Tsukuba 32-m VLBI Station

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Abstract

The Tsukuba 32-m VLBI station is operated by the Geospatial Information Authority of Japan (GSI). This report summarizes the current status and the future plans of the Tsukuba 32-m VLBI station and related facilities. Over 200 sessions were observed with Tsukuba 32-m, Kashima 34-m, and other GSI antennas in accordance with the IVS Master Schedule. Lightning struck the Tsukuba facility in July, and the antenna and some devices were damaged. Some IVS sessions planned at Tsukuba were canceled, and Kashima 34-m antenna filled in for Tsukuba 32-m antenna during two months. In addition, several ultra-rapid dUT1 experiments and compact VLBI system experiments were conducted.

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 three regional stations besides TSUKUB32: SINTOTU3, CHICHI10, and AIRA, which form the Geodetic VLBI network in Japan covering the whole country (Figure 2). GSI carried out the domestic VLBI session series called "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 deformations. Additionally, Mizusawa (VERAMZSW) and Ishigakijima (VERAISGK), which are part of the VERA network of the National Astronomical Observatory of Japan (NAOJ), also participated in the JADE sessions.

Figure 1. Tsukuba 32-m VLBI station and VLBI team.

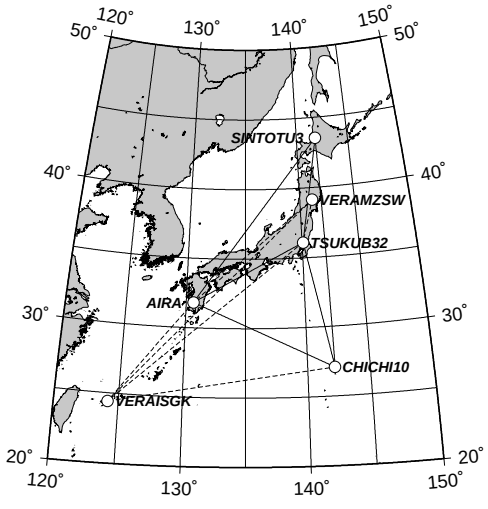

Figure 2. Geodetic VLBI network in Japan.

2. Component Description

The specifications of the Tsukuba 32-m antenna are summarized in Table 1.

Table 1. Tsukuba 32-m antenna specifications.

Owner and operating agency	Geospatial Information Authority of Japan
Year of construction	1998
Radio telescope system	Az-El
Receiving feed	Cassegrain
Diameter of main reflector	32 m
Azimuth range	10 – 710°
Elevation range	5 – 88°
Az/El drive velocity	3°/sec
Tsys (X/S)	50 K / 75 K
SEFD (X/S)	320 Jy / 360 Jy
RF range (X1)	7780 – 8280 MHz
RF range (X2)	8180 – 8680 MHz
RF range (X3)	8580 – 8980 MHz
RF range (S with BPF)	2215 – 2369 MHz
Recording terminal	K5/VSSP32, ADS3000+ with DBBC

In 2010, a hydrogen maser frequency standard (Anritsu Corp., SA0D05A) and the next generation gigabit sampler (Cosmo Research Corp., ADS3000+) were installed at Tsukuba 32-m station. And as the Field System PC, having been used since 2002, became dated, we replaced it with a new rack mount type PC.

3. Staff

Table 2 lists the regular operating staff belonging to the GSI VLBI observation group. The former head of the Space Geodesy Division, Shigeru Matsuzaka, transferred to the Planning Department as the Assistant Director for International Observation, and Misao Ishihara took over the division head position in April. Ryoji Kawabata newly joined our group as a technical official in April. Yoshihiro Fukuzaki and Yuji Miura moved to another division in June, and Jiro Kuroda became the deputy head of our division. Kensuke Kokado had been visiting the Haystack Observatory in the United States as a visiting researcher until January 6, but after that, he came back to our group. Kazuhiro Takashima had been an IVS Directing Board at-large member, but he left the post for health reasons. Shinobu Kurihara succeeded to the post in October. Routine operations were mainly performed under contract with Advanced Engineering Service Co., Ltd. (AES).

4. Current Status and Activities

4.1. Geodetic VLBI Observations

The regular sessions in the IVS Master Schedule are shown in Table 3. TSUKUB32 participated in 61 domestic and international 24-hr VLBI sessions and 118 Intensive 1-hr sessions this year. SINTOTU3, CHICHI10, and AIRA participated not only in domestic sessions but also in some international sessions.

