

Tsukuba 32-m VLBI Station

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Abstract

Tsukuba 32-m radio telescope is operated by Geographical Survey Institute (GSI) VLBI group. This report summarizes the current status and the future plans of Tsukuba 32-m VLBI station. We had participated in a total of 164 domestic/international VLBI sessions scheduled at the beginning of this year and some new sessions, such as INT3 and Ultra Rapid dUT1 experiments in 2007. All of the observations have been performed with the K5/VSSP32 system. We had some troubles at our facility, so we ran an overall check of the antenna. In the near future, we plan to do an overall maintenance.

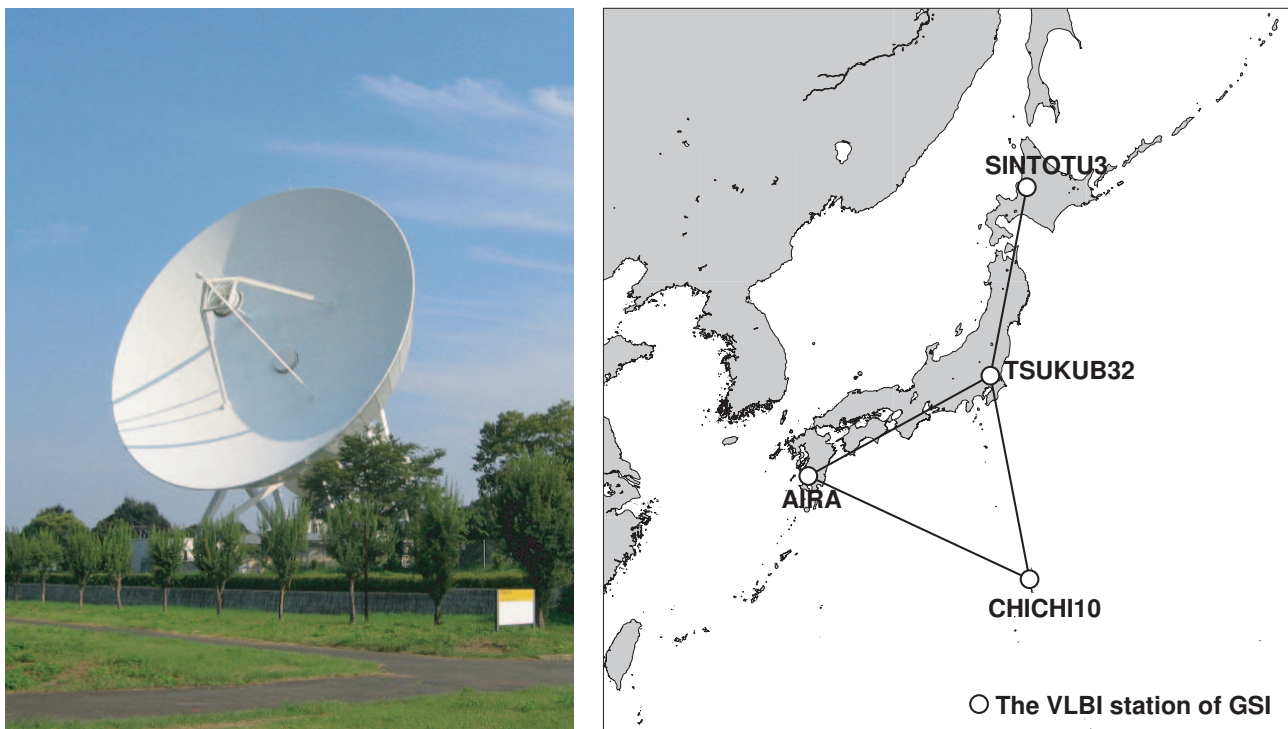


Figure 1. Tsukuba 32-m VLBI station and GARNET (GSI VLBI network).

1. General Information

The Tsukuba 32-m VLBI station (TSUKUB32) is located at GSI in Tsukuba Science City, which is about 50 km to the northeast of the capital Tokyo. GSI has four VLBI stations: TSUKUB32, AIRA, CHICHI10, and SINTOTU3. These four stations form our domestic VLBI network named GARNET (GSI Advanced Radio telescope NETwork). We have performed our domestic VLBI observations using GARNET. A series of the observations is named JADE (Japanese Dynamic Earth observation by VLBI). The main purposes of the JADE series are to define the reference frame of Japan and to monitor the plate motions for the advanced study of crustal de-

formations. The GARNET stations, centered on TSUKUB32, are located to cover the Japanese mainland.

