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The State and Development Direction of the Geodetic VLBI Station in Korea

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Abstract

A permanent geodetic VLBI station with a 22-m diameter antenna will be newly constructed in Korea by the National Geographic Information Institute (NGII) under the project Korea VLBI system for Geodesy (KVG) that aims at maintaining the Korean geodetic datum accurately on the International Terrestrial Reference Frame (ITRF).

KVG can receive 2, 8, 22, and 43 GHz bands simultaneously in order to conduct geodetic and astronomical VLBI observations with Korea astronomical VLBI stations along with geodetic observations with IVS stations. This simultaneous four-band receiving capability is a unique feature of the KVG system. The KVG has started officially in October 2008. A new geodetic VLBI station will be constructed at Sejong city (about 120 km south of Seoul and about 20 km north-northwest of Daejeon) and construction of all systems will be completed in 2011.

1. Introduction

This paper describes the state of the geodetic VLBI station project in Korea which is carried out by the National Geographic Information Institute (NGII). We focus on the overall status rather than give technical explanations. Firstly, we give information about NGII such as vision and main mission. Secondly, the state of the Korea VLBI system for Geodesy (KVG) is explained. Finally, we talk about the development direction and future plans.

2. Korean Geodetic Datum

2.1. About NGII

This section gives an introduction to NGII. NGII is tasked with establishing surveying standards and implementing surveying policies in Korea. More specifically, NGII's tasks are to:

- maintain the national control points,
- produce a national base map,
- construct a national geo-spatial database,
- publish the geographic book and land survey results,
- operate geographical names committee,
- develop surveying and GIS technology, and

- strengthen the relationship with overseas organizations.

NGII consists of six divisions under the President. These divisions are Planning & Policy, General Service, Geodesy, Geospatial Imagery Information & Photogrammetry, Geographic Information, and National Land Information Survey division, employing a total of 103 civil servants. The directors in each division work with high technology equipment for geodesy, photogrammetry, cartography, and print and computerized management systems. Figure 1 shows an organizational chart of NGII.

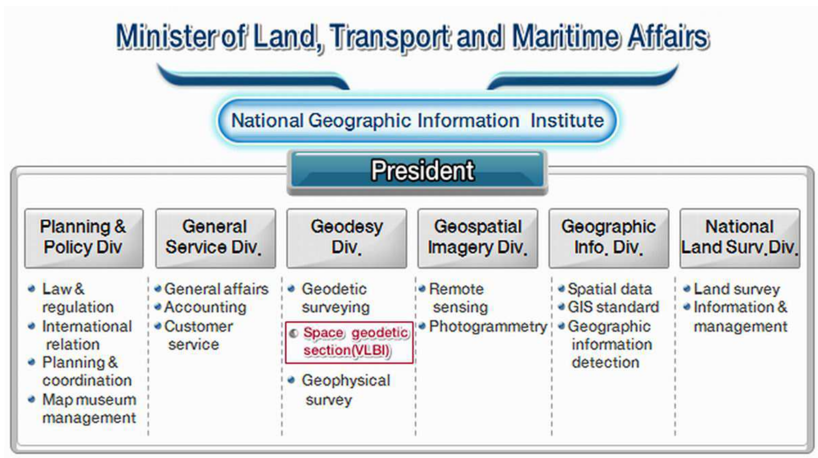

Figure 1. Organization of NGII

2.2. History of the Korean Geodetic Datum

A locally defined datum was used as Korean Geodetic Datum until 2002. It was realized through Bessel coordinates by carrying out astronomical surveys from 1981 to 1985. As the geodetic reference system of Korea was changed to geocentric in 2003, the Korean geodetic datum was redetermined accurately based on GPS and VLBI measurements. To maintain a Korean geodetic reference network, NGII has maintained 68 GPS stations continuously observing since 2000, 16,400 triangulation points, and 7,000 BMs, and it provided and published accurate coordinates and heights.

