Korea Geodetic VLBI Station, Sejong

Baek Donghyun, Yi Sangoh, Oh Hongjong, Han Sangchul

Abstract

The Sejong VLBI station officially joined the IVS as a new Network Station in 2012. This report summarizes the activities of the Sejong station during 2012. The following are the activities at the station. 1) VLBI test observations were carried out with the Tsukuba 34-m antenna of the GSI in Japan. As a result, the Sejong antenna needs to improve its efficiency, which is currently in progress. 2) A survey to connect the VLBI reference point to GNSS and ground marks was conducted. 3) To see the indirect effects of RFI (Radio Frequency Interference) at this place, we checked the omni-direction (AZ 0° to 360°, EL fixed at 7°) for RFI influence.

1. General Information

The Sejong station is the first geodetic VLBI station in the Republic of Korea which is dedicated to geodetic purposes only. The station is located about 120 km south of Seoul, in the middle of Sejong City, which serves as a new administrative capital. The Sejong antenna is 22 meters in diameter, and its slew speed is 5°/sec in both azimuth and elevation; its specifications have been designed for the possible addition of other small antennas in the future.

The observatory was constructed on the top of a small mountain in Sejong City, which was officially approved as a new town in July 2012. The city is a newly designated administrative capital city planned by the government, and it will be developed in phases over the next 20 years. The Sejong VLBI station was previously called "KVG" (Korea VLBI system for Geodesy) which was named after the project purpose in its initial stage. However, now "Sejong Station" is the official title to prevent possible confusion in addressing the station.

National Geographic Information Institute (NGII, http://ngii.go.kr) manages the observatory, and Table 1 shows the staff members of the Sejong station. A newly appointed site director, Mr. Baek Dong Hyun, started work in November 2012, and Mr. Joo Hyun Hee, who showed outstanding work in Sejong VLBI construction, was transferred to another group. Staff at the observatory carry out the VLBI observation, baseline analysis, international cooperation including the IVS, antenna maintenance, and management of the observatory.

Table 1. Staff members of the Sejong station.

Name	Function	e-mail
Baek Donghyun	Site Director	baekdh@korea.kr
Yi Sangoh	S/W engineer	sangoh.yi@korea.kr
Oh Hongjong	H/W engineer	stockoh11@korea.kr
Han Sangchul	Antenna system	hsc4907@korea.kr

2. Sejong VLBI System

The Sejong VLBI configuration is listed in Table 2. The IVS letter codes and the CDP and DOMES numbers have been newly registered during this year. The antenna has the Cassegrain

Figure 1. VLBI 22-m antenna, monument pillars 1 - 4, GNSS, and UCP (Unified Control Point) layout.

shape, and the 22-m main reflector consists of 200 rectangular aluminium panels. Each panel has four elevation adjustments at the edge of the panel, so that the antenna main reflector surface can be properly arranged.

Technical parameters of the receiver are presented in Table 3. However, some items are omitted due to the antenna efficiency improvement work. The Sejong station uses the Field System (version FS-9.10.4) and a K5 data recorder.

3. Activities in 2012

3.1. VLBI Observation

The Sejong antenna carried out several fringe tests with the Tsukuba 34-m antenna in Japan. A few observations failed to get fringes due to a wrong setting for time synchronization. After that we successfully got fringes from all channels in the S and X bands. As a result, the Sejong antenna needs to improve its antenna efficiency, which is currently in progress.

3.2. Co-location

We performed a ground survey that used four pillars to tie the cross point of the axes of the VLBI antenna to the Sejong GNSS monument. Figure 2 shows the local tie layout in the site. The antenna reference position was calculated by a 3D circle fitting method, with measurement of the distances from the pillars to the reflection sheet on the antenna surface. Therefore, a ground network consisting of VLBI, GNSS, and the pillars was established. Monitoring for the antenna reference position and ground subsidence of the new site will regularly be done by local tie survey.

Table 2. Sejong Antenna parameters.

Parameters	Sejong VLBI
IVS letter codes	Sejong (Kv)
CDP number	7368
DOMES number	23907S001
Location	127°18'E, 36°31'N Elevation 177 m
Diameter of main reflector	22 m
Antenna type	Shaped Cassegrain
Aperture efficiency	about 60%
Pointing accuracy	0.0131°
Reflector surface accuracy	86μm
Operation range	AZ: ±270° EL: 0 ∼ 90°
Slew speed	5°/sec (AZ and EL)
FS Version	9.10.4
Data acquisition Rack/Recorder	K4/K5

Table 3. Receiving system of the Sejong VLBI system.

Bands	S	X	K	Q
Freq. [GHz]	2.1-2.6	8.0-9.0	21-23	42-44
Receiver noise temp.	< 20K	< 30K	< 50K	< 80K
Polarization	R,L	R,L	R,L	R,L
First LO Freq.	NONE	NONE	13.5 GHz	33.9 GHz
First IF Freq.	NONE	NONE	8-10 GHz	8-10 GHz
IF Pout/BW	-50 dbm/500 MHz			
Phase noise@1KHz	-120 dBc/Hz			
Reference Freq.	100 MHz			

3.3. RFI Monitoring

Even at the Sejong site, RFI is unavoidable. We scanned all directions (AZ 0° to 360°) at a fixed elevation of 7° to see the maximum values in S band (2.2 ∼ 2.4GHz). Figure 3 shows the change of signal power. It shows that most RFI is detected over 2.3 GHz. It is also direction-dependent. In other words, there was more RFI coming from the north direction.

