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 Research Center (KSRC) in Japan. This brief report summarizes the status of this telescope, the staff, and activities during 2010.

1. General Information

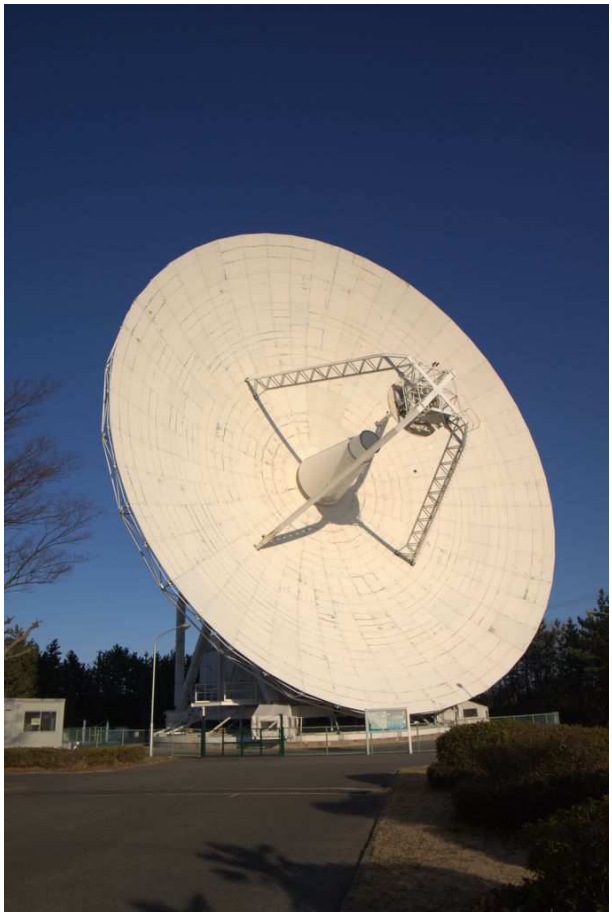
The Kashima 34-m radio telescope (Figure 1, left) was constructed as a main station of the "Western Pacific VLBI Network Project" in 1988. After that project's termination, the telescope has been used not only for geodetic experiments but also for astronomy and other purposes [1]. The station is located about 100 km east of Tokyo, Japan and is co-located with the 11-m radio telescope and the International GNSS Service station (KSMV) (Figure 1, right). The station is maintained within the Space-Time Measurement Project of the Space-Time Standards Group, NICT.

2. Component Description

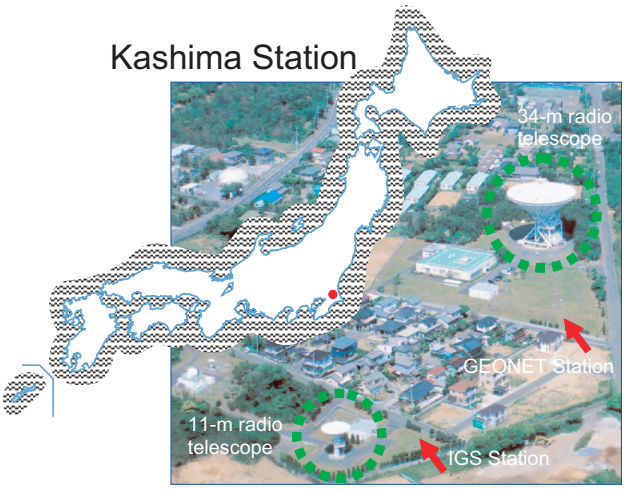
The receiver equipment of the Kashima 34-m radio telescope is summarized in Table 1 and Table 2. In particular the S-band receiver is equipped with a high-temperature superconductor (HTS) band-pass filter for RFI mitigation [2]. We also installed a band-pass filter on July 15, 2008 to cut out signals between 1405 MHz and 1435 MHz for L-band RFI mitigation.

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



The Kashima 34-m radio telescope.



Facilities at Kashima.

Figure 1. The Kashima Station.

Table 2. The receiver specifications 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. Dr. Kondo has returned to KSRC in March 2010 and is continuing the development of the K5 system. On the other hand, Dr. Sekido has temporarily moved to a government office.

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 is an active facility for both geodetic and radio astronomical purposes. In addition, experimental VLBI measurements for spacecraft tracking and precise time transfer have been performed over the recent years. Figure 2 shows a pie chart of the annual operation time for each purpose. The total operation time during 2010 was 1543 hours, which increased as compared to the previous year's total of 1246.5 hours. The increase of operation time of the 34-m Kashima antenna was caused mainly by filling in for the 32-m Tsukuba antenna of Geospatial Information Authority of Japan (GSI) during a necessary repair caused by a lightning damage. During this time we performed more than twenty IVS sessions including 1-hour "Intensive" dUT1 sessions.