3. The State of the Korea VLBI System for Geodesy

3.1. Overview of the KVG Project

The first Korean VLBI experiment was done between NGII (National Geographic Information Institute, Korea) and GSI (Geographical Survey Institute, Japan) in 1995 using a 3.8-m mobile antenna at the Korean end. Step by step, the KVG project was proceeding. After that, the Korea VLBI system for Geodesy (KVG) started officially in October 2008. Construction of all systems will be completed in 2011.

Ajou University, High Gain Antenna Co., Ltd, and GigaLane Co., Ltd, are involved in a domestic collaboration in the project. NICT (National Institute of Information and Communications

Technology) and GSI participate as international partners. Figure 2 shows an overview of the KVG project.

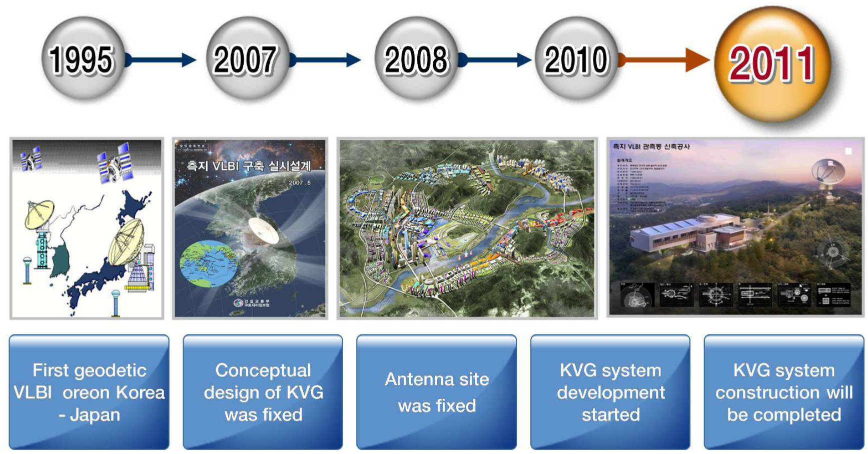

Figure 2. Overview of the KVG project.

3.2. Antenna Site

A new geodetic VLBI station for the KVG project will be constructed at Sejong city, which is located about 120 km south of Seoul and about 20 km north-northwest of Daejeon. Three VLBI antennas at Seoul, Ulsan, and Jeju are for a radio astronomical project, which is called KVN. Sejong is located within the triangle formed by the KVN stations. Figure 3 shows the location of the KVG antenna and the KVN antenna sites.

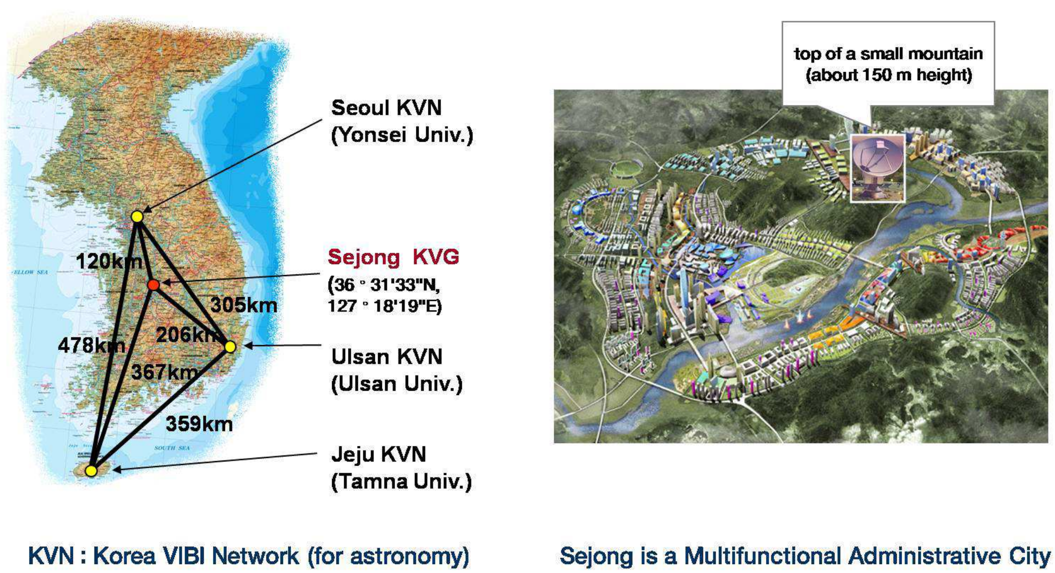

Figure 3. Location of the KVG system.

