Kashima 34-m Radio Telescope

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Abstract

The Kashima 34-m radio telescope has been continuously operated and maintained by the National Institute of Information and Communications Technology (NICT) as a facility of the Kashima Space Technology Center (KSTC) in Japan. This brief report summarizes the status of this telescope, the staff, and activities during 2012.

1. General Information

The Kashima 34-m radio telescope (Figure 1, left) was constructed as a main station of the "Western Pacific VLBI Network Project" in 1988. The telescope has been used not only for geodetic experiments but also for astronomical observations and spacecraft tracking under the collaboration with National Astronomical Observatory of Japan (NAOJ), Kagoshima University, Institute of Space and Astronautical Science (ISAS), and other related institutes. The 34m antenna was damaged by the big earthquake occurred at north east of Japan on 11 March 2011, and its operation has been stopped for repair work until the end of March 2013.

The Kashima 34m station is located about 100 km east of Tokyo in Japan. The Kashima 11-m radio telescope and the International GNSS Service station (KSMV) (Figure 1, right) are also co-located in the Kashima Space Technology Center. The station is maintained by the Space-Time Measurement Project of the Space-Time Standards Group, NICT.

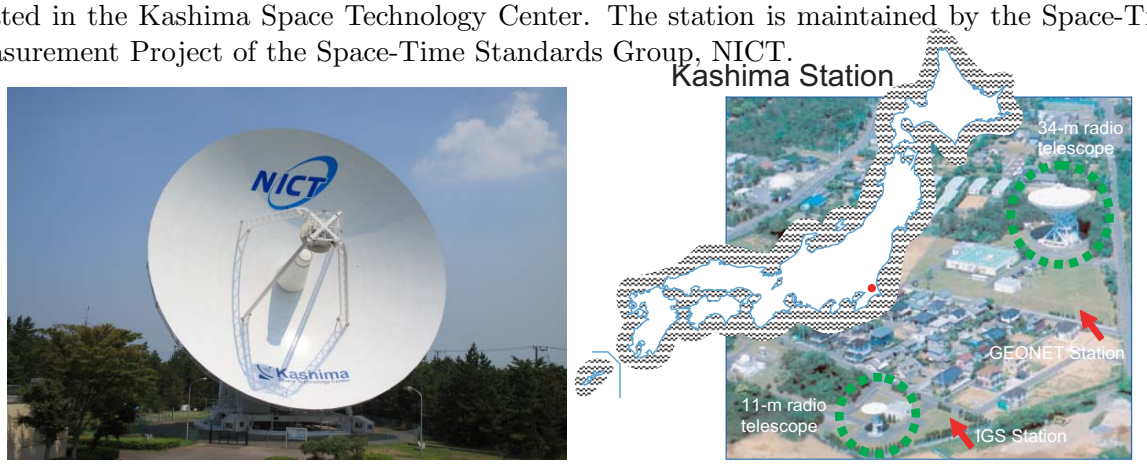

Figure 1. Left panel is a picture of the 34m diameter radio telescope. Right panel indicates the location of Kashima KSTC in Japan, and locations of 34m-antenna, 11m-antenna, and GNSS station (KSMV) in the site.

2. Component Description

The receiver equipment of the Kashima 34-m radio telescope is summarized in Table 1 and Table 2. For radio frequency interference (RFI) mitigation, high-temperature superconductor (HTS) band-pass filter (2193 - 2473 MHz) for S-band [1] and conventional band-pass filter (1405 - 1435 MHz) for L-band have been used since 2008.

Table 1. Main specifications of the 34-m radio telescope.

Main reflector aperture	34 m
Latitude	N 35° 57' 21.27"
Longitude	E 140° 39' 36.33"
Height of AZ/EL intersection above sea level	43.7 m
Height of azimuth rail above sea level	26.9 m
Antenna design	Modified Cassegrain
Mount type	AZ-EL mount
Drive range azimuth	±270° from the North
Drive range elevation	7°-90°
Maximum speed azimuth	0.8°/sec
Maximum speed elevation	0.64°/sec
Maximum operation wind speed	13 m/s

Table 2. The receiver specifications of the 34-m radio telescope.