We repaired and maintained several parts of the antenna (i.e., rustproof painting of reflector structure) between the end of May and July of 2010 in order to keep all components working.

5. Future Plans

As more than two decades have passed, the Kashima 34-m radio telescope requires continuous repairs. We are now preparing some countermeasures to maintain the antenna performance in anticipation of the new project for the next five years. Fortunately NICT headquarters supports the replacement of the AZ/EL drive units. We are going to install them in the next fiscal year.

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., 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.

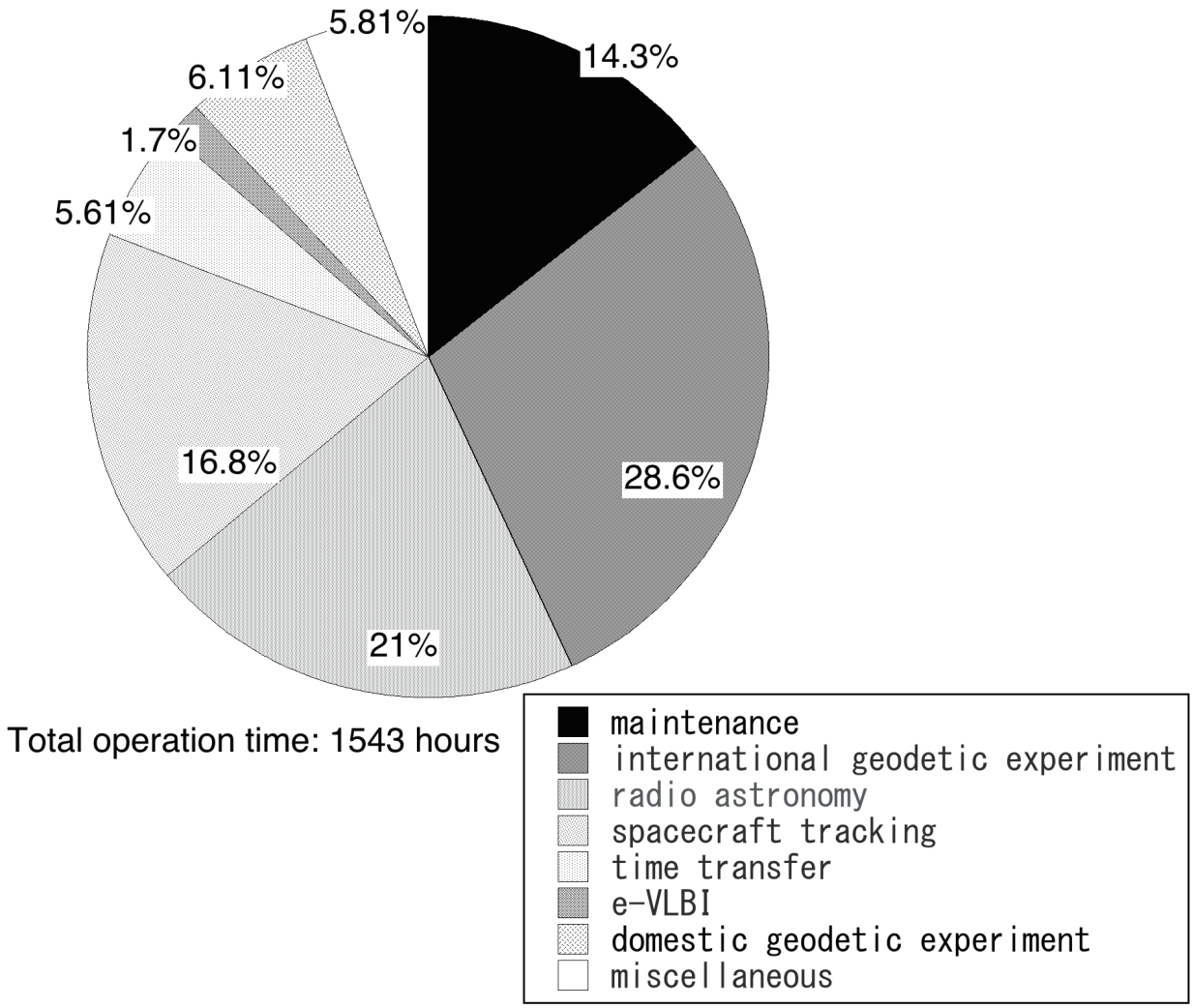


Figure 2. Statistical chart of the telescope operation time according to purpose.