemetry reception are performed by the S-band antennas owned by JAXA. On the other hand, tracking for phase transfer and reception of observation data are performed in the Ka-band (40 GHz UP and 37-38 GHz down) by tracking stations in all over the world. We also need to make data flow for the orbit determination. In addition to a space radio telescope, Space VLBI observations require ground telescopes and correlaters.

The scheme, such as observation planning, to generate and distribute the schedule, data flow and interfaces to each elements, the format of the observation output from the correlaters, follows the VSOP-1, but we also need to consider additional new functions coming from the upgrade of the new space VLBI system in VSOP-2. They are the phase referencing functions, which require high agility of the attitude control system and high accuracy orbit determination. The GPS / SLR (Satellite Laser Ranging) orbit determination requires different ground support system. The attitude control of ASTRO-G is more flexible than that of HALCA, and it enable us to make rather complex attitude control, for the calibration observation. The synchronization between ground and space antenna is also important. We need to include such new functions to the operation system.