Kashima 34-m Radio Telescope

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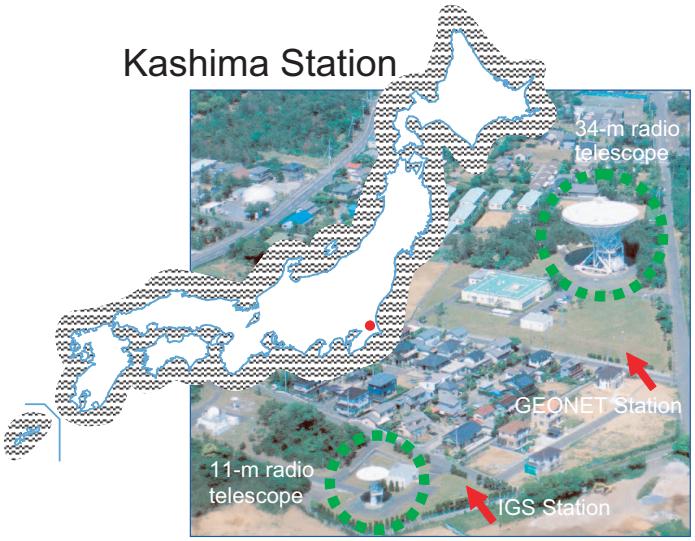
Abstract

The Kashima 34-m radio telescope is continuously operated and maintained by the National Institute of Information and Communications Technology (NICT) as a facility of the Kashima Space Research Center (KSRC) in Japan. This brief report summarizes the status of this telescope, the staff and activities during 2009.

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. After that project's termination, the telescope has been used not only for geodetic purposes but also for astronomy and other purposes [1]. The station is located about 100 km east of Tokyo, Japan and co-located with the 11-m radio telescope and the International GNSS Service station (KSMV) (Figure 1, right). This station is maintained by the Space-Time Measurement Project of the Space-Time Standards Group of KSRC, NICT.

The Kashima 34-m radio telescope.



The layout map of Kashima station.

Figure 1. The Kashima Station.

2. Component Description

The Kashima 34-m radio telescope can observe L, C, K, Ka, Q, S, and X bands. The main specifications of the telescope and receivers are summarized in Table 1 and Table 2.

The original frequency coverage of the X-band was from 7860 MHz to 8600 MHz. In order to support IVS observing, we expanded the frequency range of the X-band receiver up to 9080 MHz [2]. For S-band, we have been using the high-temperature superconductor (HTS) band-pass filter

to mitigate the radio frequency interference (RFI) signal due to a third-generation mobile phone system (IMT-2000) [3]. For L-band, we also installed a band-pass filter to mitigate RFI on July 15, 2008. The band-pass frequency is from 1405 to 1435 MHz.

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

Main reflector aperture	34.073 m
Latitude	N 35° 57' 21.78"
Longitude	E 140° 39' 36.32"
Height of AZ/EL intersection above sea level	43.4 m
Height of azimuth rail above sea level	26.6 m
Antenna design	Modified Cassegrain
Mount type	AZ-EL mount
Drive range azimuth	North ±270°
Drive range elevation	7°-90°
Maximum speed azimuth	0.8°/sec
Maximum speed elevation	0.64°/sec
Maximum operation wind speed	13 m/s
Panel surface accuracy r.m.s.	0.17 mm

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

Band	frequency (MHz)	Trx (K)	Tsys (K)	Efficiency	SEFD (Jy)	Polarization
L	1350-1750⋆	18	45	0.68	200	L/R
S	2193-2350	19	72	0.65	340	L/R
C	4600-5100	100	127	0.70	550	L(R)
X-n	8180-9080∗	41	48	0.68	210	L/R
X-wL	8180-9080#	41	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(R)
Ka	31700-33700	85	150	0.4	1100	R(L)
Q	42300-44900	180	350	0.3	3500	L(R)

∗ : 8GHz LNA narrow band use. # : 8GHz LNA wide band use.
⋆ : Narrow bandwidth filter, 1405 - 1435 MHz, is used generally to mitigate RFI.

3. Staff

The engineering and technical staff of the Kashima 34-m radio telescope are listed in Table 3. Shingo Hasegawa joined K5 operation and data transfer. Tetsuro Kondo has been working in Korea since April 2008, but he continues to support the software correlator of NICT. Yasuhiro Koyama moved to NICT HQ in July 2008, but he also continues to support the 34-m antenna. Ryuichi Ichikawa is responsible for the project at Kashima.

Table 3. The engineering and technical staff of the Kashima 34-m radio telescope.