2. Component Description

In March 2007, we finished the installation and adjustment of K5/VSSP32 [1], which enables us to record at 32 Msps/ch. Since then, we have performed all domestic/international sessions with the K5/VSSP32. After the installation, we moved the previous K5 system (K5/VSSP) to VERAISGK station of NAOJ on Ishigaki Island. VERAISGK has participated in JADE sessions throughout the year. At VERAISGK, we introduced a high-speed optical network. Now, we transfer the data to Tsukuba at about 24 Mbps. We also renewed a Low Noise Amplifier (LNA) for stable refrigeration of X-band receiver at TSUKUB32 station in December 2007.

We made a joint research agreement with Tsukuba University for installing a K-band receiver at TSUKUB32 station. In test observations, we found a noise pattern of standing wave type in the receiver system. Investigations revealed that the water resistant sheet for the feed horn of the antenna reflects part of the radio wave, and that the reflected wave is the cause of the standing wave. After we had changed the water resistant sheet to remove the standing wave, Tsukuba University performed some astronomical observations in December 2007. They succeeded in observing recombination lines of ammonia molecules and ionized gas. Meanwhile, we implemented K-band VLBI observations for finding fringes with KASHIM34 or GIFU11 station. We could find fringes for the first time in May 2007.

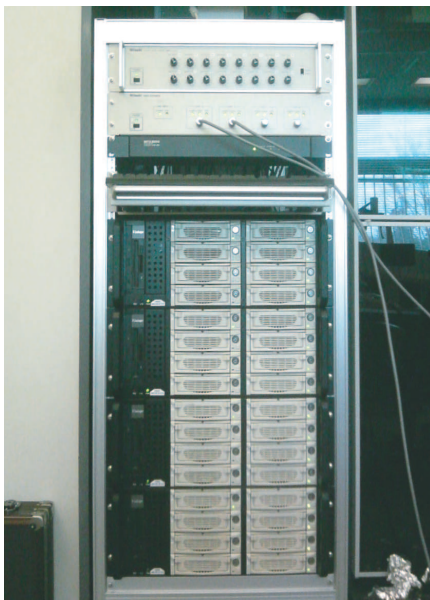


Figure 2. K5/VSSP32

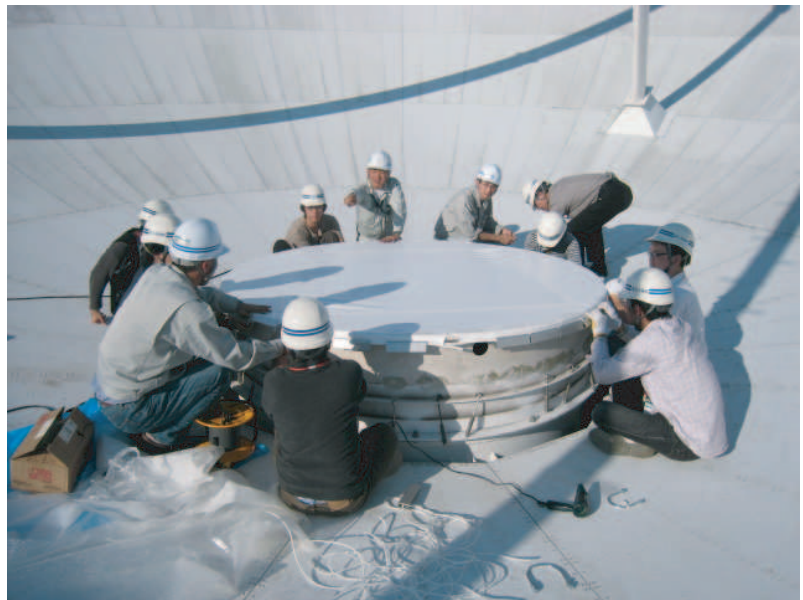


Figure 3. Change of the water resistant sheet

In 2007, we had some problems with the equipment of the station. One of the insulator panels of the antenna was broken by strong wind and fell down to the ground on January 3rd. As a result of immediate investigation, we found three more dangerous panels which lacked the fixation screws. We reinforced these panels on March 23rd and ran an overall check of the antenna in May

2007, because other equipment might have a problem. Another problem was the hydrogen maser, which went down twice (March and November). As we have two hydrogen masers at TSUKUB32 station, we could continue to participate in VLBI sessions switching the main hydrogen masers. However, these masers have a short life expectancy because they were manufactured more than 10 years ago, so we will have to renew them in the near future.