4. Future Plans

We will take on the following activities in 2013: 1) The Sejong station, as a new IVS Network Station in 2012, will participate in regular IVS sessions. 2) Antenna efficiency improvement is currently in progress. 3) After that, we will proceed to join IVS observing as soon as possible by contacting the IVS Coordinating Center. 4) A local tie survey is also planned.

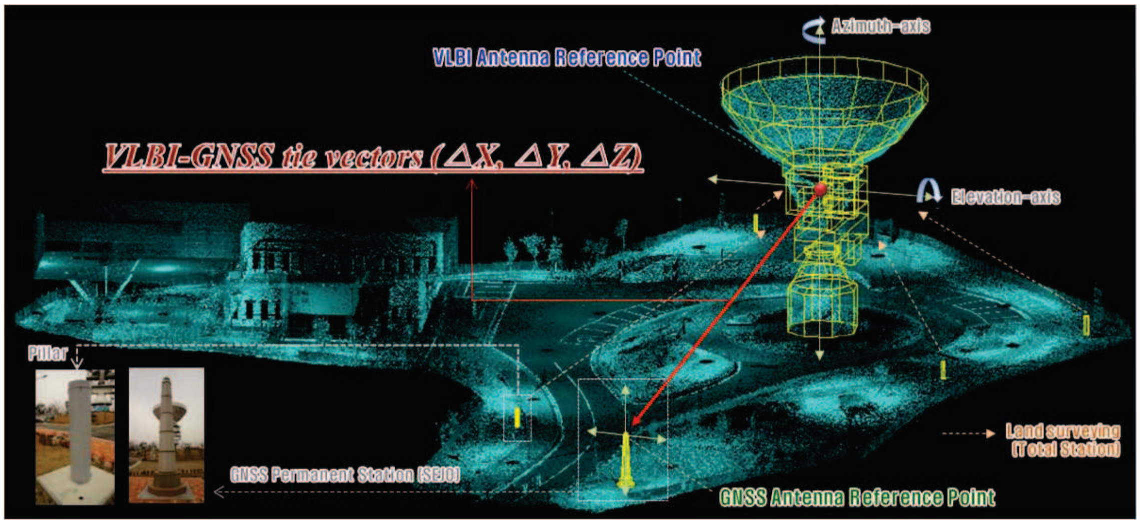

Figure 2. Facilities for local ties at the Sejong station.

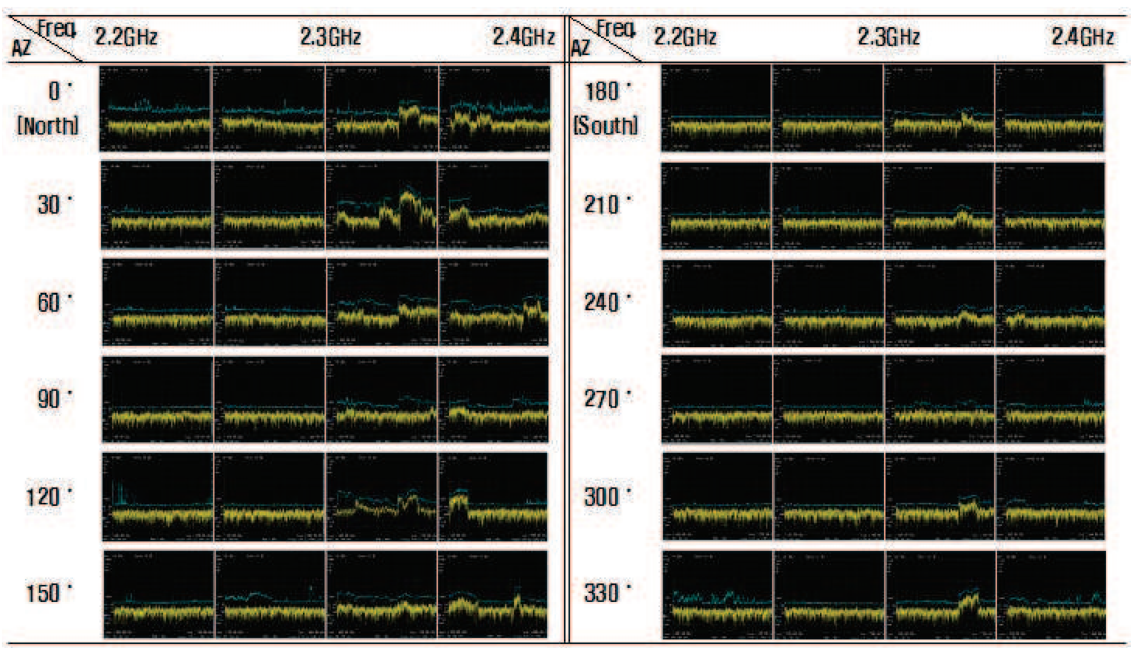

Figure 3. RFI measurement results using a spectrum analyzer.