Name	Main Responsibilities
Eiji Kawai	responsible for operations and maintenance
Mamoru Sekido	software and reference signals
Kazuhiro Takefuji	mechanical and RF related parts
Shingo Hasegawa	K5 operation and data transfer
Ryuichi Ichikawa	responsible for the project
Yasuhiro Koyama	international e-VLBI
Tetsuro Kondo	software correlator development and e-VLBI

4. Current Status and Activities

The 34-m radio telescope contributed to various experiments (such as geodesy, radioastronomy, space navigation, and time transfer). Statistical charts of the telescope operation time according to purpose, including maintenance, is shown in Figure 2. The total operation time during 2009 was 1246.5 hours, which decreased compared to the previous year's total of 2047 hours. The main reason for this is that there was repainting of the backup structure and quadripod.

The repainting of the backup structure was carried out from February until March, and from September until October. The repainting period was about three months.

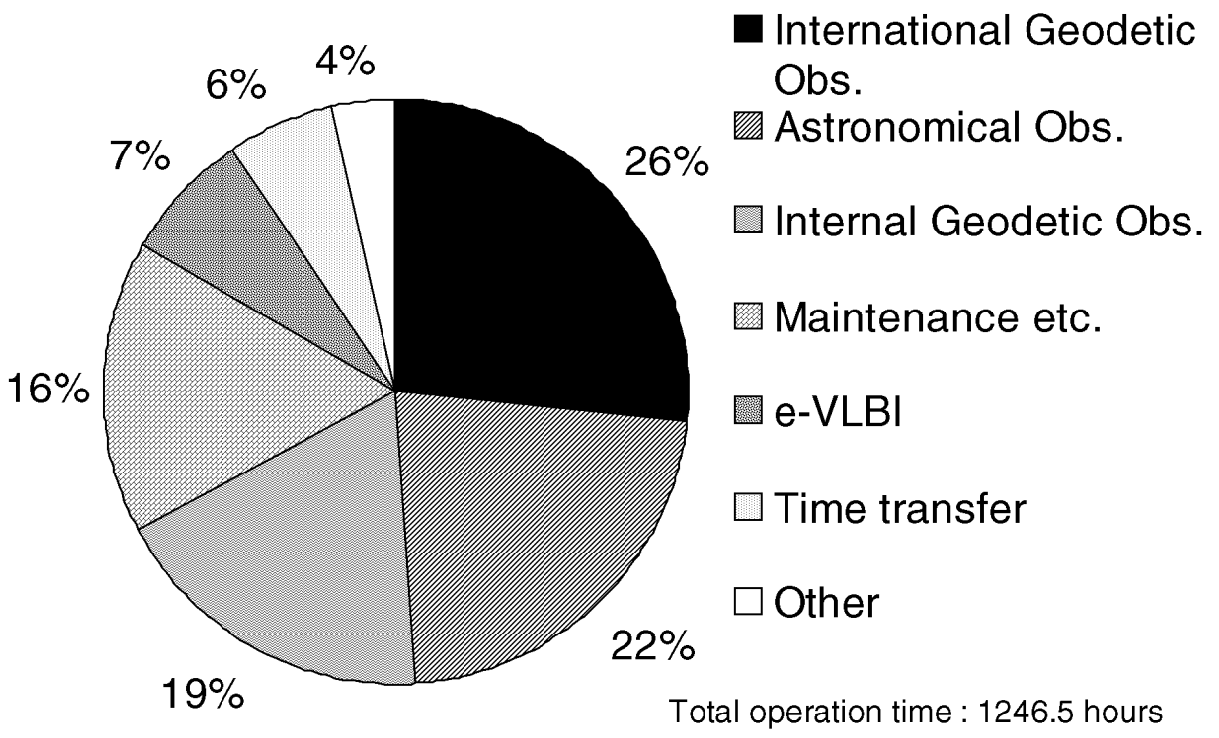


Figure 2. Statistical charts of the telescope operation time according to purpose.

5. Future Plans

The Kashima 34-m radio telescope is a main telescope of our project, and already a lot of sessions such as "Experiment for the development of a 1.6 m antenna system", "Ultra-rapid UT1 experiment with e-VLBI", and "VLBI experiment for Time Transfer" have been scheduled. We are planning annual maintenance in February and March. Also we are planning repainting in June and July to keep up the telescope's good condition.

References

[1] Kawai, E., M. Sekido, R. Ichikawa, Kashima 34-m Radio Telescope, International VLBI Service for Geodesy and Astrometry 2008 Annual Report, NASA/TP–2009-214183, D. Behrend and K. D. Baver (eds.), pp. 114–117, 2008.

[2] Kawai, E., H. Kuboki, Y. Koyama, T. Kondo, On the expansion of the frequency coverage of an X-band of Kashima 34-m antenna, IVS NICT TDC News, 26, pp. 23–25, 2005.

[3] 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.