Figure 4 shows a bird's eye view of the KVG antenna site.

Figure 4. Bird's eye view of the KVG site.

3.3. System Outline

Construction of the antenna is carried out by High Gain Antenna Co., Ltd. This company also built part of the antennas of the KVN project in a domestic collaboration. The type of the antenna is Cassegrain. The KVG antenna will look similar to the KVN antennas after completion.

The receiver is designed to be able to receive 2, 8, 22, and 43 GHz bands simultaneously. This choice was made in order to be able to carry out geodetic VLBI observations with the current geodetic VLBI stations equipped with 2/8 GHz receivers and also with the KVN stations that will be equipped with 22/43 GHz receivers in the future. This is an outstanding feature of the KVG system, distinguishing it from other geodetic VLBI stations. Figure 5 summarizes the specifications of the KVG system. The unique features of the KVG system and its optics are shown in Figure 6.

The development of the backend system progressed in close cooperation with NICT. The backend system consists of two parts. The down converter, phase-calibration-signal generation system, and E/O transmission system will be installed in the antenna cabin. The IF selector, PC-based formatter and recorder, frequency standard, and software correlator will be installed in the observation building. The color of the equipment indicates a progress schedule.

The 22 and 43 GHz receiver systems, as well as the K5/VSSP32 and S/X down converter, are shown in Figure 7. Figure 8 shows a block diagram of the backend system.

4. Conclusions

The Korea VLBI system for Geodesy (KVG) has officially started in October 2008. Construction of all systems will be completed in 2011. We believe that the KVG system will play an important role for the Korea Geodetic Datum. Furthermore, we hope to become an IVS Network Station, and we look forward to exchanging information with IVS partners.

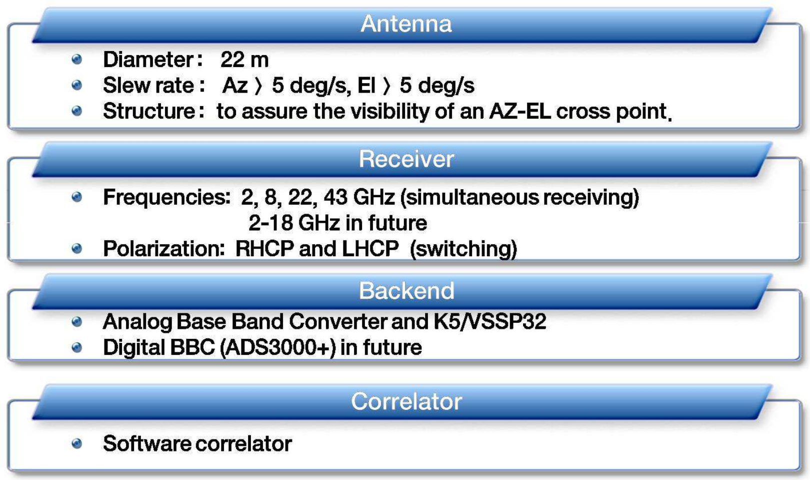

Figure 5. Specifications of the KVG system.