3. Staff

Table 1 shows the regular operating staff of GSI's VLBI observation group. Kazuhiro Takashima (former leader of VLBI group) and Junichi Fujisaku (former operation chief) moved to different departments in April. In their stead, Kozin Wada and Shinobu Kurihara came back to GSI VLBI group after a few years interval. Yoshihiro Fukuzaki is in charge of the analysis of SYOWA experiments and a member of the IVS Directing Board (Networks Representative). Routine operation were mainly performed under contract with Advanced Engineering Service Co., Ltd (AES), over 230 days in 2007. The information about the correlator staff are listed in the report of Tsukuba VLBI Correlator in the correlator section of this volume.

Table 1. Staff list of the GSI VLBI group

Name	Position
Shigeru MATSUZAKA	Director of Space Geodesy Division
Kozin WADA	Deputy Director of Space Geodesy Division
Shinobu KURIHARA	Leader of VLBI group
Etsurou IWATA	Network chief
Morito MACHIDA	Operation chief
Kensuke KOKADO	Technical staff (Observation and Analysis)
Daisuke TANIMOTO	Technical staff (routine observation)
Yoshihiro FUKUZAKI	Researcher, IVS DB

4. Current Status and Activities

The regular sessions are shown in Table 2. TSUKUB32 station participated in a total of 164 domestic/international VLBI sessions in 2007. We have conducted INT3 sessions since August 27th, 2007, with Ny-Ålesund and Wettzell every Monday. The aim is to obtain the UT1 estimate within 24 hours after the session. Therefore, we adapt “e-VLBI” and “Tsunami” protocol which is a UDP/IP based protocol developed by Advanced Network Management Laboratory of Indiana University. We can transfer the data to Bonn correlator at about 300 Mbps using “Tsunami”. We also use “Tsunami” to transfer the data to Bonn correlator in IVS-R sessions.

In addition, we had two special experiments in 2007. The first one was the intensive experiment for ultra-rapid UT1 measurement. The goal of the experiment is to obtain the UT1 result within 30 minutes after the end of the last scan. The stations that participated in the experiment are TSUKUB32, KASHIM34, ONSALA60, and METSAHOV, all with high-speed network connections. In the ultra rapid experiment, we used “Tsunami” protocol, because one of the key factors

to enable the rapid UT1 measurement is to transfer the data as fast as possible. We transferred the data from the stations in Europe to Japan using the Tsunami protocol and the PC-EVN system. We succeeded in obtaining the UT1 result within 1 hour after the end of the experiment with ONSALA60 on November 22th, 2007.

The second was a special domestic VLBI experiment for getting more precise positions of the Japanese VLBI stations. USUDA64 station of Japan Aerospace Exploration Agency (JAXA) and YAMAGUCH station of Yamaguchi University participated in the experiment together with the four stations of GSI. Further, we performed test observations for geodetic VLBI with UCHINOURA station of JAXA. As we found fringes in X-band, we plan geodetic VLBI sessions for 2008. We expect to get more precise positions of these stations by analyzing the data of these sessions. These results will be used as reference positions for astronomical observations at these stations.

Table 2. The regular sessions at Tsukuba 32-m VLBI station in 2007

Sessions	Code	Number
IVS-R	R1258,R1259 ... R1307,R1308	31
IVS-T	T2052	1
VLBA	RDV66	1
APSG	APSG20,APSG21	2
JADE	JD0701-0712	12
IVS-INT1	I07267,I07268,I07269	3
IVS-INT2	K07007,K07013 ... K07349,K07350	96
IVS-INT3	K07239,K07246 ... K07344,K07351	18
Total		164

5. Future Plans

At present, we make domestic observations in 8 MHz sampling mode, because the video converters at participating stations cannot accept a wider band than 4 MHz. Therefore, we plan to broaden the frequency range and will perform a fringe test in January 2008.

GSI VLBI group has made co-location surveys for connecting the result of VLBI observations to the geodetic network at all of the GSI VLBI stations. We will conduct a second co-location survey at TSUKUB32 station in February 2008.

References

- [1] J. Fujisaku, S. Kurihara, K. Takashima: Tsukuba 32m VLBI station, IVS 2004 Annual Report, February 2005
- [2] J. Fujisaku, K. Kokado, K. Takashima: Tsukuba 32m VLBI station, IVS 2005 Annual Report, April 2006
- [3] K. Kokado, J. Fujisaku, K. Takashima: Tsukuba 32m VLBI station, IVS 2006 Annual Report, April 2007