Table 2. Staff list of the GSI VLBI group.

Name	Position/Company	Function
Misao ISHIHARA	Head of Space Geodesy Div.	Supervisor
Jiro KURODA	Deputy head of Space Geodesy Div.	Management, Collocation
Shinobu KURIHARA	VLBI operation chief	Responsible official, IVS DB member
Kensuke KOKADO	Analysis chief	Correlation, Analysis, Data transfer
Ryoji KAWABATA	Technical official	VLBI operation, miscellaneous work
Kazuhiro TAKASHIMA	Senior researcher	Research
Daisuke TANIMOTO	AES, Co., Ltd.	Observation
Yasuko MUKAI	AES, Co., Ltd.	Observation and Correlation
Toshio NAKAJIMA	I-JUSE	System engineer

Table 3. The number of regular sessions in 2010.

Sessions	TSUKUB32	KASHIM34	SINTOTU3	CHICHI10	AIRA
IVS-R1	38	6	–	–	–
IVS-T2	6	1	–	7	7
APSG	2	–	2	2	2
VLBA	4	1	–	–	–
IVS-R&D	5	–	–	–	–
JADE	6	2	7	4	4
IVS-INT2	80	12	–	–	–
IVS-INT3	38	7	–	–	–
Total	179	29	9	13	13

4.2. Lightning Strike at Tsukuba 32-m Antenna

On July 25, Tsukuba 32-m antenna was damaged by a lightning strike. The air conditioner in the observation room stopped, and the interface port of the ACU and the encoders for the Az drive & reflector in the waveguide were broken. Since it was expected to require a long time to restore the antenna, colleagues at NICT KSRC (National Institute of Information and Communications Technology, Kashima Space Research Center) kindly let us use Kashima 34-m antenna during repair period. We could operate totally 29 sessions using Kashima 34-m antenna in August and September as shown in Table 3. The session numbers in the KASHIM34 column only reflect sessions that were operated by GSI during the period of the Tsukuba 32-m repair. With the IVS-INT2 on October 2, Tsukuba 32-m resumed operation.

4.3. Ultra-rapid dUT1 Experiments

The ultra-rapid dUT1 experiment is a joint project of Japan (GSI & NICT) and Fennoscandia (Onsala & Metsähovi). This year again, we tried to transfer the regular IVS 24-hr data from the Fennoscandian station to the Tsukuba correlator and to carry out automatic data conversion, correlation, and data analysis. The experiment was conducted in 22 IVS 24-hr sessions and seven special schedules. For IVS-R1417 on February 8, we demonstrated the ultra-rapid experiment by near real-time Internet broadcasting of antenna image, correlation fringe image, and dUT1 time series plot at the 6th IVS General Meeting. The details of the analysis are reported in the Tsukuba Analysis Center report.

4.4. Developing a Compact VLBI System (MARBLE)

GSI and NICT are developing a compact VLBI system with a 1.5-m diameter aperture dish (MARBLE: Multiple Antenna Radio-interferometry of Baseline Length Evaluation) in order to provide reference baseline lengths for GPS and EDM calibration. In the report year, eight geodetic experimental observations were carried out between two MARBLEs and two large antennas (TSUKUB32 or KASHIM34). In particular, the last two experiments were implemented using ADS3000+ for data acquisition, and we succeeded in IF data sampling and obtaining geodetic solutions.

5. VLBI2010

GSI started the consideration of VLBI2010 by setting up the VLBI2010 Exploratory internal Committee in the Geodetic Department in January. So far, eight meetings have been convened, and the committee decided their policy to construct a new VLBI2010 antenna. After the decision, GSI included an expense for VLBI2010 in the budget requests for the next fiscal year starting in April 2011. The expense request is for RFI environment and underground condition surveys. In the government draft budget for the fiscal year 2011, the request was approved. The budget will be formally approved, when the bill is passed by the Diet.

6. Future Plans

The gigabit digital sampler "ADS3000+" will be used in routine operation. The anti-aliasing filters necessary for "ADS3000+" will be delivered by the end of March 2011. First we will try "ADS3000+" in a JADE session.

7. Other Topics

On December 24, Mr. Hyun-Hee Joo commenced a six-month visit to Japan from NGII (National Geographic Information Institute) of the Republic of Korea. He will stay at GSI until the middle of June 2011 to acquire VLBI-related technique and management skills necessary to succeed in their KVG (Korean VLBI for Geodesy) project.