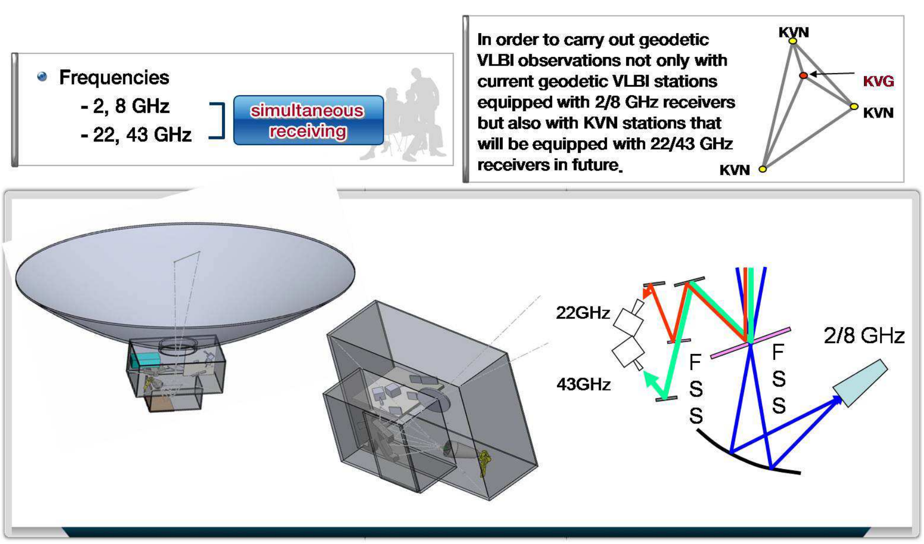

Figure 6. Unique features of the KVG system and KVG optics.

Figure 7. The 22 and 43 GHz receiver systems (left) and the K5/VSSP32 and S/X down converter (right).

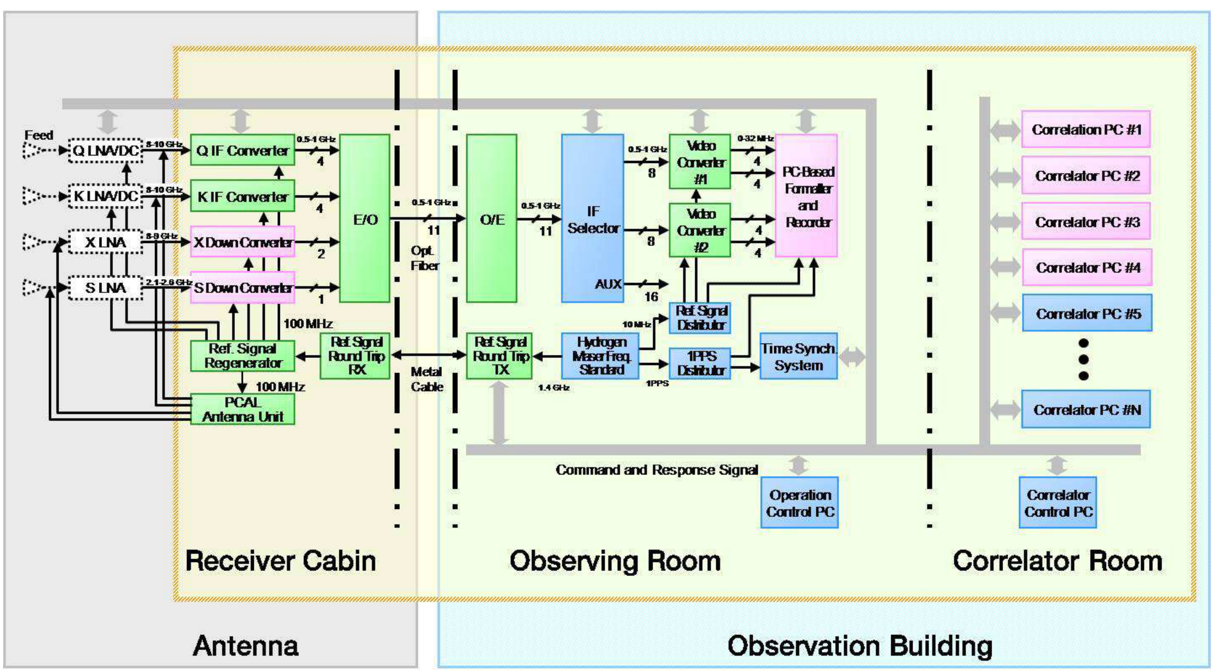

Figure 8. Block diagram of the backend system.