Band	frequency (MHz)	Trx (K)	Tsys (K)	Efficiency	SEFD (Jy)	Polarization
L	1405-1435	18	45	0.68	200	L/R
S	2193-2350	19	72	0.65	340	L/R
X-n (∗)	8180-9080	40	48	0.68	210	L/R
X-wL(#)	8180-9080	40	67	0.68	300	L/R
X-wH(#)	7860-8360	-	67	0.68	300	L/R
K	22000-24000	105	141	0.5	850	L
Ka	31700-33700	85	150	0.4	1100	R
Q	42300-44900	180	350	0.3	3500	– (†)

∗ : 8 GHz narrow band LNA . # : 8 GHz wide band LNA. † : No Polarizer

3. Staff

The engineering and technical staff of the Kashima Station are listed in Table 3.

4. Current Status and Activities

Recent status and activities related with the 34m radio telescope in the NICT VLBI group are as follows:

Repair of Az Wheel and Rail Cracking damage to the azimuth wheel, which is due to the big earthquake, was found in the inspection. Repair work of replacement of azimuth wheels and rails is in progress and will finish at the end of March 2013.

IVS sessions The 34m antenna could not participate to the IVS sessions since 2011 because of the damages. After April 2013, 34m station will come back to the IVS sessions as it used to be.

Data transport of international and domestic VLBI observations has been made via e-

Table 3. The engineering and technical staff of the Kashima Station.

Name	**Responsibility**
KAWAI Eiji	Operations and maintenance.
SEKIDO Mamoru	Operations, maintenance, and coordination of development.
ICHIKAWA Ryuichi	Keeping GNSS observation systems
TAKEFUJI Kazuhiro	Development and experiments of wide-band VLBI system.
UJIHARA Hideki	Designing of new wide band feed.
TSUTSUMI Masanori	Computer network and computer systems.
HASEGAWA Shingo	Computers for K5 system and supporting data conversion for e-transfer of IVS VLBI sessions.

transfer, rather than physical shipping of recorded data disks. Depending on the request, Mark5 data or K5 data are prepared and provided to IVS correlation centers from our data server, which is accessible from the Internet with 1 Gbps connection.

Development of New Wideband Feed The main project of VLBI group in NICT is VLBI application for frequency comparison between distant atomic frequency standards. For pursuit of this project, wideband observation system semi-compliant with VLBI2010 system is under the development. Due to some restriction, we decided to fix four observation frequency bands (3.2-4.2 GHz, 4.8-5.8 GHz, 9.6-10.6 GHz, and 12.8-13.8 GHz) for the new observation system. New wideband feed system for this frequency selection is being designed. It will be installed by replacement with original C-band receiver. The C-band receiver has been already removed in June 2012, and the new wideband feed system will be installed in 2013.

5. Future Plans

The 34m station will come back to operation from the first quarter in 2013. As mentioned in the former section, new wideband feed is going to be installed, and a new optical wideband signal transmission system is to be installed for that. A new direct-sampling system, which convert analog RF signal to digital data without frequency conversion by taking advantages of aliasing effect of sampling, is going to be employed experimentally for the wideband observation. More detail on the technology development will be fond in the other article in this issue.

References

[1] Kawai, E., J. Nakajima, H. Takeuchi, H. Kuboki, T. Kondo, M. Suzuki, K. Saito, RFI mitigation at a 2 GHz band by using a wide-band high-temperature superconductor filter, J. Geod. Soc. Jpn., Vol. 54, No. 1, pp. 31–37, 2008.

[2] Takefuji, K, and H. Ujihara, Technology Development Center at NICT, International VLBI Service for Geodesy and Astrometry 2012 Annual Report, edited by K. D. Baver and D. Behrend, NASA/TP-2013-??????, 2013.